

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

<b>Seat No.</b>	
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**[4162]-101**

**S.E. (Civil) (First Semester) EXAMINATION, 2012**

**ENGINEERING MATHEMATICS—III**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Solve any *three* :** [12]

(i) 
$$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = e^x \cos 2x$$

P.T.O.

$$(ii) \quad \frac{d^3y}{dx^3} + y = \sin(2x + 3)$$

$$(iii) \quad \frac{d^2y}{dx^2} + 4y = \sec^2(2x), \quad (\text{by the method of variation of parameters})$$

$$(iv) \quad x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} - 3y = x^2 \log x.$$

(b) Solve the following simultaneous linear differential equations :

$$\frac{dx}{dt} - 7x + y = 0, \quad \frac{dy}{dt} = 2x + 5y. \quad [5]$$

Or

2. (a) Solve any three : [12]

$$(i) \quad \frac{d^2y}{dx^2} - 7 \frac{dy}{dx} - y = e^x \cosh 3x$$

$$(ii) \quad \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = xe^x \sin x$$

$$(iii) \quad (3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = x^2$$

$$(iv) \quad \frac{d^2y}{dx^2} + y = \operatorname{cosec} x \quad (\text{by the method of variation of parameters})$$

(b) Solve :

$$\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}. \quad [5]$$

3. (a) The deflection of a strut of length  $L$  with one end at  $x = 0$  fixed and the other end supported and subjected to end thrust  $P$ , satisfies the equation :

$$\frac{d^2y}{dx^2} + a^2y = \frac{a^2R}{P}(L - x),$$

where  $a$ ,  $R$ ,  $P$  are constants. Prove that the deflection of the curve is given by :

$$y = \frac{R}{P} \left( \frac{\sin ax}{a} - L \cos ax + L - x \right),$$

where  $aL = \tan(aL)$ . [8]

- (b) The temperature at any point of an insulated metal rod is governed by the differential equation, provided that the length of rod is  $L$ ,

$$\frac{\partial u}{\partial t} = k^2 \frac{\partial^2 u}{\partial x^2}.$$

Find  $u(x, t)$ , subject to the following conditions :

(i)  $u(0, t) = 0$

(ii)  $u_t(L, t) = 0$

(iii)  $u(x, 0) = \frac{u_0 x}{L}$

where  $u_t = \frac{\partial u}{\partial t}$ . [8]

Or

4. (a) Solve the Laplace's equation :

$$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial y^2} = 0,$$

subject to the conditions :

(i)  $z(0, y) = 0$

(ii)  $z(1, y) = 0$

(iii)  $z(x, \infty) = 0$

(iv)  $z(x, 0) = \sin^3(\pi x), \quad 0 < x < 1.$  [8]

- (b) A body weighing 20 kg is hung from a spring. A pull of 40 kg will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position in time  $t$  seconds, the maximum velocity and period of oscillation. [8]

5. (a) Using Gauss-Seidel method, solve the following system of equations starting with initial values as  $x = y = z = 0$  where :

$$5x - y = 9,$$

$$x - 5y + z + 4 = 0,$$

$$y - 5z = 6. \quad [9]$$

- (b) Use Runge-Kutta method of 4th order to solve :

$$\frac{dy}{dx} = x + y, \quad y(0) = 1$$

to find  $y$  at 0.2 with  $h = 0.1.$  [8]



Or

6. (a) Solve :

$$\frac{dy}{dx} = y - \frac{2x}{y}, \quad y(0) = 1$$

in the range  $0 \leq x \leq 0.2$  using modified Euler's method with  $h = 0.1$ . [9]

(b) Solve the system of the following algebraic equations by Gauss elimination method :

$$x + 9y - 6z = 1$$

$$2x - 7y + 4z = 9$$

$$3x - 8y - 5z + 6 = 0. \quad [8]$$

## SECTION II

7. (a) Lives of two models of refrigerators turned for new models in a recent years are :

Life (No. of Years)	No. of Refrigerators	
	Model A	Model B
0—2	5	2
2—4	16	7
4—6	13	12
6—8	7	9
8—10	5	9
10—12	4	1

Find which model has more uniformity ? [6]

- (b) Obtain the correlation between population density (per square mile) and death rate (per thousand persons) from the data to 5 cities : [6]

<b>Population Density</b>	<b>Death Rate</b>
200	12
500	18
400	16
700	21
300	10

- (c) 10 coins thrown simultaneously. Find the probability of getting :
- (i) 8 heads
- (ii) At least 8 heads. [5]

*Or*

8. (a) Find the four moments about the mean of the following :

<b><math>x</math></b>	<b><math>f</math></b>
61	5
64	18
67	42
70	27
73	8

Also find  $\beta_1$  and  $\beta_2$ . [6]

- (b) In a certain factory turning out razor blades, there is a small chance of  $1/500$  for any blade to be defective. The blades are supplied in a packets of 10. Use Poisson distribution to calculate the approximate number of packets containing no defective and two defective blades, in a consignment of 10,000 packets. [6]
- (c) A random sample of 200 screws is drawn from a population which represents the size of screws. If a sample is distributed normally with a mean 3.15 cm and standard deviation 0.025 cm, find expected number of screws whose size falls between 3.12 cm and 3.2 cm.

Given :

Area corresponding to 1.2 is 0.3849.

Area corresponding to 2.0 is 0.4772. [5]

9. (a) A particle moves along the curve  $x = t^3 + 1$ ,  $y = t^2$ ,  $z = t$ , where  $t$  is the time. Find the velocity and acceleration at time  $t = 1$ . [4]
- (b) Find the directional derivative of  $\phi = 2xz^4 - x^2y$  at the point (2, -2, 1) in the direction of the tangent to the curve  $x = e^t$ ,  $y = 2 \sin t + 1$ ,  $z = t - \cos t$  at  $t = 0$ . [5]

(c) Prove the following (any two) : [8]

$$(i) \quad \nabla \left( \frac{\bar{a} \cdot \bar{r}}{r^n} \right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a} \cdot \bar{r})}{r^{n+2}} \bar{r}$$

$$(ii) \quad \nabla^4 (r^2 \log r) = \frac{6}{r^2}$$

$$(iii) \quad \bar{a} \cdot \nabla \left[ \bar{b} \cdot \nabla \left( \frac{1}{r} \right) \right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{\bar{a} \cdot \bar{b}}{r^3}.$$

Or

10. (a) Verify whether the vector field given by :

$$\bar{F} = (y^2 \cos x + z^3) \bar{i} + (2y \sin x - 4) \bar{j} + (3xz^2 + 2) \bar{k}$$

is irrotational. If so find corresponding scalar potential  $\phi$  such that  $\bar{F} = \nabla\phi$ . [6]

(b) Find the directional derivative of  $xy^2 + yz^3$  at  $(2, -1, 1)$  along the line  $2(x - 2) = (y + 1) = (z - 1)$ . [5]

(c) If

$$\bar{u} = 2xy^3 \bar{i} + 3xyz^2 \bar{j} - x^2yz \bar{k}$$

and  $\phi = 3x^2 - yz$ , then find :

$$(i) \quad \bar{u} \cdot \nabla\phi$$

(ii)

at  $(1, 2, -1)$ . [6]

11. (a) If

evaluate :

$$\int_C \bar{F} \cdot d\bar{r}$$

where C is the curve  $x = t, y = t^2, z = t^3$  joining the points (0, 0, 0) and (1, 1, 1). [6]

(b) Evaluate by Stokes' theorem

$$\bar{F} = (2xy + 3z^2)\bar{i} + (x^2 + 4yz)\bar{j} + (2y^2 + 6xz)\bar{k}, \iint_S \nabla \times \bar{F} \cdot \hat{n} dS$$

where S is the surface of paraboloid  $z = 4 - x^2 - y^2$  ( $z \geq 0$ ) and  $\bar{F} = y^2\bar{i} + z\bar{j} + xy\bar{k}$ . [5]

(c) Evaluate :

$$\iint_S (x\bar{i} + y\bar{j} + z^2\bar{k}) \cdot d\bar{S}$$

where S is the curved surface of cylinder  $x^2 + y^2 = 4$  bounded by the planes  $z = 0$  and  $z = 2$ . [5]

Or

12. (a) Evaluate :

$$\int_C \bar{F} \cdot d\bar{r} \quad \text{for} \quad \bar{F} = \sin y \bar{i} + x(1 + \cos y) \bar{j}$$

where C is the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, \quad z = 0. \quad [5]$$

(b) Evaluate :

$$\iint_S \bar{r} \cdot \hat{n} \, dS$$

over the surface of a sphere of radius 1 with centre at origin. [5]

(c) Show that the velocity potential

$$\phi = \frac{1}{2}a(x^2 + y^2 - 2z^2)$$

satisfies the Laplace's equation. Also determine the stream lines. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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**[4162]-102**

**S.E. (Civil) (First Semester) EXAMINATION, 2012**

**BUILDING MATERIALS AND CONSTRUCTION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Your answers will be valued as a whole.

**SECTION I**

1. (a) Define shallow foundation. Explain strap footing in detail. [6]

(b) Explain necessity of plinth in Residential Building. [6]

(c) Explain the following terms with neat sketches : [6]

(i) Header stone

(ii) Cornice

(iii) Lap

(iv) Coping.

P.T.O.

*Or*

- 2.** (a) State functions of foundation. Explain Raft foundation in detail. [6]
- (b) State any *four* components of building. State special function of each. [6]
- (c) Comment if no bond is provided in masonry. Explain Flemish Bond. [6]
- 3.** (a) Explain with sketch the checking of line and level of Block Masonry. [6]
- (b) Write short notes on the following : [6]
- (i) Composite Masonry
- (ii) Reinforced Brick Lintel.
- (c) Draw neat and detailed sketch of slab formwork. Name different parts. [4]

*Or*

- 4.** (a) Describe the detailed procedure of manufacturing of concrete blocks. [6]
- (b) What is cavity wall ? State advantages of cavity wall. [6]
- (c) Give field names of any *six* formwork parts. [4]



5. (a) State functional requirements of good flooring materials. [6]
- (b) Explain with neat sketches the following : [6]
- (i) Ridge Cover
- (ii) Tie Beam
- (iii) Dado
- (iv) Skirting.
- (c) Write a short note on King-Post Truss. [4]

*Or*

6. (a) Explain step by step procedure of fixing of A.C. sheet with sketches. [6]
- (b) Name with reason the flooring tiles which as an engineer you would suggest for the following rooms : [6]
- (i) Verandah
- (ii) Hall
- (iii) Kitchen
- (iv) Pooja Room.
- (c) Write a short note on Lean to Roof. [4]

## SECTION II

7. (a) State different types of fixtures and fastenings used for Doors and Windows. Give sketches of any *two*. [6]

(b) Differentiate between : [6]

(i) Linted and Arch

(ii) Bay Windows and Dormer Windows.

(c) Describe any *four* types of tools used in plastering with sketches. [6]

*Or*

8. (a) Explain with neat sketches any *three* types of Hinges used for Doors and Windows. [6]

(b) Draw neat sketch of Arch and show on it : [6]

(i) Spring Line

(ii) Span

(iii) Extrados

(iv) Haunch.

(c) Write down the objectives of plastering. Explain defects in painting. [6]

9. (a) Explain the following terms with sketches : [6]

(i) Winder

(ii) Newel Post

(iii) Rise

(iv) Soffit.

- (b) State safety precautions to be observed during the excavation in hard strata in dense area. [6]
- (c) Differentiate between Escalators and Ramps. [4]

*Or*

- 10.** (a) Define circulation. State different means of vertical circulation. Explain quarter turn stair in detail. [6]
- (b) Explain safety measures to be adopted in construction of Residential Building in developed colony. [4]
- (c) What is underpinning ? Describe Needle Beam method in detail. [6]
- 11.** (a) Write short notes on : [6]
- (i) Ceramic product
- (ii) Seasoning of timber.
- (b) State different defects in timber and explain any *one* in detail. [6]
- (c) State any *four* types of Building materials. Write down their advantages and disadvantages. [4]

*Or*

- 12.** (a) What is seasoning of timber ? State different methods of seasoning of timber. Explain any *one* in detail. [6]

- (b) Write down engineering properties of : [6]
- (i) Timber
  - (ii) Glass
  - (iii) Plastic.
- (c) Write short notes on : [4]
- (i) Plaster of Paris
  - (ii) Glass—A building material.

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

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[4162]-103

**S.E. (Civil) (First Semester) EXAMINATION, 2012**

**STRENGTH OF MATERIALS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answers to the two Sections should be written in separate answer-books.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

(vi) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10 and Q. No. 11 or Q. No. 12 from Section II.

**SECTION I**

1. (a) A bar made of Brass and having cross-sectional area  $1000 \text{ mm}^2$  is subjected to axial forces as shown in Fig. 1. Find the total change in length of the bar.

Take  $E = 1.05 \times 10^5 \text{ N/mm}^2$ . [8]

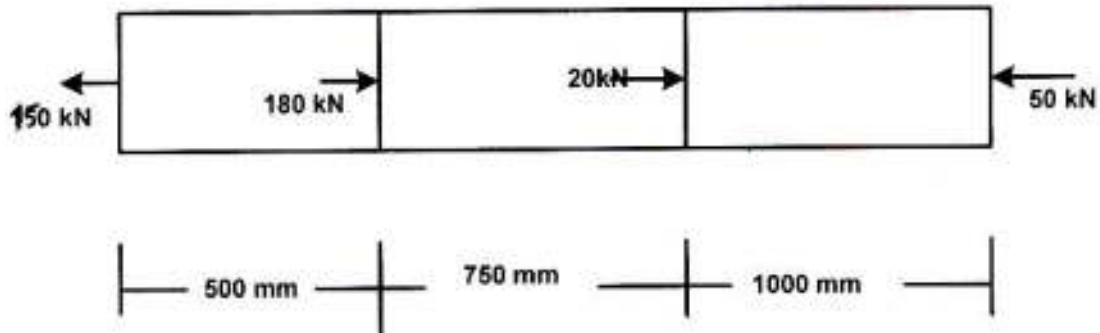


Fig. 1

P.T.O.

(b) For the composite section fixed at both ends as shown in Fig. 2, find : [10]

(i) Reactions at both ends

(ii) Stresses in each part

(iii) Construct axial force diagram.

Assume :

for Copper,  $A_C = 4000 \text{ mm}^2$ ,  $E_C = 120 \text{ kN/mm}^2$

for Aluminium,  $A_{al} = 6000 \text{ mm}^2$ ,  $E_{al} = 70 \text{ kN/mm}^2$

for Brass,  $A_b = 5500 \text{ mm}^2$ ,  $E_b = 100 \text{ kN/mm}^2$ .

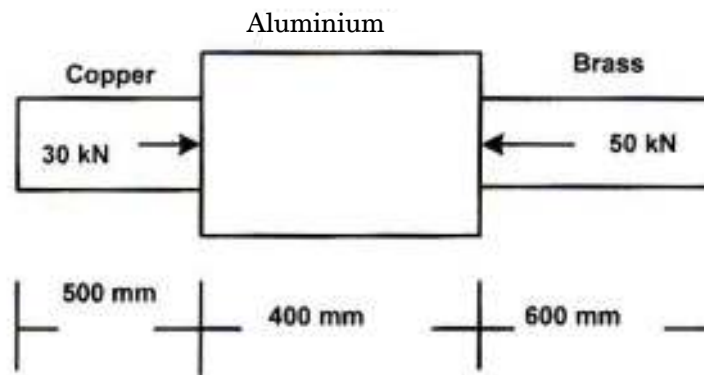


Fig. 2

Or

2. (a) A cylindrical piece of steel 80 mm diameter and 120 mm long is subjected to an axial compressive force 70 kN. Calculate the change in volume of the piece if Bulk modulus is  $1.7 \times 10^5 \text{ N/mm}^2$  and Poisson's ratio is 0.3. [8]

- (b) A steel rod of 30 mm diameter is placed centrally inside a hollow Bronze tube of external diameter 40 mm. The steel rod is tightly fitted with bronze tube so that entire section acts as composite section subjected to compressive force of 30 kN. Determine stresses in rod and tube when temperature falls by 30°C. Assume : [10]

$$E_{\text{steel}} = 2 \times 10^5 \text{ N/mm}^2 \quad E_{\text{bronze}} = 8 \times 10^4 \text{ N/mm}^2$$

$$\alpha_{\text{steel}} = 12 \times 10^{-6}/^\circ\text{C} \quad \alpha_{\text{bronze}} = 18 \times 10^{-6}/^\circ\text{C}.$$

3. (a) Construct shear force and bending moment diagrams for a beam loaded as shown in Fig. 3 and locate point of contraflexure : [8]

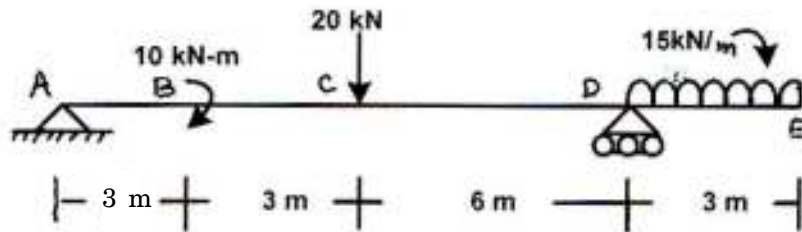


Fig. 3

- (b) The beam with overhangs on both sides is having total length of 10 m. It carries a u.d.l. of 180 N/m all over the span in addition to a point load of 200 N at the left end. The beam is supported at two points 7 m apart so chosen that each support carries half the total load. Draw S.F.D. and B.M.D. [8]

Or

4. (a) The bending moment diagram of a beam of span 12 m is as shown in Fig. 4. Construct shear force diagram and load diagram : [8]

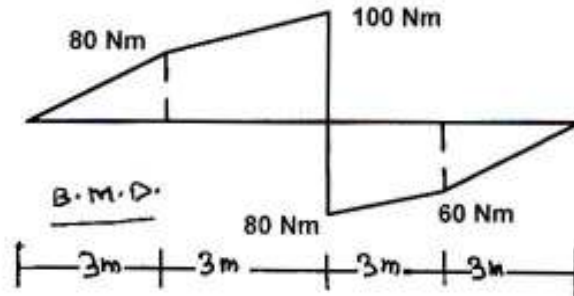


Fig. 4

- (b) Draw S.F.D. and B.M.D. for the beam ABCD loaded as shown in Fig. 5 : [8]

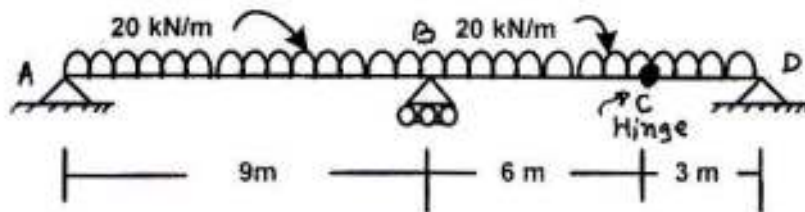


Fig. 5



5. (a) A beam of span 4 m carries u.d.l. of 15 kN/m. The cross-section of the beam is as shown in Fig. 6. Find maximum stress induced. Draw bending stress diagram. [8]

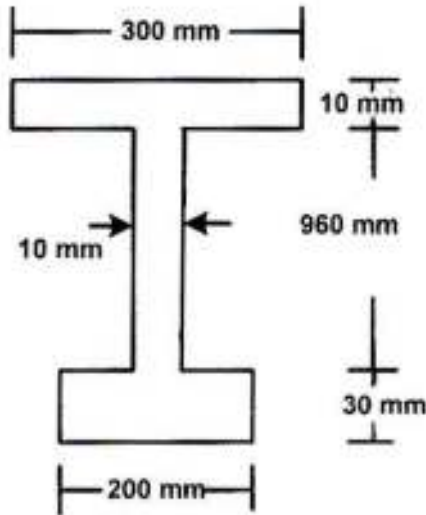


Fig. 6

- (b) The cross-section of the beam is as shown in Fig. 7. If this cross-section is subjected to a shear force of 15 kN, draw shear stress distribution diagram and find ratio of maximum shear stress to average shear stress. [8]

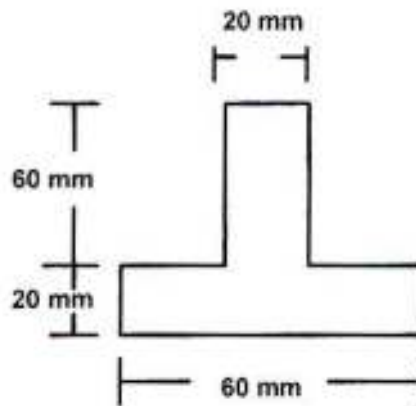


Fig. 7

*Or*

- 6.** (a) Construct the shear stress distribution diagrams showing salient points : [8]
- (i) Rectangular section
  - (ii) Symmetrical I-section
  - (iii) Triangular section
  - (iv) Hollow circular section.
- (b) A cast iron beam section is an I section with top flange 80 mm × 20 mm, bottom flange 160 mm × 40 mm and web 200 mm deep and 20 mm thick. The beam is simply supported on a span of 5 m. If the tensile stress is not to exceed 20 N/mm<sup>2</sup>, find the safe u.d.l. which the beam can carry and also maximum compressive stress. [8]

## SECTION II

- 7.** (a) A shaft transmits 75 kW power at 120 rpm. Determine the diameter of shaft if allowable shear stress is 50 N/mm<sup>2</sup>. The twist in the shaft shall not exceed 1.5° in 5 m length. Take  $G = 85 \text{ kN/mm}^2$ . [9]

- (b) A hollow shaft whose internal diameter is 0.55 times its external diameter and is to replace a solid shaft of the same material to transmit the same power at the same speed. Find the ratio of external diameter of hollow shaft to the diameter of solid shaft. Find also the % saving in the weight. [9]

*Or*

8. (a) Using equation of strain energy, derive the stress intensity due to the following types of axial loading : [9]
- (i) Gradually Applied Load
  - (ii) Suddenly Applied Load
  - (iii) Impact Load.
- (b) A load of 50 N falls by gravity through a vertical distance of 2000 mm. When it is suddenly stopped by a collar at the end of a vertical rod of length 6 m and diameter 20 mm, calculate the maximum stress and strain induced in the bar. The top of the bar is rigidly fixed to ceiling. Assume  $E = 1.96 \times 10^5 \text{ N/mm}^2$ . [9]

9. (a) The principal tensile stresses at a point are  $100 \text{ N/mm}^2$  and  $60 \text{ N/mm}^2$ . Find normal tangential and resultant stress on a plane at  $30^\circ$  with major principal plane. What is angle of obliquity ? Show by sketch how normal stress and tangential stress act. [8]
- (b) Find magnitudes of principal stresses and show position of principal plane and maximum shear stress and position of plane of maximum shear stress for the state of stress as shown in Fig. 8 (a) & (b) : [8]

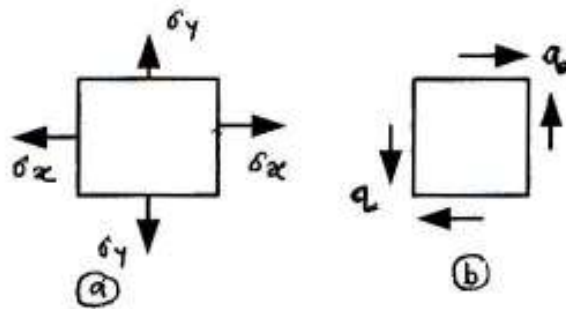


Fig. 8 (a) & (b)

Or

10. (a) A shaft section 100 mm diameter is subjected to a bending moment of 4000 N.m and a torque of 6000 N.m. Find the maximum direct stress induced on the section and specify the position of the plane on which it acts. Find also what stress acting alone can produce the same maximum strain. Take Poisson's ratio = 0.25. [8]

(b) Derive the expression for equivalent bending moment and equivalent torque for element subjected to combined action of B.M. and torque. [8]

11. (a) State assumptions made in Euler's theory and its limitations. [8]

(b) Find the greatest length of mild steel rod 25 mm × 25 mm which can be used as a compression member with one end fixed and other end free to carry a working load of 50 kN. Allow factor of safety of 5. [8]

Take :

$$\alpha = 1/7500 \text{ and } f_c = 320 \text{ N/mm}^2.$$

*Or*

12. (a) The T-section shown in Fig. 9, is subjected to a tensile force 220 kN, the line of action of the force being at 40 mm from the lower edge. Find the extreme stresses for the section. [8]

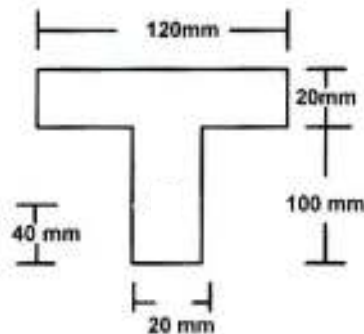


Fig. 9

- (b) Compare the crippling loads given by Rankine's formula and Euler's formula for a tubular strut 3 m long having outer diameter 47.5 mm and 42.5 mm as inner diameter. Assume both ends pin-jointed. Take  $f_y = 315$  MPa,  $\alpha = 1/7500$ ,  $E = 200$  GPa. [8]

Total No. of Questions—12] [Total No. of Printed Pages—4+1 Design

<b>Seat No.</b>	
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**[4162]-104**

**S.E. (Civil Engg.) (First Semester) EXAMINATION, 2012**

**ENGINEERING GEOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Attempt Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6 from Section I and Q. Nos. 7 or 8, Q. Nos. 9 or 10, Q. Nos. 11 or 12 from Section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

(v) Neat diagrams must be drawn wherever necessary.

**SECTION I**

1. (a) Enumerate the different branches of geology and how these helps an engineer to solve the problems in the field. [6]
- (b) How are conglomerates and sandstones formed ? Explain the processes of transportation, rounding and reduction in the grain size. [10]

P.T.O.

*Or*

2. (a) How igneous rocks are classified on the basis of variation of textures ? Explain with suitable examples and diagrams. [10]
- (b) What are the common metamorphic structures and textures ? Explain with suitable examples. [6]
3. (a) Explain the regional cycle of river erosion with the help of neat diagrams. [8]
- (b) Define Historical Geology. Write about the commercial importance of Gondwana and Vindhyan rocks. [8]

*Or*

4. (a) What are the different physiographic divisions of India ? Explain various rock types and structural features occurring in the state of Maharashtra. [10]
- (b) What is rejuvenation of a river ? Give any *two* landforms resulted by this process. [6]
5. (a) Which structural feature is resulted due to time gap in the deposition ? Give a detailed account of it with neat diagrams. [8]
- (b) Explain various parts and types of folds with neat sketches. [10]

*Or*

6. (a) Write an essay on mechanism of faults. Add a note on various types of faults with suitable examples. [10]
- (b) Explain the following terms :
- (i) Inliers and Outliers. [5]
- (ii) Dip and Strike. [3]



## SECTION II

7. With the help of Fig. No. 1 (attached), answer the following questions :
- (a) Describe the geography of the area represented by the map. [4]
  - (b) How many series of beds are occurring in the area represented by the map ? State order of superposition of these series. [6]
  - (c) Mention DOWN THROW SIDE and AMOUNT OF DOWN THROW w.r.t. the Fault plane. [6]

*Or*

8. (a) Describe the importance of ANGLE HOLES in the Preliminary Geological Exploration with suitable examples. [6]
- (b) What is the engineering significance of inspection of returning drill water during drilling ? [6]
- (c) Write a note on 'Geographical Information System' (GIS). [4]
9. (a) What is Landslide ? What are the causes of landslide ? Describe preventive measures against landslide. [12]
- (b) Write a note on cone of depression and circle of influence. [4]

*Or*

10. (a) Describe any *two* geological conditions leading to the Artesian conditions. Draw neat sketches. [8]
- (b) What are the requirements of Good Building Stone ? [8]

11. (a) Describe the feasibility of dam construction in the tectonically disturbed area. What treatment will you suggest to avoid further consequences ? [8]
- (b) What problems may have to be faced while excavating tunnel through folded strata ? [6]
- (c) Write a note on Unlined Tunnel. [4]

*Or*

12. (a) Describe feasibility of tunneling through compact basalt and amygdaloidal basalt. [6]
- (b) Describe geological conditions unsuitable for the reservoir site. [6]
- (c) Write a note on the dam located on folded geological structure. [6]



Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-105**

**S.E. (Civil) (First Semester) EXAMINATION, 2012**

**GEOTECHNICAL ENGINEERING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Figures to the right indicate full marks.
  - (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) What are the various index properties of soil ? Explain the significance of each. [6]

P.T.O.

- (b) What is Stokes' Law ? What are the limitations of Stokes' law ? [6]
- (c) Sketch the plasticity chart and show thereon a soil with  $W_L = 55\%$ ,  $W_P = 20\%$ . Assign its IS classification. [6]

*Or*

2. (a) Explain the terms with the help of three-phase diagram, void ratio, degree of saturation, water content and bulk unit weight. [6]
- (b) Draw a typical particle size distribution curve and for a well graded, uniformly graded and gap graded soil. [6]
- (c) The grading curve of a soil gives the effective size as 0.16 mm,  $D_{30} = 0.4$  mm and  $D_{60} = 0.3$  mm. Find  $C_u$  and  $C_c$ . Classify the soil. [6]
3. (a) What is Laplace equation ? Derive it from the first principles for two-dimensional flow. [6]
- (b) Explain the variable head method to determine the permeability of soil. Derive the equation used. [6]

- (c) A soil profile consists of layers of thickness equal to 2 m, 3 m and 4 m with coefficient of permeability equal to  $2 \times 10^{-4}$  cm/sec,  $3.5 \times 10^{-3}$  cm/sec and  $2 \times 10^{-3}$  cm/sec. Find the equivalent coefficient of permeability, when the flow is perpendicular to the layers. [4]

*Or*

4. (a) What is flow net ? What are the properties of flow net ? [6]  
(b) What are the various factors affecting permeability ? [6]  
(c) In order to compute the seepage loss through the foundation of a cofferdam flow nets were constructed. The results of the flow net study gave  $N_f = 5$  and  $N_d = 15$ . The head of water lost during seepage was 6 m. If the coefficient of permeability of soil  $K = 5 \times 10^{-4}$  m/min. Compute the seepage loss per meter length of dam per day. [4]
5. (a) How will you ensure compaction control at the time of construction of an earthen dam ? [5]  
(b) Explain Boussinesq's equation for estimation of vertical stress below the soil mass. [4]

- (c) In a standard proctor test the following observations were recorded :

Sample No.	Bulk density (kg/m <sup>3</sup> )	Water content (%)
01	1978	11.3
02	2083	12.2
03	2147	13.0
04	2208	14.2
05	2188	15.1
06	2147	16.4

Plot the moisture density curve and find MDD and OMC. [7]

*Or*

6. (a) What is compaction curve ? Give its salient features. What is zero air void line ? [5]
- (b) What is pressure bulb ? Explain its use. [5]
- (c) A water tank is constructed by a ring foundation having outer diameter of 8 m and inner diameter of 6 m. The uniform load intensity on foundation is 200 kN/m<sup>2</sup>. Determine the vertical stress caused by the water tank at a depth of 4 m below the centre of the foundation. [6]

## SECTION II

7. (a) How would you find the shear strength of soil with the help of unconfined compression test ? What are its limitations ? [6]
- (b) State the advantages and disadvantages of triaxial test. [6]
- (c) For a soil with  $\phi = 20^\circ$ ,  $C = 40 \text{ kN/m}^2$ , what will be the major principle stress at failure, if cell pressure is  $120 \text{ kN/m}^2$ . [6]

*Or*

8. (a) What is sensitivity ? How are soils classified based on sensitivity ? [6]
- (b) State and explain Coulomb's law of shear strength. How is it affected by the pore pressure ? [6]
- (c) An in-situ vane shear was conducted in a clay at the bottom of a bore hole. A torque of  $153 \text{ N-m}$  was required to shear the soil. What was the undrained strength of clay ? The vane was  $100 \text{ mm}$  in diameter and  $150 \text{ mm}$  long. [6]



9. (a) Explain the terms : Active earth pressure, Passive earth pressure and Earth pressure at rest. [6]
- (b) What is stability number ? What is its use ? [4]
- (c) Derive the expression for the critical height of a vertical cut that can stand unsupported in a C- $\phi$  soil. [6]

*Or*

10. (a) Draw a neat sketch to show :
- (i) Toe failure
- (ii) Face failure and
- (iii) Base failure. [5]
- (b) Explain finite and infinite slopes with suitable examples. [5]
- (c) A retaining wall with a vertical smooth back is 8 m high. It supports a cohesionless soil with  $\gamma = 19 \text{ kN/m}^3$ ,  $\phi = 30^\circ$ . The surface of soil is horizontal. Determine the thrust in the wall. [6]
11. (a) What are different modes of failure of rocks ? Give examples of each. [8]
- (b) What are different index properties of rocks ? How are they determined ? Explain any *two*. [8]

*Or*

**12.** Write short notes on :

[16]

- (a) Beam bending test
- (b) Unconfined compression test
- (c) Ring shear test
- (d) Hardness of rock.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-106**

**S.E. (Civil) (Second Semester) EXAMINATION, 2012**

**FLUID MECHANICS—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 from Section I and Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Explain :**

- (i) Capillarity
- (ii) Surface tension.

[6]

P.T.O.

(b) If the surface tension at air-water interface is 0.07 N/m, what is the pressure difference between inside and outside of an air bubble of diameter 0.01 mm ? [4]

(c) The velocity distribution near the solid wall at a section in a laminar flow is given as :

$$u = 5 \sin (5\pi y)$$

for  $y \leq 0.1$  m. Compute shear stress at a section at

(i)  $y = 0$

(ii)  $y = 0.1$  m.

Take dynamic viscosity of the fluid as 5 poise. [6]

(d) Give expression for Reynolds Number and Froude Number. [2]

*Or*

2. (a) (i) State Buckingham's  $\pi$  theorem. [2]

(ii) Explain Geometric, Kinematic and Dynamic similarity. [6]

(iii) Explain Viscosity. [4]

(b) The pressure drop  $\Delta P$  generated by a pump of a given geometry is found to depend on the impeller diameter  $D$ , rotational speed  $N$ , fluid discharge  $Q$ , the fluid density  $\rho$  and viscosity  $\mu$ . Obtain the dimensionless form of the functional relationship. [6]

3. (a) A 6 m deep tank contains 4 m of water and 2 m of oil of relative density 0.8. Determine the pressure at the bottom of the tank. [6]
- (b) An open cylindrical vessel of 20 cm diameter and 50 cm high contains water to a height of 30 cm.
- (i) If the cylinder is rotated at 180 rpm about its axis, calculate the pressure, on the bottom, at the centre and at the edges of the vessel.
- (ii) What speed of rotation would cause the water surface to just touch the top rim of the vessel ? [10]

*Or*

4. (a) Define centre of pressure and total pressure. Derive the formula for total pressure on a plane surface submerged vertically in the liquid. [8]
- (b) With usual notations, prove that  $BM = \frac{I}{V}$ . [8]
5. (a) For the following flow, find the equation of the streamline passing through (1, 1) :
- $$V = 3xi - 3yj. \quad [8]$$
- (b) Derive the continuity equation of a steamline. [8]

*Or*

6. (a) Define :
- (i) Steady flow
- (ii) Non-uniform flow
- (iii) Streamline
- (iv) Path line. [8]

- (b) Obtain a stream function to the following velocity components,  
 $u = x + y$  and  $v = x - y$ . [4]
- (c) Write a short note on flownet. [4]

## SECTION II

7. (a) Derive Euler's equation of motion for one-dimensional flow. Also derive Bernoulli's equation from it. [8]
- (b) Derive an expression for flow rate through venturimeter. [8]

*Or*

8. (a) A 30 cm × 15 cm venturimeter is installed in a vertical pipe carrying water. The flow is in upward direction. The difference of levels between the throat and inlet is 80 cm. The water-mercury differential manometer gives deflection of 17.5 cm of mercury. Find the discharge of water. Take coefficient of meter as 0.98. [8]
- (b) Write short notes on :
- (i) Prandtl's Pitot tube
- (ii) Energy correction factor. [8]

9. (a) For a steady laminar flow in a horizontal circular pipe derive expression for :

(i) Shear stress

(ii) The pressure drop. [8]

(b) For the following velocity profile in the boundary layer, calculate displacement and momentum thickness :

$$\frac{u}{U} = 2\eta - \eta^2, \text{ where } \eta = y/\delta. \quad [8]$$

*Or*

10. (a) A viscous liquid was flowing under laminar flow condition, through a 6 cm diameter circular pipe. A Pitot tube at a radial distance of 2 cm from the axis indicated a velocity of 0.6 m/s. Calculate :

(i) Maximum and average velocity

(ii) Discharge through the pipe. [8]

(b) Explain :

(i) Laminar Sublayer

(ii) Boundary Layer separation and its control. [8]

11. (a) Explain :

(i) Prandtl's mixing length theory

(ii) Moody's diagram. [6]

- (b) Draw TEL and HGL for a syphon, connecting higher level and lower level reservoirs. [6]
- (c) Derive the expression for loss of energy due to sudden enlargement. [6]

*Or*

- 12.** (a) What are various losses in the pipe ? Give the expression for each. [6]
- (b) Derive Darcy-Weisbach equation for finding head loss due to friction in pipes. [6]
- (c) For turbulent flow through a pipe 60 cm in diameter, the velocities are 4.5 m/s and 4.2 m/s on the centre line and at a radial distance of 10 cm from pipe axis. Calculate the discharge in the pipe. [6]



Total No. of Questions—11]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-107**

**S.E. (Civil) (Second Semester) EXAMINATION, 2012**

**BUILDING PLANNING**

**(2008 PATTERN)**

**Time : Four Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4 and Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10. Q. No. 11 from Section II is compulsory.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Enlist the documents to be submitted along with building plans. [5]

(b) Explain the importance of orientation of building with respect to cardinal direction. [5]

(c) Write a short note on services and amenities in the town. [6]

P.T.O.

*Or*

- 2.** (a) What do you understand by submission drawing ? What is the necessity of it ? [6]
- (b) Explain the role of Plan Sanctioning Authority for township. [5]
- (c) Write a short note on Rain water harvesting and future scope of it. [5]

- 3.** (a) State the byelaws regarding road width and height of building. [9]
- (b) Explain with sketches wind effects and stack effects. [9]

*Or*

- 4.** (a) What are the criteria for minimum area of plot ? [6]
- (b) What are the considerations for natural lighting in a residential building ? [6]
- (c) What is the difference between built-up area and carpet area ? [6]

- 5.** (a) Define noise pollution. Enlist various effects of noise pollution. [6]
- (b) Compare fire resisting properties of : [4]
- (1) Concrete
- (2) Steel.
- (c) Write a short note on septic tank with soak pit. [6]

*Or*

6. (a) Explain : [6]
- (1) Sabine's formula
- (2) Sound foci and Dead spots.
- (b) Discuss important considerations in fire protection. [4]
- (c) State and discuss briefly the necessary building services. [6]

## SECTION II

7. A line plan for a residential building is shown in Fig. 1 :

Data :

- (a) All external walls are of 230 mm thick.
- (b) All partition walls are of 115 mm thick.
- (c) Size of W.C.–1200 mm × 1000 mm.
- (d) Size of Bath–2200 mm × 1500 mm.
- (e) RCC framed structure.
- (f) Beam sizes–230 mm × 400 mm
- (g) Column sizes – 230 × 300
- (h) Floor to floor height – 3000 mm
- (i) Plinth height – 450 mm

- (j) All dimensions are in mm :
- (i) Draw to scale 1 : 50 detailed plan. [8]
  - (ii) Draw to scale 1 : 50 detailed section XX. [9]
  - (iii) Give schedule of openings. [1]
  - (iv) Show design calculations for staircase [1]
  - (v) Show column positions in plan. [1]

Fig. 1

*Or*

8. Plan a residential building G+1 framed structure with the following requirements. Calculate the total built-up area and give schedule of

openings. The ext. wall tk. is 230 mm and int. wall tk. is 150 mm.

Indicate N-line :

[20]

<b>Sr. No.</b>	<b>Type of Unit</b>	<b>No. of Units</b>	<b>Internal area of Unit (in sq.m.)</b>
01	Living room	01	18
02	Bedroom	02	12
03	Additional bedroom with attached toilet	01	16
04	Kitchen	01	12
05	W.C.	01	1.5
06	Bath	01	2.8
07	Staircase	01	Use suitable dimensions

9. It is proposed to construct a Post-office with the following data :

(i) Entrance-cum-waiting space = 50 sq.m.

(ii) Public dealing counter (six in numbers) = total 30 sq.m.

(iii) Working space for other staff = 35 sq.m.

(iv) Post separation room = 30 sq.m

(v) Post-master office = 15 sq.m.

(vi) Storeroom = 15 sq.m.

- (vii) Meeting room = 20 sq.m.
- (viii) Sanitary units : as per standards
- (ix) All passages = 2000 mm wide
- (x) Assume any additional suitable data if necessary and mention it clearly with justification :
  - (a) Draw a scale 1 : 100 or suitable line plan showing location of doors and windows. [15]
  - (b) Show line sketches of furniture arrangement. [3]

*Or*

**10.** Design a single-storeyed restaurant building on a Highway. The following units are to be provided :

- (i) Entrance and general stationary shop = 45 m<sup>2</sup>
- (ii) Dining hall = 300 m<sup>2</sup>
- (iii) Service = 35 m<sup>2</sup>
- (iv) Kitchen = 45 m<sup>2</sup>
- (v) Storeroom = 18 m<sup>2</sup>
- (vi) Cloakroom for keeping baggage = 15 m<sup>2</sup>
- (vii) Water closet for gents = 2 nos.  
Water closet for ladies = 2 nos.

Draw to a scale of 1 : 50 or suitable :

- (a) Line plan showing locations of doors and windows. [15]
- (b) Furniture arrangement in dining hall. [3]

11. Draw to scale of 1 : 100 or suitable a two point perspective view of the steps shown in Fig. 2 :

- Eye level at 1500 mm above ground level.
- All dimensions are in mm.
- Station point 5000 mm away from picture plane vertically below the corner of the steps touching the picture plane.
- Retain all construction lines : [12]

Fig. 2

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-108**

**S.E. (Civil) (Second Semester) EXAMINATION, 2012**

**SURVEYING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Your answers will be valued as a whole.
- (vi) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

**SECTION I**

1. (a) What is meant by orientation in plane table survey ? Explain method of orientation by the magnetic needle. [5]

P.T.O.



- (b) Find which station is free from local attraction and work out correct bearings : [8]

<b>Line</b>	<b>F.B.</b>	<b>B.B.</b>
AB	191° 45'	13° 0'
BC	39° 30'	222° 30'
CD	22° 15'	200° 30'
DE	242° 45'	60° 45'
EA	330° 15'	147° 45'

- (c) Differentiate between declination and dip. The magnetic bearing of the sun at noon is 355° 30'. Find out the declination. [5]

*Or*

2. (a) The following bearings were taken with prismatic compass at the closed traverse :

<b>Line</b>	<b>F.B.</b>	<b>B.B.</b>
AB	120° 30'	300°
BC	30°	209°
CD	330° 30'	150° 30'
DE	260° 30'	80°
DA	210°	31°

Find included angles and corrected bearings and record them in a tabular form. [8]

- (b) State the advantages and disadvantages of plane table survey over other type of survey. [5]
- (c) State the methods of plane table surveying. Explain in brief intersection method of plane table survey. [5]
3. (a) During a fly levelling operation the following observations were made :
- BS – 0.650, 2.155, 1.405, 2.655, 2.435 m
- FS – 2.455, 1.305, 0.555, 2.405 m
- The first backsight was taken on BM of R.L. 90.500 m. From the last backsight, it is required to set four pegs each at a distance of 30 m on a falling gradient of 1 in 100. Calculate the RLs of these four pegs and apply usual arithmetic check. [8]
- (b) Explain with the aid of a neat sketch, the working of “Tilt compensator” in auto level. [4]
- (c) With neat sketch explain any *four* characteristics of contour lines. [4]

*Or*

4. (a) With the help of neat sketch derive the expression for combined correction for curvature and refraction. [6]

- (b) In testing a dumpy level, the following records were noted while undertaking reciprocal levelling :

<b>Instrument</b>	<b>Reading at</b>	
	<b>A</b>	<b>B</b>
<b>at</b>		
A	1.725	1.370
B	1.560	1.235

is the line of collimation in adjustment ? What should be the correct staff reading at A, during the second setup to make the line of collimation truly horizontal find the amount of collimation error also. [6]

- (c) How do you estimate the volume storage capacity of a reservoir behind a dam ? [4]

5. (a) State different errors eliminated by measuring the horizontal angle by repetition. [4]

- (b) The following observations were taken from station P & Q :

<b>Line</b>	<b>Length (m)</b>	<b>Bearings</b>
PA	125.0	S 60° 30' W
PQ	200.0	N 30° 30' E
QB	150.5	N 50° 15' W

Calculate the length and bearing of AB and also the angle  $\angle$  PAB and  $\angle$  QBA. [8]

(c) Define the following terms : [4]

(i) Latitude

(ii) Departure

(iii) Consecutive co-ordinates

(iv) Independent co-ordinates.

*Or*

6. (a) The following table gives the latitude and departures of the sides of a closed traverse ABCD :

<b>Side</b>	<b>Latitude</b>	<b>Departure</b>
	(m)	(m)
AB	+214.8	+124.0
BC	-245.1	+205.7
CD	-155.9	-90.0
DA	+186.2	-239.7

Find out the total co-ordinates and area of the traverse by assuming the total co-ordinates of A as (200, 100). [6]

(b) Explain closing error in the traverse survey in detail. [6]

(c) State and explain transit rule. [4]

## SECTION II

7. (a) State the situations where tacheometric survey is carried out. Explain second method of determination of constant of tacheometer in the field. [6]
- (b) Enlist the fundamental axes of theodolite. State the relation between the fundamental lines when transit is in perfect adjustment. [6]
- (c) The following observations are made on a vertically held staff with a tacheometer fitted with an anallatic lens. The multiplying constant of the instrument was 100 : [6]

Inst Stn.	Staff Station	Vertical Angle	Hair Readings			Remarks
0	BM	$-4^{\circ} 30'$	0.750	1.200	1.400	R.L of
	P	$+ 10^{\circ} 00'$	0.600	0.900	1.100	BM = 150.00 m

Find RL of point P.

*Or*

8. (a) Explain how you will test and adjust the transit theodolite to ensure that the horizontal plate bubble tube perpendicular to the vertical axis. [6]

- (b) The following observations are made on a vertically held staff with a tacheometer fitted with an anallatic lens. The multiplying constant of the instrument was 100 : [6]

<b>Inst.</b>	<b>Staff</b>	<b>Vertical</b>	<b>Hair Readings</b>			<b>Remarks</b>
<b>Stn.</b>	<b>Station</b>	<b>Angle</b>				
0	P	+4° 30'	0.750	1.200	1.400	RL of point P
	Q	+10° 00'	0.600	0.900	1.100	= 150.00 m

Find the distance OQ and level difference between P and Q.

- (c) Explain detailed procedure of carrying out radial survey. (Use sketch and RL's). [6]
9. (a) Define curve. State different types of horizontal circular curves. Explain compound curve. [6]
- (b) Two straight intersects at a chainage of 2700 m. The deflection angle being 36°. A circular curve of 350 m radius is to be set out by method of offset from long chord. Calculate the chainage of tangent points and the value of offset at mid-point 30 m and 60 m, peg interval 30 m. [6]
- (c) What is transition curve ? Explain objects of providing transition curve. [4]

*Or*

- 10.** (a) Draw sketch of circular curve and define different elements of circular curve. [6]
- (b) Calculate and tabulate data necessary for setting out a  $5^\circ$  curve by tangential deflection angle method between two tangent lines BA and BC produced with the following data. Included angle  $ABC = 144^\circ$ , chainage of B is 1550.00 m, Peg interval 30 m. [6]
- (c) Draw an illustrative sketch of compound curve and show its elements. [4]
- 11.** (a) Explain with neat sketch step by step procedure of setting out a building. [6]
- (b) Write a short note on construction survey. [5]
- (c) Explain the principle used in total station. Classify different types of total stations based on range. [5]

*Or*

- 12.** (a) Explain horizontal and vertical control in construction survey. State steps in road survey. [6]
- (b) Write a short note on survey of drainage line. [5]
- (c) What is total station ? State uses of total station. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-109**

**S.E. (Civil) (Second Semester) EXAMINATION, 2012**

**CONCRETE TECHNOLOGY (Theory)**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer questions 1 or 2, 3 or 4 and 5 or 6 from Section I and questions 7 or 8, 9 or 10 and 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of electronic pocket calculator is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is bulking of sand and its effect on batching ? [6]
- (b) Write a short note on Bogue's compounds. [6]
- (c) What are the different functions of admixtures ? [6]

P.T.O.



*Or*

- 2.** (a) Explain the wet process of manufacturing of cement. [6]  
(b) Write a short note on Classification of Aggregates. [6]  
(c) Write short notes on : [6]  
(i) Fly ash  
(ii) Soundness of aggregates.
- 3.** (a) Write a short note on Compaction of concrete. [6]  
(b) Explain indirect tension test on concrete. [5]  
(c) What care should be taken to while transporting and placing of concrete ? [5]

*Or*

- 4.** (a) Write a short note on Shrinkage and its different types. [6]  
(b) Explain the relationship between compressive strength and tensile strength of concrete. [5]  
(c) Write a short note on creep of concrete. [5]
- 5.** (a) Using Indian standard recommended guidelines, design a concrete mix for a structure to be subjected to the moderate exposure

conditions for the following requirements : [16]

(a) **Design situations :**

- (i) Characteristic strength at 28 days—25 MPa
- (ii) Maximum nominal size of aggregates—20 mm
- (iii) Types of aggregate—Angular (crushed)
- (iv) Degree of quality control—Good
- (v) Source of aggregates—Natural
- (vi) Degree of workability—Compaction Factor : 0.8
- (vii) Grading zone :
  - (a) Coarse aggregates—II
  - (b) Fine Aggregates—II.

(b) **Characteristics of material :**

**Cement :**

- (i) Type of cement—OPC 53 grade
- (ii) Specific gravity— 3.15
- (iii) Bulk density— 1450 kg/m<sup>3</sup>.

**Aggregates :**

	<b>Fine aggregates</b>	<b>Coarse aggregates</b>
(i) Specific gravity	2.6	2.65
(ii) Bulk density (kg/m <sup>3</sup> )	1750	1800
(iii) Free surface moisture (%)	1.5	Nil
(iv) Water absorption (%)	0.6	1.0

(c) **Mix design considerations (Use fig. 1)**

(i)  $t = 1.65$

(ii) For moderate exposure conditions with normal weight aggregates of 20 mm nominal maximum size and for RC work :

(iii) Minimum cement content—  $300 \text{ kg/m}^3$

(iv) Maximum free water cement ratio—0.5.

(b) Table 1 : Approximate sand and water contents per cubic meter of concrete :

<b>Nominal size of aggregate (mm)</b>	<b>Water content per cubic meter of concrete (kg)</b>	<b>Sand as percentage of total aggregates (by Volume)</b>
10	208	40
20	186	35
40	165	30

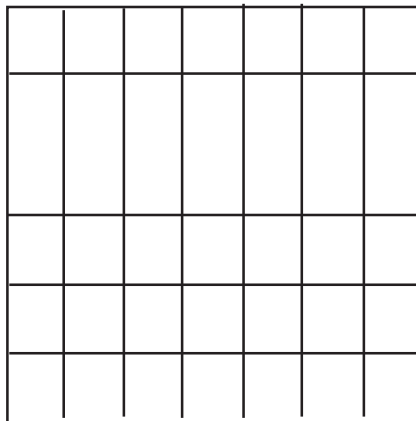


Figure No. 1

*Or*

6. (a) Explain mix design by IS recommended guidelines in detail. [8]  
(b) Write a short note on Trial mixes in mix design. [5]  
(c) Define : nominal mix and design mix. [3]

**SECTION II**

7. (a) Write a short note on Non-destructive testing of concrete. [8]  
(b) Write a short note on Analysis of fresh concrete. [8]

*Or*

8. Write short notes on : [16]  
(i) Principles of design of formwork  
(ii) Impact echo test  
(iii) Marsh cone test  
(iv) Test cores.
9. (a) Write a short note on Light weight concrete. [8]  
(b) Write short notes on : [8]  
(i) Pumps  
(ii) Vibrators.

*Or*

10. (a) Explain in detail Ferrocement. [8]  
(b) Write a short note on Fibre Reinforced concrete. [8]

- 11.** (a) Explain in detail Common types of repairs. [10]
- (b) Write short notes on : [8]
- (i) Shotcrete
- (ii) Attack by sea water.

*Or*

- 12.** (a) State and explain factors affecting permeability of concrete. [6]
- (b) Write short notes on : [12]
- (i) Repair by stitching
- (ii) Sulphate attack on concrete
- (iii) Chlorine attack on concrete.

Total No. of Questions—12]

[Total No. of Printed Pages—8+1

<b>Seat No.</b>	
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**[4162]-110**

**S.E. (Civil) (Second Semester) EXAMINATION, 2012**

**STRUCTURAL ANALYSIS-I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of Non-programmable Electronic Scientific calculator is allowed.

(vi) Use of Cell Phone is not allowed.

(vii) Assume suitable data, if necessary.

**SECTION I**

1. (a) Differentiate Static and Kinematic indeterminacy. [4]

(b) A simply supported beam AB of 6 m span is loaded and supported as shown in Fig. 1 (b). Using Macaulay's method, determine :

(i) deflection at point C

P.T.O.

(ii) maximum deflection and

(iii) slope at end A.

Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $I = 2000 \text{ cm}^4$ . [7]

Fig. 1(b)

- (c) Using Moment area method, find the slope and deflection at the free end B of a cantilever beam with uniform cross section, subjected to point load P at the centre of the beam. [7]

*Or*

2. (a) Explain with sketches the types and classification of structures based on structural forms. [4]
- (b) A vertical load W is applied at the free end of the rigid cantilever frame as shown in Fig. 2(b). Assuming EI to be constant for all the members of the frame, determine the horizontal

and vertical displacement of the point C. Neglect Initial deformations. [7]

Fig. 2(b)

- (c) A simply supported beam AB of span 12 m carries a point load of 120 kN at C, 6 m from support 'A'. Using conjugate beam method, find the slope at support 'A' and maximum deflection of the beam.

Assume,  $E = 200 \text{ kN/mm}^2$  and  $I = 1.25 \times 10^9 \text{ mm}^4$ . Refer Fig. 2(c). [7]

Fig. 2(c)



3. (a) A continuous beam ABC has fixed supports A and C and roller support at B. A beam has a span  $AB = \text{span } BC = 5 \text{ m}$  and span AB carries a UDL of  $20 \text{ kN/m}$  and span BC carries a point load of  $100 \text{ kN}$  at centre of BC.

Analyze the beam ABC using theorem of three moment and draw SFD and BMD. [8]

- (b) A fixed beam AB of span  $6 \text{ m}$  is subjected to udl  $50 \text{ kN/m}$  over a  $2 \text{ m}$  starting from support A. Determine the support moments from the first principle; and draw SFD and BMD. [8]

*Or*

4. (a) State the principle of superposition and explain it with suitable example. [4]
- (b) State the expression for strain energy under the effect of axial force, shear force, bending moment and torsion. [4]
- (c) Analyze the prop cantilever beam of span  $L$  subjected to udl  $w/m$  throughout the span and draw S.F.D. and B.M.D. [8]

5. Find the forces in the members of the truss supported and loaded as shown in Fig. 5(a). Assume that the elastic modulus and area of cross-section for all the members are the same. [16]

Fig. 5(a)

*Or*

6. A framed structure is loaded and supported as shown in Fig 6(a). Find the vertical deflection of the joint D if : [16]
- (a) Area of all horizontal members =  $5 \times 10^{-4} \text{ m}^2$
  - (b) Area of all vertical members =  $10^{-4} \text{ m}^2$
  - (c) Area of all inclined members =  $5.6 \times 10^{-4} \text{ m}^2$  and
  - (d)  $E = 2 \times 10^8 \text{ kPa}$ .

Fig. 6(a)

## SECTION II

7. (a) Draw and explain the stress-strain distribution diagram from elastic to plastic stage for hot rolled steel 'I' section. [4]
- (b) Write assumption in plastic theory. [4]
- (c) Fixed beam AB with uniform cross-section and total span 10 m is subjected to a udl,  $w/m$  run over its left half span. If the plastic moment capacity of the section of the beam is 250 kNm, determine the maximum intensity of the udl,  $w/m$  run the beam can support. Assume constant EI throughout the beam. [10]

*Or*

8. (a) Explain the failure mechanisms of one bay one story rigid jointed portal frame. [4]
- (b) Explain upper bound and lower bound theorem. [4]
- (c) A fixed base one bay-one story rigid jointed portal frame ABCD is subjected to concentrated load,  $W$  at mid span of beam. A frame is also subjected to horizontal load of  $W/2$  at the beam level causing sway towards right. Find

the value of load  $W$  at which the frame will collapse. Assume constant  $EI$  for beam and columns. Column height = beam span =  $L$ . [10]

9. (a) State the Muller Breslau's principle. [4]
- (b) For the compound beam shown in the Fig 9(b), draw the ILD for the following : [12]
- (i) Reaction at A and B
- (ii) Shear force and Bending moment at G
- (iii) Shear force and Bending moment at H.

12 m                  6 m                  6 m                  6 m                  12 m

Fig. 9(b)

*Or*

10. (a) What is truss ? State the assumptions made in the analysis of truss. [4]
- (b) An udl of intensity 10 kN/m for a span of 30 m traverses over the pinned jointed truss shown in Fig. 10(b). Draw the ILD for the members  $U_3U_4$ ,  $U_3L_4$ ,  $L_3L_4$  and  $U_3L_3$  when a

unit load travels on the bottom chord of the truss. Find the maximum forces induced in all these members. [12]

$U_0$     $U_1$     $U_2$     $U_3$     $U_4$     $U_5$     $U_6$

Fig. 10(b)

11. (a) Two wheel loads 50 kN and 100 kN, spaced 3 m apart are moving on the girder of span 12 m. If any wheel load can lead the other, find the maximum reactions. Also find the maximum negative and maximum positive SF at 5 m from the left support. [8]
- (b) A simply supported beam AB of span 20 m is loaded with udl, 60 kN/m over a span of 5 m. Determine the maximum negative and positive SF and BM at section 8 m from left support. [8]

*Or*

- 12.** (a) Four point loads 150, 150, 250 and 100 kN spaced at 2, 2.5 and 3 m in order crosses a girder of span 24 m from left to right with 100 kN load leading. Determine the maximum SF and maximum BM at 8 m from left support. [8]
- (b) For the condition of maximum bending moment under chosen wheel load, prove that the chosen wheel load and resultant of all wheel loads should be equidistance from centre of the girder. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-110-A**

**S.E. (Civil) EXAMINATION, 2012**  
**ENGINEERING ECONOMICS AND MANAGEMENT**  
**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain the importance of Economics in construction sector. Why is study of Economics necessary ? [6]
- (b) Explain the terms cost and values with suitable examples. [6]
- (c) Explain the term Marginal Utility with the help of suitable example. [6]

*Or*

2. (a) Give definitions of the following : [6]
- (i) Assets
  - (ii) Liabilities

P.T.O.

(iii) Wealth

(iv) Wants

(v) Price

(vi) Investment.

(b) Explain the Law of Demand and Supply. Explain how the equilibrium is achieved. [6]

(c) What are the factors that determine the price of any commodity ? Explain by giving assumptions if any. [6]

**3.** (a) Define productivity. Differentiate between productivity of materials and labour. [8]

(b) What are the laws of return ? Explain with suitable examples. [8]

*Or*

**4.** (a) What are *four* factors of production ? Explain in brief. [8]

(b) Explain the terms GNP and GDP. [8]

**5.** (a) Explain the role of Reserve Bank of India. [8]

(b) Differentiate between shares and debentures. [8]



*Or*

- 6.** (a) Explain the procedure adopted in foreign direct investment. [8]  
(b) Explain the following terms : [8]  
(i) Overhead cost  
(ii) Depreciation.

## SECTION II

- 7.** (a) Write in detail the working of Private Limited Company. [6]  
(b) What is the meaning of Delegation of Authority ? Explain with suitable example. [6]  
(c) What is the importance of Organisation ? What are the principles of management to be followed for a successful organization ? [6]

*Or*

- 8.** (a) Write down the contributions by Taylor in the development of management. [6]  
(b) What are advantages and disadvantages of proprietorship ? [6]  
(c) Explain in detail any *two* principles of management. [6]
- 9.** (a) Explain the use of decision tree. [8]  
(b) What is the importance of training ? Give advantages and disadvantages of the same. [8]

*Or*

- 10.** (a) Explain the scope of HR Department. [8]  
(b) Give the types of motivation. Differentiate between reward and punishment. [8]
- 11.** (a) Explain Kaizen and Kanban in short. [8]  
(b) What is the importance of studying the Industrial Psychology ? Explain with suitable examples. [8]

*Or*

- 12.** (a) Write a detailed note on 'Work study.' [8]  
(b) What are the advantages and disadvantages of Trade Unions ? [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-111**

**S.E. (Mechanical) (First Semester) EXAMINATION, 2012**

**APPLIED THERMODYNAMICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

## **SECTION I**

### **UNIT I**

1. (a) Write a note on reversibility. [4]

(b) Prove that Kelvin-Planck statement and Clausius statement are equivalent. [6]

P.T.O.

- (c) At steady state, a refrigerator cycle removes 18,000 kJ/h of energy by heat transfer from a space maintained at  $-40^{\circ}\text{C}$  and discharges energy by heat transfer to the surroundings at  $20^{\circ}\text{C}$ . If the actual COP of the cycle is 25% of that of the theoretical cycle operating between thermal reservoirs of these two temperatures, determine power input to the cycle in kW. [6]

*Or*

2. (a) Write a note on 'Principle of Increase of Entropy'. [4]  
(b) State and prove 'Clausius Inequality'. [8]  
(c) Two kg of air is heated at constant pressure of 200 kPa to  $500^{\circ}\text{C}$ . Calculate entropy change if the initial volume is  $0.8 \text{ m}^3$ . [4]

## UNIT II

3. (a) Derive an expression for available energy of non-flow system. [6]  
(b) Sketch the following processes on P-V and T-S planes :  
(i) Reversible adiabatic  
(ii) Isothermal. [4]

- (c) 0.25 kg of air at a pressure of  $140 \text{ kN/m}^2$  occupies  $0.15 \text{ m}^3$  and from this condition is compressed to  $1.4 \text{ MN/m}^2$  according to  $PV^{1.25} = C$ . Determine :
- (i) Change in internal energy of air
  - (ii) Work done and
  - (iii) Heat transfer. [6]

*Or*

4. (a) Prove that reversible adiabatic ideal gas process law is  $PV^K = C$  where K is ratio of specific heats. [6]
- (b) Explain :
- (i) Helmholtz function
  - (ii) Gibbs function. [4]
- (c) One kg of air is contained in a rigid tank at  $500 \text{ kPa}$  and  $700 \text{ K}$ . Calculate maximum useful work :
- (i) if the system changes to dead state
  - (ii) when the air is cooled in tank to  $400 \text{ K}$ . Take dead state as  $20^\circ\text{C}$  and  $100 \text{ kPa}$ . [6]

### UNIT III

5. (a) Define :
- (i) Dryness fraction at wet steam
  - (ii) Degree of superheat. [4]

- (b) Explain Rankine cycle with T-S diagram. [6]
- (c) Two kg of saturated steam is contained in  $0.2 \text{ m}^3$  rigid vessel. Heat is transferred to the surroundings at  $30^\circ\text{C}$  until the quality reaches to 20%. Calculate work done, entropy change and heat transfer. [8]

*Or*

6. (a) Explain separating calorimeter with the help of a neat sketch. Show the process on h-s plane. [8]
- (b) Define :
- (i) Work ratio
- (ii) Specific steam consumption. [4]
- (c) A Carnot vapour power cycle operates between 20 kPa and 800 kPa steam pressures. Calculate net work per cycle and cycle efficiency. [6]

## SECTION II

### UNIT IV

7. (a) Explain the method of writing the complete combustion equation of a fuel with air with the help of an example. [5]
- (b) Differentiate between mass fraction and mole fraction. [5]

(c) In a bomb calorimeter the following observations were recorded :

Weight of coal tested = 3.0 gm

Weight of water in the calorimeter = 1.4 kg

Water equivalent of calorimeter = 0.9 kg

Rise in temperature of jacket water = 9°C

The coal contains 3% moisture by weight and room temperature is 25°C. If one kg of moisture at 0°C requires 2470 kJ to evaporate to form dry and saturated steam, calculate the lower calorific value of coal. [6]

*Or*

8. (a) Name the apparatus used for measurement of C.V. of gaseous fuels and discuss its working with the help of neat sketch. [8]

(b) A sample of fuel has the following percentage composition C = 86%, H<sub>2</sub> = 8%, S = 3%, O<sub>2</sub> = 2% and Ash = 1% for an air-fuel ratio of 12 : 1. Calculate :

(i) Mixture strength as a percentage rich or weak

(ii) Volumetric analysis of dry products of combustion. [8]

## UNIT V

9. (a) Discuss the different methods of capacity control used for reciprocating compressor. [6]
- (b) Define clearance ratio in air compressor. What is its effect on work and volumetric efficiency ? [4]
- (c) A single stage single acting reciprocating air compressor has air entering at 1 bar, 20°C and compression occurs following polytropic process with index 1.2 up to delivery pressure of 12 bar. The compressor runs at the speed of 240 rpm and has L/D ratio of 1.8. The compressor has mechanical efficiency of 0.88. Determine the isothermal efficiency and cylinder dimensions. Also find out the rating of drive required to run the compressor which admits 1 m<sup>3</sup> of air per minute. [8]

*Or*

10. (a) Draw P-V and T-S diagram for a single stage reciprocating air compressor without clearance. Derive the expression for work done when compression is :
- (i) Isothermal and
- (ii) Isentropic. [6]
- (b) Explain the working of Root blower with a neat sketch. [4]



- (c) A reciprocating air compressor has four stage compression with  $2 \text{ m}^3/\text{min}$  of air being delivered at 150 bar when initial pressure and temperature are 1 bar  $27^\circ\text{C}$ . Compression occur polytropically following polytropic index of 1.25 in four stages with perfect intercooling between stages. For the optimum intercooling conditions determine the intermediate pressures and the work required for driving compressor. [8]

### UNIT VI

11. (a) Explain with neat sketches fusible plug and superheater. [8]
- (b) A boiler uses 1350 kg of coal per hour. The temperature of flue gases is 660 K and outside ambient temperature is 300 K. If the draught produced by 30 m high chimney is 18 mm of water column. Determine :
- (i) Air supplied per kg of coal burnt and
- (ii) Base diameter of the chimney. [8]

*Or*

12. (a) Define equivalent evaporation from and at  $100^\circ\text{C}$  and the boiler efficiency. [4]
- (b) What is IBR ? Explain some of its provisions. [4]

- (c) The following data relate to a trial on boiler using economiser, air preheater and superheater :
- (i) Condition of steam at exit of boiler = 20 bar and 0.96 dry
  - (ii) Temperature of steam at exit of superheater = 300°C
  - (iii) Steam evaporation rate/kg of fuel = 13 kg
  - (iv) Room temperature = 30°C
  - (v) Temperature of feed water at exit of economiser  $t_1 = 50^\circ\text{C}$ .
  - (vi) Temperature of air at exit of air preheater,  $t_a = 70^\circ\text{C}$ , the temperature of flue gases at inlet to superheater, economiser, air preheater and exit of air preheater are 650°C, 430°C, 300°C and 180°C respectively.

Assume that air supplied is 19 kg/kg of fuel of C.V. of 45,000 kJ/kg.

Find :

- (a) equivalent evaporation with and without economiser from and at 100°C.
- (b) Thermal efficiency of boiler with and without economiser.
- (c) Thermal efficiency of superheater, economiser and air preheater. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-112**

**S.E. (Mechanical) (First Semester) EXAMINATION, 2012**

**METALLURGY**

**(Mechanical and Mechanical S/W)**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from each Section.  
(ii) Answers to the two Sections should be written in separate answer-books.  
(iii) Neat diagrams must be drawn wherever necessary.  
(iv) Figures to the right indicate full marks.  
(v) Assume suitable data, if required.

**SECTION I**

**Unit I**

1. (a) What are the various point defects in a crystal ? What is the effect of these defects on the property of material ? [6]  
(b) Define and explain coldworking of metals. Why is annealing followed by coldworking ? [6]  
(c) Derive an expression for critical resolved shear stress of a single crystal. Calculate resolved shear stress of a single crystal if applied tensile stress is  $25 \text{ kg/mm}^2$  and slip plane is oriented  $60^\circ$  to tensile axis. [6]

P.T.O.

*Or*

2. (a) Explain phenomenon of strain hardening on the basis of theory of dislocation. [6]
- (b) Represent the following planes and directions in cubic system : [6]
- (i)  $221$
- (ii)  $\bar{2}10$
- (iii)  $1\bar{1}0$
- (c) Explain the following in brief (any *two*) : [6]
- (i) Recrystallisation
- (ii) Polygonisation
- (iii) Dislocation.

### Unit II

3. (a) Tensile test was conducted on a steel specimen of diameter 12 mm and gauge length 60 mm. The load at upper and lower yield point are 4800 kg and 4500 kg respectively. The maximum and fracture load are 7800 kg and 5000 kg respectively. Gauge length 75 mm and gauge dia. 8 mm at the time of fracture. Calculate :
- (i) Upper and lower yield stress
- (ii) UTS
- (iii) % elongation. [6]

- (b) What is fatigue ? Explain factors affecting fatigue life. Draw S.N. curve showing all details. [6]
- (c) Differentiate between Charpy and Izod Impact Test. [4]

*Or*

4. (a) Define Engineering stress-strain and True stress-strain. Derive relationship between Engineering stress-strain and True stress-strain. [6]
- (b) Find true stress-strain and engineering stress-strain of a low carbon steel rod if load applied to specimen is 4000 N, initial diameter 0.30 cm and diameter of specimen under load of 4000 N is 0.27 cm. [6]
- (c) Which NDT test will you recommend for testing of the following :
- (i) Sorting of steel components of identical shape and size from mixed lot.
  - (ii) Surface cracks in steel bar.
  - (iii) Subsurface cracks in a 8 cylinder crankshaft.
  - (iv) Slag inclusion in a welded joint. [4]

### Unit III

5. (a) Write short notes on (any *three*) : [12]
- (i) Classification of steels
  - (ii) Specification of steels
  - (iii) Stainless steels
  - (iv) Tool steels.
- (b) Which steel would you select for : [4]
- (i) Gear
  - (ii) Wrist watch
  - (iii) Crankshaft
  - (iv) Ball bearing ?

*Or*

6. (a) Draw Fe-Fe<sub>3</sub>C diagram showing all the details. Explain along with reactions, various phases and temperatures. [10]
- (b) Draw and label microstructures of the following plain carbon steels : [6]
- (i) Hypoeutectoid
  - (ii) Eutectoid
  - (iii) Hypereutectoid.

## SECTION II

### Unit IV

7. (a) Represent martempering, austempering, petenting and ausforming with respect to TTT diagrams. State the transformation products of each process. [6]
- (b) Explain transformation products of Austenite. [6]
- (c) What is hardenability ? Explain any *one* method of evaluation and discuss factors affecting hardenability. [6]

*Or*

8. (a) State true or false and justify (any *two*) : [6]
- (i) Hypereutectoid steels are hardened above  $A_{cm}$  temperature.
- (ii) Hardness increases during tempering
- (iii) Annealed steel shows more hardness than normalised steels.
- (b) Explain flame hardening and induction hardening. Differentiate them with respect to other case hardening processes. [6]
- (c) Write short notes on any *two* : [6]
- (i) Quench Cracks
- (ii) Secondary Hardness
- (iii) Carbonitriding.

## Unit V

9. (a) Explain the following characteristics of metal powder : [6]  
(i) Particle size and shape distribution  
(ii) Flow rate  
(iii) Apparent density.
- (b) What is a requirement for self-lubricated bearing ? Explain working and steps involved in manufacturing of those bearings. [6]
- (c) Explain merits and demerits of powder metallurgical process. [4]

Or

10. (a) Give composition, properties and application of the following metals (any *three*) : [6]  
(i) Gun metal  
(ii) Muntz metal  
(iii) LM6  
(iv) Babbitts alloy.
- (b) Explain the factors affecting microstructures of cast iron. [6]
- (c) Draw the phase diagram of Cu-Zn alloy system, showing all details. [4]

## Unit VI

11. (a) Explain properties and application of the following fibers : [6]  
(i) Aramid  
(ii) Alumina  
(iii) Glass.



- (b) Explain characteristics of a good composite material. [4]
- (c) Write a short note on Shape Memory Alloy. [4]
- (d) State application of biomedical material. [2]

*Or*

- 12.** Write short notes on (any *four*) : [16]
- (i) Fiber reinforced composites
  - (ii) Advanced ceramics
  - (iii) Structural composites
  - (iv) Refractory metals and alloys
  - (v) Cryogenic materials.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-113**

**S.E. (Mechanical) (First Semester) EXAMINATION, 2012**

**(Common to Sandwich)**

**FLUID MECHANICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Your answers will be valued as a whole.

(vi) Use of electronic pocket calculator, logarithmic tables, slide rule, Mollier charts and Steam table is allowed.

(vii) Assume suitable data, if necessary.

## SECTION I

### Unit I

1. (a) State Stokes law. What are the various assumptions made in it ? [4]

P.T.O.

(b) Derive an expression for capillary fall. [6]

(c) The velocity potential function ( $\phi$ ) is given by :

$$\phi = \frac{xy^3}{3} - x^2 + \frac{x^3y}{y} + y^2$$

(i) Calculate the velocity components in  $x$  and  $y$  direction.

(ii) Check possibility of fluid flow. [6]

*Or*

2. (a) Differentiate between the convective and local acceleration. [4]

(b) Prove that equi-potential and streamline are perpendicular to each other. What is the significance of this perpendicularity ? [6]

(c) The velocity distribution of fluid flow over plate is given by :

$$u = \frac{2}{3} y - y^2$$

where,  $u$  is the velocity in m/s at distance 'y' meter above plate. Determine the shear stress at  $y = 0, 0.1$  and  $0.2$  m. Take  $\mu = 6$  Poise. [6]

## Unit II

3. (a) Derive an expression for the total pressure acting on plane surface kept in liquid at an angle ' $\theta$ ' with free surface of liquid and also determine the location of centre of pressure. [10]

- (b) A dam has a parabolic spape :

$$x = 2\sqrt{y}$$

Taking height of water retained by dam as 9 m, calculate the resultant thrust exerted by water per meter length of dam. [8]

*Or*

4. (a) Derive an expression for the metacentric height of floating body. [10]
- (b) A wooden cylinder of specific gravity 0.6 is circular in cross-section with height 'L' and diameter 'D' floats in an oil of specific gravity 0.90. Find an expression for L/D ratio for the cylinder with its longitudinal axis vertical in an oil. [8]

### Unit III

5. (a) Prove that, the discharge over a right angled V notch as :

$$Q = 1.42 H^{5/2}$$

where H = height of water above the notch. [8]

- (b) Determine the flow rate of oil with specific gravity 0.7 flows through pipe of diameter 400 mm inclined at 30° with horizontal connected with mercury differential Venturimeter of throat 200 mm gives the deflection of 500 mm. Take throat to mouth distance of 600 mm and flow meter coefficient as 0.98. [8]

*Or*

6. (a) Explain the principle of Venturimeter with a neat sketch. Derive an expression for the flow rate of fluid through it. [8]
- (b) A sub-marine with its axis 15 m below water surface fitted with Pitot tube moves horizontally in sea of specific gravity 1.026 is fitted with mercury U-tube differential manometer giving a deflection of 170 mm. Calculate the speed of sub-marine. [8]

## SECTION II

### Unit IV

7. (a) Prove that, in case of steady laminar flow through a circular pipe average velocity is half the maximum velocity. [8]
- (b) Using Buckingham  $\pi$  theorem, show that the velocity through a circular orifice is given by :

$$V = \sqrt{2gH} \phi(D/H, \mu / \rho VH)$$

where H = Head;  $\rho$  = Mass density;  $g$  = Acceleration due to gravity; D = Diameter of orifice,  $\mu$  = Coefficient of viscosity. [10]

*Or*

8. (a) A lubricating oil of viscosity of 1 poise and specific gravity 0.9 is pumped through a 30 mm diameter pipe. If the pressure drop per meter length of pipe is 20 kN/m<sup>2</sup>, determine :
- (1) Mass flow rate in kg/min.
  - (2) Shear stress of pipe wall.
  - (3) Reynolds number of flow.
  - (4) Power required per 50 m length of pipe to maintain flow. [10]

- (b) A geometrically similar model of an air duct is to be built to 1/25 scale and tested with water which is 50 times more viscous and 800 times than air. When tested under dynamically similar conditions, the pressure drop is 2 bar in the model. Find corresponding pressure drop in the full scale prototype. [8]

### Unit V

9. (a) Explain the concept of equivalent pipe and derive Dupit's equation. [8]
- (b) Two reservoirs containing water have difference of levels of 70 m, and are connected by a 250 mm diameter pipe which is 4 km long. The pipe is tapped midway between reservoirs and water is drawn at rate of  $0.04 \text{ m}^3/\text{sec}$ . Assuming friction factor = 0.04, determine rate at which water enters in the lower reservoir. [8]

*Or*

10. (a) Explain major and minor losses in the pipe in detail. [6]
- (b) Two reservoirs are connected by a pipeline consisting of two pipes, one of 15 cm diameter and length 6 m and other of diameter 22.5 cm and 16 m length. If difference of water levels in the two reservoirs is 6 m, calculate the discharge and draw E.G.L. Take coefficient of friction ( $f$ ) = 0.04. [10]

## Unit VI

11. (a) Define the following :

(i) Boundary layer thickness

(ii) Displacement thickness

(iii) Momentum thickness

(iv) Energy thickness. [8]

(b) The velocity distribution in the boundary layer is given by :

$u/U = y/\delta$ , where  $u$  is the velocity at a distance  $y$  from the plate and  $u = U$  at  $y = \delta$ ;  $\delta$  being boundary layer thickness.

Find :

(1) Displacement thickness

(2) Momentum thickness

(3) Energy thickness

(4) Value of  $\delta^*/\theta$ . [8]

*Or*

12. (a) What is meant by Drag and Lift and explain various types of drags. [8]

(b) Experiments were conducted in a wind tunnel at 50 kmph on a flat plate of size of 2 m  $\times$  1 m. The specific weight of air is 11.28 N/m<sup>2</sup>. The plate is kept at such an angle that the coefficient of lift and drag are 0.75 and 0.15 respectively. Determine lift force, drag force, resulting force and power exerted by air stream on plate. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8+3

<b>Seat No.</b>	
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**[4162]-114**

**S.E. (Mech./Prod./SW) (I Sem.) EXAMINATION, 2012**

**ENGINEERING MATHEMATICS—III**

**(Common to Mech. S/W—Prod.-Prod. S/W and Industrial)**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) In Section I : Attempt Q. No. 1  $\sigma$  Q. No. 2,  
Q. No. 3  $\sigma$  Q. No. 4, Q. No. 5  $\sigma$  Q. No. 6.

In Section II : Attempt Q. No. 7  $\sigma$  Q. No. 8,  
Q. No. 9  $\sigma$  Q. No. 10, Q. No. 11  $\sigma$  Q. No. 12.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of electronic pocket calculator is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Solve any three :** [12]

(i)  $(D^3 - 5D^2 + 8D - 4)y = 4e^{2x} + 2^x + 3$

P.T.O.



$$(ii) \quad (D^2 + 4) y = \sin x \cos 3x$$

$$(iii) \quad (D^2 + 1) y = x + \tan x \quad (\text{By variation of parameters})$$

$$(iv) \quad \left( \frac{d}{dx} + \frac{1}{x} \right)^2 y = \frac{1}{x^4}$$

$$(v) \quad (D^2 + 4) y = x + \sin^2 x.$$

(b) Solve : [5]

$$3 \frac{dx}{dt} + \frac{dy}{dt} + 2x = 3 \cos t$$

$$2 \frac{dy}{dt} + \frac{dx}{dt} + 3y = 7 \cos t - 4 \sin t.$$

Or

2. (a) Solve any three : [12]

$$(i) \quad \frac{d^3 y}{dx^3} - 4 \frac{dy}{dx} = 2 \cosh 2x$$

$$(ii) \quad (D^3 + 2D^2 + D) y = x(x + 1) e^{-x}$$

$$(iii) \quad (D^2 + 9) y = \operatorname{cosec} 3x \quad (\text{By Variation of Parameters})$$

$$(iv) \quad (4x + 1)^2 \frac{d^2 y}{dx^2} + 2(4x + 1) \frac{dy}{dx} + y = 2x + 1$$

$$(v) \quad \frac{dx}{xy} = \frac{dy}{y^2} = \frac{dz}{xyz - 2x^2}.$$

(b) The differential equation

$$\frac{d^2x}{dt^2} + 2k\frac{dx}{dt} + n^2x = 0 \quad (k < n)$$

represents the damped harmonic oscillations of a particle, solve this equation and show that the ratio of the amplitude of any oscillation to that of the preceding one is constant. i.e. its amplitude form G.P. [5]

3. (a) Find the Laplace transform of (any two) : [6]

(i)  $f(t) = e^t \frac{\sin t}{t}$

(ii)  $f(t) = te^{-2t} \cosh 3t$

(iii)  $f(t) = \int_0^t \left( \frac{e^t - \cos 2t}{t} \right) dt.$

(b) Using Laplace transform find the solution of : [5]

$$\frac{dy}{dt} + 4y + 5 \int_0^t y dt = e^{-t}, \quad y(0) = 0.$$

(c) Find the Fourier transform of  $e^{-|x|}$  hence show that : [6]

$$\int_{-\infty}^{\infty} \frac{e^{i\lambda x}}{1 + \lambda^2} d\lambda = \pi e^{-|x|}.$$

Or

4. (a) Find the inverse Laplace transform of (any two) : [8]

$$(i) \frac{5s + 3}{(s - 1)(s^2 + 2s + 5)}$$

$$(ii) \frac{2s + 1}{(s^2 + s + 1)^2}$$

$$(iii) \frac{1}{s} \log\left(1 + \frac{1}{s^2}\right).$$

(b) Evaluate : [4]

$$\int_0^{\infty} e^{-t} (\sin t + t \cos t) dt.$$

(c) Using Fourier Integral representation show that : [5]

$$\int_0^{\infty} \frac{2\lambda}{\lambda^4 + 4} \sin \lambda x d\lambda = \frac{\pi}{2} e^{-x} \sin x.$$

5. (a) If

$$\frac{\partial^2 u}{\partial t^2} = a^2 \frac{\partial^2 u}{\partial x^2}$$

represents the vibrations of a string of length L fixed at both ends find the solution with boundary conditions :

$$(i) u(0, t) = 0$$

$$(ii) \quad u(L, t) = 0$$

$$(iii) \quad \left( \frac{\partial u}{\partial t} \right)_{t=0} = 0$$

$$(iv) \quad u(x, 0) = Lx - x^2 \quad 0 \leq x \leq L. \quad [8]$$

(b) Solve the equation

$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$$

Subject to the conditions :

$$(i) \quad u(0, t) = 0$$

$$(ii) \quad u(L, t) = 0$$

$$(iii) \quad u = \begin{cases} \frac{2T}{L}x & 0 \leq x \leq \frac{L}{2} \\ \frac{2T}{L}(L-x) & \frac{L}{2} \leq x \leq L \end{cases} \text{ at } t = 0. \quad [8]$$

Or

6. (a) A rectangular plate with insulated surface is 10 cm wide and so long to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature of the short edge  $y = 0$  is given by :

$$\begin{aligned} u &= 20x \text{ for } 0 \leq x \leq 5 \\ &= 20(10 - x) \text{ for } 5 \leq x \leq 10 \end{aligned}$$

and the two long edges  $x = 0$ ,  $x = 10$  as well as the other short edge are kept at  $0^\circ\text{C}$ , then find the temperature  $u$  at any point  $(x, y)$ . [8]

(b) Use Fourier transform to solve the equation

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

subject to the following conditions :

(i)  $\frac{\partial}{\partial t} u(0, t) = 0$

(ii)  $u(x, 0) = \begin{cases} 1 - x^2 & 0 < x < 1 \\ 0 & x \geq 1 \end{cases}$

(iii)  $u(x, t)$  is bounded. [8]

## SECTION II

7. (a) The mean and standard deviation of 30 items is found to be 12 and 4 respectively. It was observed that one item 10 was incorrect. Calculate the mean and standard deviation if wrong item is replaced by 14. [5]

(b) The first four moments about the assumed mean 30.00 of a distribution are 0.3, 6, 30 and 400. Calculate the moments about the mean and coefficients of skewness and kurtosis. [6]

- (c) The accidents per shift in a factory are given by the table : [5]

Accidents $x$ per shift	Frequency $f$
0	142
1	158
2	67
3	27
4	5
5	1

Fit a Poisson distribution to the above table and calculate the frequencies as per Poisson fit.

*Or*

8. (a) Determine the equations of regression lines for the following data : [6]

$x$	$y$
1	9
2	8
3	10
4	12
5	11
7	13
7	14

- (b) Among 64 offsprings of a certain cross between European horses 34 were red, 10 were black and 20 were white. According to a genetic model, these numbers should be in the ratio 9 : 3 : 4. Is the data consistent with the model at 5% level ?

$$\left[ \chi_{2:0.05}^2 = 5.991 \right] \quad [5]$$

- (c) In a distribution, exactly normal, 7% of the items are under 35 and 89% are under 63. Find the mean and standard deviation of the distribution.

$$[z_1 = 1.23, A_1 = 0.39; z_2 = 1.48, A_2 = 0.43] \quad [5]$$

9. (a) Show that tangent at any point of the curve  $x = e^t \cos t$ ,  $y = e^t \sin t$ ,  $z = e^t$  makes a constant angle with  $z$ -axis. [5]
- (b) With usual notations, establish the following (any two) :

$$(i) \quad \nabla \times [\bar{a} \times (\bar{b} \times \bar{r})] = \bar{a} \times \bar{b}$$

$$(ii) \quad \nabla \times \left( \frac{\bar{a} \times \bar{r}}{r^3} \right) = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$$

- (iii) For a solenoidal vector field  $\bar{F}$

$$\text{curl curl curl curl } \bar{F} = \nabla^4 \bar{F}. \quad [6]$$

- (c) Find the directional derivative of  $\phi = e^{2x} \cos(yz)$  at  $(0, 0, 0)$  in a direction normal to the surface  $\phi_1 = x^2y + y^2z + z^2x$  at the point  $(1, 1, 1)$ . [5]

Or

10. (a) Find the constants  $a$  and  $b$ , so that the surface  $ax^2 - byz = (a + 2)x$  will be orthogonal to the surface  $4x^2y + z^3 = 4$  at the point  $(1, -1, 2)$ . [5]

- (b) If the vector field

$$\bar{F} = (x + 2y + az) \bar{i} + (bx - 3y - z) \bar{j} + (4x + cy + 2z) \bar{k}$$

is irrotational, find  $a, b, c$  and determine  $\phi$  such that

$$\bar{F} = \nabla\phi. \quad [5]$$

- (c) With usual notations, show that : [6]

$$(i) \quad \bar{a} \cdot \nabla \left[ \bar{b} \cdot \nabla \left( \frac{1}{r} \right) \right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{(\bar{a} \cdot \bar{b})}{r^3}$$

$$(ii) \quad \bar{b} \times \nabla [\bar{a} \cdot \nabla \log r] = \frac{(\bar{b} \times \bar{a})}{r^2} - \frac{2(\bar{a} \cdot \bar{r})}{r^4} (\bar{b} \times \bar{r}).$$

11. (a) Find the work done in moving the particle once round the circle  $x^2 + y^2 = 4, z = 0$  under the field of force :

$$\bar{F} = (2x - y^3 + z^2) \bar{i} + (x + y - z) \bar{j} + (2x - 3y + 5z) \bar{k}.$$

Is the field conservative ? [6]



(b) Evaluate

$$\iint_S 2x^2y \, dy \, dz - y^2 \, dz \, dx + 4xz^2 \, dx \, dy$$

over the closed surface of hemisphere  $x^2 + y^2 + z^2 = a^2$   
bounded by the plane  $z = 0$ . [6]

(c) Verify Stokes' theorem for :

$$\bar{F} = xy^2\bar{i} + y\bar{j} + z^2x\bar{k}$$

for the surface of rectangular lamina bounded by  $x = 0$ ,  
 $y = 0$ ,  $x = 2$ ,  $y = 3$ ,  $z = 0$ . [6]

*Or*

**12.** (a) Evaluate

$$\int_C \bar{F} \cdot d\bar{r} \text{ for } \bar{F} = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$$

along the straight line joining  $(2, 1, 1)$ ,  $(3, 1, 2)$ . [6]

(b) Evaluate

$$\iiint_V \nabla \cdot \bar{F} \, dV,$$

where  $V$  is the volume of the cone  $z^2 = x^2 + y^2$  and the  
plane  $z = 4$  and

$$\bar{F} = 4xz\bar{i} + xyz^2\bar{j} + 3z\bar{k}. [6]$$

(c) Evaluate

$$\iint_S \text{curl } \bar{F} \cdot \hat{n} ds$$

for the surface of the paraboloid :

$z = 9 - (x^2 + y^2)$  above the plane  $z = 0$  and

$$\bar{F} = (x^2 + y - 4)\bar{i} + 3xy\bar{j} + (2xz + z^2)\bar{k}. \quad [6]$$

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-115**

**S.E. (Mechanical) (First Semester) EXAMINATION, 2012**

**MANUFACTURING PROCESSES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Attempt question nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8, 9 or 10, 11 or 12.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain different characteristics of moulding sand. [6]

(b) Describe 'Gating System' in casting with suitable sketch. [6]

(c) Describe the following casting defects with its causes and remedies : [4]

(i) Blow holes

(ii) Hot tears.

P.T.O.

*Or*

2. (a) Explain moisture content test with a neat diagram. [6]  
(b) Compare hot chamber and cold chamber die-casting. [6]  
(c) What are the different additives used in Moulding sand ? [4]
3. (a) Compare direct and indirect extrusion. [6]  
(b) Describe tube drawing operation with a neat diagram. [6]  
(c) Explain swaging in detail. [4]

*Or*

4. (a) Explain Machine or Upset Forging with a neat diagram. State its advantages and disadvantages. [10]  
(b) With a neat diagram explain deep drawing. [6]
5. (a) Describe SMAW principle, working and setup with suitable diagram. [10]  
(b) Describe different types of flames used in gas welding along with their applications. [8]

*Or*

6. (a) Describe GTAW principle, working and setup with suitable diagram. [10]  
(b) Write short notes on : [8]  
(i) Brazing  
(ii) Soldering.

## SECTION II

7. (a) Explain Taper turning by a Taper Attachment with a neat diagram. Give its merits and demerits. [8]
- (b) Explain the following lathe operations : [6]
- (i) Chamfering
  - (ii) Grooving
  - (iii) Knurling.
- (c) Find the time required for one complete cut on a piece of work 300 mm long and 60 mm in diameter. The cutting speed is 28 m/min; and feed is 0.05 mm/rev. [4]

*Or*

8. (a) Explain with a block diagram capstan lathe and turret lathe. [8]
- (b) Only draw block diagram of lathe machine and show the following parts on it : [6]
- (i) Tool post
  - (ii) Tailstock
  - (iii) Headstock
  - (iv) Feed box
  - (v) Bed
  - (vi) Lead screw.
- (c) Write a note on single point cutting tool. [4]

9. (a) Compare conventional milling and climb milling. [6]  
(b) Explain thread milling with single and multiple thread cutter. [6]  
(c) Write a short note on Gear Milling. [4]

*Or*

10. (a) List and describe in brief the main parts of a planer. [6]  
(b) How does VBM differ from HBM ? [6]  
(c) Write a short note on Radial Drilling Machine. [4]
11. (a) “Hard grinding wheel recommended for soft work material and Soft grinding wheel for hard material.” Comment. [6]  
(b) Write short note on truing and dressing of grinding wheels. [6]  
(c) Explain the meaning of W-C-500-H-4-V-17. [4]

*Or*

12. Write short notes on :
- (i) Polishing and Buffing [6]  
(ii) Centreless Grinders [5]  
(iii) Barrel burnishing. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—8+3

Seat No.	
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[4162]-116

**S.E. (Mechanical) (Second Semester) EXAMINATION, 2012**

**THEORY OF MACHINES—I**

**(2008 PATTERN)**

**Time : Four Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from each Section.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

**SECTION I**

**UNIT I**

1. (a) Describe the three kinds of lower pairs, giving a sketch of each kind, and state the types of relative motion that each pair permits. [6]

P.T.O.

- (b) Match the pairs by selecting most appropriate alternative from column (X) for the elements from column (Y) and write down the correctly formed pair : [4]

<b>Column (X)</b>	<b>Column (Y)</b>
<b>(Mechanisms)</b>	<b>(Its Application)</b>
(1) Scotch yoke	(a) Steam pump
(2) Crank and slotted lever	(b) Slotting machine
(3) Double crank	(c) Coupled wheel of locomotive
(4) Elliptic trammel	(d) To draw ellipse

(c) Calculate the number of degrees of freedom of the mechanism as shown in Fig. 1. [6]

Fig. 1

*Or*

2. (a) Explain with a neat sketch 'Geneva Mechanism'. [6]



(b) Fill in the blanks with correct alternative and rewrite the complete sentences : [4]

(i) Oldham's coupling is the inversion of..... .

- (a) Four bar mechanism
- (b) Crank and lever mechanism
- (c) Single slider crank mechanism
- (d) Double slider crank mechanism

(ii) .....number of pairs are associated with quaternary joint.

- (a) 1
- (b) 2
- (c) 3
- (d) 4

(iii) A combination of kinematic pairs, joined in such a way that the relative motion between the links is completely constrained, is called a..... .

- (a) Structure
- (b) Mechanism
- (c) Kinematic Chain
- (d) Inversion

- (c) What is meant by a 'steering gear mechanism' ? Why is it necessary ? Why are steering gear mechanisms seen in four-wheelers and not in two or three-wheelers ? Explain. [6]

## UNIT II

3. In the mechanism shown in Fig. 2, determine the acceleration of the slider C.  $O_1A = 100$  mm,  $AB = 105$  mm,  $O_2B = 150$  mm and  $BC = 300$  mm. Crank  $O_1A$  rotates at 180 rpm. Use relative method of finding velocity and acceleration. [16]

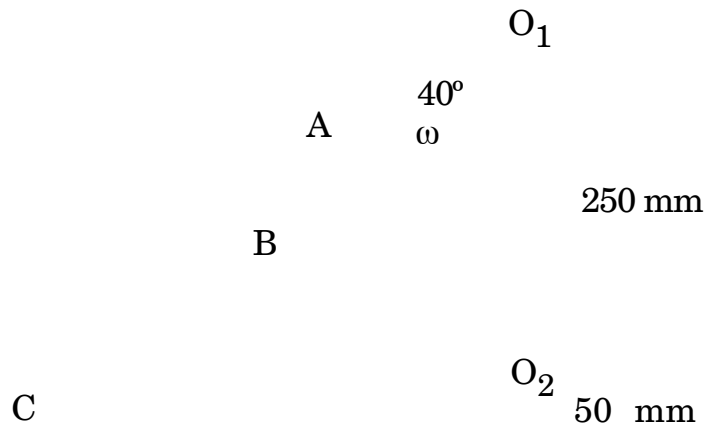


Fig. 2

*Or*

4. (a) State and explain Kennedy's theorem. [4]

- (b) For the mechanism shown in Fig. 3, the crank OA rotates at an angular speed of 10 rad/s anti-clockwise. Find the velocity of slider D. Also, determine the angular velocity of links AB, BEC and CD. Use ICR method. [12]

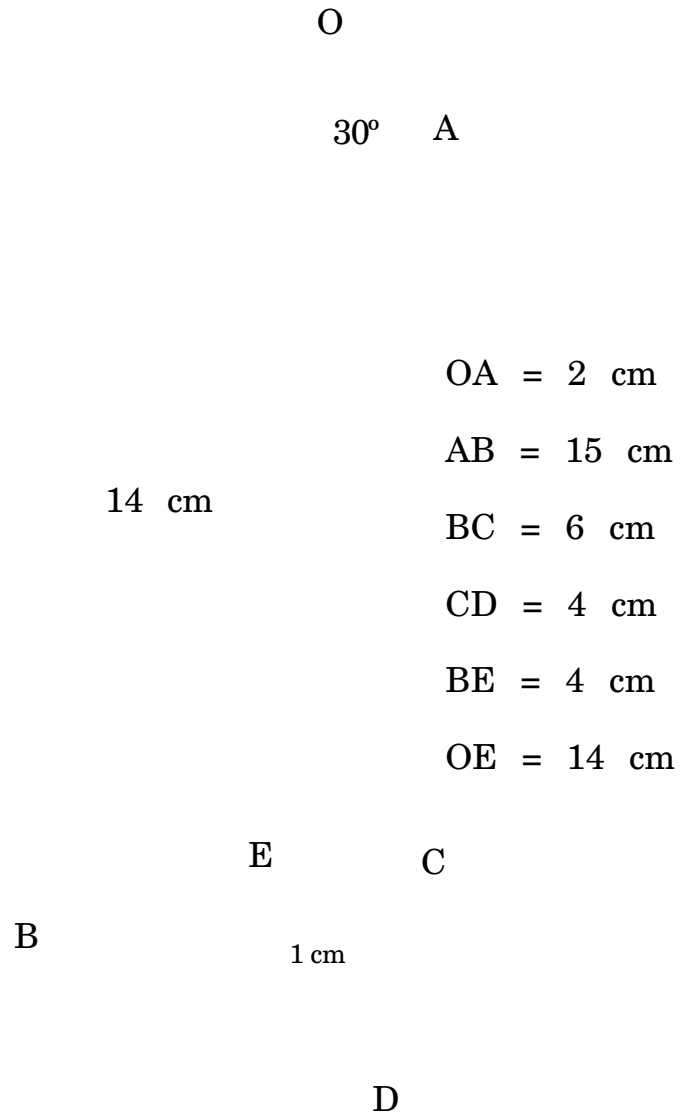


Fig. 3

### UNIT III

5. (a) What is Coriolis acceleration ? Find the magnitude and direction of this acceleration in the cases shown in Fig. 4. [4]

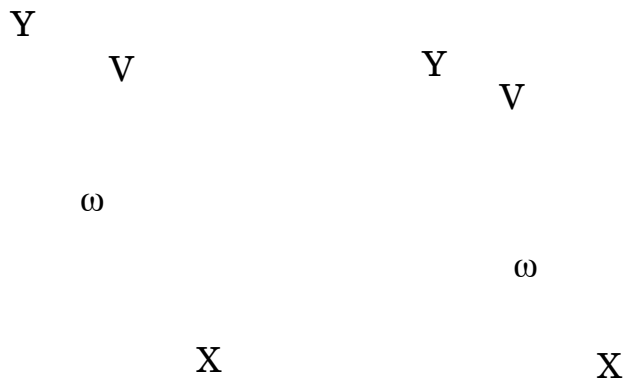


Fig. 4

- (b) The kinematic diagram of one of the cylinders of a rotary engine is shown in Fig. 5. The crank OA which is vertical and fixed, is 50 mm long. The length of the connecting rod is 125 mm. The line of the stroke OB is inclined at  $50^\circ$  to the vertical. The cylinders are rotating at a uniform speed of 300 rpm in a clockwise direction, about the fixed centre O.

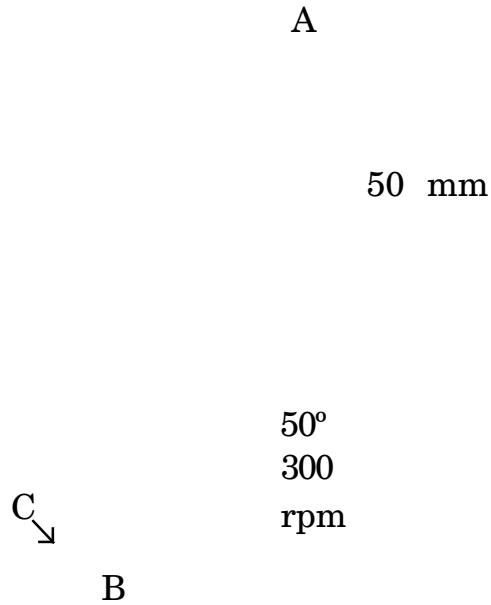


Fig. 5

Determine :

- (i) acceleration of the piston inside the cylinder
- (ii) angular acceleration of the connecting rod. [14]

*Or*

6. (a) In an I.C. mechanism, the stroke length is 40 cm and obliquity ratio is 4. The angular acceleration of the connecting rod is found to be  $54 \text{ rad/s}^2$ , when the crank makes an angle of  $45^\circ$  with the IDC, while rotating at a uniform angular speed.

Determine :

- (i) The crank speed in rpm

(ii) The acceleration of the piston

(iii) The velocity and acceleration of the mid-point of the connecting rod.

Use Klein's construction. [10]

(b) Explain Klein's construction for slider-crank mechanism when the crank rotates with non-uniform angular velocity. [8]

## SECTION II

### UNIT IV

7. (a) A slider crank mechanism with zero offset has the crank and connecting rod lengths equal to 30 mm and 150 mm respectively. The crank rotates at 600 rpm in clockwise direction using analytical method, find :

(i) The maximum velocity of slider and the corresponding crank position.

(ii) The acceleration of the slider in its extreme positions. [8]

(b) A universal coupling is used to connect two shafts whose axes intersect at  $160^\circ$ . The driving shaft rotates uniformly at 300 r.p.m. The driven shaft operates against a steady torque of 200 N-m and carries a rotor whose mass is 22 kg and a radius of gyration of 1500 mm. What is the maximum value of the torque which must be exerted by the driving shaft ? [8]

Or

8. (a) The four-bar mechanism ABCD is shown in the Fig. 6, which is driven by link 2 at  $w_2 = 45$  rad/s, counterclockwise. Find the angular velocities of links 3 and 4 by using complex number method.

$$AB = 100 \text{ mm}$$

$$CD = 300 \text{ mm}$$

$$AD = 250 \text{ mm.} \quad [10]$$

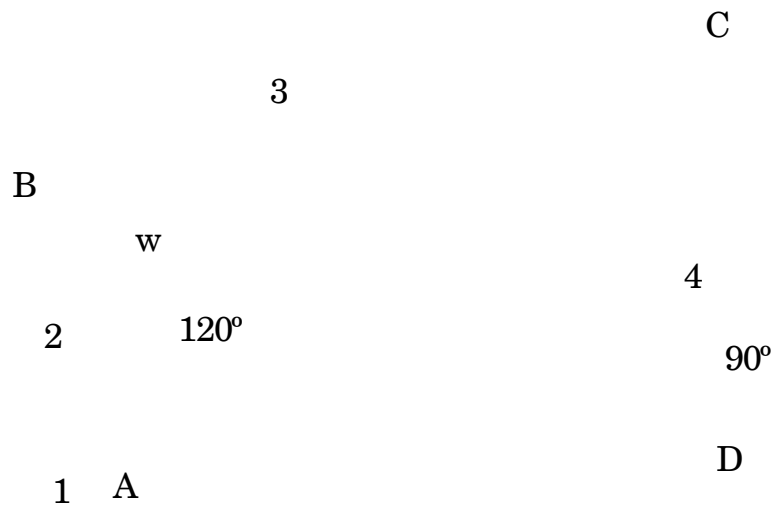


Fig. 6

- (b) Derive angular velocity of driven shaft of the Hooke's joint. [6]

### UNIT V

9. (a) Synthesize a four bar mechanism by the method of inversion. Assume the following data :
- (i) Length between fix points 10 cm.

(ii) 2-positions of the input link from the initial position  $30^\circ$  and  $60^\circ$ .

(iii) 2-positions of the output link from the initial position  $20^\circ$  and  $40^\circ$ . [8]

(b) Explain branch defect and order defect in detail. [8]

*Or*

10. (a) Determine the Chebychev spacing for function  $y = x^{1.5}$  for the range  $0 < x < 3$ , where three precision points are required. For those precision points, determine  $\theta_2$ ,  $\theta_3$  and  $\theta_2$ ,  $\theta_3$  if  $\theta_1 = 40^\circ$  and  $\theta_1 = 90^\circ$ . [10]

(b) Explain the following terms :

(i) Path Generation

(ii) Motion Generation. [6]

## UNIT VI

11. (a) With the help of diagram, derive expression for the natural frequency of "Bifilar-Suspension". [8]

(b) A connecting rod is suspended from a point 25 mm above the centre of small end, and 650 mm above its centre of gravity, its mass being 37.5 kg. When permitted to oscillate, the time period is found to be 1.87 seconds. Find the dynamical equivalent system constituted of two masses, one of which is located at the small end centre. [10]



*Or*

**12.** A vertical engine running at 1200 r.p.m. with a stroke of 110 mm has a connecting rod 250 mm between centers and mass 1.25 kg. The mass centre of the connecting rod is 75 mm from the big end centre and when suspended as pendulum from the gudgeon pin axis makes 21 complete oscillations in 20 seconds :

(i) Calculate the radius of gyration of the connecting rod about an axis through its mass centre.

(ii) When the crank is at  $40^\circ$  from the top dead centre and the piston is moving downwards, find analytically, the acceleration of the piston and the angular acceleration of the connecting rod. Hence find the inertia torque exerted on the crankshaft. To make the two-mass system to be dynamically equivalent to the connecting rod, necessary correction torque has to be applied and since the engine is vertical gravity effects are to be considered. [18]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-117**

**S.E. (Mech.) (Second Semester) EXAMINATION, 2012**

**I.C. ENGINES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer any *three* questions from each Section.
- (ii) Answers to the two Sections should be written in separate answer books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of electronic pocket calculator is allowed.
- (vi) Assume suitable data, if necessary.

### **SECTION I**

#### **Unit I**

1. (a) Draw self explanatory p-V diagrams of theoretical and actual dual cycles. [4]
- (b) “Actual thermal efficiency of an engine is much less than that of theoretical/ideal efficiency.” Justify by giving any 4 reasons. [4]

P.T.O.

- (c) In an ideal Otto cycle, compression ratio is 10. Initial pressure and temperature of air are 1 bar and 27°C. Maximum pressure in the cycle is 50 bar. For 1 kg of air flow rate, calculate the values of pressure, volume and temperature at *four* salient points of the cycle. [8]

*Or*

2. (a) Derive the expression for efficiency of standard Otto cycle. [6]
- (b) A diesel engine uses a compression ratio of 16 and at the end of compression stroke, the temperature of air is 827°C. Now the air is supplied heat energy at constant pressure by combustion of fuel having air to fuel ratio of 25. Calorific value of the fuel is 44.2 MJ/kg. Specific heat at constant volume is given as  $C_v = (0.762 + 2 \times 10^{-4} T)$  kJ/kgK, where T is in Kelvin. Find the cut-off percentage of the engine. [10]

## Unit II

3. (a) What are the drawbacks of carburettor system in S.I. engines? Explain MPFI system for gasoline engine with the help of neat diagram. [8]
- (b) A petrol engine consumes 10 kg of petrol per hour. Fuel/Air ratio is 0.06 : 1. Coefficient of discharge for the venturi is

0.8 and that for main petrol jet 0.75. Choke dia is 23 mm. Top of the jet is 6 mm above the petrol level in the float chamber. Calculate size of fuel jet of a simple carburettor. Take specific gravity of petrol as 0.75, atmospheric pressure 1 bar and air temperature 25°C. [8]

*Or*

4. (a) Higher compression ratio (CR) increases the thermal efficiency of engines, then why CR of diesel engine range (say 16 to 21) are not adopted in petrol engines ? Explain the phenomenon with the help of diagram. [8]
- (b) Write short notes on : [8]
- (i) Pre-ignition
  - (ii) Auto-ignition
  - (iii) HUCR
  - (iv) Delay period and ignition lag.

### **Unit III**

5. (a) With the help of neat  $p-\theta$  diagram, explain combustion stages in C.I. engines. [8]
- (b) What are the objectives of combustion chamber design for diesel engines ? Differentiate between DI and IDI combustion chambers. Explain any *one* swirl combustion chamber with a diagram. [10]

*Or*

- 6.** (a) “Gasoline engines are generally not supercharged but C.I. engines are supercharged.” Justify. Explain general turbo charging system of an engine with the help of neat diagram. [8]
- (b) Draw the labelled layout of fuel system in C.I. engine. Explain the working of Bosch Fuel Pump (Jerk type individual pump) with the help of diagram. [10]

## **SECTION II**

### **Unit IV**

- 7.** (a) List down various parts of battery ignition system and explain it briefly with neat sketch. [8]
- (b) Compare between air cooling system and water cooling system. [4]
- (c) Explain briefly overhead valve mechanism. [4]

*Or*

- 8.** (a) Explain with neat sketch dry sump lubrication system. [8]
- (b) Write a note on electric arrangement of engine starting system. [4]
- (c) Write advantages of electronic ignition system over conventional ignition system. [4]

## Unit V

9. (a) In a test of an oil engine under full load condition, the following results were obtained : [12]

Indicated power = 33 kW

Brake power = 27 kW

Fuel used = 8 kg/h

Rate of flow of water through gas calorimeter = 12 kg/min

Cooling water flow rate = 7 kg/min

Calorific value of fuel = 43 MJ/kg

Inlet temperature of cooling water = 15°C

Outlet temperature of cooling water = 75°C

Inlet temperature of water to exhaust gas calorimeter = 15°C

Outlet temperature of water to exhaust gas calorimeter = 55°C

Final temperature of the exhaust gases = 80°C after calorimeter

Room temperature = 17°C

Air-fuel ratio on mass basis = 20

Mean specific heat of exhaust gas = 1 kJ/kgK

Specific heat of water = 4.18 kJ/kgK.

Draw up a heat balance sheet on kJ/min basis and estimate the brake thermal and mechanical efficiencies.

- (b) Explain Willan's line method and give out its limitations. [4]

*Or*

10. (a) An eight cylinder, four stroke engine of 0.09 m bore and 0.08 stroke with a compression ratio of 7 is tested at 4500 r.p.m. on a dynamometer which has 0.54 m arm. During 10 min test the dynamometer scale beam reading was 42 kg and the engine consumed 4.4 kg of gasoline having calorific value of 44000 kJ/kg. Air 27°C and 1 bar was supplied to the carburettor at the rate of 6 kg/min. Take  $R = 287 \text{ J/kgK}$ . [12]

Find :

- (i) the brake power delivered
  - (ii) the brake mean effective pressure
  - (iii) the brake specific fuel consumption
  - (iv) the brake thermal efficiency
  - (v) the volumetric efficiency
  - (vi) the air-fuel ratio.
- (b) Explain air box method for air consumption measurement. [4]

## Unit VI

11. (a) Explain catalytic converter used in S.I. engines. [6]  
(b) Discuss various types of exhaust emissions from C.I engine. [6]  
(c) Explain Octane No. and Cetane No. [6]

*Or*

12. (a) State and explain the concept of hybrid vehicle. [6]  
(b) Discuss with neat sketch exhaust gas recirculation. [6]  
(c) Explain in detail factors affecting formation of Nox. [6]



Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-118**

**SE. (Mech./Prod.) (Second Semester) EXAMINATION, 2012**

**(Common to Mech. S/W and Produ./Industrial)**

**ELECTRICAL TECHNOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answers to the two sections should be written in separate answer-books.

(ii) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(iii) Figures to the right indicate full marks.

(iv) Use of non-programmable pocket size scientific calculator is permitted.

(v) Neat diagrams must be drawn wherever necessary.

(vi) Assume suitable data, if necessary.

### **SECTION I**

1. (a) With neat circuit diagram explain how two wattmeters can be used to measure total active power consumed by three-phase balanced load. [8]

P.T.O.

- (b) Why is power factor improvement necessary ? How can it be done ? Explain any *one* method used for p.f. improvement. [8]

*Or*

2. (a) Three identical coils, each having resistance of 10 ohms and inductance of 0.0318 H are connected in (i) Star and (ii) Delta across three-phase 400 V, 50 Hz supply. Find in each case the readings in two wattmeters connected to measure power consumed. [10]

- (b) With neat diagram explain use of C.T. and P.T. for measurement of power in single phase system. [6]

3. (a) Derive the equation for torque developed by the three-phase induction motor.

Sketch the Torque-slip characteristic and show on it effect of variation in Rotor resistance. [10]

- (b) A three-phase, 4 pole 75 kW, 600 V, 60 Hz induction motor runs at 1763 rpm on full load. The stator losses are 5 kW and mechanical losses are 1.2 kW. Calculate :

(i) Rotor Cu. loss per phase

(ii) Mechanical power developed, and

(iii) Efficiency of motor. [8]

*Or*

4. Write short notes on any *three* :
- (i) Equivalent circuit of single phase transformer
  - (ii) Three-phase transformer connections
  - (iii) Auto transformer starter
  - (iv) Typical layout of a distribution transformer substation. [18]
5. (a) Derive from first principle emf generated by three-phase Alternator. Also state effect of coil span factor and distribution factor on it. [8]
- (b) With neat diagram explain working of shaded pole type induction motor and state its applications. [8]

*Or*

6. (a) Compare the salient pole and non-salient pole type synchronous generator. [6]
- (b) A 3-phase, 16 pole alternator has a star-connected winding with 144 slots and 10 conductors per slot. The flux per pole is 0.03 Wb sinusoidally distributed and speed is 375 rpm. Find the phase and line value of induced e.m.f. Assume  $K_c = 1$ . [6]
- (c) State applications of :
- (i) Split phase induction motor and
  - (ii) Capacitor start capacitor run induction motor. [4]

## SECTION II

7. (a) Draw and explain the torque armature current and speed armature current char. of D.C. shunt and series motor. [8]
- (b) A 250 V D.C. shunt motor has armature resistance of 0.5 ohm and shunt field resistance of 125 ohm. It drives a load at 1000 rpm and takes current of 25 Amp. Calculate the speed of the motor, if a resistance of 25 ohm is added in series with field circuit and load torque remains constant. [10]

*Or*

8. (a) State necessity of starter for D.C. shunt motor and with neat diagram explain the working of Three Point starter. [10]
- (b) With circuit diagram, explain working of universal motor and state its applications. [8]
9. (a) Draw and explain V-I characteristic of SCR. Show on the char. forward and reverse conduction regions. [8]
- (b) Explain construction and working of GTO. Sketch its characteristic and state its applications. [8]

*Or*

- 10.** (a) Explain construction and working of DIAC. Sketch its characteristic and state its applications. [8]
- (b) Sketch and explain switching characteristic of MOSFET and state its applications. [8]
- 11.** (a) State advantages of electrical drives and state disadvantages of group drive. [8]
- (b) With neat sketch explain working of class E choppers. [8]

*Or*

- 12.** (a) With neat circuit diagram explain v/f speed control method for three-phase induction motor. [8]
- (b) State *two* applications each of the following industrial motors/drives :
- (i) D. C. series motor
- (ii) Squirrel cage induction motor
- (iii) Three-phase synchronous motor
- (iv) Single phase shaded pole motor. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—15

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[4162]-119

**S.E. (Mechanical) EXAMINATION, 2012**

**(Common to Mech. S/W Sem. I and Mech. Branch Sem. II)**

**STRENGTH OF MACHINE ELEMENTS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

**UNIT I**

1. (a) A uniform rod of cross-sectional area 'A', length 'L' is held vertically and fixed at top. Derive expression for strain energy due to self-weight. Assume Young's modulus of elasticity 'E' and mass density ' $\rho$ '. [6]

P.T.O.

- (b) In a tensile test on steel tube of external diameter 18 mm and internal diameter 12 mm, an axial pull of 2 kN produces stretch of  $6.72 \times 10^{-3}$  mm in a length of 100 mm and lateral contraction of  $3.62 \times 10^{-4}$  mm in a outer diameter. Calculate the values of three Moduli and Poisson's ratio of material. [6]
- (c) A three bar assembly shown in Fig. 1 supports vertical load 'P'. Bars AB and BD are identical, each of length 'L' and cross-sectional area 'A<sub>1</sub>'. Vertical rod BC is also of length 'L' but having area 'A<sub>2</sub>'. All bars are having same modulus of elasticity 'E' and pinned at A, B, C and D. Determine axial force in each rod. [6]

Fig. 1

*Or*

2. (a) A vertical steel bar ABC is pin supported at its upper end as shown in Fig. 2 and loaded by 10 kN force at its lower end. A horizontal beam BDE is pinned to vertical bar at point 'B' and supported at point 'D'. Beam carries load of 25 kN at end 'E'. 'AB' is having length 500 mm and c/s area  $160 \text{ mm}^2$ . BC has length 750 mm and c/s area  $100 \text{ mm}^2$ . Modulus of elasticity E is 200 GPa. Calculate vertical displacement of point 'C' neglecting weight of bar and beam. [6]

Fig. 2



- (b) A hollow steel tube of 75 mm diameter and 2.5 mm thickness encloses centrally a solid copper bar of 40 mm diameter. The bar and tube are rigidly connected together at ends at 25°C. Find stresses in each metal when heated to 165°C. Also find increase in length if original length of assembly is 325 mm. Take :

$$\alpha_s = 1.08 \times 10^{-5} \text{ per } ^\circ\text{C}$$

$$E_s = 200 \text{ GPa}$$

$$\alpha_c = 1.7 \times 10^{-5} \text{ per } ^\circ\text{C}$$

$$E_c = 100 \text{ GPa.} \quad [6]$$

- (c) A composite bar is subjected to forces as shown in Fig. 3. Small end diameter of tapering bar and big end diameter are 12.5 mm and 40 mm respectively. Determine magnitude of force P such that net deformation in the bar does not exceed 1.5 mm. Take :

$$E_{\text{steel}} = 200 \text{ GPa, } E_{\text{Al}} = 70 \text{ GPa.} \quad [6]$$

Fig. 3

## UNIT II

3. (a) The overhanging beam is loaded as shown in Fig. 4. Draw shear force and bending moment diagram. Indicate all important points on diagram and find point of contraflexure if any. [8]

Fig. 4

- (b) Determine slope at point 'C' and deflection at points 'C' and 'D' for the beam as shown in Fig. 5. Take  $EI = 4 \times 10^4 \text{ kN-m}^2$ . [8]

⊥

Fig. 5

*Or*

4. (a) Derive expression for slope and deflection at free end of cantilever beam of length 'L', carrying UVI as shown in Fig. 6. [6]

Fig. 6

- (b) Shear force diagram for beam is as shown in Fig. 7. Identify location and nature of support. Draw loading and bending moment diagram indicating all important points. Also indicate point of contraflexure if any. [10]

Fig. 7

6

### UNIT III

5. (a) An element in plane stress is subjected to stresses as shown in Fig. 8. Determine principal stresses and show them on sketch of properly oriented element. Determine maximum shear stress and show them on properly oriented element. [8]

84 MPa

$$\tau_{xy} = 32 \text{ MPa}$$

30 MPa

Fig. 8

- (b) Stresses induced at critical point in a m/c component made of steel are as follows :

$$\sigma_x = 120 \text{ MPa}$$

$$\sigma_y = -40 \text{ N/mm}^2$$

$$\tau_{xy} = 80 \text{ N/mm}^2.$$

Calculate factor of safety by :

- (1) Max. Shear stress theory
- (2) Max. Normal stress theory
- (3) Max. Distortion energy theory.

Take  $S_{yt} = 380 \text{ N/mm}^2$ . [8]

*Or*

**6.** (a) At a point in strained material, stress pattern is as shown in Fig. 9 by using Mohr's circle, determine :

- (1) Normal and shear stresses on plane AC as shown in figure.
- (2) Magnitude and nature of principal stresses.
- (3) Orientation of principal planes.
- (4) Max. shear stress. [8]

$50 \text{ N/mm}^2$

Fig. 9

- (b) Explain Maximum strain energy theory and Maximum distortion energy theory. [6]
- (c) Define principal plane and principal stress. [2]

## SECTION II

### UNIT IV

7. (a) Derive the expression for shear stress induced at a distance 'Y' from neutral axis in the cross-section of a beam subjected to shear force. [6]
- (b) A simply supported beam with overhang is loaded with point load as shown in Fig. 10. The cross-section of beam is I-section. The allowable bending stresses in tension and compression are  $\sigma_t = 150$  MPa and  $\sigma_c = 100$  MPa. Find the safe load 'w' on the overhang. [10]

Fig. 10

*Or*

8. (a) A simply supported beam carries an udl of 25 kN/m over the entire span. The cross-section of the beam is as shown in Fig. 11. If the maximum bending stress is 60 MPa, find the span of the beam. Also find the maximum shear stress developed in the section. Draw the shear stress distribution diagram. [8]

Fig. 11

(b) The cross-section of beam is as shown in Fig. 12. Determine maximum tensile and compressive stresses when the beam is subjected to udl of 2 kN/m and length of span is 3 m for :

(i) cantilever

(ii) simply supported.

The beam resists bending moment about neutral horizontal axis. [8]

Fig. 12



## UNIT V

9. (a) Bar ABC fixed at both ends consist of solid circular portion AB and hollow circular portion BC as shown in Fig. 13. Derive  $(a/L)$  ratio for which reactive torque at A and C are of equal magnitude. [4]

Fig. 13

- (b) A composite shaft consists of a steel rod of 60 mm diameter surrounded by a closely fitting tube of brass. Find the outside diameter of the brass tube, when a torque of 1 kN-m is applied on the composite shaft and shared equally by the two material. Take  $G_{st} = 84$  GPa and  $G_{br} = 42$  GPa. Also determine the common angle of twist in a length of 4 m. [6]

- (c) Derive Euler's formulae for buckling load for column with hinged ends. [6]

*Or*

10. (a) A solid steel shaft is subjected to a torque of 45 kN-m. If the angle of twist is  $0.5^\circ$  per meter length of shaft and shear stress is not to exceed  $90 \text{ N/mm}^2$ , find :

- (i) Suitable diameter of shaft.  
(ii) Final maximum shear stress and angle of twist for the diameter of shaft selected.  
(iii) Maximum shear strain in shaft.

Take modulus of rigidity as 80 GPa. [8]

- (b) Compare the crippling load given by Euler's and Rankine's formula for a tubular steel strut 2.3 m long having external diameter is 38 mm and internal diameter is 33 mm. Strut is fixed at one end and hinged at other end. Take  $\sigma_c = 335 \text{ MPa}$ ,  $E = 205 \text{ GPa}$ ,  $a = 1/7500$ . [8]

## UNIT VI

11. (a) Explain the term 'product life cycle'. [4]
- (b) Explain various steps in the process of designing a machine component. [6]
- (c) A bracket shown in Fig. 14 is subjected to a pull of 5 kN acting at an angle of  $45^\circ$  to vertical. The bracket has a rectangular section whose depth is two times its thickness. If the permissible tensile stress is  $55 \text{ N/mm}^2$ , determine the cross-section of the bracket. [8]

Fig. 14

*Or*

- 12.** (a) Design a cotter joint to transmit a load of 90 kN in tension or compression. Assume the following stresses for socket, spigot and cotter. Assume thickness of cotter is 40% of rod diameter :

Allowable tensile stress = 90 MPa

Allowable crushing stress = 120 MPa

Allowable shear stress = 60 MPa. [10]

- (b) Explain the term design synthesis. [4]
- (c) Explain briefly the consideration of energy requirement. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—7

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**[4162]-120**

**S.E. (Mech.) (Second Semester) EXAMINATION, 2012**

**PRODUCTION TECHNOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) In orthogonal cutting if the feed is 1.25 mm/rev. and chip thickness after cutting is 2 mm, determine the following :

(i) Chip thickness ratio

(ii) Shear angle (for rake angle  $10^\circ$ ). [6]

(b) In a certain tool test, a single point cutting tool had a life of 10 minutes when operating at 240 m/min. At what speed should the tool have to be operated in order to have a tool life of 3 hours ? Assume  $n = 0.2$ . [6]

P.T.O.

- (c) What are the functions of cutting fluid ? Name the various types of cutting fluid. [6]

*Or*

2. (a) How do you define cutting speed and feed ? State various factors that may be considered to fix cutting speed and feed. [4]
- (b) Prove the relation between chip thickness ratio ( $r$ ), rake angle ( $\alpha$ ) and shear angle ( $\phi$ ). [6]
- (c) In orthogonal cutting operation, the following observations are obtained : [8]

(i) Cutting speed : 120 m/min

(ii) Rake angle :  $10^\circ$

(iii) Thrust force : 227 N

(iv) Uncut chip thickness : 0.127 mm

(v) Chip thickness : 0.228 mm

(vi) Width of cut : 6.35 mm

(vii) Cutting force : 567 N

Calculate shear angle, friction angle, shear stress along the shear plane, chip velocity, shear strain, cutting power.

3. (a) Describe with neat sketch gear hobbing process. [6]  
(b) Draw and explain broach tool geometry. [5]  
(c) Explain thread rolling process with neat sketch. [5]

*Or*

4. (a) Explain the various types of broaching methods. [8]  
(b) What is a thread chaser ? Briefly describe it. [4]  
(c) Explain any *two* gear finishing process. [4]
5. (a) Write short notes on (any *two*) : [8]

(i) FMS

(ii) DNC

(iii) Machining centre.

- (b) Explain the meaning of every word written in the following programming line :

G01 G94 X30 Z-16 M03 T01 F60. [6]

- (c) What are the advantages of CNC over NC ? [2]

*Or*

6. (a) Explain the classification of NC system according to tool positioning with suitable example. [6]

- (b) Explain the following codes : [6]
- (i) G00
  - (ii) G91
  - (iii) M05
  - (iv) M09
  - (v) G92
  - (vi) M00
- (c) Explain ATC with neat sketch. [4]

## SECTION II

7. (a) Write short notes on (any *two*) : [10]
- (i) PAM
  - (ii) ECM
  - (iii) USM.
- (b) What is LASER ? Explain how LASER is used to machine the parts. [6]

*Or*

8. (a) Explain the working principle of AJM. List common abrasive used in AJM. Discuss various parameters affecting the process. [8]



- (b) Explain with neat sketch EDM process. State its advantages, limitations and applications. [8]
9. (a) Find Centre of pressure of the given figure. [8]

(All dimensions are in mm)

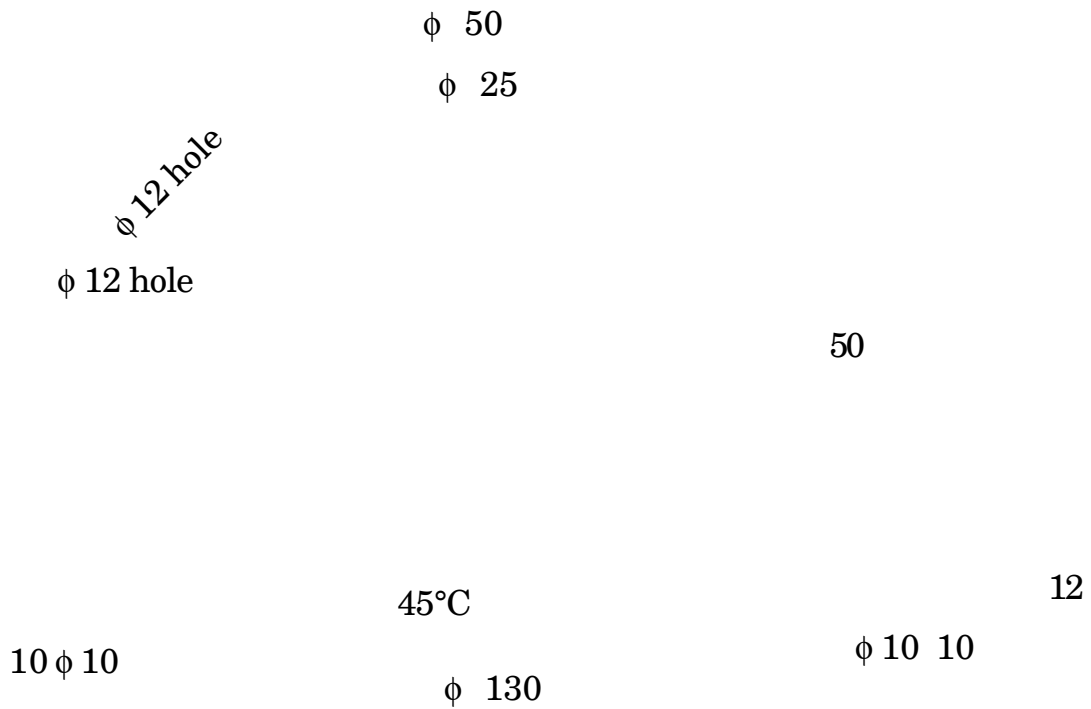
- (b) Write short notes on (any *two*) : [10]
- (i) Strip layout
  - (ii) Methods of reducing cutting forces
  - (iii) Types of dies used in sheet metal work.

*Or*

- 10.** (a) Draw the neat sketch of progressive die and combination die. [8]
- (b) Estimate the blanking force to cut a blank of 25 mm wide and 30 mm long from a 1.5 mm thick metal strip, if the ultimate shear stress of the material is  $450 \text{ N/mm}^2$ . Also determine the work done if the percentage penetration is 25% of the material thickness. [4]
- (c) Find the total pressure, dimensions of tools to produce a washer 5 cm. Outside diameter, with a 2.5 cm diameter hole, from material 4 mm thick, having a shear strength of  $360 \text{ N/mm}^2$ . Assume clearance as 10% of stock thickness. [6]
- 11.** (a) State various types of clamping devices used in jig and fixture. Explain any *one* in detail. [8]
- (b) List out various types of jig and fixtures. Explain any *one* with neat sketch. [8]

Or

12. (a) Explain with figure the restricted motions of work-piece by 3-2-1 principle of Location. [6]
- (b) Design and draw drilling jig to drill the  $\phi$  12 hole as shown in figure below. [10]



(All dimensions are in mm)

Total No. of Questions—12]

[Total No. of Printed Pages—8+1

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[4162]-121

**S.E. (Mechanical Sandwich) (First Semester) EXAMINATION, 2012**

**THERMAL ENGINEERING-I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from each Section.
- (ii) Answer to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Derive characteristic equation of gas. What are characteristic gas constant and universal gas constant ? Give their S.I. unit values. [8]
- (b) 5 kg of air is compressed in a reversible steady flow polytropic process from 100 kPa and 40°C to 1000 kPa and during this

P.T.O.

process the law followed by the gas is  $PV^{1.25} = \text{constant}$ . Determine the shaft work, heat transferred and the change in entropy.

$$C_v = 0.717 \text{ kJ/kg}^\circ\text{K}, R = 0.287 \text{ kJ/kg}^\circ\text{K}. \quad [8]$$

*Or*

- 2.** (a) Give the *two* statements of Second Law of Thermodynamics. Hence explain the concept of heat engine and heat pump. [4]
- (b) Explain the concept of available, unavailable energy and irreversibility using Carnot cycle. [4]
- (c) Steam is supplied to a fully loaded 1100 kW turbine at 15 bar with an internal energy of 2935 kJ/kg and specific volume of 0.16 m<sup>3</sup>/kg and velocity of 110 m/sec. Exhaust takes place at 0.05 bar with internal energy of 1885 kJ/kg and specific volume equal to 26 m<sup>3</sup>/kg and velocity of 300 m/sec. Heat loss from the steam in the turbine is 21 kJ/kg. Potential energy change is negligible. Determine :
- (i) shaft work output per kg and
- (ii) steam flow rate in kg/hr. [8]
- 3.** (a) What are boiler mountings and accessories ? Explain in detail. [8]

- (b) What are high pressure boilers ? Explain construction and working of LaMont boiler. [8]

*Or*

4. (a) Give the detailed classification of boilers. [4]

- (b) The following data were obtained during a trial on a steam boiler fired with natural draught :

Feed water temperature 71°C

Feed water supplied per hr. 4500 kg

Steam pressure (gauge) 10 bar (gauge)

Barometer reading 750 mm of Hg

Throttling calorimeter readings :

(i) Pressure of steam after throttling (gauge) 15.5 mm of Hg

(ii) Temperature of steam after throttling 104°C

(iii) Assume sp. heat of superheated steam after throttling in calorimeter 2 kJ/kg°K

Coal fired per hour 400 kg

Higher calorific value of coal 39350 kJ/kg

Moisture in fuel 4.25% by mass

Temperature of flue gases discharged 275°C

Boiler house temperature 25°C

Analysis of dry coal by mass was as follows :

C—89%, H<sub>2</sub>—3%, Ash—4% and other volatile matter—4%.

The analysis of flue gas by volume was as follows :

CO<sub>2</sub>—10.9%, CO—1.1%, O<sub>2</sub>—7% and N<sub>2</sub>—81%.

Assume the specific heat of dry flue gases as 0.963 kJ/kg°K and specific heat of superheated steam in products of combustion 2 kJ/kg°K. Draw up the heat balance for the boiler per kg of coal fired. What is the thermal efficiency of the boiler ? Also find the quality of steam generated. [12]

5. (a) Write a short note on Mollier diagram. [6]
- (b) Explain the method of finding dryness fraction of steam using combined separating and throttling calorimeter and discuss its limitations. [6]
- (c) Rankine cycle steam leaves the boiler and enters turbine at 4 MPa (40 bar) and 400°C. The condenser pressure is 10 kPa (0.1 bar). Determine the Rankine cycle efficiency and the Carnot efficiency for the same temperature limits. [6]

*Or*

6. (a) Discuss the effect of boiler and condenser pressure on Rankine cycle. [6]

- (b) Compare Carnot and Rankine Cycle. [6]
- (c) Find the enthalpy, internal energy and entropy of 1 kg of steam at a pressure of 10 bar :
- (i) when steam is dry saturated
- (ii) when steam is 0.75 dry
- (iii) when steam is superheated to 250°C.

Use steam tables and neglect volume of water. [6]

## SECTION II

7. (a) Explain the determination of the calorific value of fuel by Boy's gas calorimeter. [8]
- (b) A sample of dry anthracite (coal) has the following compositions by mass :
- C = 90%, H<sub>2</sub> = 3% , O<sub>2</sub> = 2.5%, N<sub>2</sub> = 1%, S = 0.05%, Ash = 3%, calculate :
- (i) Stoichiometric A/F ratio;
- (ii) A/F ratio and dry and wet analysis of the product of combustion by mass and by volume when 20% excess air is supplied. [8]



Or

8. (a) Define the following :
- (i) Flash point
  - (ii) Fire point
  - (iii) Higher calorific value of fuel
  - (iv) Viscosity index. [4]
- (b) What are the alternative fuels used in I.C. Engine ? [4]
- (c) A gas consists of 14.2% CH<sub>4</sub>, 5.9% CO<sub>2</sub>, 36% CO, 40.5% H<sub>2</sub>, 0.5% O<sub>2</sub> and 2.9% N<sub>2</sub>. Determine the stoichiometric volume of air required for complete combustion of 1 m<sup>3</sup> of this gas and also the products of combustion both in m<sup>3</sup>/m<sup>3</sup> of gas and as a percentage. [8]
9. (a) Compare Otto, Diesel and Dual cycle for :
- (i) Same compression ratio and same heat input;
  - (ii) Same maximum pressure and temperature. [8]
- (b) An oil engine with 20 cm cylinder diameter and 30 cm stroke works on theoretical Diesel cycle. The initial pressure and temperature of the air used are 1 bar and 30°C. The cut-off is 10% of the stroke. Find the following :
- (i) Pressure and temperature at all salient points;

- (ii) Theoretical air standard efficiency;
- (iii) Mean effective pressure;
- (iv) The power developed by the engine if the working cycles per minute are 400.

Assume the compression ratio is 16 and working fluid is air. [8]

*Or*

10. (a) Derive an expression for the air standard efficiency of Diesel Cycle. [6]

(b) An air standard Dual cycle has a compression ratio of 16 and compression begins at 1 bar, 50°C. The maximum pressure is 70 bar. The heat transferred to air at constant pressure is equal to that at constant volume. Calculate :

(i) The pressure and temperature at the cardinal points of the cycle.

(ii) Cycle efficiency;

(iii) Mean effective pressure of the cycle.

Take  $C_v = 0.718$  kJ/kgK,  $C_p = 1.005$  kJ/kgK. [10]

11. (a) Derive an expression for the volumetric efficiency of a reciprocating compressor in terms of clearance ratio, pressure ratio and index of compression. [6]
- (b) Why are multistage compressors preferred over single stage? Explain in detail with P-V diagram. [4]
- (c) A single stage double acting air compressor is required to deal with  $15 \text{ m}^3/\text{min}$ . of air measured at ambient conditions of 1 bar and  $17^\circ\text{C}$ . The pressure and the temperature at the end of suction are 0.95 bar and  $27^\circ\text{C}$  and the delivery pressure is 6.75 bar. The speed of compressor is 480 rpm. Assuming a clearance volume of 6% of the stroke volume and the law of compression and expansion to be  $PV^{1.3} = \text{const}$ . Calculate the volumetric efficiency referred to ambient condition, the stroke volume and indicated power of the compressor. Assume  $R = 300 \text{ Nm/kgK}$ . [8]

*Or*

12. (a) Prove that volumetric efficiency of an air compressor is given by :

$$\eta_{\text{vol}} = 1 + C - C \left( \frac{P_2}{P_1} \right)^{1/n}$$

with usual notations. [6]

(b) Explain in brief : [4]

(i) Isothermal efficiency

(ii) F.A.D.

(c) A two stage single acting reciprocating air compressor takes in air at 1 bar and 300 K. Air is delivered at 15 bar. The intermediate pressure is ideal and intercooling is perfect. The law for compression is  $PV^{1.25} = \text{const}$ . The rate of discharge is 10 kg/min. Find :

(i) Power required to drive the compressor

(ii) Saving in work as compared with single stage

(iii)  $\eta_{\text{iso}}$  for multistage and single stage

(iv) Heat rejected in intercooler.

Take  $R = 0.287 \text{ kJ/kgK}$ ,  $C_p = 1.005 \text{ kJ/kgK}$ . [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

<b>Seat No.</b>	
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**[4162]-122**

**S.E. (Mechanical S/W) (Second Semester) EXAMINATION, 2012**

**THEORY OF MACHINE AND MACHINE DESIGN—I**

**(2008 PATTERN)**

**Time : Four Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from each Section
- (ii) Answer *three* questions from Section I and *three* questions from Section II.
- (iii) Answers to the two sections should be written in separate answer-books.
- (iv) Neat diagrams must be drawn wherever necessary.
- (v) Figures to the right indicate full marks.
- (vi) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vii) Assume suitable data, if necessary.

**SECTION I**

**UNIT I**

1. (a) Define the following terms : [4]
- (i) Kinematic chain
- (ii) Mechanism
- (iii) Inversion
- (iv) Mobility.

P.T.O.

- (b) Define the kinematic pair and give its classification. [6]  
(c) Explain Whithworth quick return mechanism with neat sketch. [6]

*Or*

2. (a) What is Grubler's and Kutrbach criteria ? Explain. [6]  
(b) Explain pantograph with neat sketch and give its application. [4]  
(c) Derive the equation of maximum and minimum speeds of output shaft. [6]

## UNIT II

3. (a) Write a note on 'Loop-closure equation'. [6]  
(b) The dimensions of the toggle mechanism in which the crank 'OA' rotates at 120 r.p.m. are as given below in Fig. 1, find the velocity and acceleration of the slider 'D', also find angular velocity and angular acceleration of link 'BD'. [12]

$$OA = 40 \text{ mm}$$

$$AB = 90 \text{ mm}$$

$$QB = 120 \text{ mm}$$

$$BD = 135 \text{ mm}$$

Fig. 1

*Or*

4. (a) Define ICR and state and prove Kennedy's theorem. [6]
- (b) In the mechanism shown in Fig. 2, the crank OA drives the sliders B and D in straight paths through connecting links 'AB' and 'CD'. The length of the links are 'OA' = 150 mm, AB = 300 mm, AC = 100 mm, CD = 450 mm. 'OA' rotates at 60 rpm anticlockwise and at the instant has angular acceleration of  $16 \text{ rad/s}^2$ . Determine :
- (i) The velocity and acceleration of sliders 'B' and 'D' and
- (ii) The angular velocity and angular acceleration of link CD. [12]

Fig. 2

### UNIT III

5. (a) In a slider crank mechanism, the crank is 250 mm long and connecting rod 1000 mm long. Find analytically :
- (i) the velocity and acceleration of piston
  - (ii) angular velocity and acceleration of connecting rod when the crank is turned through  $45^\circ$  from IDC. The angular velocity of crank is 30 rad/s and is increasing at rate of  $15 \text{ rad/s}^2$  every second. [6]
- (b) Derive formula for velocity of slider analytically for single slider crank mechanism. [6]
- (c) Explain the method of bifilar suspension to find out radius of gyration of rigid body and hence the MMI. [6]

*Or*

6. (a) The crank and connecting rod of steam engine are 0.3 m and 1.5 m in length. The crank rotates at 250 r.p.m. in clockwise direction. Determine velocity and acceleration of piston when the crank is  $50^\circ$  from IDC. Also find the position of crank for zero acceleration of the piston. [6]
- (b) Explain the terms 'dynamically equivalent system' and 'correction couple'. [4]



- (c) In slider crank mechanism, the crank is 200 mm long and connecting rod 800 mm long. The piston is of 80 mm in diameter and gas pressure acting on the piston is 6 MPa. When the crank has moved thro'  $45^\circ$  from IDC. Find :
- (i) Thrust in connecting rod
  - (ii) Piston side thrust
  - (iii) Torque acting on crankshaft and
  - (iv) Radial load. [8]

## SECTION II

### UNIT IV

7. (a) Determine the size of the welds, for the eccentrically loaded member, shown in Fig. 3. The permissible normal stress for the weld material is 75 MPa. [8]

Fig 3

- (b) Explain with neat sketches, design of rigid flange coupling. [8]

*Or*

8. (a) A line shaft supporting two pulleys A and B is as shown in Fig. 4. Power is supplied to the shaft by means of a vertical belt on the pulley A, which is then transmitted to the pulley B carrying a horizontal belt. The ratio of belt tension on tight and loose sides is 3 : 1. The limiting value of tension in the belts is 2.7 kN. The shaft is made of plain carbon steel 40C 8 ( $S_{ut} = 650 \text{ N/mm}^2$ ) and ( $S_{yt} = 380 \text{ N/mm}^2$ ). The pulleys are keyed to the shaft. Determine the diameter of the shaft according to the ASME code, if :

$$k_b = 1.5 \text{ and } k_t = 1.0. \quad [10]$$

Fig. 4

- (b) Give the classification of keys and explain the procedure of designing key. [6]

### UNIT V

9. (a) The lead screw of a lathe has single start ISO metric trapezoidal threads of 50 mm nominal diameter and 8 mm pitch. The screw is required to exert an axial force of 2 kN in order

to drive the tool carriage during turning operation. The thrust is carried on a collar of 100 mm outer diameter and 60 mm inner diameter. The values of coefficient of friction at the screw threads and the collar are 0.15 and 0.12 respectively. The lead screw rotates at 30 rpm. Calculate :

(i) The power required to drive the lead screw and

(ii) The efficiency of the screw. [6]

(b) A helical compression spring made of circular wire, is subjected to an axial force, which varies from 2.5 kN to 3.5 kN. Over this range of force the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of patented  $f$  cold-drawn steel wire with ultimate tensile strength of  $1050 \text{ N/mm}^2$  and modulus of rigidity of  $81370 \text{ N/mm}^2$ . The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate :

(i) Wire diameter

(ii) Mean coil diameter

(iii) No. of active coils

(iv) Total number of coils

(v) Solid length of the spring

- (vi) Free length of the spring
- (vii) Required spring rate and
- (viii) Actual spring rate.

(Assume there will be a gap of 0.5 mm between the consecutive coils, when the spring is subjected to the maximum force of 3.5 kN) [10]

*Or*

- 10.** (a) A differential screw jack is to be made as shown in Fig. 5. Neither screw rotates. The outside screw diameter is 50 mm. The screw threads are of square form single start and coefficient of thread friction is 0.15. Determine :
- (i) Efficiency of the screw jack.
  - (ii) Load that can be lifted if the shear stress in the body of the screw is limited to 28 MPa. [10]

Fig. 5 : Differential Screw

- (b) A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity  $84 \text{ kN/mm}^2$ , find the axial load which the spring can carry and the deflection per active turn. [6]

## UNIT VI

11. (a) Define :
- (i) Coefficient of fluctuation of speed
  - (ii) Coefficient of fluctuation of energy. [4]
- (b) What are the advantages and disadvantages of V-belt drive over flat belt drive. [4]
- (c) Design a belt drive to transmit 110 kW for a system consisting of two pulleys of diameters 0.9 m and 1.2 m as shown in Fig. 6, centre distance of 3.6 m, a belt speed 20 m/s coefficient of friction 0.3 slip of 1.2% at each pulley and 5% friction loss at each shaft, 20% overload. [10]

Fig. 6

*Or*

- 12.** (a) It is stated that the speed at which a belt should be run to transmit maximum power is that at which the maximum allowable tension is three times the centrifugal tension in the belt at that speed. Prove the statement. [4]
- (b) A 5 kW induction motor running at 960 rpm operates a riveting machine. The flywheel to it is of mass 120 kg with radius of gyration equal to 0.35 m. Each riveting takes 1 second and required 9 kW, determine :
- (i) The no. of rivets form per hour
- (ii) The reduction in speed of flywheel after riveting operation. [8]
- (c) Discuss in detail, stresses in flywheel rim. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—8  
+1 Design Attached

<b>Seat No.</b>	
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**[4162]-123**

**S.E. (Mech./SW) (Second Semester) EXAMINATION, 2012**

**THERMAL ENGINEERING—II**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Discuss the effect of variable suction and discharge pressure and subcooling on performance of vapour compression system. [5]

P.T.O.

- (b) Write notes on :
- (i) Azeotropes
  - (ii) Secondary refrigerants. [5]
- (c) A refrigerating machine (8 TR capacity) works on ideal Bell-Coleman cycle. The pressure of air entering compressor is 1 bar and corresponding temperature is 20°C. The highest pressure reached in cycle is 6 bar. The air after compression gets cooled to 40°C before entering in expansion cylinder. Assuming expansion and compression be adiabatic ( $\gamma = 1.4$ ), calculate :
- (i) C.O.P. of cycle
  - (ii) Mass flow rate of refrigerant
  - (iii) Power required
  - (iv) Piston displacement of compressor
  - (v) Bore and stroke of compressor cylinder if compressor used is double acting and runs at 300 rpm.
- (Given Bore = Stroke) [8]

*Or*

2. (a) Explain with neat sketch simple ammonia-water vapour absorption refrigeration system. [5]
- (b) What are the desirable properties of refrigerants ? [5]



- (c) An ammonia refrigerator produces 20 tons of ice per day from and at 0°C. The condensation and evaporation occurs at 20°C and -20°C respectively. The temperature of vapour at the end of compression is 50°C and there is no undercooling of liquid. The actual cop is 70% of theoretical cop. Calculate mass flow rate of ammonia. Draw T-S diagram. Take latent heat of fusion of ice = 335 kJ/kg. Specific heat of superheated vapour = 2.8 kJ/kgK. Use the properties of ammonia as given below :

[8]

Temp. °C	Enthalpy (kJ/kg)		Entropy (kJ/kgK)	
	$h_f$	$h_g$	$s_f$	$s_g$
20	274.98	1461.58	1.04341	5.0919
-20	89.72	1419.05	0.3682	5.6204

3. (a) Discuss different factors which affect human comfort. [5]  
 (b) Explain 'Winter air conditioning' with neat sketch. [5]  
 (c) The conditions of air at a particular place are as follows :  
 Atmospheric pressure :  $P = 101.35$  kPa,  $t_{db} = 25^\circ\text{C}$  and specific humidity :  $W = 0.009$  kg/kg of air.

Calculate :

- (i) Partial pressure of water vapour  
 (ii) Relative humidity  
 (iii) Dew point temperature  
 (iv) Degree of saturation.

[6]

*Or*

4. (a) Explain the following terms : [4]  
(i) Relative humidity  
(ii) Bypass factor.
- (b) Obtain all psychrometric properties of moist air at 36°C DBT and 20°C WBT without using psychrometric chart. [6]
- (c) 800 m<sup>3</sup>/min of recirculated air at 22°C DBT and 10°C DPT is mixed with 300 m<sup>3</sup>/min of fresh air at 30°C DBT and 50% RH adiabatically. Calculate enthalpy, specific volume, humidity ratio and final DBT of mixture. [6]
5. (a) Describe any *two* types of expansion devices in refrigerating system. [6]
- (b) Write a short note on Hermetic sealed compressor. [4]
- (c) Explain friction losses and dynamic losses for air flow through duct. [6]

*Or*

6. (a) What are the different methods of duct design ? Explain equal friction method. [6]
- (b) What do you understand by static and velocity pressure in duct ? [4]
- (c) Write a note on preventive maintenance in air conditioning equipments. [6]

## SECTION II

7. (a) Explain with neat sketch common rail-diesel injection system. [5]
- (b) Compare battery ignition system and magneto-ignition system. [5]
- (c) A two-stroke diesel engine was subjected to motoring test. The wattmeter reading was 1.6 kW. The engine was tested for one hour and the following observations were noted :
- Net brake torque = 125 Nm  
Engine r.p.m. = 610  
Fuel consumption = 2.7 kg  
C.V. of fuel = 41000 kJ/kg  
Cooling water used = 825 kg  
Temperature rise of cooling water = 8°C  
Exhaust gas temperature = 350°C  
Room temperature = 30°C  
Air-fuel ratio = 32 : 1  
Sp. heat of exhaust gas = 1.05 kJ/kgK
- Calculate :
- (i) Brake power  
(ii) Indicated power  
(iii) Mechanical efficiency  
(iv) Indicated thermal efficiency  
(v) Heat balance on minute and percentage basis. [8]

*Or*

8. (a) Explain with neat sketch water cooling system using thermostat valve. [5]
- (b) Explain splash lubrication system. [5]
- (c) A four-stroke petrol engine 80 mm bore, 100 mm stroke is tested at full throttle at constant speed. The fuel supply is fixed at 0.068 kg/min and plugs of four cylinders are successively short circuited without change of speed, brake torque being correspondingly adjusted. The brake power measurements are the following :

With all cylinders firing = 12.5 kW

With cylinder No. 1 cut-off = 9 kW

With cylinder No. 2 cut-off = 9.15 kW

With cylinder No. 3 cut-off = 9.2 kW

With cylinder No. 4 cut-off = 9.1 kW

Determine indicated power under these conditions. Also determine indicated thermal efficiency. Calorific value of fuel is 44100 kJ/kg. Compare this efficiency with air standard efficiency. Clearance volume of one cylinder is  $70 \times 10^3 \text{ mm}^3$ . [8]

9. (a) Explain stages of combustion in CI engine. [6]
- (b) What are the basic requirements of good SI engine combustion chamber ? [5]
- (c) Discuss variables affecting delay period. [5]

*Or*

10. (a) Describe phenomenon of detonation or knocking in SI engine. [6]
- (b) Discuss validity of statement “Factors tending to increase detonation in SI engine tend to reduce knock in CI engine.” [5]
- (c) How are CI engine combustion chambers classified ? [5]
11. (a) What is supercharging ? How is it achieved ? Explain it with P-V diagram. [6]
- (b) What are the supercharging limits for SI engine and CI engine ? [4]
- (c) What is meant by crankcase blowby ? How can it be controlled ? [6]

*Or*

- 12.** (a) Describe with neat sketch catalytic converter system. [6]
- (b) Compare diesel engine and petrol engine emissions. [4]
- (c) What are various methods of turbocharging ? Compare their relative merits. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—7

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**[4162]-124**

**S.E. (Mech. S/W) (Second Semester) EXAMINATION, 2012**

**MANUFACTURING ENGINEERING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer *three* questions from Section I and *three* questions from Section II
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain various types of patterns with neat sketch. List out materials used for pattern. [6]
- (b) Describe the properties of sand used for moulding. [4]

P.T.O.

- (c) Describe the following processes with neat sketch : [8]
- (i) Wire drawing
  - (ii) Shot peening.

*Or*

2. (a) What are various casting defects ? How can these defects be minimised ? [6]
- (b) What is extrusion ? How does direct extrusion differ from indirect extrusion ? Discuss their relative merits and demerits. [8]
- (c) Describe with neat sketch process of Roll Forging. [4]
3. (a) Explain principle of resistance welding. What are the types and applications. Explain : [8]
- (i) Seam welding
  - (ii) Projection welding.
- (b) Describe various types of adhesives and explain the reasons for replacing other joining processes by adhesive bonding with suitable example/application. [8]

*Or*

4. (a) Describe with the help of suitable working setup, the principle and operation of FCAW. Explain process of shielding used in FCAW. [8]



- (b) Write a short note on : [8]
- (i) Flames used for gas welding process
  - (ii) Comparison between welding soldering, brazing.
5. (a) List different accessories used on lathe and state purpose of each with neat sketch. [8]
- (b) Sketch and explain the following : [8]
- (i) Reaming
  - (ii) Counterboring
  - (iii) Counterstriking
  - (iv) Spot facing.

*Or*

6. (a) Explain with neat sketch the following milling operations : [9]
- (i) Plain milling
  - (ii) Form milling
  - (iii) Straddle milling.
- (b) Explain the principle of boring machine. Give classification of boring machines. Explain vertical boring machine with neat sketch. [7]

## SECTION II

7. (i) What are the types of tool failures ? Explain flank wear and crater wear. [4]
- (ii) Explain working principle of generating the gears with neat figure of gear hobbing. [4]
- (iii) How does thread milling differ from thread cutting ? [6]
- (iv) The following data relate to an orthogonal cutting process :
- |                      |          |
|----------------------|----------|
| Chip length obtained | = 96 mm  |
| Uncut chip length    | = 240 mm |
| Rake angle used      | = 20°    |
| Depth of cut         | = 0.6 mm |
- Horizontal and vertical components of cutting force = 2400 N and 240 N respectively. Determine :
- (i) Chip thickness ( $t_c$ )
- (ii) Shear plane angle ( $\phi$ )
- (iii) Friction angle ( $\beta$ )
- (iv) Resultant cutting force (R). [4]

*Or*

8. (i) Prove the relation between chip thickness rake angle and shear angle. [4]
- (ii) What are various gear finishing methods ? [4]

(iii) What are the types of broaching machine ? Explain any two. [4]

(iv) Cylindrical bars of 100 mm diameter and 576 mm length are turned in a single pass operation. The spindle speed used is 144 r.p.m. and tool feed is 0.2 mm/rev. Taylor's tool life relationship is :

$$V_T^{0.75} = 75.$$

Calculate :

(i) Time for turning one piece.

(ii) Tool life. [6]

9. (i) How do you classify CNC machines ? Compare open loop and closed loop control system in CNC with figures. [5]

(ii) Explain with neat sketch, working principles and process parameters and application of Electro-Discharge machining. [5]

(iii) Write short notes on (any two) : [6]

(a) Automatic tool changer

(b) Ultrasonic machining process

(c) Plasma arc machining process.

*Or*

- 10.** (i) What is NC system ? Explain its elements and types of NC control systems. [5]
- (ii) Explain with neat sketch, working principles and process parameters and application of Abrasive jet machining. [5]
- (iii) Write short notes on (any *two*) : [6]
- (a) Automatic pallet changer
- (c) DNC
- (c) Laser beam machining.
- 11.** (i) State different types of dies used in press working operations. Explain any *one* die. [4]
- (ii) Why stripper is required ? Explain types of strippers with neat figures. [4]
- (iii) Explain different types of locating methods and devices in jig and fixture with neat sketches. [4]
- (iv) Write in short different types of drill bushes used in jig. [4]

*Or*

- 12.** (i) Design and draw a progressive die for manufacturing a MS part of 1 mm thickness as shown in Fig. Take ultimate shear strength of MS is 200 N/mm<sup>2</sup>. [8]
- Find :
- (a) Strip layout and % utilization

(b) Centre of pressure

(c) Press capacity.

Fig.

All dimensions are in mm

(ii) What are the design consideration of jig and fixture. [4]

(iii) Describe different types of clamping devices with neat sketches. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—8+1

<b>Seat No.</b>	
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**[4162]-125**

**S.E. (Mech. S/W) (Second Semester) EXAMINATION, 2012**

**COMPUTER APPLICATION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answers to the two Sections should be written in separate answer-books.
- (ii) Attempt Q. No. 1 or 2; Q. No. 3 or 4 and Q. No. 5 or 6 from Section I and Q. No. 7 or 8; Q. No. 9 or 10 and Q. No. 11 or 12 from Section II.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.
- (v) Use of electronic pocket calculator is allowed.
- (vi) Neat diagrams must be drawn wherever necessary.

**SECTION I**

**UNIT I**

1. (a) Find a real root of the equation  $x \log_{10} x = 1.2$  by Regula-Falsi method correct to four decimal places. [6]
- (b) Represent Newton-Raphson Method graphically. [2]
- (c) Evaluate  $\int_0^{\pi} \frac{\sin^2 x}{e^x + \cos x} dx$  using Simpson's  $\frac{3}{8}$ th rule, take six strips. [8]

P.T.O.

Or

2. (a) The velocity  $v$  (km/hr) of vehicle which starts from rest is given at fixed interval of time  $t$  (min.) as follows :

Time ( $t$ ) (in min)	Velocity ( $v$ ) (in km/hr)
2	10
4	18
6	25
8	29
10	32
12	20
14	11
16	05
18	02
20	00

Estimate approximately the distance covered in 20 minutes. [6]

- (b) What is the modified Newton-Raphson method ? State its advantages. [5]
- (c) Draw a flowchart for numerical integration by Simpson's  $\frac{3}{8}$ th rule. [5]

## UNIT II

3. (a) Determine interpolation polynomial for the following data points. State degree of the polynomials and find the value of function at  $x = 3.5$  and  $x = 6$ . [8]

$x$	$y$
1	3.5
2	-5
3	0
4	24

- (b) From the following table find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $x = 1.5$ . [8]

$x$	$y$
1.5	3.375
2.0	7.000
2.5	13.625
3.0	24.000
3.5	38.875
4.0	59.0



*Or*

4. (a) A rod is rotating in a plane. The following table gives angle  $\theta$  (radians) through which the rod has rotated for various value of time  $t$  (seconds). [8]

$t$	$\theta$
0	0
0.2	0.12
0.4	0.49
0.6	1.12

Calculate angular velocity of rod at  $t = 0.6$  seconds.

- (b) From the tabulated values of  $x$  and  $y$  given below, prepare forward difference table. Estimate value of  $y$  when  $x = 3$ . [8]

$x$	$y$
2	30
4	43
6	64
8	87
10	104

### UNIT III

5. (a) Explain advantages of partial pivoting for solving simultaneous equations using, Gauss Elimination Method, Gauss-Jordan Method and Gauss-Seidel Iteration Method. [6]

- (b) By using, Gauss-Seidel Iteration method, solve the following equations. (Six Iterations only.)

$$4x_1 + 2x_3 = 4$$

$$5x_2 + 2x_3 = 3$$

$$5x_1 + 4x_2 + 10x_3 = 2. \quad [12]$$

*Or*

6. (a) Solve the following equations using by Gauss-Jordan method :

$$3x_1 - 0.1x_2 - 0.2x_3 = 7.85$$

$$0.1x_1 + 7x_2 - 0.3x_3 = -19.3$$

$$0.3x_1 - 0.2x_2 + 10x_3 = 71.4. \quad [10]$$

- (b) Explain Cholesky method. [8]

## SECTION II

### UNIT IV

7. (a) The table below gives the temperature  $T$  (in  $^{\circ}\text{C}$ ) and length  $l$  (in mm) of a heated rod. If  $l = a_0 + a_1T$ . Find the best values for  $a_0$  and  $a_1$  : [8]

$T$ (in $^{\circ}\text{C}$ )	$l$ (in mm)
20	800.3
30	800.4
40	800.6
50	800.7
60	800.9
70	801.0

- (b) Explain the following types of errors with examples : [8]
- (i) Absolute errors
  - (ii) Relative error
  - (iii) Percentile error
  - (iv) Round-off error.

Or

8. (a) Determine the constants  $a$  and  $b$  by the method of least square such that :

$y = ae^{bx}$  fits the following data : [10]

$x$	$y$
2	4.077
4	11.084
6	30.128
8	81.897
10	222.62

- (b) Draw flowchart for fitting a curve of the type :

$$y = ax^2 + bx + c. \quad [3]$$

- (c) Explain error propagation. [3]

### UNIT V

9. (a) Given :

$$\frac{dy}{dx} = 3x + y/2$$

with condition  $y(0) = 1$ .

Evaluate  $y(0.2)$  by :

- (i) Euler method
- (ii) Modified Euler method
- (iii) Fourth order Runge-Kutta method.

Take  $h = 0.05$ . [10]

- (b) Explain Milne's method along with flowchart. [6]

Or

10. (a) Solve :

$$\frac{dy}{dx} = 2e^x - y$$

using Milne's Predictor-Corrector method. Given  $y(0) = 2$ . Find  $y$  at  $x = 0.4$  with step size of 0.1. The value of  $x$  and  $y$  are given in table below : [10]

$x$	$y$
0	2
0.1	2.01
0.2	2.04
0.3	2.09

(b) Draw a flowchart for solution of D.E. by using Taylor's series method. [6]

### UNIT VI

11. (a) By Iteration method solve the equation :

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \quad (\text{Elliptic equation})$$

over a square region of side 4 satisfying boundary conditions.

(i)  $u(0, y) = 0$  for  $0 \leq y \leq 4$

(ii)  $u(4, y) = 12 + y$  for  $0 \leq y \leq 4$

(iii)  $u(x, 0) = 3x$  for  $0 \leq x \leq 4$

(iv)  $u(x, 4) = x^2$  for  $0 \leq x \leq 4$ . [12]

(b) Draw a flowchart for Poisson's equation :

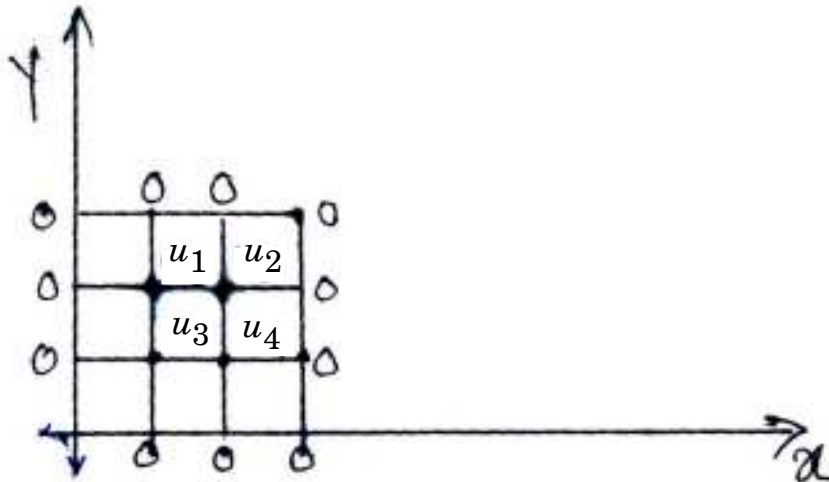
$$\nabla^2 u = F(x, y). \quad [6]$$

Or

12. (a) Solve the Poisson's equation :

$$\nabla^2 u = -10(x^2 + y^2 + 10)$$

at the interior points of square mesh is given below. [10]



(b) Draw flowchart to solve Laplace equation.

[8]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-131**

**S.E. (Common to Prod. S/W) (Production/Industrial)**

**(First Semester) EXAMINATION, 2012**

**HEAT AND FLUID ENGINEERING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Define : Mass density, Specific weight, Specific volume and Specific gravity. 3.2 m<sup>3</sup> of certain oil weighs 27.5 kN. Calculate the Specific weight, Mass density, Specific volume and Specific gravity with respect to water. If kinematic viscosity of oil is  $7 \times 10^3$  stokes, what would be its dynamic viscosity in centipoises ?

[8]

P.T.O.

- (b) Explain the characteristics of fluid properties to which the following fluid phenomenon are attributable :
- (i) Formation of bubbles and discontinuity in flow systems.
  - (ii) Water hammer in pipe flow.
  - (iii) Petrol evaporates more readily than water at ordinary temperature.
  - (iv) Breaking up of liquid jet. [8]

*Or*

2. (a) State and prove the Pascal's Law and give some examples where this principle is applied. [8]
- (b) An isosceles triangular plate of base 4 m and altitude 6 m is immersed vertically in water. Its axis of symmetry is parallel to and at a depth of 6 m from the free water surface. Calculate the magnitude and location of total pressure force. [8]
3. (a) Derive Euler's equation of motion along a streamline, and hence derive the Bernoulli's theorem. [8]
- (b) A 2 m long pipeline tapers uniformly from 10 cm diameter to 20 cm diameter at its upper end. The pipe centerline slopes upwards at an angle of  $30^\circ$  to the horizontal and the flow



direction is from smaller to bigger cross-section. If the pressure gauges installed at the lower and upper ends of the pipeline read 200 kPa and 230 kPa respectively, determine the flow rate and the fluid pressure at the mid-length of the pipeline. Assume no energy losses. [8]

*Or*

4. (a) Define and distinguish between :
- (i) Rotational and Irrotational flow
  - (ii) Uniform and Non-uniform flow
  - (iii) Steady and Unsteady flow. [6]
- (b) Explain the principle of venturimeter with a neat sketch and establish an expression for the rate of flow through it.

In a 100 mm diameter horizontal pipe, a venturimeter of 0.5 contraction ratio has been fitted. The head of water on the meter when there is no flow is 3 m (gauge). Find the rate of flow for which the throat pressure will be 2 m of water absolute. Discharge coefficient for the meter is 0.97. [10]

5. (a) What are the different types of losses of energy in pipes ?  
Write the equation for each loss with neat sketch. [10]
- (b) Explain the working principle of Centrifugal pump with neat sketch. Compare it with Reciprocating pump. [8]

*Or*

6. (a) A 5 cm diameter pipe takes off abruptly from a large tank and runs 8 m, then expands abruptly to 10 cm diameter and runs 45 m, and next discharge directly into the open air with a velocity of 1.5 m/s. Compute the necessary height of water surface above the point discharge. Take friction coefficient  $f = 0.0065$  in the Darcy equation. [10]
- (b) Explain the following terms :
- (i) Pipe in series
  - (ii) Pipe in parallel
  - (iii) Equivalent pipe
  - (iv) Water hammer. [8]

## SECTION II

7. (a) Describe with neat sketch the working of Babcock and Wilcox boiler, show the position of different mountings and explain the function of each. [8]

- (b) Calculate the Equivalent Evaporation and Efficiency of the boiler for the following data :

Pressure of steam – 9 bars, Quality of steam – 0.97 dry,  
Quantity of steam – 5600 kg/h, Temperature of feed water – 36°C, Coal consumption – 700 kg/h, Calorific value of Coal – 31380 kJ/kg of fuel.

What will be the saving in coal consumption per hour if by putting an economizer the temperature of feed water is raised to 100°C and other data remains the same except the increase in boiler efficiency by 5% ? [8]

*Or*

8. (a) Discuss various methods to express the boiler performance. [6]  
(b) Calculate the proportion of the heat of fuel carried away by the flue gases for the following data :

Coal with a CV of 29566 kJ/kg of coal has a composition by mass C = 78%, H = 5%, O<sub>2</sub> = 8%, S = 2% N<sub>2</sub> = 2% and remainder is ash. It is burned in a furnace with 5% excess air. The flue gas leaving the chimney is 327°C and the atmospheric

temperature is 15°C. Assume perfect combustion,  $C_p$  for air as 1.005 kJ/kgK,  $C_p$  for dry products as 1.045 kJ/kgK, heat carried away per kg of moisture in the flue gases 2990 kJ. The composition of air by mass :  $O_2 = 23\%$ ,  $N_2 = 77\%$ . [10]

9. (a) Explain the following terms :
- (i) Refrigerating effect
  - (ii) Ton of Refrigeration
  - (iii) Coefficient of Performance
  - (iv) Hermetic compressor. [8]
- (b) Describe the working of Vapor Compression Refrigeration system with neat sketch. Draw P-h and T-s diagram. [8]

*Or*

10. (a) Explain the heat transfer by conduction, convection and radiation takes place in a casting process. [6]
- (b) What are the various psychrometric processes ? Show them on a psychrometric chart. [4]
- (c) Explain the importance of air-conditioning in manufacturing industry. [6]

11. (a) Derive an expression for volumetric efficiency and discuss its physical significance. [10]
- (b) Draw PV and TS diagram for multistage Air-compressor. Write advantages of multistage compressor. [8]

*Or*

12. (a) Define Indicated Power, Brake Power and Frictional Power. What are the methods to determine these ? [8]
- (b) Describe the methods of measuring fuel consumption and air consumption. What is the purpose of measuring these ? [10]

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**[4162]-132**

**S.E. (Prod. & Prod. Sandwich) (First Semester)**  
**EXAMINATION, 2012**  
**STRENGTH ANALYSIS OF MACHINE ELEMENT**  
**(2008 PATTERN)**

**Time : Three Hours****Maximum Marks : 100**

- N.B. :-** (i) Attempt *one* question from each Unit in Section I and Section II.  
(ii) Answers to the two Sections should be written in separate answer-books.  
(iii) Figures to the right indicate full marks.  
(iv) Assume suitable data, if necessary.  
(v) Neat diagrams must be drawn wherever necessary.

**SECTION I**  
**Unit I**

1. (a) Define and explain the following terms : [6]  
(i) Bulk modulus  
(ii) Volumetric strain  
(iii) Poisson's ratio.
- (b) The bar shown in Fig. 1 is subjected to a tensile load of 160 kN. If the stress in the middle portion is limited to  $150 \text{ N/mm}^2$ , determine the diameter of the middle portion. Find also the length of the middle portion if the total elongation of the bar is to be 0.2 mm. Young's modulus is given as equal to  $2.5 \times 10^5 \text{ N/mm}^2$ . [10]

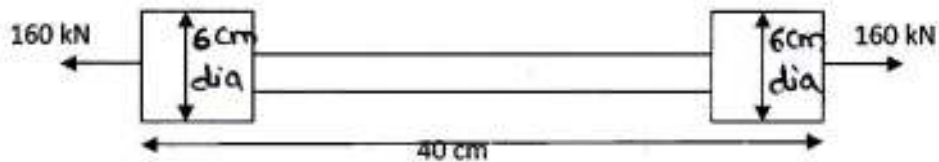


Fig. 1

P.T.O.

*Or*

2. (a) A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1 mm and change in diameter is 0.004 mm. Calculate Young's modulus, Poisson's ratio and Bulk modulus. [6]
- (b) Calculate the modulus of rigidity and bulk modulus of a cylindrical bar of diameter 30 mm and of length 1.5 m if the longitudinal strain in a bar during a tensile stress is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm<sup>2</sup>. [10]
- Take :  $E = 1 \times 10^5$  N/mm<sup>2</sup>.

### Unit II

3. (a) A steel tube of 30 mm external diameter and 25 mm internal diameter encloses a gun metal rod of 20 mm diameter to which it is rigidly joined at each end. The temperature of the whole assembly is raised to 140°C and the nuts on the rod are then screwed lightly home on the ends of the tube. Find intensity of stress in the rod when the common temperature has fallen to 30°C. Take  $E_S = 2.1 \times 10^5$  N/mm<sup>2</sup> and  $E_{\text{gun metal}} = 1 \times 10^5$  N/mm<sup>2</sup> respectively. The linear co-efficient of expansion for steel and gun metal is  $12 \times 10^{-6}$  per °C and  $20 \times 10^{-6}$  per °C. [8]

- (b) A simply supported beam of length 10 m carries the uniformly distributed load and two points loads as shown in Fig. 2. Draw the SFD and BMD for the beam and also calculate maximum bending moment. [10]

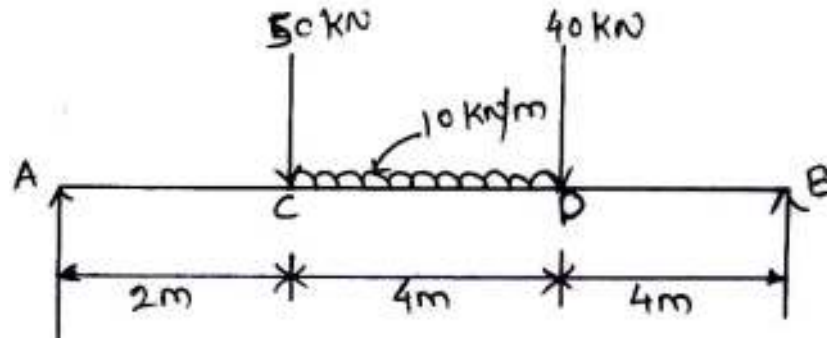


Fig. 2

Or

4. (a) Draw the SFD and BMD for the beam which is loaded as shown in Fig. 3. Determine the points of contraflexure within the span AB. [8]

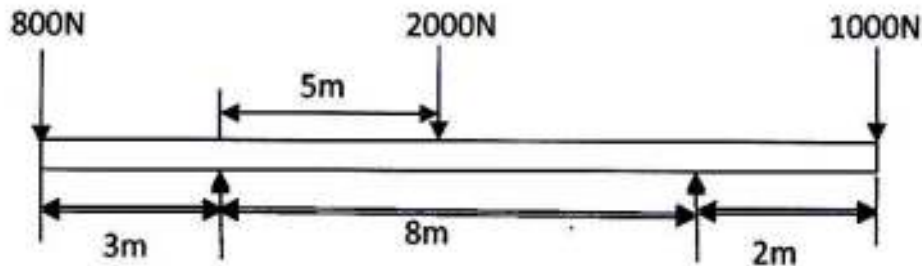


Fig. 3



- (b) A horizontal beam 10 m long carrying distributed load of 1 kN/m. The beam is supported on two supports 6 m apart. Find the position of the supports so that the B.M. on the beam is as small as possible. Also draw the SFD and BMD. [10]

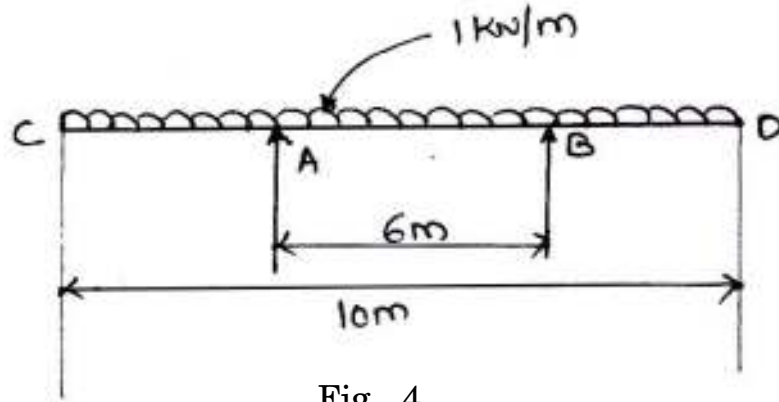


Fig. 4

### Unit III

5. (a) Prove the relation : [6]

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

- (b) A cast iron bracket subjected to bending has the c/s of I form with unequal flanges. The dimensions of the section are shown in Fig. 5. Find the position of neutral axis and M.I. of the section about neutral axis. If max. bending moment on the section is 40 MN mm, determine the max. bending stress. What is the nature of stress ? [10]

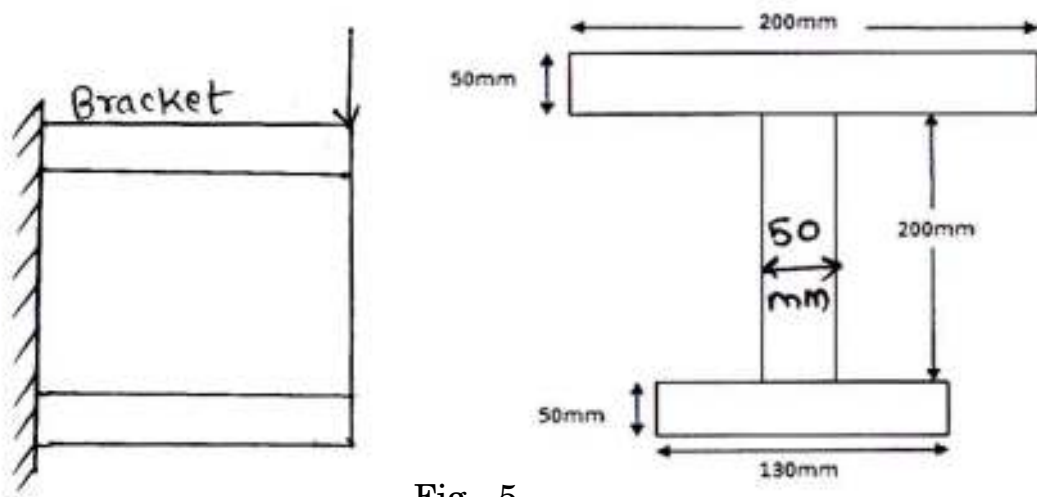


Fig. 5

Or

6. (a) State the assumptions made in the theory of simple bending. [6]
- (b) Three beams have the same length, same allowable bending stress and the same bending moment. The c/s of the beams are a square, rectangle with depth twice the width and a circle. Find the ratios of weights of the circular and the rectangular beams with respect to square beams. [10]

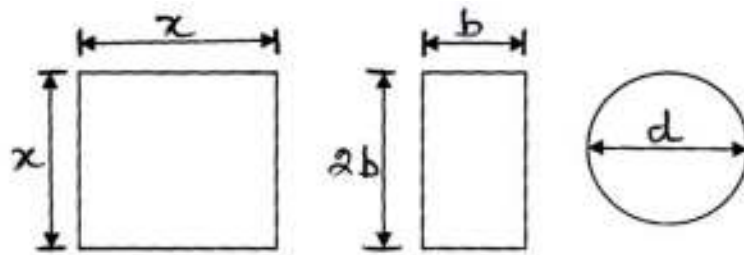


Fig. 6

## SECTION II

### Unit IV

7. (a) Derive an expression for the major and minor principal stresses on an oblique plane, when the body is subjected to direct stresses in two mutually perpendicular directions accompanied by a shear stress. [8]

- (b) An elemental cube is subjected to tensile stresses of  $30 \text{ N/mm}^2$  and  $10 \text{ N/mm}^2$  acting on two mutually perpendicular planes and a shear stress of  $10 \text{ N/mm}^2$  on these planes. Draw the Mohr's circle of stresses and hence or otherwise determine the magnitudes and directions of principal stresses and also the greatest shear stress. [8]

*Or*

8. (a) What is strain energy of a material ? Derive the expressions for the same in different forms. [8]
- (b) A load of  $100 \text{ N}$  falls through a height of  $2 \text{ cm}$  on to a collar rigidly attached to the lower end of a vertical bar  $1.5 \text{ m}$  long and of  $1.5 \text{ cm}^2$  cross-sectional area. The upper end of the vertical bar is fixed. Determine : [8]
- (i) Maximum instantaneous stress induced in the vertical bar.
- (ii) Maximum instantaneous elongation.
- (iii) Strain energy stored in the vertical bar.

### Unit V

9. (a) Deduce the torsion equation stating the assumptions made. [8]

- (b) Two shafts of the same material and of same lengths are subjected to the same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section, whose internal diameter is  $\frac{2}{3}$  of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts. [10]

*Or*

10. (a) A hollow circular shaft 20 mm thick transmits 300 kW power at 200 rpm. Determine the external diameter of the shaft if the shear strain due to torsion is not to exceed 0.00086. Take modulus of rigidity =  $0.8 \times 10^5$  N/mm<sup>2</sup>. [10]
- (b) A solid shaft of diameter 80 mm is subjected to a twisting moment of 8 MN mm and a bending moment of 5 MN mm at a point. Determine principal stresses and position of the plane on which they act. [8]

### Unit VI

11. (a) Explain Macaulay's method of beam deflection analysis and discuss its advantages over the direct integration method. [6]
- (b) A cantilever of length 2 m carries a uniformly distributed load 2 kN/m over a length of 1 m from the free end, and a point load of 1 kN at the free end. Find the slope and deflection at the free end if  $E = 2.1 \times 10^5$  N/mm<sup>2</sup> and  $I = 6.667 \times 10^7$  mm<sup>4</sup>. [10]

*Or*

- 12.** (a) What do you mean by end conditions of a column ? What are the important end conditions for a column ? Explain them. [6]
- (b) A simply supported beam of length 4 m is subjected to a uniformly distributed load of 30 kN/m over the whole span and deflects 15 mm at the centre. Determine the crippling loads when this beam is used as a column with the following conditions : [10]
- (1) One end fixed and other end hinged
  - (2) Both the ends pin jointed.

Total No. of Questions—12]

[Total No. of Printed Pages—3

<b>Seat No.</b>	
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**[4162]-133**

**S.E. (Production) (First Semester) EXAMINATION, 2012**

**MACHINE TOOL OPERATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Solve *three* questions from each Section.

(ii) Use separate answer-sheet for each Section.

(iii) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain any *three* types of taper turning methods with suitable sketches. [9]

(b) Explain the different types of mandrels with suitable sketches. [9]

*Or*

2. (a) Explain various types of centres, catch plates and carriers, face plates and angle plates with suitable sketches. [9]

(b) Explain working of apron mechanism with the suitable sketch. [9]

3. (a) Discuss types of boring machines with suitable sketches. [8]

(b) Explain various operations which can be performed on drilling machine with suitable sketches. [8]

P.T.O.

*Or*

4. (a) Draw a sketch of twist drill nomenclature and explain importance of twist drill elements. [8]
- (b) Explain radial drilling machine and sensitive drilling machines with suitable sketches. [8]
5. (a) Explain any *four* types of milling cutters with suitable sketches and their applications. [8]
- (b) List different methods of indexing and explain compound indexing with suitable example. [8]

*Or*

6. (a) Explain plain milling straddle milling, Gang milling, profile milling with suitable sketches. [8]
- (b) Explain elements of plain milling cutter with a suitable sketch. [8]

## **SECTION II**

7. (a) Explain crank and slotted link mechanism with suitable sketch. [9]
- (b) Explain how to specify shaper, planer, slotter. [9]

*Or*

8. (a) Explain Whitworth quick return mechanism with suitable sketch. [9]
- (b) Explain classification of broaching on the basis of method of operation. [4]
- (c) Draw a sketch of Internal pull broach elements and form of broach teeth. [5]

9. (a) Explain plain centre-type grinder with suitable sketch. [8]  
(b) Explain tool and cutter grinders with a suitable sketch. [8]

*Or*

10. (a) Discuss various types of abrasives used in grinding. [8]  
(b) Discuss wheel shapes and sizes used in grinding with suitable sketches. [8]

11. (a) Explain honing with a suitable sketch. [8]  
(b) Explain electroplating with a suitable sketch. [8]

*Or*

12. Write short notes on the following : [16]  
(i) Polishing  
(ii) Hot dipping  
(iii) Burnishing  
(iv) Tumbling.



Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-134**

**S.E. (Production Engg.) (First Semester) EXAMINATION, 2012**

**MATERIAL SCIENCE**

**(Common to Production S/W)**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer questions 1 or 2, 3 or 4 and 5 or 6 from Section I and questions 7 or 8, 9 or 10 and 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Define the following : [4]**

(i) Space lattice

(ii) Unit cell

(iii) APF

(iv) Lattice parameter.

(b) What is dislocation ? Compare the edge and screw dislocations. [4]

P.T.O.

- (c) Discuss in brief with one example of composite about increasing importance of new/modern Engineering. Materials in the field of science and engg. [4]
- (d) Explain why medium carbon steel is preferred in application like gear. [4]

*Or*

2. (a) Draw the following planes and directions : [8]  
(101), (222), [111], [011].
- (b) Explain : Copper is more ductile than iron. [2]
- (c) Describe various types of imperfections in crystals with diagram. [6]
3. (a) State the advantages, disadvantages and applications of Rockwell hardness test. [6]
- (b) What is endurance limit of metals ? How is it determined ?  
Draw typical fatigue fracture characteristics. [6]
- (c) Compare X-Ray radiography with Gama Radiography. [4]

*Or*

4. (a) Write short notes on the following (any *two*) : [6]
- (i) Erichson cupping test
- (ii) Durometer
- (iii) Shear and bend test
- (iv) Poldi test.

- (b) Draw self-explanatory sketches of the following (any *three*) : [6]
- (i) S-N Curves for ferrous and non-ferrous metals
  - (ii) Izod and Charpy specimens
  - (iii) Intercrystalline and Intracrystalline fractures
  - (iv) Dye penetrant test.
- (c) What is creep ? Draw a typical creep curve and explain the various stages of curve. [4]

5. (a) What is phase diagram ? What information can be analyzed from the diagram ? [4]
- (b) Explain in brief the method to plot the equilibrium diagram with the use of the cooling curves. [6]
- (c) Draw the equilibrium diagram from the following data and discuss slow cooling of 15% alloy from its liquidus temp to solidus temp. [6]

<b>% B</b>	0	20	40	60	80	100
<b>Liquidus</b>						
<b>Temp °C</b>	1083	1200	1275	1345	1410	1455
<b>Solidus</b>						
<b>Temp °C</b>	1083	1165	1235	1310	1380	1455

- (d) What is solid solution ? Explain with example. [2]

*Or*

- 6.** (a) Define the following : [3]
- (i) Phase
  - (ii) Intermediate phases
  - (iii) Variable.
- (b) State the Hume Rothery rules of solid solubility. [4]
- (c) Explain Gibbs phase rule on-off eutectic cooling curve. [4]
- (d) What is coring ? [3]
- (e) Define : [4]
- (i) Peritectic transformation
  - (ii) Monotectic transformation.

## SECTION II

- 7.** (a) Fine grained material shows better strength than Coarse grained materials. Explain with Hall-Petch equation. [4]
- (b) What factors decide the success of Dispersion hardening ? [4]
- (c) What is the working principle of a Thermocouple ? State various types of the thermocouples with their specific applications. [4]
- (d) Al-Cu alloy can be precipitation hardened explain. [4]

*Or*

8. Write short notes on the following (any *four*) : [16]

- (i) Calibration of a thermocouple
- (ii) Composite Materials
- (iii) Martensitic transformation
- (iv) Resistance pyrometer
- (v) Total radiation pyrometer.

9. (a) Which factors are consider in material selection to get good corrosion resistance ? [8]
- (b) What is Electroplating ? State advantages, disadvantages and applications over other processes of surface coating. [6]
- (c) Write a short note on diffusion coating. [4]

*Or*

10. (a) Explain CVD process and its advantages over PVD. [8]
- (b) Write short notes on (any *two*) : [8]
- (i) Ion implantation
  - (ii) Anodic protection
  - (iii) Electroplating.
- (c) Corrosion rate is high in humid atmosphere. [2]

11. (a) The characteristics of metal powders are dependent on the method of powder production. Discuss. [8]
- (b) Discuss in detail the specific surface and apparent density of metal powders. What is their importance in the P/M field ? [4]
- (c) How Powder Metallurgy is best suitable production method for production of self-lubricating bearings ? Explain. [4]

*Or*

12. (a) Explain with the flow chart production of refractory materials. [4]
- (b) What is the effect of improper mixing of the powders on quality of P/M product ? [4]
- (c) What is the role played by lubricant in compaction ? [4]
- (d) Explain cold compaction process. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—8+3

<b>Seat No.</b>	
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**[4162]-135**

**S.E. (Production/Industrial) (Second Semester)**

**EXAMINATION, 2012**

**THEORY OF MACHINES**

**(Common to Prod-S/W)**

**(2008 PATTERN)**

**Time : Four Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data, if necessary.
- (vi) Use of scientific calculator, steam table, Mollier charts is allowed.

**SECTION I**

1. (a) Write a short note on classification of Kinematic pairs. [6]

P.T.O.

- (b) Define the following terms :
- (i) Kinematic chain
  - (ii) Mechanism
  - (iii) Higher pair
  - (iv) Constrained motion in mechanism
  - (v) Quaternary link. [5]
- (c) Explain with neat sketch Watt's straight line mechanism. What are the practical uses of straight line mechanism ? [5]

*Or*

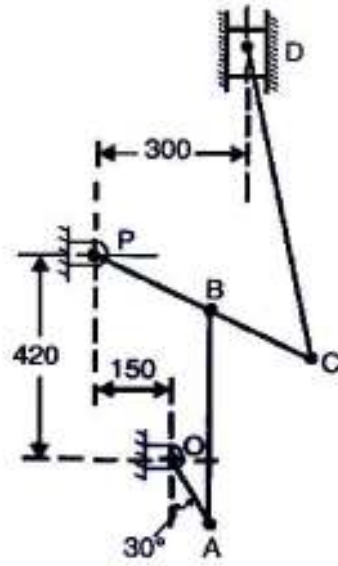
2. (a) What do you understand by Degree of Freedom ? For a plane mechanism, derive an expression for Grubler's equation. [5]
- (b) List inversion of single slider crank chain and explain any *two* with neat sketches. [6]
- (c) Write a short note on "Ackermann Steering Gear Mechanism". [5]

3. (a) Find out the acceleration of the slider D and the angular acceleration of link CD for the engine mechanism shown in Fig. 1.

The crank OA rotates uniformly at 180 r.p.m. in clockwise direction. The various lengths are : OA = 150 mm; AB = 450 mm;



PB = 240 mm; BC = 210 mm; CD = 660 mm. [12]



(All dimensions are in mm)

Fig. 1

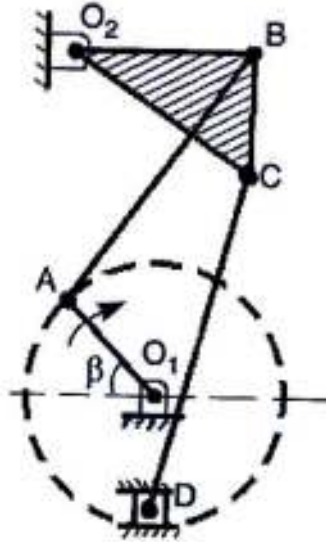
- (b) What do you mean by Coriolis component of acceleration ?  
How will you find the direction of it ? [6]

Or

4. (a) Fig. 2 shows a sewing needle bar mechanism  $O_1ABO_2CD$  wherein the different dimensions are as follows :

Crank  $O_1A = 16$  mm;  $\angle \beta = 45^\circ$ ; Vertical distance between  $O_1$  and  $O_2 = 40$  mm; Horizontal distance between  $O_1$  and  $O_2 = 13$  mm;  $O_2B = 23$  mm;  $AB = 35$  mm;  $\angle O_2BC = 90^\circ$ ;  $BC = 16$  mm;  $CD = 40$  mm. D lies vertically below  $O_1$ .

Find the velocity of needle at D for the given configuration.  
 The crank  $O_1A$  rotates at 400 r.p.m. [10]



(All dimensions are in mm)

Fig. 2

- (b) The crank and connecting rod of a reciprocating engine are 200 mm and 700 mm respectively. The crank is rotating in clockwise direction at 120 rad/s. Find with the help of Klein's construction :
- (i) Velocity and acceleration of the piston,
  - (ii) Velocity and acceleration of the mid point of the connecting rod, and
  - (iii) Angular velocity and angular acceleration of the connecting rod, at the instant when the crank is at  $30^\circ$  to I.D.C. (inner dead centre). [8]

5. (a) Explain in detail the following :
- (i) Coulomb's Theory of Interlocking.
  - (ii) Stick-slip Mechanism of friction. [8]
- (b) Explain in detail various types of friction. [8]

*Or*

6. (a) Write short notes on (any *two*) :
- (i) Two body and three body abrasive wear
  - (ii) Corrosive wear
  - (iii) Surface fatigue wear. [8]
- (b) Define 'Tribology'. Discuss the different areas covered under 'Tribology'. [5]
- (c) Define the terms :
- (i) Friction
  - (ii) Coefficient of friction. [3]

## SECTION II

7. (a) Obtain an expression for the length of an open belt drive. [6]
- (b) An open belt running over two pulleys 240 mm and 600 mm

diameter connects two parallel shafts 3 metres apart and transmits 4 kW from the smaller pulley that rotates at 300 r.p.m. The coefficient of friction between the belt and the pulley is 0.3 and the safe working tension is 10 N per mm width.

Determine :

(i) Minimum width of the belt,

(ii) Initial belt tension, and

(iii) Length of the belt required. [10]

*Or*

8. (a) For a flat belt drive, prove that :

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where,  $T_1$  = Tension on tight side of belt.

$T_2$  = Tension on slack side of belt.

$\mu$  = Coefficient of friction between the belt and the pulley surface.

$\theta$  = Angle of contact between the belt and the pulley. [6]

- (b) An open belt drive connects two pulleys 1.2 m and 0.5 m diameter, on parallel shafts 4 metres apart. The mass of the belt is 0.9 kg per metre length and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 1.2 m pulley, which is the driver, runs at 200 r.p.m. Due to belt slip on one of the pulleys, the velocity of the driven shaft is only 450 r.p.m.

Calculate :

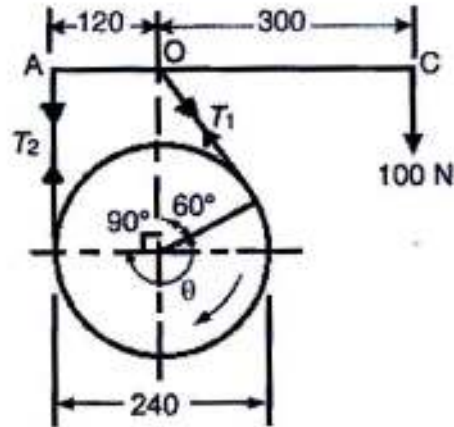
- (i) The torque on each of the two shafts,  
(ii) The power transmitted, and power lost in friction.  
(iii) What is the efficiency of the drive ? [10]

9. (a) The simple band brake, as shown in Fig. 3, is applied to a shaft carrying a flywheel of mass 400 kg. The radius of gyration of the flywheel is 450 mm and runs at 300 r.p.m. If the coefficient of friction is 0.2 and the brake drum diameter is 240 mm,

Find :

- (i) The torque applied due to a hand load of 100 N,  
(ii) The number of turns of the wheel before it is brought to rest, and

- (iii) The time required to bring it to rest, from the moment of the application of the brake. [10]



(All dimensions are in mm)

Fig. 3

- (b) Write a short note on differential band brake. [6]

*Or*

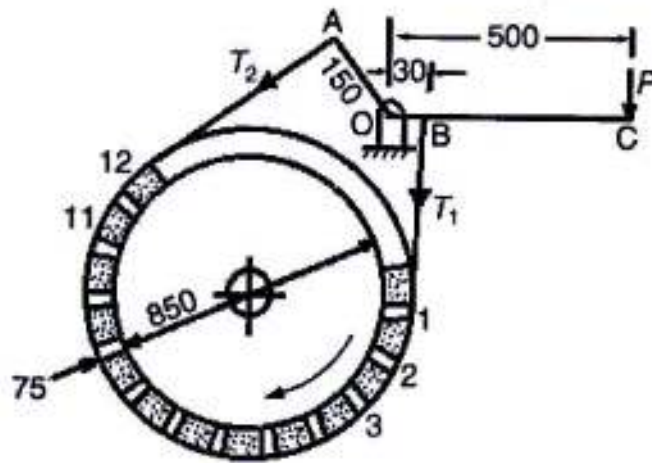
10. (a) In the band and block brake shown in Fig. 4, the band is lined with 12 blocks each of which subtends an angle of  $15^\circ$  at the centre of the rotating drum. The thickness of the blocks is 75 mm and the diameter of the drum is 850 mm.  $OA = 150$  mm and  $OB = 30$  mm. If, when the brake is in action, the greatest and least tensions in the brake strap are

$T_1$  and  $T_2$ , show that :

$$\frac{T_1}{T_2} = \left( \frac{1 + \mu \tan 7.5^\circ}{1 - \mu \tan 7.5^\circ} \right)^{12}$$

Where,  $\mu$  is the coefficient of friction for the blocks.

With the lever arrangement as shown in Fig. 4, find the least force required at C for the blocks to absorb 225 kW at 240 r.p.m. The coefficient of friction between the band and blocks is 0.4. [10]



(All dimensions are in mm)

Fig. 4

- (b) Explain with the help of a neat sketch the construction and working of Prony Brake Absorption Dynamometer. [6]

11. (a) Explain how mass moment of inertia of connecting rod is determined by compound pendulum method. [6]

(b) The following data relate to a connecting rod of a reciprocating engine :

Mass = 55 kg; Distance between bearing centres = 850 mm;  
Diameter of small end bearing = 75 mm; Diameter of big end bearing = 100 mm; Time of oscillation when the connecting rod is suspended from small end = 1.83 sec; Time of oscillation when the connecting rod is suspended from big end = 1.68 sec.

Determine :

(i) The radius of gyration of the rod about an axis passing through the centre of gravity and perpendicular to the plane of oscillation,

(ii) The moment of inertia of the rod about the same axis, and

(iii) The dynamically equivalent system for the connecting rod, constituted of two masses, one of which is situated at the small end centre. [12]



*Or*

- 12.** (a) Explain D'Alembert's principle. [4]
- (b) With the help of the neat schematic diagram, derive frequency equation of Bifilar Suspension System. [6]
- (c) The connecting rod of an oil engine has a mass of 60 kg, the distance between the bearing centres is 1 metre. The diameter of the big end bearing is 120 mm and of the small end bearing is 75 mm. When suspended vertically with a knife-edge through the small end, it makes 100 oscillations in 190 seconds and with knife-edge through the big end it makes 100 oscillations in 165 seconds. Find the moment of inertia of the rod in  $\text{kg-m}^2$  and the distance of C.G. from the small end centre. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-136**

**S.E. (Production) (Second Semester) EXAMINATION, 2012**

**WELDING AND FOUNDRY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answers to the two Sections should be written in separate answer-books.
  - (ii) Neat diagrams must be drawn wherever necessary.
  - (iii) Figures to the right indicate full marks.
  - (iv) Assume suitable data if necessary.

**SECTION I**

- 1.**
- (a) Compare Tungsten Inert Gas (TIG) and Metal Inert Gas (MIG) weldings. [10]
  - (b) Describe with neat sketch Submerged Arc Welding (SAW). [8]

*Or*

- 2.**
- (a) Explain with sketch Voltage Vs Current and Voltage Vs Arc length characteristics in welding. [8]
  - (b) Explain Gas Tungsten Arc Welding (GTAW) process with its working principle, advantages, disadvantages and applications. [10]

P.T.O.

3. (a) Explain with suitable sketches different types of oxyacetylene gas flames. [8]
- (b) Compare with neat sketch leftward and rightward gas welding techniques. [8]

*Or*

4. (a) Compare spot welding and seam welding with neat sketch. [8]
- (b) Describe different variables in resistance welding process. Explain how heat balance is obtained in spot welding. [8]
5. (a) Compare soldering and brazing processes. [8]
- (b) Describe explosive welding with its advantages, disadvantages and applications. [8]

*Or*

6. (a) Compare electron beam welding with laser beam welding. [8]
- (b) Write a short note on dye penetrant testing of weld. [8]

## **SECTION II**

7. (a) Which are the important properties of moulding sand ? How is permeability moulding sand tested ? [8]

- (b) Explain with neat sketch construction and working of Cupola furnace. [10]

*Or*

8. (a) Explain with neat sketch different type of patterns. List out merits and demerits of different pattern materials. [10]
- (b) Explain with neat sketch function of various components of gating system. [8]
9. (a) Explain with neat sketch Investment Casting process. [8]
- (b) Differentiate between hot chamber and cold chamber die casting. [8]

*Or*

10. (a) Explain with neat sketch centrifugal casting processes. [8]
- (b) Explain various casting defects with their causes and remedies. [8]
11. (a) Define gating ratio. Differentiate pressurized and un-pressurized gating. [8]

- (b) Explain modulus method and NRL method for riser design. [8]

*Or*

12. (a) What is meant by directional and progressive solidification of casting ? [8]

- (b) Using Caine's method and NRL method calculate the size of cylindrical riser [Height = Diameter] necessary to feed steel slab casting  $100 \times 50 \times 10$  cm with side riser, casting is poured horizontally into the mould.

Data for steel casting  $a = 0.1$ ,  $b = 0.03$  and  $c = 1.0$

Ratio Volume of riser to Volume of casting = 0.47. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-137**

**S.E. (Production/Prod S/W) (Second Semester) EXAMINATION, 2012**

**DESIGN OF MACHINE ELEMENTS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of electronic pocket calculator is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Why factor of safety is necessary in the design of mechanical components ? Discuss the important factors that influence the selection of the factor of safety. [4]

(b) What are the various types of stresses induced in a mechanical component ? Support your answer with necessary equations. [6]

P.T.O.

- (c) A C-frame subjected to a force of 8 kN is shown Fig. 1. It is made of gray cast iron FG 300. If factor of safety is 5, determine the dimensions of the cross-section of frame. [8]

Fig. 1

*Or*

2. (a) State various considerations influencing machine component design. [6]
- (b) Two rod ends of a pump are joined by means of a cotter and spigot and socket at the ends. Design and draw a joint for an axial load of 100 kN which alternately changes from tensile to compressive. The allowable stresses for the material is as follows :
- (1) Allowable tensile stress = 50 N/mm<sup>2</sup>
  - (2) Allowable crushing stress = 100 N/mm<sup>2</sup>
  - (3) Allowable shear stress = 40 N/mm<sup>2</sup>. [12]

3. (a) A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is  $180^\circ$  and  $\mu = 0.24$ . Determine suitable diameter for a shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear. Assume that the torque on one pulley is equal to other pulley. [12]
- (b) Explain A.S.M.E. code for shaft design. [4]

*Or*

4. (a) Explain with a neat sketch the construction and working of protected type rigid flange coupling and show the important dimensions. [10]



- (b) Explain basic procedure for the design of muff coupling with neat sketch. [6]
5. (a) A steel plate subjected to a force of 8 kN is fixed to a channel by means of three identical bolts as shown in Fig. 2. The bolts are made of 45C8 ( $S_{yt} = 380 \text{ N/mm}^2$ ). If the required factor of safety is 2.5, determine the size of the bolts.[10]

Fig. 2

- (b) Derive an expression for torque required to tighten the bolt with metric threads. [6]

*Or*

6. (a) With neat sketches, describe the various types of welded joints. [6]
- (b) A bracket plate carrying a load of 120 kN is to be welded to a column as shown in Fig. 3. Find the size of the weld, if the allowable shear stress in the weld is 110 MPa. [10]

Fig. 3

## SECTION II

7. (a) What do you understand by self-locking screw ? Explain the condition for self-locking. [4]
- (b) A square threaded, triple start power screw, used in a screw-jack, has a nominal diameter of 50 mm and a pitch of 8 mm. The screw-jack is used to lift a load of 7.5 kN. The coefficient of thread friction is 0.12 and collar friction is negligible. If the length of nut is 48 mm, calculate :
- (1) The maximum shear stress in the screw body.

- (2) The direct shear stress in screw and nut and
- (3) The bearing pressure.

State whether the screw is self-locking ? [12]

*Or*

8. A  $26 \times 5$  square threaded, double start power screw is used to support a load of 15 kN. The effective diameter of the collar is 50 mm and the coefficient of friction is 0.16. The nut is made of phosphor bronze having 0.2 as coefficient of friction and 6 MPa as allowable bearing pressure. The length of the handle is 300 mm.

Calculate :

- (1) The force required to raise the load;
- (2) The force required to lower the load;
- (3) The yield strength of material for a factor of safety of 5.
- (4) The overall efficiency of the screw and
- (5) The number of threads in nut. [16]

9. (a) Explain the following terms in springs :

- (1) Wahl stress factor
- (2) Surge in springs
- (3) Solid and free length. [6]

- (b) Design a helical spring for a spring loaded safety valve for the following conditions :

- (1) Diameter of valve seat = 65 mm
- (2) Operating pressure =  $0.7 \text{ N/mm}^2$
- (3) Maximum pressure when valve blows off freely =  $0.75 \text{ N/mm}^2$ .

- (4) Maximum lift of the valve when the pressure rise from 0.7 to 0.75 N/mm<sup>2</sup> = 3.5 mm
- (5) Maximum allowable stress = 550 MPa.
- (6) Modulus of rigidity = 84 kN/mm<sup>2</sup>
- (7) Spring index = 6

Draw a neat sketch of the free spring showing the main dimensions. [10]

*Or*

10. (a) Write a short note on helical torsion spring. [4]
- (b) It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of a spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 N/mm<sup>2</sup> and 81370 N/mm<sup>2</sup> respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate :
- (1) Wire diameter;
  - (2) Mean coil diameter
  - (3) Number of active coils
  - (4) Total number of coils
  - (5) Free length of the spring and
  - (6) Pitch of the coil

Draw a neat sketch of the spring showing various dimensions. [12]

11. (a) Explain the man-machine relationship. How does the working environment affects this relationship ? [6]
- (b) Explain the role of the following aspects in the aesthetic design :
- (1) Shape
  - (2) Proportion
  - (3) Impression. [6]
- (c) Write a short note on designing for appearance. [6]

*Or*

12. (a) Explain the guidelines to be followed in the design of the parts for the following processes :
- (1) Casting
  - (2) Forging. [6]
- (b) Write short notes on :
- (1) Design for manufacturing (DFM)
  - (2) Design for Assembly (DFA)
  - (3) Concurrent Engineering. [12]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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[4162]-138

**S.E. (Production) (Second Semester) EXAMINATION, 2012**

**INDUSTRIAL ORGANISATION AND MANAGEMENT**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of logarithmic table is allowed.

(v) Assume suitable data, if necessary.

**SECTION I**

**UNIT I**

1. (a) Define management. Explain the characteristics and objectives of management. [10]

(b) Why is line and staff organization preferred over line or functional organization ? [6]

P.T.O.

*Or*

2. (a) Define organization and explain its principles. [8]  
(b) Explain the following with the chart : [8]  
(i) Matrix organization  
(ii) Line and staff organization.

## UNIT II

3. (a) Define Motivation. Explain why there is a need of Motivation ? [9]  
(b) Discuss Herzberg's theory of two factors. What is the major criticism of this theory ? [9]

*Or*

4. (a) What are the basic types of groups in organizations ?  
Which types of group do you think is the most significant ?  
Why ? [9]  
(b) Define Leadership. What do you mean by managerial grid ? [9]

## UNIT III

5. (a) Define entrepreneurship and explain its concept. List down qualities of entrepreneur. [8]  
(b) M/s Techno Engineers is manufacturing a product which is sold for Rs. 10.50/unit and the fixed cost of the assets is Rs. 50,000 with a variable cost of Rs. 6.50/unit. How many

units should be produced to break even ? How many units must be produced to earn a profit of Rs. 10,000 ? What would be the profit for sales volume of 20,000 units ? [8]

*Or*

6. (a) Explain the need of break-even analysis in entrepreneurship. [8]
- (b) The fixed cost for the year 2011-2012 are Rs. 1,00,000. The estimated sales are Rs. 3,00,000. The variable cost per unit for single product made is Rs. 5.00. If each unit sells at Rs. 30 and the number of units involved coincides with the expected volume of output, construct the break-even chart and
- (i) Determine B.E.P.
  - (ii) Determine the profit at a turn-over of Rs. 1,80,000
  - (iii) Find the margin of safety
  - (iv) Measure the angle of incidence. [8]

## SECTION II

### UNIT IV

7. (a) Why is it important that the advertising media and creative departments work together ? [8]
- (b) Define marketing and explain various steps in marketing process. [8]



*Or*

- 8.** (a) Describe the decisions company makes regarding : [8]  
(i) Individual products  
(ii) Product lines  
(iii) Product mixes.
- (b) Describe the stages of the product life cycle. [8]

### **UNIT V**

- 9.** (a) Define manpower planning and discuss the process of manpower planning. [8]
- (b) Define selection and describe various steps in the selection procedure. [8]

*Or*

- 10.** (a) Define human resource management. Explain objectives of human resource management. [8]
- (b) Discuss merits and limitations of recruitment from within the organization and through advertising. [8]

### **UNIT VI**

- 11.** (a) Define job evaluation. Explain steps in job evaluation process. [8]

- (b) The standard time of a job is 8 Hrs. and hourly rate of payment is Rs. 10. The worker completes the job in 6 Hrs. Calculate bonus and total wages earned by worker by 50-50 Halsey Incentive Plan. Compare bonus and earnings by Rowan Plan. [4]
- (c) Discuss imposition of fine and penalty under the Payment of Wages Act. [6]

*Or*

- 12.** (a) Discuss the scope and important aspects of the Industrial Disputes Act. [8]
- (b) The workers are paid as per Bedaux plan. The hourly wage rate is Rs. 15. Standard time for a particular job is 8 hrs. Calculate daily earning of a worker if the job is completed in 6 hrs. and 8 hrs. respectively. [4]
- (c) Explain factor comparison method of Job Evaluation. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-139**

**S.E. (Prod. S/W) (First Semester) EXAMINATION, 2012**

**MANUFACTURING PROCESSES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

(vi) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

## **SECTION I**

### **Unit I**

1. (a) What are split and multipiece patterns ? What are the advantages of making them in two or more pieces ? Sketch it and give examples. [6]

P.T.O.

- (b) How are the 'Moisture content' and 'Clay content' of a moulding sand tested ? [6]
- (c) What are chaplets ? Why are they used ? Sketch and describe various types of chaplets. [6]

*Or*

- 2.** (a) Explain the causes and remedies of the following casting defects :
- (i) Fusion
- (ii) Shifts
- (iii) Swells. [6]
- (b) With the help of neat diagram describe the process of true centrifugal casting. Name the products made by this method, its advantages and limitations if any. [9]
- (c) Differentiate between hot chamber and cold chamber die casting processes. [3]

## **Unit II**

- 3.** (a) Explain with neat sketches the following forging operations :
- (i) Upsetting
- (ii) Fullering
- (iii) Drawing Out. [3]
- (b) With a neat sketch explain Indirect Extrusion, stating advantages, limitations and area of applications. [7]

- (c) Explain with the help of neat sketch the working of Board Drop Hammer. [6]

*Or*

4. (a) With a neat figure examine a 2-high and 3-high rolling mill. [8]
- (b) Explain only operation principle of the following processes with the help of the neat sketch :
- (i) HERF (High energy rate of forming)
- (ii) Rotary swaging cold working process. [8]

### Unit III

5. (a) Describe with the help of suitable working setup, principle of operation and area of application of GMAW process. [8]
- (b) Explain with a neat sketch, 'Electron Beam' welding process stating its advantages, limitations and area of applications. [8]

*Or*

6. (a) Differentiate between the following processes :
- (i) Forehand and backhand gas welding techniques
- (ii) Spot welding and seam welding. [8]
- (b) Explain with neat sketch 'Thermit welding' process. State its advantages and limitations and area of application. [8]

## SECTION II

### Unit IV

7. (a) Sketch and explain the construction and working of the tailstock of a lathe. [6]
- (b) Sketch and describe the following :
- (i) Angle Plate
  - (ii) Lathe dogs. [6]
- (c) State the functions of the following in Lathe :
- (i) Half centre
  - (ii) Follower rest
  - (iii) Chasing dial
  - (iv) Mandrel. [6]

*Or*

8. (a) Explain the following operations performed on lathe with the help of simple sketch :
- (i) Eccentric turning
  - (ii) Facing
  - (iii) Parting off. [6]
- (b) Discuss any *three* cutting tool material. [6]
- (c) How do you specify a lathe machine ? “Box section casting is best for lathe bed”. Comment. [6]

## Unit V

9. (a) Explain the following terms related to drilling :
- (i) Cutting speed
  - (ii) Feed
  - (iii) Depth of cut. [3]
- (b) Sketch and describe in short the following milling cutters :
- (i) Plain milling cutter
  - (ii) End mill
  - (iii) Angular milling cutter. [6]
- (c) What is twist drill ? Draw neat sketch of twist Drill showing various parts and name it properly. [7]

*Or*

10. (a) Differentiate between up milling and down milling. [4]
- (b) Calculate differential indexing for 89 divisions :
- Hole circles are 15, 16, 17, 18, 19 and 20.
- Gear set is 24(2), 28, 32, 40, 44, 48, 56, 64, 72, 86 and 100 teeth. [6]
- (c) Sketch and describe in brief a Sensitive Drilling Machine. [6]

## Unit VI

11. (a) Define abrasive and differentiate between aluminium oxide and silicon carbide grinding wheel in respect of :
- (i) hardness of wheel
  - (ii) application
  - (iii) type of bond
  - (iv) cost of wheel. [8]
- (b) Explain the principle of centreless grinding. How do the 'Through feed' and 'Infeed' methods differ in centreless grinding and where are they used ? [8]

*Or*

12. (a) How a grinding wheel is marked (Coded) ? Describe Indian Standard marking system with example. [4]
- (b) Explain the terms 'Loading' and 'Glazing' as applied to grinding wheels. [6]
- (c) What is super finishing ? How does it differ from lapping and honing ? [6]



Total No. of Questions—6]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-140**

**S.E. (Production / S/W) (Second Semester) EXAMINATION, 2012**

**PRODUCTION AND INDUSTRIAL MANAGEMENT-I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Attempt *All* questions.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Use of logarithmic tables, slide rule, Mollier chart, and steam tables is allowed.

(iv) Assume suitable data if necessary.

1. (a) Define management and its necessity. Explain contribution of F.W. Taylor and H. Fayol in detail. [14]
- (b) Explain different types of management. [2]

*Or*

- (a) Explain the following (any *two*) : [8]
- (i) Types of organization
- (ii) Group dynamics
- (iii) Principles of organization.
- (b) Explain different forms of business ownership. Explain public limited company in detail. [8]

P.T.O.

2. (a) For production management explain the following : [12]
- (i) Objectives
  - (ii) Elements
  - (iii) Productivity
  - (iv) Functions.
- (b) Draw (only sketch) showing various types of plant layout. [4]

*Or*

Write short notes on the following (any *two*) : [16]

- (i) Types of production
  - (ii) Production planning and control
  - (iii) Process planning.
3. (a) Define method study. Explain *eight* basic procedures of method study. [8]
- (b) Explain the following (any *two*) : [8]
- (i) Flow process chart
  - (ii) SIMO chart
  - (iii) 5 W and 1 H.
- (c) Explain how will you select the job to be analyzed in method study. [2]

Or

- (a) Explain the following (any *two*) : [16]
- (i) Flow diagrams
  - (ii) Chronocyclograph
  - (iii) Different method study symbols for recording data and their description with suitable example.
- (b) Define Ergonomics. State its importance in industry. [2]

4. In making a time study of a laboratory technician in a canned factory following times are noted for particular operation :

Run	Observed time in (mins)
1	12
2	21
3	14
5	24
6	25
7	18
8	19
9	17
10	15

Watch reading falls 50% above and 25% below the average and is excluded from further analysis.

For further time-study analysis, manual ratings are 80% for cycle time upto 15 mins and 85%, above 15 mins. Element no. 5, 7 and 9 are machine elements. Calculate standard time considering policy allowance of 10%. [16]

*Or*

- (a) A work sampling study was carried out giving the following recorded facts : [4]

Total time observed = 6500 min

No. of working observations = 3000

Number of idle observations = 200.

Estimate the accuracy of 95% confidence level.

- (b) Compare MTM1, MTM2 and MTM3 with respect to Therbligs utilized and Time Measurement Unit (TMU). [8]

- (c) For basic MOST, explain  $A_{10}$   $B_6$   $G_{10}$   $B_0$   $P_1$   $A_0$ . [4]

5. For theories of motivation explain the following (any *two*) : [16]

(i) McGregor's theory of X and theory Y

(ii) Herzberg's theory of two factor

(iii) Theory of Victor Vroom

(iv) Porter and Lawler's model.

*Or*

Write short notes on the following (any *two*) : [16]

(i) Styles and functions of leadership

(ii) Role of leader

(iii) Qualities of good entrepreneur.

6. (a) Explain any *two* of the following : [16]

(i) Difference between HRM and personnel management

(ii) Job evaluation and merit rating

(iii) Types of incentive systems

(b) Explain the need of training and development. [2]

*Or*

(a) A product is manufactured as per following details :

Annual sales (8000 units at the rate of ₹ 10/unit) :

Variable Expenses = ₹ 64,000

Contribution = ₹ 16,000

Fixed Expenses = ₹ 24,000

Loss = ₹ 8,000.

(i) What sales are needed to break-even ? [4]

(ii) What sales are necessary to result in a net income of ₹ 9,000 with a sales tax rate of 12.5%. [8]

(iii) What should be selling price per unit if break-even point is to be brought down to 10,000 units. [4]

(b) State different types of financial institutions from whom you can raise finance for setting up new industry. [2]

Total No. of Questions—6]

[Total No. of Printed Pages—16

<b>Seat No.</b>	
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**[4162]-140A**

**S.E. (Production S/W) (Second Semester) EXAMINATION, 2012**

**MANUFACTURING ENGINEERING AND**

**METROLOGY PRACTICES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) *All* questions are compulsory.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(v) Assume suitable data, if necessary.

### **SECTION I**

1. (a) In orthogonal turning of an engineering alloy, it has been observed that friction force acting at chip tool interface is 402.5 N and the friction force is also perpendicular to the cutting velocity vector.

P.T.O.

The feed velocity is negligibly small with respect to cutting velocity. The ratio of friction force to normal force associated with chip-tool interface is 1. The uncut chip thickness is 0.2 mm and the chip thickness is 0.4 mm. The cutting velocity is 2 m/sec.

Calculate :

(i) Friction angle [2]

(ii) Shear force [in (N)] acting along the primary shear plane. [4]

(b) In a machining operation, tool life was found to vary with cutting speed in the following manner :

<b>Cutting Speed (m/min)</b>	<b>Tool Life (min)</b>
60	81
90	36

Calculate :

(i) The exponent ( $n$ ) and the constant ( $c$ ) of Taylor's tool life equation. [4]

(ii) What is the percentage increase in tool-life when cutting speed is halved ? [2]

(c) Answer the following (any *four*) : [4]

(Only first attempt will be evaluated)

(i) Friction angle between chip and tool may be reduced by :

(a) Increase in sliding velocity

(b) Increase in shear angle

(c) Use of low tool finish

(d) Decrease in shear angle

(ii) During turning of low carbon steel bar with Tin coated insert, one needs to improve surface finish without sacrificing material removal rate. To achieve improved surface finish, one should :

(a) Decrease nose radius of cutting tool and increase depth of cut

(b) Increase nose radius of cutting tool

(c) Increase feed and decrease nose radius of cutting tool

(d) Increase depth of cut and increase feed

(iii) Discontinuous chips are formed, when machining speed is :

(a) High

(b) Low

(c) Medium

(d) Irrespective of cutting speed



(iv) Describe the tool represented by :

10, 10, 6, 6, 8, 1 mm in ASA system.

(v) For shear angle relationships, write mathematical equations for :

(a) Ernst and Merchant

(b) Lee and Shaffer.

*Or*

(a) For designing a single point cutting tool, to turn a M.S. bar with a linear cutting speed of 40 m/min, on a lathe equipped with a 10 kW motor. Safe stress for tool material is 250 MPa and efficiency of machine tool is 70%.

Determine :

(i) Cutting force

(ii) Width of shank

(iii) Height of shank

(iv) Shank overhange. [8]

(b) For designing a drill, explain the following (any *four*) :

(i) Mathematical expression for feed angle

(ii) Mathematical expression for thrust force

(iii) Mathematical expression for rake angle

(iv) Draw a free-hand sketch of drill geometry showing helix angle, lip relief angle.

(v) Mathematical expression for machining time including approach of drill. [8]

2. (a) Draw the tool layout for manufacturing knurled screw and nut on capstan lathe as per the following sketch : [8]

Also write all the operations to be carried out for producing above job on capstan lathe. [2]

(b) Draw the following Work-Holding Equipment for turret lathe collets : Drawback collet and push out collet. [4]

(c) Distinguish between 'Saddle type turret lathe' and 'Ram type turret lathe'. [2]

*Or*

- (a) For the procedure of laying out tools for an automatic screw machine to manufacture the component as shown in Fig. 2 (a) (ii) determine the following :
- (i) Spindle speed if Material is Brass of 16 mm diameter [1]
  - (ii) Sequence of operations [1]
  - (iii) Travel for each tool or cam throw [2]
  - (iv) Operation sheet for automatic screw machine showing hundredths on cam for all operative units [6]
  - (v) Sketch of CAM layout. [4]
- (b) In a shaper, length of stroke is 210 mm, number of double strokes per minute is 32 and ratio of return time to cutting time is 2 : 3. Calculate cutting speed. [2]

3. (a) Draw a schematic sketch of a typical internal broach showing rear pilot, root diameter, front pilot, pull end, follow-rest grip, shank length, cutting length and overall length.  
(correct sketch with above 8 nomenclatures 1 mark each) [8]
- (b) Depending upon direction of feed of hob, explain the following gear hobbing process, with a neat sketch. Showing position of Hob and a Gear blank. (any *two*)
- (i) Axial Hobbing
- (ii) Radial Hobbing
- (iii) Tangential Hobbing. [8]
- (c) Explain which material, you will use for the following mechanical characteristics, to produce gears. (any *two*) [2]
- (i) If stress on gear is high and it is difficult fabricate gears
- (ii) For industry applications where conditions are of varying loads and shocks
- (iii) If hardness is very high in the range of [750 to 800 BHN]

*Or*

- (a) Explain the difference between form Gear Grinding and Generation Gear Grinding. [4]
- (b) Differentiate between 'Traverse thread grinding' and 'plunge cut grinding' ? [4]

- (c) Draw only sketch along with their nomenclatures for the following thread rolling machines :
- (i) Reciprocating, flat die machines [2]
  - (ii) Cylindrical die machines [4]
  - (iii) Rotary planetary machines having a rotary die and one or more stationary concave-die segments. [4]

## SECTION II

4. (a) A CNC vertical milling machine has to cut a straight slot of 10 mm width and 2 mm depth by a cutter of 10 mm diameter between points (0, 0) and (100, 100) on  $xy$  plane (dimensions in mm). The feed rate used for milling is 50 mm/min. Calculate milling time for the slot (in seconds). [4]
- (b) For a 3-axes CNC table, the slide a long the vertical axis of a table is driven by DC servo-motor via a lead-screw-nut mechanism. The lead-screw has a pitch of 5 mm. This lead screw is fitted with a relative (incremental) circular encoder. The basic length unit (BLU) of the slide along the vertical axis of table is 0.005 mm. Calculate the corresponding number of pulses generated by encoder if the table moves along the vertical axis by 9 mm. [4]

- (c) Calculate the total angular movement (in degrees) of a lead-screw with a pitch of 5.0 mm is used to drive the work-table by a distance of 200 mm. [4]
- (d) Explain the function of interpolator in CNC machine control and explain interpolation in detail. [4]

*Or*

- (a) Write a CNC program in G and M code for a part as shown in the following figure Q. 4 (a). Also write a remark for each block. [10]

(b) Explain the following for Flexible Manufacturing System (FMS)  
(any *three*) : [6]

(i) Schedule change test

(ii) Error recovery test

(iii) Dedicated FMS

(iv) Traffic and shuttle control

(v) Only sketch of ladder type FMS Layout.

5. Answer any *eight* of the following (2 Each) : [16]

(First attempt in answer paper only going to be evaluated) :

(1) Circular blanks of 35 mm diameter are punched from a steel sheet of 2 mm thickness. If the clearance per side between punch and die is to be kept as 40 microns, the sizes of punch and die should be :

(i)  $35^{+0.00}$  and  $35^{+0.040}$

(ii)  $35^{-0.040}$  and  $35^{-0.080}$

(iii)  $35^{+0.00}$  and  $35^{+0.080}$

(iv)  $35^{+0.040}$  and  $35^{-0.080}$

(calculation steps are essential for finalizing answer).

- (2) In a blanking operation, clearance is provided on :
- (i) The die
  - (ii) The punch
  - (iii) Both punch and die equally
  - (iv) Neither punch nor die
- (3) The force required to pierce a circular hole of diameter 20 mm in a 2 mm thick plate of mild steel with the help of flat ended die and punch in a press tool ? Shear strength of work material is 350 MPa.
- (Show all calculation steps) :
- (i) 43.98 kN
  - (ii) 42.98 kN
  - (iii) 43.04 kN
  - (iv) 42.00 kN.
- (4) Give mathematical expression for calculating blank size if :
- (i)  $\frac{d}{r} \geq 20$
  - (ii)  $\frac{d}{r}$  is between 15 and 20
  - (iii)  $\frac{d}{r}$  is between 10 and 15
  - (iv)  $\frac{d}{r}$  is  $< 10$

where  $d$  = diameter of finished shell and  $r$  is radius of bottom corner, in a drawing process for plain cylindrical shells.



- (5) Draw a neat sketch of commercial die set.
- (6) Draw a schematic sketch of progressive die for manufacturing washer.
- (7) Explain coining process.
- (8) Explain different advantages of Hydraulic press over mechanical press.
- (9) Explain terms : Pitman, Shut Height.

*Or*

- (a) A washer with a 12.7 mm internal hole and an outside diameter of 25.4 mm is to be made from 1.5 mm thick strip of 0.2 percent carbon steel. Considering the elastic recovery of material find :
  - (i) Clearance [1]
  - (ii) Blanking die opening size [2]
  - (iii) Blanking die punch size [4]
  - (iv) Piercing punch size [2]
  - (v) Piercing die size. [1]
- (b) For sheet metal working process, explain the following (any two) : [6]
  - (i) Center of pressure
  - (ii) Sheet utilization ratio
  - (iii) Methods of reducing forces.

6. (a) Answer the following (any four) (two each) : [8]

(1) The floating position of holding fixture in a rotary transfer device is used to :

(a) Improve accuracy of location

(b) Reduce tendency to over index

(c) Reduce cycle time

(d) Improve upon acceleration and deceleration characteristics

(2) When supported on three points, out of 12 degrees of freedom arrested in a body is :

(a) 3

(b) 4

(c) 5

(d) 6

(3) Consider the following statements regarding fixtures employed for holding workpiece during machining :

(i) The location is based on 3-2-1 principle.

(ii) The number refers to the pins employed in three mutually perpendicular planes to arrest all degrees of freedom.

(iii) Fixture also provides good guidance

of these statements :

(a)  $i$ ,  $\bar{i}$  and  $\bar{\bar{i}}$  are correct

(b)  $\bar{i}$  and  $\bar{\bar{i}}$  are correct

(c)  $i$  and  $\bar{\bar{i}}$  are correct

(d)  $i$  and  $\bar{i}$  are correct

- (4) Match List I and List II and select the answer using codes given below the lists :

<b>List I</b>	<b>List II</b>
<b>(Task)</b>	<b>(Recommendation)</b>
(A) Three component in a straight line should be worked in one loading	(1) Clamp with floating pad
(B) Unloading of clamp element from jig is essential	(2) Quick action nut
(C) Clamping of rough surfaces	(3) Cam clamp
(D) Need for heavy clamping force	(4) Equalising clamp
	(5) Strap clamp

Codes :

	A	B	C	D
(a)	5	2	3	4
(b)	1	4	2	3
(c)	4	2	1	5
(d)	4	1	5	5

(5) 3-2-1 method of location in a jig or fixture would collectively restrict the workpiece in  $n$  degrees of freedom, where value of  $n$  is :

(a) 6

(b) 8

(c) 9

(d) 12

(Note for all 1-5, only first attempted answers will be evaluated)

(b) Explain the procedure of error analysis for locating the workpiece in jigs and fixture for dimensional and geometrical errors. [8]

(c) List at least four types of drill bushes for drilling jig. [2]

*Or*

(a) Explain the difference between jig and fixture with respect to the following : [6]

(i) Holding and positioning of work and tool

(ii) Easiness of locating and clamping

(iii) Operations such as milling, grinding, planing or turning, drilling, reaming or tapping operations.

- (b) Draw only sketch for the following (any *four*) : [12]
- (i) Box type jig
  - (ii) Setting block used for milling fixture
  - (iii) Fool proofing for jig and/or fixture
  - (iv) Use of quick acting nut
  - (v) Channel type jig
  - (vi) Cam-operated clamp.

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-140-B**

**S.E. (Production/Production S/W)**

**EXAMINATION, 2012**

**MANUFACTURING PROCESS-I**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) *All* units are compulsory.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

**SECTION I**

**UNIT I**

1. (a) Explain with suitable sketches, the different types of patterns used in sand moulding. [9]
- (b) Explain machine moulding processes with suitable sketches. [9]

P.T.O.

*Or*

2. (a) Explain various types of sand testing methods with suitable sketches. [9]
- (b) Explain types of risers with suitable sketches. [9]

### **Unit II**

3. (a) Explain investment casting with suitable sketches. [8]
- (b) Discuss the need of automation in foundry and explain how it can be achieved from sand preparation to the finishing of castings ? [8]

*Or*

4. (a) Explain causes and remedies for the following casting defects :
- (i) Blow holes
- (ii) Cold shut
- (iii) Hot-tear
- (iv) Sand drop. [8]
- (b) Explain pressure die casting with suitable sketches. [8]

### **Unit III**

5. (a) Explain taper turning methods with suitable sketches. [8]
- (b) Explain all geared headstock with suitable sketch. [8]

*Or*

6. (a) Explain Tumbler gear mechanism with suitable sketch. [8]  
(b) Explain different types of rests used in lathe machine. [8]

## **SECTION II**

### **Unit IV**

7. (a) Explain working of radial drilling machine with suitable sketch. [9]  
(b) Explain types of drills with suitable sketches. [9]

*Or*

8. (a) Explain sensitive drilling machine with suitable sketch. [9]  
(b) Explain various operations which can be performed on drilling machine with suitable sketches. [9]

### **Unit V**

9. (a) Explain types of milling cutters with suitable sketches. [8]  
(b) Explain column and knee type milling machine with suitable sketch. [8]

*Or*

10. (a) Explain up-milling and down-milling with suitable sketches. [8]  
(b) Explain working of universal dividing head with suitable sketch. [8]



## Unit VI

11. (a) Explain types of bonds in grinding wheels. [8]  
(b) Explain grit, grade, structure of grinding wheel. [8]

*Or*

12. (a) Explain types of broaching machine with suitable sketches. [8]  
(b) Explain plain centre type grinding machine with suitable sketch. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-140-C**

**S.E. (Production-Sandwich) (Second Semester)**

**EXAMINATION, 2012**

**INDUSTRIAL ELECTRONICS**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Draw and explain VI characteristics of the following devices :
- (i) SCR
  - (ii) MOSFET

Give any *one* application of each device.

[8]

P.T.O.

- (b) What are the different types of protection circuits for power supply ? Explain any *two* in detail. [10]

*Or*

2. (a) Explain with neat circuit diagram the working of light dimmer. [8]  
(b) Explain RC and UJT triggering of a thyristor with waveform. [10]
3. (a) Explain S-R flip-flop with waveform. [2]  
(b) Define counter. Design 3 bit asynchronous up-counter with neat timing diagram. [6]  
(c) What is race around condition ? What are the different ways to eliminate it ? [8]

*Or*

4. (a) What are the requirements of an instrumentation amplifier ? Draw neat sketch of 3 op-amp instrumentation amplifier. Derive the expression for output voltage. [8]  
(b) Explain the operation of an Integrator with neat ckt. diagram along with examples. [8]
5. (a) With the help of neat diagram, explain overall system of PLC. What are the advantages of PLC over the relay system ? [8]

- (b) State the working principle of stepper motor. Explain construction of stepper motor in detail. [8]

*Or*

6. Write notes on : [16]
- (i) CNC
  - (ii) Fuzzy logic controller
  - (iii) DNC
  - (iv) Fan Regulator.

## SECTION II

7. (a) Explain the following with block diagram : [8]
- (i) Temperature controller
  - (ii) Ultrasonic level measurement.
- (b) Explain in detail what factor you will consider while selecting a transducer for particular application. [8]

*Or*

8. (a) Explain with neat diagram, how displacement can be measured using LVDT. [8]
- (b) Define proximity sensors and explain its types in detail. [8]

9. (a) Draw and explain the response of first-order system to a step input. [8]
- (b) State the explain the following specifications of a first-order system : [8]
- (i) Rise time
  - (ii) Time constant
  - (iii) Delay time
  - (iv) Percentage overshoot.

*Or*

10. (a) Obtain the solution of differential equation given below using Laplace transform.  
Neglect initial conditions : [4]
- $$\frac{d^2y(t)}{dt^2} + 6 \frac{dy(t)}{dt} + 8y(t) = 16 e^{-t}.$$
- (b) State the advantages of Laplace transform technique in solving linear differential equation. [4]
- (c) w.r.t. 2nd order system define the following terms : [8]
- (i) Delay time
  - (ii) Rise time
  - (iii) Maximum peak overshoot
  - (iv) Settling time.

**11.** Write short notes on : [18]

(i) Robotics

(ii) Water treatment plant

(iii) DAS

*Or*

**12.** Write short notes on : [18]

(i) Thermal power plant

(ii) Steel plant

(iii) SCADA.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-141**

**S.E. (Electrical) (First Semester) EXAMINATION, 2012**

**POWER PLANT ENGINEERING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

(v) Use of scientific calculator, steam table, Mollier charts is allowed.

**SECTION I**

**UNIT I**

1. (a) Explain with neat sketch working of Bomb Calorimeter. [8]

(b) Define : [8]

(i) HCV of fuel

(ii) LCV of fuel

(iii) Stoichiometric A; F ratio

(iv) Excess air.

P.T.O.

*Or*

- 2.** A steam power plant works on Rankine cycle, the steam enters to the turbine at 20 bar pressure and 300°C. It enters to the condenser at a pressure of 0.10 bar. Determine the following :
- (i) Pump work
  - (ii) Turbine work
  - (iii) Network done
  - (iv) Dryness fraction of the steam entering into the condenser
  - (v) Total heat supplied to the boiler
  - (vi) Work ratio
  - (vii) Rankine cycle efficiency
  - (viii) Specific steam consumption. [16]

## UNIT II

- 3.** (a) Explain with neat sketch working of a Modern Thermal Power Plant. [10]
- (b) Explain with neat sketch working of “Air Preheater”. [6]



*Or*

4. (a) Write a short note on “Coal Handling” and “Ash Handling”. [8]  
(b) Write a short note on “Thermal Power Plant Development Programme of India”. [8]

### **UNIT III**

5. (a) Explain with neat sketch working of a “Modern Hydroelectric Power Plant”. [10]  
(b) Explain with neat sketch working of “Pelton wheel”. [8]

*Or*

6. (a) Write a short note on “Selection of Turbines” and “Types of Dams”. [10]  
(b) Write a short note on “Spillways” and “Penstocks” in case of Hydropower Plant. [8]

### **SECTION II**

#### **UNIT IV**

7. (a) Explain advantages and disadvantages of Nuclear Power Plant. [6]

- (b) Discuss in brief concepts of : [6]
- (i) Isotopes
  - (ii) Nuclear fission.
- (c) Explain any *six* major factors to be considered for selection of site for Nuclear Power Plant. [6]

*Or*

8. (a) Explain with neat sketch working of Pressurised Water Reactor (PWR). Write its advantages and disadvantages. [10]
- (b) Enlist main components of Diesel Engine Power Plant and state application of Diesel Power Plant. [8]

## UNIT V

9. (a) What is the role of : [8]
- (i) Intercooling
  - (ii) Reheating for performance improvement in Gas Turbine Power Plant.
- (b) Explain in brief : [8]
- (i) Solar energy
  - (ii) Fuel cell and its applications.

*Or*

10. (a) Write short notes on : [8]
- (i) Geothermal Power Plant
  - (ii) Wind Power Generation Plant.
- (b) Draw and explain open and closed Loop Cycle Gas Power Plant. [8]

### UNIT VI

11. (a) A power plant has the following : [10]
- Load factor = 70%
- Plant capacity factor = 50%
- Plant use factor = 60%
- Maximum load = 30 MW
- Calculate :
- (i) Annual energy production
  - (ii) Reserve capacity over and above peak load
  - (iii) Number of hours the plant is not in operation per year.
- (b) Write short note on reduction cost by interconnecting generators. [6]

*Or*

- 12.** (a) Determine the generating cost per unit of 80 MW power station with the following data : [10]

$$\text{Capital cost} = \text{Rs. } 160 \times 10^7$$

$$\text{Annual cost} = \text{Rs. } 32 \times 10^8$$

$$\text{Annual wages and taxes} = \text{Rs. } 36 \times 10^6$$

$$\text{Interest and depreciation} = 10\% \text{ capital cost}$$

$$\text{Annual load factor} = 45\%.$$

- (b) Write a short note on base load and peak load plant. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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**[4162]-142**

**S.E. (Electrical) (First Sem.) EXAMINATION, 2012**

**MATERIAL SCIENCE**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.

(vi) Assume suitable data, if necessary.

**Physical Constants :**

1. Angstrom Unit (AU) =  $1 \times 10^{-10}$  metres
2. Boltzmann's Constant ( $k$ ) =  $1.380 \times 10^{-23}$  joule.degree<sup>-1</sup>
3. Charge on Electron ( $e$ ) =  $1.601 \times 10^{-19}$  coulomb
4. Mass of Electron ( $m$ ) =  $9.107 \times 10^{-31}$  kg
5. Electron volt (eV) =  $1.602 \times 10^{-19}$  joules

P.T.O.

6. Mass of Proton ( $m_p$ ) =  $1.627 \times 10^{-27}$  kg
7. Velocity of light ( $c$ ) =  $2.998 \times 10^8$  m/sec
8. Dielectric constant of free space ( $\epsilon_0$ ) =  $8.854 \times 10^{-12}$  F/m
9. Permeability of free space ( $\mu_0$ ) =  $4\pi \times 10^{-7}$  H/m
10. Debye Unit =  $3.33 \times 10^{-30}$  coulomb.metre.

### SECTION I

1. (a) Explain the following terms : [8]
  - (i) Electric Dipole Moment
  - (ii) Dielectric Constant
  - (iii) Ferroelectricity
  - (iv) Photoconductivity.
- (b) State different types of photoelectric cells. Describe with neat diagram, construction and working of any *one* type. [8]

*Or*

2. (a) Explain the term 'polarization' of dielectric. With neat diagram, explain Electronic Polarization and Orientational Polarization. [8]
- (b) Write a note on piezoelectricity and pyroelectricity. [8]
3. (a) State the properties and applications of : [8]
  - (i) Mica
  - (ii) Transformer Oil.

- (b) Explain various factors that affect breakdown in gaseous insulating materials. [8]

*Or*

4. (a) Discuss insulating materials used for : [8]
- (i) Capacitors
- (ii) Switchgears.
- (b) Explain the following terms : [8]
- (i) Breakdown voltage and breakdown strength
- (ii) Breakdown in solid insulating materials
- (iii) Townsend's primary ionization coefficients
- (iv) Townsend's secondary ionization coefficients.
5. (a) Explain Curie-Weiss law for ferromagnetic materials. Is this law applicable for spontaneous magnetization ? Hence explain spontaneous magnetization. [8]
- (b) In a certain transformer the hysteresis loss is 500 W when the maximum flux density is 0.78 tesla and frequency is 40 Hz. What would be the hysteresis loss if maximum flux density is increased to 1.6 tesla and frequency is 70 Hz ? Assume hysteresis loss over this range is to be proportional to  $B_m^{1.7}$ . [4]

- (c) What are Ferrites ? Give properties and applications of ferrites. [6]

*Or*

6. (a) Explain classification of magnetic materials on the basis of distribution of magnetic dipole moments. [6]
- (b) Write short notes on : [8]
- (i) Compact Disc
- (ii) Magnetic Recording Materials.
- (c) Calculate hysteresis loss in a specimen of iron subjected to magnetization at 50 Hz. The weight of the specimen is 70 kg and its density is  $7680 \text{ kg/m}^3$ . The hysteresis loop area is equivalent to  $300 \text{ J/m}^3$ . [4]

## SECTION II

7. (a) State properties and application of : [12]
- (i) Eureka
- (ii) Nichrome
- (iii) ACSR
- (iv) Carbon.



- (b) A copper conductor of resistance  $80 \Omega$  at  $40^\circ\text{C}$  is heated upto  $100^\circ\text{C}$ . The temperature coefficient of resistance at  $0^\circ\text{C}$  is  $0.00531$  per degree. Calculate the resistance when the conductor is at  $100^\circ\text{C}$ . [4]

*Or*

8. (a) Why is carbon preferred for brushes in electric machines ? [4]
- (b) What are thermocouple ? Name some thermocouples and their applications. [4]
- (c) A filament of a  $230 \text{ V}$ ,  $100 \text{ W}$  lamp is to be constructed. The temperature of the filament is to be  $2460^\circ\text{C}$  at  $100 \text{ W}$  dissipation. Resistivity of the filament material at  $20^\circ\text{C}$  is  $4.3 \times 10^{-6} \Omega\text{-cm}$  and temperature coefficient  $\alpha_{20} = 0.005/^\circ\text{C}$ . Calculate the length of the filament at  $20^\circ\text{C}$ . If its diameter at  $20^\circ\text{C}$  is  $0.026 \text{ mm}$ . [8]
9. (a) How are carbon nanotubes fabricated ? Give *two* methods and draw sketches where necessary. [8]
- (b) What do you mean by single electron transistor, molecular machines ? [8]

*Or*

- 10.** (a) Write down application of carbon nanotubes and BN nanotubes. [8]
- (b) Discuss briefly the energy bands in conductors, insulators and semiconductors. [8]
- 11.** (a) Describe any *three* tests on cable. [9]
- (b) Describe measurement of dielectric strength of solid insulating material with reference to IS 2584. [9]

*Or*

- 12.** (a) What is partial discharge of a dielectric ? Explain a method to determine the partial discharge of a dielectric solid in the laboratory. [9]
- (b) How will you test transformer oil ? Explain with neat diagram of test setup. [9]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-143**

**S.E. (Electrical) (First Semester) EXAMINATION, 2012**

**ANALOG AND DIGITAL ELECTRONICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

### **SECTION I**

1. (a) Explain input-output characteristics of CE configuration with neat connection diagram and characteristic curve. [8]
- (b) Explain transformer coupled multistage amplifier with neat circuit diagram. Also state its advantages and disadvantages. [8]

P.T.O.

*Or*

- 2.** (a) What is the significance of transfer and drain characteristics of FET ? Draw and explain. [8]
- (b) Draw and explain working of R-C coupled transistorized amplifier. Also state its applications. [8]
- 3.** (a) Explain op-amp used as ZCD and its practical applications. [8]
- (b) Define the following terms with respect to op-amp :
- (i) Differential Gain ( $A_d$ )
- (ii) Input off-set current ( $I_{i0}$ )
- (iii) Bandwidth (BW)
- (iv) Slew Rate. [8]

*Or*

- 4.** (a) What are the basic requirements of good instrumentation amplifier ? Draw and explain three op-amp instrumentation amplifier. [8]
- (b) Explain voltage to current converter for grounded type load. [8]
- 5.** (a) Explain with neat connection diagram first order low pass filter. Also explain its frequency response. [10]
- (b) Explain how triangular waveform can be generated using op-amp. Also draw waveform. [8]

*Or*

6. (a) Draw and explain IC 555 as an astable multivibrator with neat connection diagram. State applications. [10]  
(b) Explain the function of LM 317 as a voltage regulator. [8]

## SECTION II

7. (a) What do you mean by Universal Gate ? Implement all basic gates using NAND gate and NOR gate. [8]

(b) Convert the following :

(1)  $(10110)_2 = (?)_{10}$

(2)  $(630.4)_8 = (?)_{10}$

(3)  $(B65F)_{16} = (?)_{10}$

$Y2 = \Pi M (2, 4, 7, 8, 15)$  (4)  $(0.6875)_{10} = (?)_2$  [8]

*Or*

8. (a) Analyse 1 bit comparator using K-Map and also draw its circuit. [8]  
(b) Implement

$$Y1 = \sum m (0, 1, 3, 5, 7, 9) \text{ and}$$

using appropriate multiplexer. [8]

9. (a) Explain Race around condition and also state the remedial action for it. [10]  
(b) Draw circuit diagram and explain 4 bit Universal shift register. [8]

*Or*

- 10.** (a) What do you mean by Modulo of the counter ? Draw circuit diagram and timing diagram of 3-bit synchronous modulo 6 UP counter. [10]
- (b) Which are the various methods of triggering the flip-flop ? Explain with its symbols. [8]
- 11.** (a) Explain in brief various types of semiconductor memories. [8]
- (b) Implement 2 input AND, OR, NOR, NAND gate using 4 : 1 Multiplexer. [8]

*Or*

- 12.** (a) Explain binary weighted type analog to digital convertor. [8]
- (b) Differentiate Multiplexer and Demultiplexer and also state *two* applications of each. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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**[4162]-144**

**SE. (Electrical) (First Semester) EXAMINATION, 2012**  
**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**  
**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.
- (ii) Answers to the two sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data, if necessary.
- (vi) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

**SECTION I**

1. (a) Explain the following terms :
- (i) Static and dynamic accuracy
- (ii) Speed of response
- (iii) Repeatability
- (iv) Reproducibility. [8]
- (b) Draw and explain the operation of Digital Ammeter. [8]

P.T.O.

*Or*

2. (a) Explain advantages and disadvantages of MI and PMMC Instrument. [8]
- (b) Design a multi-range D.C. milli-ammeter using a basic movement with an internal resistance  $R_m = 50 \Omega$  and a full scale deflection current  $I_m = 1 \text{ mA}$ . The ranges required are 0—10 mA, 0—50 mA, 0—100 mA and 0—500 mA. [8]
3. (a) Draw a circuit diagram of shearing bridge, derive its expression and draw phasor diagram. [8]
- (b) Explain the construction and working principle of megger. [8]

*Or*

4. (a) Draw a circuit diagram of Anderson's bridge. Derive the expression for unknown inductance and draw the phasor diagram. [8]
- (b) A 4 terminal resistor of approximately  $50 \mu\Omega$  resistance was measured by means of a Kelvin bridge having the following component resistance :
- Standard resistance =  $100.03 \mu\Omega$ ,
- Inner ratio arms =  $100.31 \Omega$  and  $200 \Omega$ ,
- Outer ratio arms =  $100.24 \Omega$  and  $200 \Omega$
- Resistance of link connecting the standard and unknown resistance =  $700 \mu\Omega$ .
- Calculate the unknown resistance and draw circuit diagram. [8]



5. (a) Draw and explain working principle of dynamometer type wattmeter and derive its torque equation. [9]
- (b) Draw and explain the three wattmeter method for measurement of power in three phase system for balanced and unbalanced load. [9]

*Or*

6. Write short notes on :

- (i) Digital frequency meter
- (ii) TOD meter
- (iii) Tri-vector meter. [18]

## SECTION II

7. (a) Define calibration of Energymeter. Give and explain the experimental set-up used in laboratory to calibrate the single phase energymeter. [8]
- (b) An energymeter is designed to make 200 revolutions of the disc for 1 unit of energy. Calculate the number of revolutions made by it when connected to a load carrying 10 A at 230 V at 0.8 p.f. for an hour. If it actually makes 360 revolutions, find the % error. [4]
- (c) Compare current transformer (CT) with potential transformer (PT). [6]

*Or*

8. (a) State the advantages of electronic energymeter. [8]
- (b) A 230 V, single-phase watt hour meter has a constant load of 5 A passing through it for 6 hours at 0.8 p.f. If the meter disc makes 4978 revolutions during this period. Find the meter constant in the revolutions/KWh. Calculate the power factor of the load if the number of revolutions made are 2000 when operating at 230 V and 8 A for 4 hours. [4]
- (c) Draw the connection diagram of two-element energymeter with CT and PT for range extension. [6]
9. (a) Compare Dual Trace CRO with Dual Beam CRO. [4]
- (b) With neat diagram, explain the potentiometric resistance transducer. [6]
- (c) Explain with neat sketch, the working of McLeod Gauge for vacuum measurement. [6]

*Or*

10. (a) Explain the functions of the following blocks of CRO :
- (i) Trigger circuit
- (ii) Time-base generator
- (iii) Delay line
- (iv) Horizontal amplifier. [4]

- (b) With suitable diagram, explain how capacitive transducers are used to measure pressure. [6]
- (c) Explain the working of Pirani Gauge for measurement of pressure. State its limitations. [6]
- 11.** (a) Define ultrasonic transducers. State its applications. [4]
- (b) Explain the Nucleonic method for level measurement with suitable diagram. [6]
- (c) Explain the construction and working of semiconductor strain gauge. [6]

*Or*

- 12.** (a) State the importance of level measurement. List the different level measurement methods. [4]
- (b) Explain with neat diagram, the working of Anemometer for flow measurement. [6]
- (c) Explain the construction and working of load cells. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—8

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**[4162]-145**

**S.E. (Electrical) (Second Semester) EXAMINATION, 2012**

**POWER SYSTEM—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

- 1. (a)** State the following statements are true *or* false and justify your answer :
- (1) With interconnected grid system, there is increase in load factor.

P.T.O.

- (2) Diversity factor is always greater than unity.
  - (3) Cost per generation is high in base load plants than in peak load plants.
  - (4) Area under the load duration curve can be used to calculate total number of units (kWh) generated.
  - (5) Time of use tariff can help to flatten the load curve of the system. [10]
- (b) Explain how to fit available generating stations in power plants under the area of load duration curve ? [6]

*Or*

2. (a) What is meant by tariff ? What are the objectives of tariff ? What type of tariff is employed for domestic consumers ? [8]
- (b) A generating station has a maximum demand of 100 MW, load factor of 65%, plant capacity factor 50% and plant use factor 75%. Find :
- (1) Daily energy produced
  - (2) Reserve capacity of plant
  - (3) Maximum energy that can be produced daily if plant is running all the time
  - (4) Maximum energy that can be produced daily if the plant is fully loaded. [8]

**3.** (a) Explain in brief, features of the following equipments in power plant along with the various ratings available on name plate :

(1) Alternators

(2) Power transformers

(3) Isolators

(4) Reactors. [8]

(b) Define string efficiency and also explain the methods for improving the string efficiency. [8]

*Or*

**4.** (a) Suggest with reason the type of insulator to be used for the following applications :

(1) High voltage transmission line conductors are to be supported on the tower

(2) Distribution line conductors are to be supported at bus bars

(3) Line conductors are to be stretched at river crossing

(4) Direction of line conductor is to be changed. [8]

- (b) Each conductor of a 3-phase overhead line is suspended from a cross arm of a steel tower by a string of 4 suspension insulators. The voltage across the second unit is 15 kV and across the third 27 kV. Find the voltage between conductors and string efficiency. [8]
5. (a) Derive an expression for loop inductance of a single-phase line. [8]
- (b) A double circuit 3-phase 50 Hz line has its conductors at vertices of regular hexagon of side 3.5 m. The diameter of conductor is 2 cm. Find inductance and inductive reactance of a line per phase per km. [10]

*Or*

6. (a) A 50 Hz overhead transmission line consisting of 3 conductors each of diameter 1.24 cm and spaced 2 m apart. Calculate the inductance per phase per km for the following arrangement between conductors :
- (1) Equilateral spacing
- (2) Horizontal spacing.
- Assume transposed line. [8]

- (b) What is the effect of using bundled conductors on line inductance ? [6]
- (c) Write a note on proximity effect. [4]

## SECTION II

7. (a) Explain the “Method of Images” in determining the effect of earth on the calculation of capacitance. [4]
- (b) A 3-phase, 110 kV, 50 Hz overhead line conductors are placed in a horizontal plane. The conductor diameter is 1.5 cm. If the line length is 100 km, assuming complete transposition of the line, calculate :
- (1) Capacitance per phase (line to neutral)
- (2) Charging current per phase. [6]
- (c) Derive the equation for capacitance per km of a single-phase overhead transmission line having distance ‘D’ between the conductors and radius of each conductor ‘r’. [8]

*Or*

8. (a) Derive the expression for line to neutral capacitance of a three-phase overhead transmission line with unsymmetrical spacing of conductors. Assume complete transposition. [6]



- (b) A single-phase line is having 2 single stranded conductor and radius 0.328 cm. The conductors are spaced 4 m apart and 8 m above the ground. Calculate the capacitance to neutral per km :
- (1) Considering earth's effect
  - (2) Neglecting earth's effect. [6]
- (c) Derive the expression for the capacitance to neutral of a three-phase line with equilateral spacing. [6]
- 9.** (a) Give classification of transmission line. Explain the effect of load power factor on regulation and efficiency. [8]
- (b) A balanced 3-phase load of 30 MW is supplied at 132 kV, 50 Hz and 0.85 p.f. lagging by means of a transmission line. The series impedance of a single conductor is  $(20 + j52)\Omega$  and total phase neutral admittance is  $315 \times 10^{-6}$  S. Use T-method to find :
- (1) A, B, C, D constants of the line
  - (2) Sending end voltage (line-to-line). [8]

*Or*

- 10.** (a) Determine the generalized circuit constants of medium transmission line. Also prove that the transmission line behaves like a symmetrical network and reciprocal network. [8]
- (b) An 11 kV, 3-phase transmission line has  $R = 1.5 \Omega$  and reactance  $4 \Omega$  per phase. Calculate percentage regulation and efficiency of the line when total load of 5000 kVA at 0.80 p.f. lagging is supplied at 11 kV at the distance end. [8]
- 11.** (a) What is meant by Sag in an overhead line ? Derive the expression for sag when supports are at unequal level. [8]
- (b) Give the classification of underground cables. [4]
- (c) Derive the expression for the capacitance of a single core cable. [4]

*Or*

- 12.** (a) What are the types of cable faults ? Explain any *one* method of location of faults in underground cable. [8]

(b) A transmission line has a span of 150 m between supports. The conductor has a cross-sectional area of  $2 \text{ cm}^2$ . The ultimate strength is  $5000 \text{ kg/cm}^2$ . The specific gravity of the material is  $8.9 \text{ g/cm}^3$ . If the wind pressure is  $1.5 \text{ kg/m}$  length of conductor, calculate the sag at the centre of conductor if the safety factor is 5. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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**[4162]-146**

**S.E. (Electrical) (Second Semester) EXAMINATION, 2012**

**ELECTRICAL MACHINES—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

- 1. (a)** Explain the working of 1  $\phi$  transformer on load. Show the details of flux distribution and also draw phasor diagrams to show primary current  $I_1$  with : [10]
- (i) Inductive load
- (ii) Capacitive load
- (iii) Resistive load.

P.T.O.

- (b) A 20 kVA, 3300/220 V, 50 Hz, 1  $\phi$  transformer has iron loss of 200 W and Cu loss at full load of 400 W. Find the efficiency of transformer at half load and 0.8 p.f. lagging. Also find the maximum efficiency and load at which it occurs ? [8]

*Or*

2. (a) Derive the condition : [10]
- (i) For maximum efficiency
  - (ii) Load current at maximum efficiency
  - (iii) kVA at maximum efficiency.
- (b) A 100 kVA, 2200/440 V, 50 Hz, 1  $\phi$  transformer has the primary and secondary resistance of 0.3  $\Omega$  and 0.01  $\Omega$  respectively. The corresponding leakage reactances are 1.1  $\Omega$  and 0.035  $\Omega$ . Calculate the voltage regulation and the secondary terminal voltage on full load at full load : [8]
- (i) 0.8 lagging
  - (ii) 0.8 leading
  - (iii) Unity p.f.
3. (a) With neat connection diagram explain the operation of V-V connections of transformer. State its merits and demerits. [8]
- (b) State and explain the conditions to be satisfied for parallel operation of 1  $\phi$  transformer. [8]

*Or*

4. (a) Sketch and explain standard types of 3  $\phi$  transformer connections. Also give applications of each connection. [8]
- (b) State the difference between power transformer and distribution transformer. [8]
5. (a) Draw neat constructional diagram of D.C. machine and also state the function of each part. [8]
- (b) Derive the torque equation of a D.C. motor and also state the significance of back emf. [8]

*Or*

6. (a) What do you mean by armature reaction ? Explain. Also state how to reduce the demagnetising and cross-magnetising effect ? [8]
- (b) A D.C. series motor runs at 900 r.p.m. when taking a current of 30 A at 230 V. The total resistance of the armature and the field circuit is 0.3  $\Omega$ . Calculate the values of the additional resistance required in series with the machine to reduce the speed to 500 r.p.m. if the gross torque is : [8]
- (i) Constant
- (ii) Proportional to speed
- (iii) Proportional to the square of speed
- Assume the magnetic circuit to be unsaturated.

## SECTION II

7. (a) Explain the necessity of starter in D.C. motor and explain 3-point starter with neat sketch. [8]
- (b) Draw and explain torque-armature current, speed-armature current and speed-torque characteristic of D.C. series motor. [8]

*Or*

8. (a) Explain : [8]
- (i) Flux control and
- (ii) Armature voltage control methods of speed control of D.C. shunt motor.
- (b) Write short notes on : [8]
- (i) Interpoles and
- (ii) Compensating winding.
9. (a) Prove that the rotating magnetic field is produced in three phase induction motor when its stator winding is fed with three-phase supply. Use graphical method to support your answer. [9]
- (b) The rotor resistance and reactance per phase of 4 pole 50 Hz three-phase slip ring induction motor are  $0.4 \Omega$  and  $4 \Omega$  respectively. Calculate :
- (i) The speed at maximum torque,
- (ii) The ratio of maximum torque to starting torque
- (iii) What value of resistance should be inserted per phase to have starting torque equal to half of maximum torque ? [9]

*Or*

- 10.** (a) What is the effect of slip on rotor parameters such as e.m.f. impedance, frequency, current and power factor in three phase induction motor. Derive the expression for running torque. [8]
- (b) A 500 V, 6 pole, 50 Hz three-phase induction motor develops 20 kW gross mechanical power when running at 995 r.p.m. and power factor being 0.87. Calculate : [10]
- (i) slip
  - (ii) rotor copper loss
  - (iii) total input if the stator loss is 1500 W
  - (iv) line current and
  - (v) rotor current frequency.
- 11.** (a) With neat sketch explain Autotransformer starter for three phase induction motor. [8]
- (b) Explain exact and approximate equivalent circuit for three-phase induction motor. [8]

*Or*

- 12.** (a) Explain V/f method of speed control for three-phase induction motor. [7]



(b) A three-phase cage type induction motor has a short circuit current equal to 5 times the full load current. Find the starting torque as a percentage of full load torque if the motor is started by : [9]

(i) Direct switching to the supply

(ii) Star delta starter

(iii) Autotransformer starter.

The starting supply current in (iii) is limited to 2.5 times the full load current and full load slip is 4%.

Total No. of Questions—12]

[Total No. of Printed Pages—8+1

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**[4162]-147**

**S.E. (Electrical) (Second Semester) EXAMINATION, 2012**

**NETWORK ANALYSIS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Explain the following terms : [6]**

(i) Bilateral network and Unilateral network.

(ii) Linear network and non-linear network.

(iii) Dependent and independent current sources.

P.T.O.

- (b) Obtain  $I_X$  and  $I_Y$  for the network shown in Fig. 1 by using Mesh analysis method. [6]

Fig. 1

- (c) Obtain  $V_a$  and  $V_b$  for the network shown in Fig. 2 by using Nodal analysis method. [6]

Fig. 2

*Or*

- 2.** (a) Explain the concept of supermesh and supernode with proper example. [6]
- (b) Obtain the Node voltage  $V_a$  for the network shown in Fig. 3 by using Nodal analysis method. [6]

Fig. 3

- (c) Explain the principle of duality. [6]
- 3.** (a) Find the current through the inductance of  $j4 \Omega$  reactance, using superposition theorem, for the network shown in Fig. 4. [8]

Fig. 4

- (b) State and explain :
- (i) Thevenin's theorem
  - (ii) Millman's theorem. [8]

*Or*

4. (a) Determine Norton's equivalent circuit across terminals  $a, b$  in the network shown in Fig. 5. [8]

Fig. 5

- (b) Verify the Reciprocity theorem for the voltage source and current  $I_x$  as shown in Fig. 6. [8]

Fig. 6

5. (a) Obtain the expression for the current in a series RL circuit connected to a d.c. voltage  $V$  for  $t > 0$ . Assume initial current through inductor as zero. Also draw the response graph for the current through inductor and from the graph, define time constant of the circuit. [8]

(b) In the circuit shown, the switch  $K$  is moved from position 'a' to 'b' at  $t = 0$ . Find values of  $i$ ,  $\frac{di}{dt}$ ,  $\frac{d^2i}{dt^2}$  at  $t = 0^+$ .  
 $R = 1 \ \Omega$ ,  $L = 1 \ \text{H}$ ,  $C = 0.1 \ \mu\text{F}$  and  $V = 100 \ \text{V}$ .  
Assume steady state is achieved when  $K$  is at 'a' as shown in Fig. 7. [8]

Fig. 7

*Or*

6. (a) Find the Laplace transform of the waveform shown in Fig. 8. [8]

Fig. 8

- (b) A series RLC circuit with  $R = 5 \Omega$ ,  $L = 0.1 \text{ H}$  and  $C = 500 \mu\text{F}$  has a constant voltage  $V = 10 \text{ V}$  applied at  $t = 0$ . Using Laplace  $T_X$ , find the resulting current if initial conditions are zero as shown in Fig. 9. [8]

Fig. 9

## SECTION II

7. (a) Explain the following parameters of two port network :
- (i) Hybrid parameters
  - (ii) Transmission parameters. [4]
- (b) Derive the inter-relationship between Z parameters and ABCD parameters. [6]
- (c) Obtain the Y parameters for the network shown in Fig. 10. [8]

Fig. 10

*Or*

8. (a) Explain the cascade connection of two port network parameters using transmission parameters. [8]
- (b) State and explain the maximum power transfer theorem for A.C. Network. [10]



9. Write short notes on :

(a) Evaluation of Fourier coefficients. [8]

(b) Fourier Transform of Periodic signals. [8]

*Or*

10. (a) Explain :

(i) Even symmetry

(ii) Odd symmetry

(iii) Half-wave symmetry

(iv) Quarter-wave symmetry. [8]

(b) Explain :

(i) High-pass filter

(ii) Low-pass filter. [8]

11. (a) Define all the network functions of a two port network. [8]

(b) Determine  $\frac{V_2(s)}{V_1(s)}$ ,  $\frac{I_2(s)}{I_1(s)}$  and  $Z_{12}(s)$  for the network shown

in Fig. 11. [8]

Fig. 11

*Or*

12. (a) For a given network function plot the poles and zeros in the  $s$ -plane :

$$F(s) = \frac{4(s + 3)}{s(s + 2)(s + 3 - 3j)(s + 4 + 4j)}. \quad [6]$$

- (b) Write a short note on location of poles and zeros on  $s$ -plane. [4]

- (c) Find  $Z(s) = \frac{V_1(s)}{I_1(s)}$  and  $T(s) = \frac{V_2(s)}{V_1(s)}$  for the network shown in Fig. 12. [6]

Fig. 12

Total No. of Questions—12]

[Total No. of Printed Pages—7

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**[4162]-148**

**S.E. (Electrical) (Second Semester) EXAMINATION, 2012**

**DIGITAL COMPUTATIONAL TECHNIQUE**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) State and explain Descarte's rule of sign. [6]
- (b) Find the number of roots using Strom's sequences : [6]

$$x^3 - 3x^2 - 4x + 13 = 0.$$

P.T.O.

- (c) Explain : [6]
- (i) Relative errors
  - (ii) Truncation errors
  - (iii) Absolute errors.

*Or*

2. (a) Explain concept of numerical instability. [6]
- (b) Find real root of equation : [8]

$$x^4 - 3x^3 + 3x^2 - 3x + 2 = 0$$

using Birge-Vieta method. Take  $P_0 = 0.5$  show 2 iteration only.

- (c) Using normalized floating point algebra perform the following arithmetic operations : [4]
- (i) Add (0.3879E7) and (0.813E7)
  - (ii) Subtract (583 . 1863 . E20) and (78.1671E19).

3. (a) Find the root of the equation : [8]

$$xe^x = \cos x$$

in the interval (0, 1) using Regula-Falsi method correct to 4 decimal places.

- (b) Explain secant method to find solution of a transcendental equation. [8]

*Or*

4. (a) Evaluate :

$$F(x) = x - e^x = 0$$

to five decimal places by N-R method. [8]

- (b) Derive Chebyshev iterative formula to find the root of an equation. [8]

5. (a) Explain Gauss elimination method to find the solution of simultaneous equation also explain necessity of partial pivoting. [8]

- (b) Find the inverse of the matrix : [8]

$$\begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

using Gauss-Jordan method and hence solve the system :

$$\begin{aligned} x_1 + x_2 + x_3 &= 4 \\ 4x_1 + 3x_2 - x_3 &= 12 \\ 3x_1 + 5x_2 + 3x_3 &= 15 \end{aligned}$$

*Or*

6. (a) Apply Gauss-Seidel iteration method to solve the following equation : [8]

$$\begin{aligned} 20x + y - 2z &= 17 \\ 3x + 20y - z &= -18 \\ 2x - 3y + 20z &= 25 \end{aligned}$$

- (b) Solve the following system of equation using Jacobi's iteration method : [8]

$$\begin{aligned}x_1 + 2x_2 + 5x_3 &= 12 \\4x_1 + x_2 + 2x_3 &= 16 \\x_1 + 3x_2 + x_3 &= 10\end{aligned}$$

## SECTION II

7. (a) Derive the equation for Newton's forward interpolation for equally spaced data. [8]
- (b) By means of Newton's divided difference formula find the value of  $f(8)$  and  $f(15)$  from the following data : [8]

$x$	$f(x)$
4	48
5	100
7	294
10	900
11	1210
13	2028

*Or*

8. (a) Use Stirling's formula to find  $y_{28}$ , given : [8]
- $$y_{20} = 49225, y_{25} = 48316, y_{30} = 47236, y_{35} = 45926, y_{40} = 44306.$$

- (b) In some determinations of the value  $v$  of carbon dioxide dissolved in a given volume of water at different temperature the following pairs of values were obtained :

<b>Q</b>	<b>V</b>
0	1.80
5	1.45
10	1.18
15	1.00

Obtain by method of least squares, a relation of the form  $v = a + b\theta$  which fits to these observations. [8]

9. (a) Explain modified Euler's method and advantages over Euler's method. [8]
- (b) Using Runge-Kutta method of order and find  $y(0, 2)$  for the equation : [8]

$$\frac{dy}{dx} = \frac{y - x}{y + x} \quad y(0) = 1$$

take  $h = 0.2$ .

*Or*

10. (a) Solve by Milne's method :

$$\frac{dy}{dx} = x - y^2.$$

Find the value of  $y$  at  $x = 0.8$  and  $x = 1.0$ .

The differential equation satisfies the following values of  $x$  and  $y$  :

$x$	$y$	
0.0	0.0	
0.2	0.020	
0.4	0.0795	
0.6	0.1762	[8]

- (b) Find by Taylor series method, the values of  $y$  at  $x = 0.1$  and  $x = 0.2$  to five places of decimal from : [8]

$$\frac{dy}{dx} = x^2y - 1 \quad y(0) = 1.$$

11. (a) State and prove Simpson's 1/3rd rule for numerical integration as a follow up of Newton-Cote's quadrature method. [8]

- (b) Compute the value of definite integral :

$$\int_{0.2}^{1.4} (\sin x - \log_e x + e^x) dx$$

by :

- (a) Trapezoidal rule  
 (b) Simpson's 3/8 rule.

Divide the range in 12 equal parts. [10]



Or

12. (a) From the table given below, for what value of  $x$ ;  $y$  is minimum.  
Also find this value of  $y$  : [8]

$x$	$y$
3	0.205
4	0.240
5	0.259
6	0.262
7	0.250
8	0.224

- (b) Given that : [10]

$x$	$y$
1.0	7.989
1.1	8.403
1.2	8.781
1.3	9.129
1.4	9.451
1.5	9.750
1.6	10.031

Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at :

(i)  $x = 1.1$

(ii)  $x = 1.6$

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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**[4162]-149**

**S.E. (Electrical) (Second Semester) EXAMINATION, 2012**  
**MICROPROCESSOR FUNDAMENTAL AND APPLICATIONS**  
**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain the function of Instruction register and Program counter in 8085. [4]
- (b) Explain with *one* example the following addressing modes : [6]
- (i) Register Indirect Addressing Mode.
- (ii) Implicit Addressing Mode.

P.T.O.

- (c) Draw a memory interface schematic for interfacing 1KB ROM and 1KB RAM to 8085 such that the following memory maps are realized

RAM 8000H to 83FFH

ROM 0000H to 03FFH

Use a 2 : 4 decoder. [8]

*Or*

2. (a) Explain the following instruction : [4]

(i) STA D000H

(ii) ADD M

- (b) Draw Flag register of 8085 and explain the function of each flag. [6]

- (c) Explain the functions of the following pins : [8]

(i) ALE

(ii) READY

(iii)  $\overline{\text{WR}}$

(iv) HOLD and HLDA.

3. (a) Write a program to initialize Stack pointer to FF89H and push contents of accumulator and flag register on to the stack. [4]

- (b) Explain hardware interrupts with reference to the following points : [6]
- (i) Priorities and vector locations
  - (ii) Triggering levels
  - (iii) Masking, unmasking.
- (c) Draw the timing diagram for Op-code Fetch Machine cycle. [6]

*Or*

4. (a) Write a program to enable RST 6.5 and disable all other interrupts. [4]
- (b) Define stack and explain function of stack pointer ? Explain the steps taken by 8085 on execution of the instruction PUSH PSW. [6]
- (c) Distinguish between memory mapped I/O and I/O mapped I/O. [6]
5. (a) Explain the following terms as regards to data transfer : [8]
- (i) Synchronous data transfer
  - (ii) Baud Rate
  - (iii) Asynchronous data transfer
  - (iv) Parallel data transfer.
- (b) Explain with a block diagram the architecture of 8251. [8]

*Or*

6. (a) Explain in detail interrupt driven data transfer scheme. [8]  
(b) Explain RS-232 standard of serial communication. [8]

## SECTION II

7. (a) Explain the architecture of 8255 PPI with the help of function block diagram. [8]  
(b) Explain Mode 1 and Mode 2 of 8254 PIT. [8]

*Or*

8. (a) Write an assembly language program using BSR mode to set bits  $PC_7$  and  $PC_4$  and reset them after 10 ms. Assume a delay subroutine is available at a location D000H. [8]  
(b) Draw and explain functional block diagram of Programmable Interval Timer 8254. [8]
9. (a) ADC 0809 is interfaced to 8085 through 8255. Draw an interfacing diagram and write an assembly language program to read the ADC. Assume the port addresses of 8255 as 80, 81, 82, 83 for ports A,B,C and CWR respectively. [10]  
(b) Explain with diagram frequency measurement using 8085 microprocessor. [8]

*Or*

- 10.** (a) DAC 0808 is interfaced with 8085 microprocessor. Draw an interfacing diagram and write an assembly language program for generation of saw-tooth wave. Assume suitable port addresses. [10]
- (b) Explain with diagram AC voltage measurement using 8085 microprocessor. [8]
- 11.** (a) With an interfacing diagram and flow chart, explain measurement of temperature using 8085 microprocessor. [8]
- (b) Explain with block diagram control of stepper motor (forward and reverse direction) using 8085 microprocessor. [8]

*Or*

- 12.** (a) Explain with a schematic diagram and a flow chart how 8085 can be used for DC motor control. [8]
- (b) Explain with schematic diagram interfacing of 7 segment display with 8085 microprocessor. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-150**

**S.E. (Electrical) EXAMINATION, 2012**

**INSTRUMENTATION**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is instrumentation ? State the objectives of instrumentation. [8]

(b) Give detailed classification of measuring instruments. [8]

P.T.O.

*Or*

- 2.** (a) Draw a block diagram of generalised measurement system and explain it in brief. [8]
- (b) Explain process equation with respect to process characteristics. [8]
- 3.** (a) Define transducer. Give detailed classification of transducers. [8]
- (b) Draw basic block diagram of CRO. State different controls on front panel of CRO. [8]

*Or*

- 4.** (a) What are Lissajous figures ? How are these obtained ? What are their uses ? [8]
- (b) State and elaborate the factors on which transducer selection depends. [8]
- 5.** (a) What is RTD ? Explain construction of RTD with a suitable diagram. [6]
- (b) State working principle of Bourdon tube. With a neat diagram explain its construction. State its applications. [6]
- (c) Describe working of any *one* type of manometer with a suitable diagram. [6]



*Or*

6. (a) With a neat diagram explain working of total radiation pyrometer. [6]
- (b) How can level be measured using radioactive transducer ? Draw a neat sketch and explain it. [6]
- (c) With a neat diagram explain McLeod Gauge. [6]

## SECTION II

7. (a) With a neat diagram explain construction and working of LVDT. Also draw and explain its output characteristics. [9]
- (b) What is the importance of strain measurement ? Describe different types of strain gauges. [9]

*Or*

8. (a) State the methods of flow measurement. Explain differential pressure flow meter. Also state its advantages and disadvantages. [9]
- (b) State the different applications of LVDT. Explain any *two* applications in detail. [9]
9. (a) What are actuators ? State the different types of actuators. [8]
- (b) With a neat diagram explain X-Y recorder. State its advantages and disadvantages. [8]

*Or*

- 10.** (a) What is importance of final control element in instrumentation ?  
Elaborate your answer with a suitable block diagram. [8]
- (b) Explain construction and working of magnetic tape recorder. [8]
- 11.** (a) Explain the role of PLC in industrial automation. Draw block  
diagram of PLC system. [8]
- (b) Explain supervisory master unit and supervisory remote  
unit. [8]

*Or*

- 12.** (a) Draw and explain configuration of SCADA system. Give applications  
of SCADA. [8]
- (b) What do you mean by Ladder diagram ? Draw and explain  
Ladder diagram for a suitable application. [8]

Total No. of Questions—12]

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**[4162]-151**

**S.E. (E&TC) (First Semester) EXAMINATION, 2012**

**SIGNALS AND SYSTEMS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) (i) Define unit impulse function and write its relation with unit step in CT and DT. [5]

(ii) Find even and odd part of  $x(t) = u(t)$ . [5]

(b) Find whether the following CT and DT signals are periodic, if yes, find the period :

(i)  $x(t) = 4 \cos \frac{\pi}{100} t + 2 \cos t$

P.T.O.

$$(ii) \quad x(t) = 5 \sin 200\pi t$$

$$(iii) \quad x[n] = \cos 5\pi n$$

$$(iv) \quad x[n] = \cos \quad - \sin \left[ \frac{\pi n}{8} \right]. \quad [8]$$

*Or*

**2.** (a) (i) Define energy signal and power signal. [2]

(ii) Determine whether  $x(t) = u(t)$  is power signal or energy signal. [6]

(b) Sketch the following signals if  $x[n]$  is as shown below :

$$(i) \quad x[2n + 1]$$

$$(ii) \quad x[n] \cdot u[2 - n]$$

$$(iii) \quad x[n - 1] + \delta[n - 3]$$

$$(iv) \quad x[4 - n] + u[n]$$

$$(v) \quad \frac{1}{2}x[n]. \quad [10]$$

**3.** (a) Determine convolution integral of  $x(t) = u(t)$  with

$$h(t) = \text{rect}\left(\frac{t}{w}\right). \quad [8]$$

(b) The impulse response of DT-LTI system is given below :

$$h[n] = (0.99)^n u[n + 3].$$

(i) Determine whether the system is stable or not.

(ii) Justify whether the system is causal or anticipatory. [8]

*Or*

4. (a) Test the stability of the LTI systems whose impulse responses are given below :

(i)  $h(t) = t \cdot e^{-t} u(t)$

(ii)  $h(t) = Ae^{-2t} u(t)$ . [8]

(b) Convolve the D.T. signal  $x[n]$  and  $h[n]$  by tabulation method. [8]

5. (a) State and prove the following properties of Fourier transform :

(i) Differentiation in time domain

(ii) Frequency shifting. [6]

- (b) (i) Find the Fourier Transform of sine signal. [5]
- (ii) Find the Fourier Transform using time shifting property for the following signal. [5]

*Or*

- 6.** (a) Write the equations for three types of Fourier series representation. [6]
- (b) Find exponential Fourier series for the following signal. [10]

## SECTION II

7. (a) The transfer function of LTI system is given by

$$H(s) = \frac{2s - 1}{s^2 + 3s + 2}.$$

Determine the impulse response of the system. [6]

- (b) Find the Laplace transform of the shifted gate pulse shown below. [6]

- (c) Find the final value of

$$X(s) = \frac{2s + 3}{s^3 + 5s^2 + 6s}. \quad [6]$$

*Or*

8. (a) Determine the partial fraction expansion and hence Inverse Laplace transform of

$$X(s) = \frac{s^2 + 2s - 2}{s(s + 2)(s - 3)} \quad \text{ROC } \text{Re}(s) > 3. \quad [8]$$

(b) Prove :

(i) Time shifting and

(ii) Differentiation in time domain properties of Laplace transform. [10]

9. (a) The signal  $x(t) = 10 \sin(10t)$  is applied to a system whose transfer function is

$$H(f) = 3 \operatorname{rect}\left(\frac{f}{4}\right) e^{-j4\pi f}.$$

Find the output energy spectral density. [8]

(b) State :

(i) Rayleigh's Energy Theorem

(ii) Parseval's Power Theorem. [4]

(c) Given :

$$\begin{aligned} \operatorname{rect}(t) &= A \quad -\frac{1}{2} < t < \frac{1}{2} \\ &= 0 \quad \text{otherwise.} \end{aligned}$$

Find Energy Spectral Density. [4]

*Or*

10. (a) Find the cross-correlation between the signals :

$$x_1[n] = \underset{\uparrow}{\{1, 2, 3, 4\}} \quad x_2[n] = \underset{\uparrow}{\{0, 1, 2, 3\}}. \quad [8]$$



(b) State the properties of ESD and prove its relation with autocorrelation. [8]

11. (a) Three students A, B and C are given a problem in Maths. The probabilities of their solving the problem are  $\frac{3}{4}$ ,  $\frac{2}{3}$  and  $\frac{1}{4}$  respectively. Determine the probability that the problem is solved if all of them try to solve the problem. [6]

(b) Define the terms Expectation, Variance and Standard Deviation.

Determine the above terms for uniform random variable whose p.d.f. is given by

$$\begin{aligned} f(x) &= \frac{1}{b-a} & a \leq x \leq b \\ &= 0 & \text{elsewhere.} \end{aligned} \quad [10]$$

*Or*

12. (a) The probability density function of a random variable X is given by  $f(x) = xe^{-x} \cdot u(x)$ . Determine :

(i) CDF

(ii) Evaluate  $P(X \leq 1)$

(iii)  $P(1 < X \leq 2)$

(iv)  $P(X > 2)$ . [8]

(b) Write a short note on Gaussian distribution function. [4]

(c) A continuous random variable has a probability density function expressed as :

$$f(x) = 2e^{-2x} \quad \text{for } x \geq 0.$$

Determine probability that it will take a value between 1 and 3. [4]

Total No. of Questions—12]

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**[4162]-152**

**S.E. (E&TC/Electronics) (First Semester) EXAMINATION, 2012**

**SOLID STATE DEVICES AND CIRCUITS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

### **SECTION I**

1. (a) What are the important features of switching diodes ? Draw the characteristics of switching diode and mention *two* applications of switching diode. [8]

(b) Explain construction, operation and characteristics of photo-diode. [8]

P.T.O.

Or

2. (a) Determine the output voltage  $V_o$  in the circuit shown in Fig. 1 for :

(i)  $V_1 = V_2 = 10 \text{ V}$

(ii)

(iii) . [9]



Fig. 1

(b) List the factors affecting load line and Q pt. of a diode circuit. [4]

(c) Define the following non-ideal parameters of MOSFET :

(i) Body effect

(ii) Subthreshold conduction. [3]

3. (a) Derive the expression for the voltage gain, input resistance and output resistance for a CS MOSFET amplifier with the bypass capacitor. [8]
- (b) Write a short note on Bi-CMOS inverter. [8]

*Or*

4. (a) What is enhancement load device ? Explain the circuit with enhancement load device and MOSFET driver. [8]
- (b) Calculate  $V_{GS}$ ,  $V_{DS}$  and  $I_D$  for the Fig. 2, the MOSFET parameters are :

$$V_{TN} = 0.8 \text{ V}, K_n = 0.5 \text{ mA/V}^2. \quad [8]$$

Fig. 2

5. (a) Derive the expression for CE amplifier with bypassed  $R_E$  using approximate analysis. [8]
- (b) Explain the need of multistage amplifier and comment on selection of transistor configuration. [6]
- (c) Compare CE, CB, CC configurations of transistor. [4]

*Or*

6. (a) The transistor amplifier shown in Fig. 3 assume  $h_{ie} = 1.1 \text{ K}$ ,  
 $h_{fe} = 50$ ,  $h_{re} = 2.5 \times 10^{-4}$ ,  $h_{oe} = 24 \text{ } \mu\text{A/V}$ .

Calculate :

(i)  $A_I = I_O/I_{in}$

(ii)  $A_V$

(iii)

(iv)  $R_i$

[8]

Fig. 3

- (b) For the two-stage amplifier circuit shown in Fig. 4, identify the configurations. Assuming transistor parameters as  $h_{ie} = 2K$ ,  $h_{fe} = 50$ ,  $h_{re} = 6 \times 10^{-4}$ ,  $h_{oe} = 25 \mu A/V$ . Calculate overall current gain  $A_I$ , voltage gain  $A_V$ ,  $A_{V_S}$ ,  $R_i$ ,  $R_o'$ .  
 $h_{ic} = 2K$ ,  $h_{fc} = -51$ ,  $h_{rc} = 1$ ,  $h_{oc} = 25 \mu A/V$ . [10]

Fig. 4

## SECTION II

7. (a) Explain the effect of various capacitors listed below on frequency response of an amplifier :
- (i) Coupling capacitor
  - (ii) Emitter or source bypass capacitor
  - (iii) Junction capacitance

List the advantages of square wave testing. [8]

(b) Write a short note on Heterojunction bipolar transistor. [8]

*Or*

8. (a) Draw the hybrid  $\pi$  common emitter BJT model and explain the parameters in the model. [8]

(b) Explain the operation of optocoupler. State and explain application of optocoupler. [8]

9. (a) For the feedback amplifier shown in Fig. 5 identify feedback topology with proper justification. The transistor used has the following parameters :

$h_{fe} = 200$ ,  $h_{ie} = 2 \text{ K}$ ,  $h_{re} = 10^{-4}$ ,  $h_{oe} = 10^{-6} \text{ A/V}$ . Calculate  $A_{vf}$ ,  $R_{if}$ ,  $R_{of}$ . [8]

Fig. 5



- (b) For the transistor shown in Fig. 6 the transistor has the following parameters :  $h_{ie} = 1.1 \text{ K}$ ,  $h_{fe} = 50$ ,  $h_{re} = h_{oe} = 0$ .

Calculate  $A_{vf}$ ,  $R_{if}'$ ,  $R_{of}'$ . [8]

Fig. 6

Or

10. (a) Write short notes on any two :

(i) Crystal oscillator

(ii) Hartley oscillator

(iii) Wien Bridge oscillator. [8]

- (b) What are four basic amplifier types ? Explain with the help of block diagram. What are desirable characteristics of four basic amplifiers ? [8]

11. (a) Explain the following parameters of power BJT :
- (i)  $T_j$  max
  - (ii) SOA
  - (iii)  $\theta_{jc}$
  - (iv)  $P_D$ , max. [8]
- (b) Draw the circuit diagram of class B push-pull power amplifier and discuss in brief :
- (i) its operation
  - (ii) its merits
  - (iii) crossover distortion. [10]

*Or*

12. (a) Compare power BJT with simple BJT. Draw the IV characteristics of power transistor and explain. [9]
- (b) Explain how even harmonics get eliminated in class B push-pull amplifier. [9]

Seat No.	
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**[4162]-153****S.E. (E & TC, Elex) (First Semester) EXAMINATION, 2012****NETWORK ANALYSIS****(2008 PATTERN)****Time : Three Hours****Maximum Marks : 100**

- N.B. :-** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10 and Q. No. 11 or Q. No. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Obtain the current  $I_x$  for the circuit shown in Fig. 1 using Thevenin's theorem. [6]

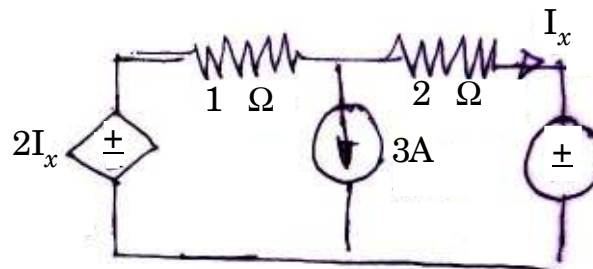


Fig. 1

- (b) For the circuit shown in Fig. 2, find branch currents  $I_1$ ,  $I_2$  and  $I_3$  and node voltages  $V_1$  and  $V_2$ . [6]

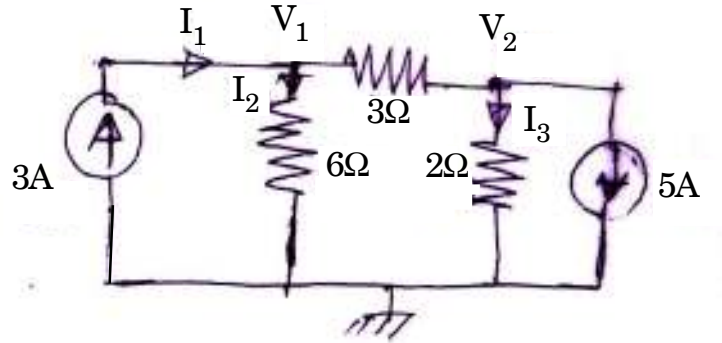


Fig. 2

- (c) Using source shifting and source transformation, find current 'I' in the circuit shown in Fig. 3 : [6]

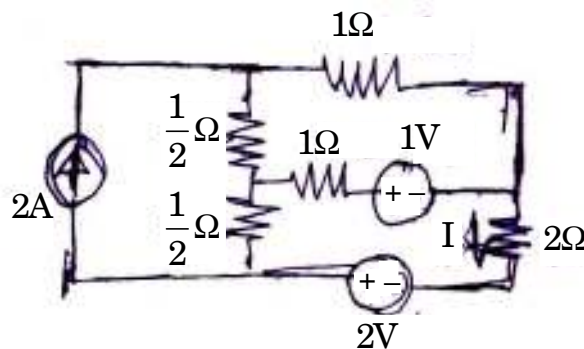


Fig. 3

Or

2. (a) Using Kirchoff's law, determine current  $i_1$  in the circuit shown in Fig. 4 : [6]

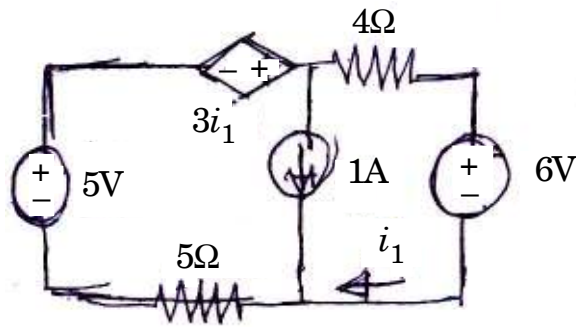


Fig. 4

- (b) Find Thevenin's and Norton's equivalent circuit across 'AB' in the circuit shown in Fig. 5 : [8]

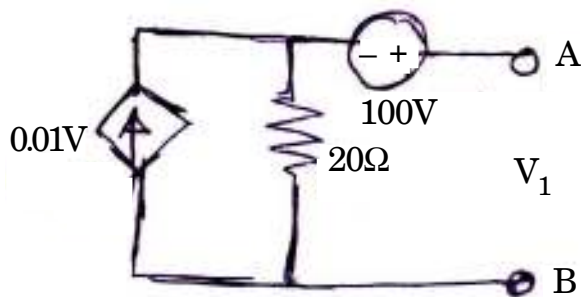


Fig. 5

- (c) State and explain maximum power transfer theorem. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-154**

**S.E. (E & TC) (First Semester) EXAMINATION, 2012**

**DIGITAL LOGIC DESIGN**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer any *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) In section I : Attempt questions Nos. **1 or 2, 3 or 4** and **5 or 6**.
  - (vi) In section II : Attempt questions Nos. **7 or 8, 9 or 10** and **11 or 12**.

**SECTION I**

1. (a) Design 4 bit Excess-3 to BCD code converter and implement using logic gates. [10]
- (b) Design 4 bit BCD adder using binary adder ICs. [8]

P.T.O.

*Or*

2. (a) Simplify the following Boolean function by using Quine-McClusky method : [10]

$$F(A, B, C, D) = \sum m(2, 4, 5, 9, 12, 13).$$

- (b) Implement the following Boolean expression using 8 : 1 Mux : [8]
3. (a) Perform the following conversion : [8]
- (i) JK FF to D FF
  - (ii) SR FF to JK FF.
- (b) Design and implement 3 bit synchronous counter using JK FF. [8]

*Or*

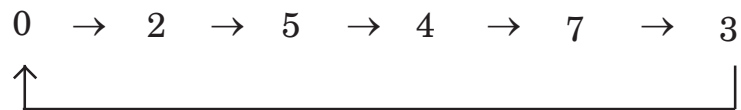
4. (a) Design MOD 6 asynchronous counter using T Flip-Flop and also draw the waveforms. [8]
- (b) Explain how shift registers are used as : [8]
- (i) Ring Counter
  - (ii) Twisted Ring Counter.
5. (a) Write a VHDL code for 2 bit comparator using data flow modelling style. [8]
- (b) Write a VHDL code for 3 bit ripple down counter. [8]

Or

6. (a) Write a VHDL code for active high 3 : 8 decoder. [8]  
(b) Write a short note on data objects in VHDL. [4]  
(c) Explain the difference between concurrent statement and sequential statement in VHDL. [4]

### SECTION II

7. (a) Draw ASM chart for a 2 bit up-down counter having mode control input M.  
M = 1 Up counter  
M = 0 Down counter. [8]  
(b) Design synchronous counter which will go through the following steps JK FF : [10]



Or

8. (a) Explain Melay circuit with example. Also compare Moore and Melay circuit. [8]  
(b) Design a pulse train generator using a shift register for the following pulse train : [10]  
..... 1000 110 .....

9. (a) Draw and explain the working of 2 input TTL NAND Gate. [8]  
(b) Explain the concept of TTL driving CMOS circuits and CMOS driving TTL circuit. [8]



*Or*

- 10.** (a) Explain the following characteristics of CMOS logic family : [8]
- (i) Power Dissipation
  - (ii) Propagation delay
  - (iii) Noise Margin
  - (iv) Fan out.
- (b) Explain the difference between current sourcing and current sinking in TTL logic. [8]
- 11.** (a) A combinational circuit is defined by the function : [8]

Implement this circuit with PLA having 3 input, 4 product terms and two outputs.

- (b) Differentiate between PLA and PAL. [4]
- (c) Write a short note on SRAM. [4]

*Or*

- 12.** (a) Design  $2K \times 8$  memory using two  $1K \times 8$  memory. [8]
- (b) Distinguish between volatile and non-volatile memories. [4]
- (c) Write a short note on EPROM. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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**[4162]-155**

**S.E. (E&TC) (First Semester) EXAMINATION, 2012**

**POWER DEVICES AND MACHINES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answers to the two Sections should be written in separate answer books.

(ii) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I; Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain switching characteristics of power diode. What is difference between soft recovery and abrupt recovery ? [9]
- (b) The reverse recovery time of diode is 3  $\mu$ sec. The rate of fall of diode current is  $\frac{di}{dt} = 30$  A/ $\mu$ sec. Determine storage charge and peak reverse current. [9]

P.T.O.

*Or*

- 2.** (a) Explain with the help of equivalent circuits, causes of latch up in IGBT and how to avoid it. [6]
- (b) Draw isolated gate drive circuit for MOSFET and explain its operation. [6]
- (c) Explain the reason for body source short in MOSFET structure. [6]
- 
- 3.** (a) Explain 'R' triggering circuit with necessary waveforms. [6]
- (b) For the S.C.R., the gate cathode characteristics is given by straight line with gradient of 16 V/Amp passing through origin. The maximum turn ON time is 4  $\mu$ sec and minimum gate current required to obtain this turn ON is 500 mA. If gate source voltage is 15 V :
- (i) Calculate the resistance to be connected in series with S.C.R. gate.
- (ii) Compute gate power dissipation, given that pulse width is equal to turn ON time and average gate power dissipation is 0.3 W.
- (iii) Compute maximum triggering frequency that will be possible when pulse firing is used. [10]

*Or*

4. (a) Describe the following ratings as applicable to SCR :
- (i) Surge current rating
  - (ii)  $I^2t$  rating
  - (iii)  $\frac{dv}{dt}$  rating
  - (iv)  $\frac{di}{dt}$  rating. [8]
- (b) Explain with neat diagram construction and operating modes of triac. [8]
5. (a) Draw the circuit diagram of single phase semi-converter for 'R' load. Explain the operation with the help of voltage and current waveforms. [8]
- (b) What is inverting and rectifying mode of single phase full wave converter with R-L load ? [8]

*Or*

6. (a) With neat circuit diagram and waveforms explain operation of single phase full wave AC voltage controller with resistive load. Derive expression for RMS output voltage. [8]

- (b) A single phase half wave AC voltage controller has resistive load  $R = 5\Omega$  and input voltage  $V_s = 120$  V, 60 Hz. The delay angle of thyristor is  $\alpha = 60^\circ$ , determine :
- (i) RMS output voltage
  - (ii) Input power factor
  - (iii) Average input current. [8]

## SECTION II

7. (a) With neat circuit diagram and necessary waveforms, explain the operation of stepdown chopper (R. load) and hence derive expression for average RMS output voltage. [9]
- (b) A stepdown D.C. chopper has resistive load of  $R = 15 \Omega$  and input voltage  $E_{dc} = 200$  V. When chopper remains ON its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If duty cycle is 50%, find :
- (i) Average output voltage
  - (ii) RMS output voltage
  - (iii) Chopper efficiency
  - (iv) Effective input resistance of chopper. [9]

*Or*

8. (a) With neat circuit diagram and necessary waveforms, explain the operation of single phase bridge inverter with 'R' load. [9]
- (b) With neat circuit diagram and necessary waveforms, explain operation of three phase bridge inverter with star-connected 'R' load in 180° mode. [9]
9. (a) With neat sketches, explain construction and working of D.C. motor. [8]
- (b) A 250 V D.C. shunt motor on no load runs at 1000 rpm and takes 5 A. The total armature and shunt field resistances are 0.2  $\Omega$  and 250  $\Omega$  respectively. Calculate the speed when loaded and taking current of 50 A. [8]

*Or*

10. (a) Explain construction and working of universal motor. Draw its characteristics. [8]
- (b) Explain the working principle of three phase induction motor. Differentiate between squirrel cage and slip ring type induction motor. [8]

- 11.** (a) Explain with neat sketches and appropriate equations, different connections for 3-phase transformers. [8]
- (b) Explain construction and working of :
- (i) Current transformer
- (ii) Potential transformer. [8]

*Or*

- 12.** Write short notes on : [16]
- (i) Variable reluctance stepper motor
- (ii) AC servo motor
- (iii) Brushless DC motor.

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

<b>Seat No.</b>	
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**[4162]-156**

**S.E. (E&TC, Electronics) (Second Semester) EXAMINATION, 2012**

**ENGINEERING MATHEMATICS—III**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) In Section I : attempt Q. No. 1  $\sigma$  Q. No. 2,  
Q. No. 3  $\sigma$  Q. No. 4, Q. No. 5  $\sigma$  Q. No. 6.  
In Section II : attempt Q. No. 7  $\sigma$  Q. No. 8,  
Q. No. 9  $\sigma$  Q. No. 10, Q. No. 11  $\sigma$  Q. No. 12.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Figures to the right indicate full marks.
- (iv) Use of non-programmable electronic pocket calculator is allowed.
- (v) Assume suitable data, if necessary.

**SECTION I**

- 1. (a) Solve the following (any three) :** [12]
- (i)  $(D^2 + 2D + 1) y = x^2 e^{3x}$

P.T.O.



$$(ii) \quad (D^3 - 3D^2 + 3D - 1) y = \sqrt{x}e^x$$

$$(iii) \quad x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 6y = 4x - 6$$

$$(iv) \quad \frac{x dx}{z^2 - 2yz - y^2} = \frac{dy}{y + z} = \frac{dz}{y - z}.$$

(b) Solve the system of equations : [5]

$$\frac{dx}{dt} - \frac{dy}{dt} - y = -e^t$$

$$\frac{dy}{dt} + x - y = e^{2t}.$$

Or

2. (a) Solve the following (any three) : [12]

$$(i) \quad (D^2 + 2D + 5) y = \sin^2 x$$

$$(ii) \quad (D^2 + 2D + 1) y = e^{-x} \log x \quad (\text{by method of variation of parameters})$$

$$(iii) \quad (D^2 - 4) y = x \sinh x$$

$$(iv) \quad (2x + 5)^2 \frac{d^2y}{dx^2} + 8y - 6(2x + 5) \frac{dy}{dx} = 6x.$$

(b) Find charge and current in a circuit in series having an e.m.f. of 100 V, a resistor of 4  $\Omega$ , an inductor of 2 H and a capacitor of 0.05 farads, if initial current and charge both are zero. [5]

3. (a) Find the analytic function  $f(z)$  whose imaginary part is  $r^n \sin n\theta$ . [5]

(b) Evaluate :

$$\oint_C \frac{z^3 - 5}{(z + 1)^2 (z - 2)} dz$$

where C is circle  $|z| = 1.5$ . [6]

(c) Show that, under the transformation  $w = z + \frac{4}{z}$ , the circle  $|z| = 2$  is mapped onto the straight line. [5]

Or

4. (a) If  $f(z)$  is analytic, show that :

$$\left( \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right) |f(z)|^2 = 4 |f'(z)|^2. \quad [5]$$

(b) Evaluate (by using residue theorem) :

$$\int_0^{2\pi} \frac{d\theta}{5 + 4 \sin \theta}. \quad [6]$$

(c) Find the bilinear transformation which maps the points  $1, i, -1$  of  $z$ -plane to the points  $0, 1, \infty$  of  $w$ -plane. [5]

5. (a) Find  $z$ -transform of the following (any two) : [6]

(i)  $f(k) = 4^k \sin(3k + 5) \quad k \geq 0$

(ii)  $f(k) = ke^{-3k} \quad k \geq 0$

(iii)  $f(k) = \left(\frac{1}{2}\right)^{|k|}$ .

(b) Find Fourier integral representation of

$$f(x) = e^{-\frac{x^2}{2}}, \quad -\infty < x < \infty. \quad [6]$$

(c) Solve the difference equation :

$$f(k+1) + \frac{1}{4}f(k) = \left(\frac{1}{4}\right)^k, \quad k \geq 0, \quad f(0) = 0. \quad [5]$$

Or

6. (a) Find inverse  $z$ -transform of (any two) : [6]

(i)  $\frac{3z^2 + 2z}{z^2 - 3z + 2}$

(ii)  $\frac{z^3}{(z-1)\left(z-\frac{1}{2}\right)^2}$

(iii)  $\frac{1}{(z-a)^3}$  (using inversion integral method).

(b) Find Fourier transform of

$$f(x) = \begin{cases} \frac{\pi}{2} \cos x & |x| \leq \pi \\ 0 & |x| > \pi \end{cases} \quad [6]$$

(c) Solve the following integral equation :

$$\int_0^{\infty} f(x) \sin \lambda x dx = \begin{cases} 1 - \lambda & 0 \leq \lambda \leq 1 \\ 0 & \lambda \geq 1 \end{cases} \quad [5]$$

## SECTION II

7. (a) From the following data, find the cubic polynomial by using Newton-Gregory Forward Interpolation formula and use it to find  $f(4)$  : [5]

$x$	$f(x)$
0	1
1	2
2	1
3	10

(b) Evaluate :

$$\int_0^1 \frac{dx}{1+x^2}$$

using Trapezoidal rule taking  $h = \frac{1}{4}$ . [5]

- (c) Using Modified Euler's method, determine the value of  $y$  when  $x = 0.1$  taking  $h = 0.05$  for the differential equation :

$$\frac{dy}{dx} = x^2 + y; \quad y(0) = 1. \quad [6]$$

Or

8. (a) Find Lagrange's interpolating polynomial passing through the set of points :

$x$	$y$
0	4
1	3
2	6

Use it to find  $y$  at  $x = 1.5$  and  $\frac{dy}{dx}$  at  $x = 0.5$ . Also find :

$$\int_0^3 y \, dx. \quad [5]$$

- (b) Evaluate :

$$\int_0^{\pi} \frac{\sin^2 \theta}{5 + 4 \cos \theta} \, d\theta$$

by Simpson's  $\frac{3}{8}$ th rule, taking  $h = \frac{\pi}{6}$ . [5]

(c) Use Runge-Kutta method of fourth order to solve :

$$; x_0 = 0, y_0 = 1$$

to find  $y$  at  $x = 0.4$  taking  $h = 0.2$ . [6]

9. (a) If

$$\bar{r} \times \frac{d\bar{r}}{dt} = 0,$$

show that  $\bar{r}$  has a constant direction. [4]

(b) Show that :

$$\bar{F} = \frac{y e^{xy} \cos z}{x + y} \bar{i} + (x e^{xy} \cos z) \bar{j} - e^{xy} \sin z \bar{k}$$

is irrotational. Find scalar field  $\phi$  such that  $\bar{F} = \nabla\phi$ . [5]

(c) With usual notations, prove the following vector identities

(any two) : [8]

(i)  $\nabla \times (\bar{a} \times \bar{r}) = 2\bar{a}$

(ii)  $\nabla \left( \frac{\bar{a} \cdot \bar{r}}{r^n} \right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a} \cdot \bar{r})}{r^{n+2}} \bar{r}$

(iii)  $\nabla^2 r^n = n(n + 1) r^{n-2}$ .

Or

10. (a) In what direction from the point  $(2, 1, -1)$  is the directional derivative of  $\phi = x^2yz^3$  a maximum ? What is the magnitude of this maximum ? [6]

- (b) Show that :

$$\vec{F} = \frac{\vec{a} \times \vec{r}}{r^n}$$

is solenoidal. [5]

- (c) If  $u = x + y$

$$v = x - y + z$$

$$w = (2x + z)^2 + (2y - z)^2$$

then show that  $\nabla u, \nabla v, \nabla w$  are coplanar vectors. [6]

11. (a) If

$$\vec{F} = (2x + y^2) \vec{i} + (3y - 4x) \vec{j}$$

then evaluate

$$\int_C \vec{F} \cdot d\vec{r}$$

where C is the boundary of triangle OPQ, where O, P, Q have the co-ordinates  $(0, 0), (2, 0), (2, 1)$  respectively. [6]

(b) Evaluate :

$$\iint_S \bar{r} \cdot \hat{n} \, dS$$

over the surface of a sphere of radius 1 with centre at origin. [5]

(c) Evaluate :

$$\iint_S (\nabla \times \bar{F}) \cdot d\bar{S}$$

where

$$\bar{F} = (x^3 - y^3) \bar{i} - xyz \bar{j} + y^3 \bar{k}$$

and S is the surface

$$x^2 + 4y^2 + z^2 - 2x = 4$$

above the plane  $x = 0$ . [6]

*Or*

**12.** (a) Find work done in moving a particle along the arc of parabola  $y = 2x^2$  from (0, 0) to (1, 2) in the plane  $z = 0$  under the field of force :

$$\bar{F} = 3xy \bar{i} - y^2 \bar{j}. \quad [6]$$



(b) Evaluate :

$$\int_C (\sin z \, dx - \cos x \, dy + \sin y \, dz)$$

where C is the boundary of rectangle  $0 \leq x \leq \pi$ ,  
 $0 \leq y \leq 1$ ,  $z = 3$ . [6]

(c) If

$$\bar{\mathbf{E}} = \nabla\phi \quad \text{and} \quad \nabla^2\phi = -4\pi\rho$$

then prove that :

$$\iint_S \bar{\mathbf{E}} \cdot d\bar{\mathbf{S}} = -4\pi \iiint_V \rho \, dV$$

where V is volume enclosed by closed surface S. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-157**

**S.E. (E & TC) (Second Semester) EXAMINATION, 2012**

**INTEGRATED CIRCUITS AND APPLICATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is need of level shifter block in op-amp ? Explain different circuits used for the level shifting. [10]
- (b) State the values for all ideal parameters of op-amp. [4]
- (c) State the different op-amp technologies and compare them. [4]

P.T.O.

Or

2. (a) Derive the expression for differential gain ( $A_d$ ), Input resistance ( $R_i$ ) and output resistance ( $R_o$ ) for dual input balanced output difference amplifier using  $\gamma$ -parameters. Draw the small signal model for the same. [10]
- (b) Design dual input balanced output differential amplifier with constant current bias using diodes to satisfy the following requirements. [Dual supply is  $\pm 10$  V] : [8]
- (i) Differential voltage gain = 45
- (ii) Current supplied by the constant current bias circuit = 4.5 mA
- (iii) Supply voltage  $|V_{CC}| = |-V_{EE}| = 10$  V.
3. (a) Explain the effect of temperature on : [8]
- (i) Input bias current
- (ii) Input offset current
- (iii) Input offset voltage
- (iv) Output offset voltage.
- (b) Write a note on noise in op-amp. [4]
- (c) Explain the method of op-amp powering. [4]

*Or*

4. (a) What is need of frequency compensation ? State the different methods of frequency compensation with explanation. [8]
- (b) Explain the following terms for op-amp : [8]
- (i) Full Power Response
  - (ii) CMRR
  - (iii) Slew Rate
  - (iv) PSRR.
5. (a) Explain voltage to current converter with grounded load using op-amp. Mention applications of this converter. [8]
- (b) Explain how the defined non-linearity can be generated between input and output using op-amp, give example. [8]

*Or*

6. (a) Draw and explain the integrator working with run, set and hold modes. [8]
- (b) Design differentiator to differentiate an input signal that varies in frequency from 10 Hz to 500 Hz.
- If a sine wave of 2 V peak at 500 Hz is applied to the differentiator, write the expression for its output and draw the output waveform. [8]

## SECTION II

7. (a) Explain the working of inverting Schmitt trigger. Also derive the equation for the trigger points. [8]
- (b) Design square wave generator to generate a perfect square wave of 50% duty cycle with an output frequency of 1 kHz.
- Assume the feedback factor to be 0.1. Also draw the output waveform and waveform across the capacitor using op-amp. [10]

*Or*

8. (a) State the important characteristics of a comparator using op-amp and explain. [4]
- (b) Draw and explain instrumentation amplifier with bridge input. Derive the expression for its output voltage. [10]
- (c) Draw the practical voltage regulator using LM 317 and justify use of each components in it. [4]
9. (a) Explain the block diagram of IC 9400 for voltage to frequency conversion. [8]
- (b) State the specifications of DAC. Also explain the applications of DAC. [8]

*Or*

- 10.** (a) Write a note on dual slope ADC. [8]  
(b) A 5-bit R-2R ladder network with reference voltage of 10 V.  
Find : [8]  
(i) Analog output due to LSB change  
(ii) Full scale output voltage  
(iii) Analog output for digital input 11001.

- 11.** (a) Explain the working of : [8]  
(i) op-amp based Active tone control.  
(ii) op-amp based pre-amplifier.  
(b) With the help of neat diagram explain function of each block of PLL. [8]

*Or*

- 12.** (a) Write notes on : [8]  
(i) FM demodulator using PLL.  
(ii) Notch filter using op-amp.  
(b) Design first order wide bandpass filter for the following specifications : [8]

$$\text{Quality factor (Q)} = 3$$

$$\text{Pass band gain} = 5$$

$$\text{Centre frequency (F}_c\text{)} = 1 \text{ kHz.}$$

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

Seat No.	
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[4162]-158

S.E. (E & TC) (Second Semester) EXAMINATION, 2012

**ELECTROMAGNETICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Derive an expression for electric field intensity ( $\bar{E}$ ) at a point P due to an infinite sheet of charge placed in XY plane with a uniform charge density  $\rho_S$ . [9]
- (b) A charge distribution is placed in the  $z = -3$  m plane in the form of a square sheet defined by  $-2 \leq x \leq 2m$ ,  $-2 \leq y \leq 2m$ . It has a charge density of  $\rho_S = 2(x^2 + y^2 + 9)^{3/2}$  nC/m<sup>2</sup>. Find the electric field intensity ( $\bar{E}$ ) at the origin. [9]

P.T.O.

Or

2. (a) Obtain the expression for  $\bar{D}$  and  $\bar{E}$  for an infinite line charge using Gauss law. [9]
- (b) Three concentric spherical surfaces of radii  $r = 2$ ,  $r = 4$  and  $r = 5$  m have uniform surface charge density of 8,  $-12$  and  $\rho_S$   $nC/m^2$  respectively. [9]
- (i) What must be the value of  $\rho_S$  so as to make  $\bar{D} = 0$  for  $r = 5$  ?
- (ii) If  $\rho_S = 2$   $nC/m^2$ , find  $\bar{D}$  for  $0 < r < b$ .
3. (a) What is an electric dipole ? Derive an expression for potential and electric field at point P due to an electric dipole. [8]
- (b) Consider a capacitor formed by a segment of two co-axial cylinders as shown below in Fig. 1 : [8]

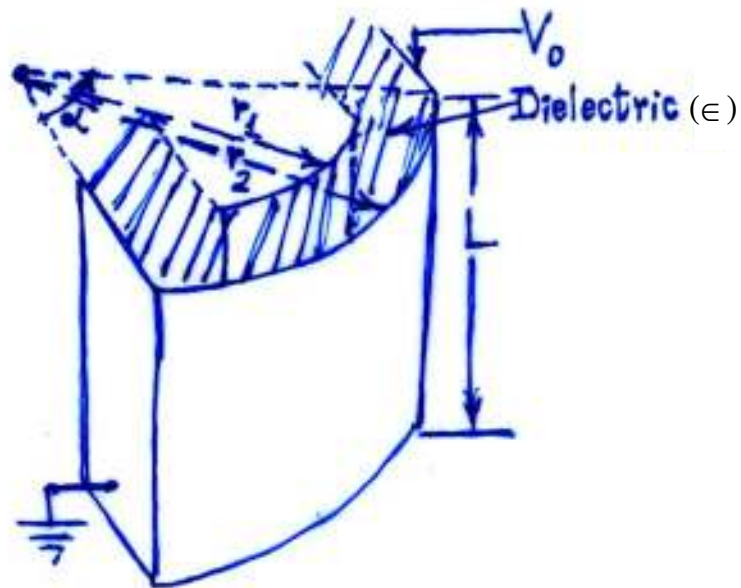


Fig. 1

For the given dimensions, find the capacitance (C). Neglect fringing.



Or

4. (a) Derive an expression for the capacitance of spherical capacitor with two concentric spherical conductors. [8]
- (b) Two semi-infinite conducting planes at  $\phi = 0$  and  $\phi = \pi/6$  are separated by an infinitesimal insulating gap as shown in Fig. 2 : [8]

If  $V(\phi = 0) = 0$  and  $V(\phi = \pi/6) = 100$  V.

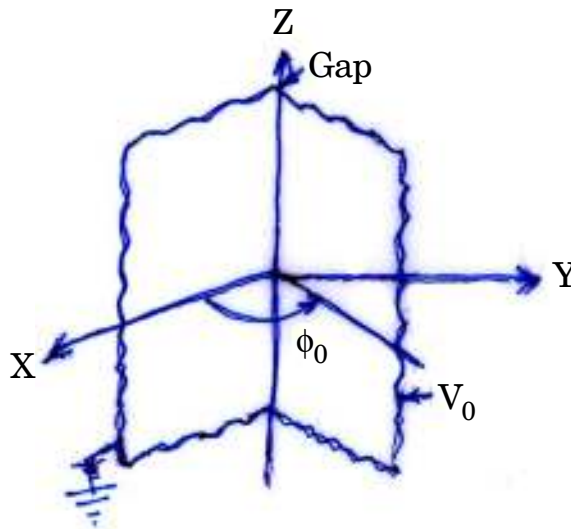


Fig. 2

Calculate  $V$  and  $\vec{E}$  in the region between the planes.

5. (a) Derive the expression for  $\vec{H}$  at a point due to an infinite sheet of current placed in  $z = 0$  plane. [8]

- (b) Planes  $z = 0$  and  $z = 4$  carry a current  $\vec{K} = -10\vec{a}_x$  A/m and  $\vec{K} = 10\vec{a}_x$  A/m respectively. Find  $\vec{H}$  at :
- (i) P(1, 1, 1)
- (ii) Q(0, -3, 10).

Or

6. (a) State and prove Ampere's law in integral and differential form. [8]
- (b) A current of 0.4 A in the  $\vec{a}_z$  direction in free space is in a filament parallel to the  $z$ -axis and passing through point (2, -4, 0). Find  $\vec{H}$  at (0, 1, 0) if the filament lies in the range :
- (i)  $-\infty < z < \infty$
- (ii)  $-3 < z < 3$  and
- (iii)  $0 < z < \infty$ .

## SECTION II

7. (a) Derive the boundary conditions for the conductor-dielectric interface. [6]
- (b) A region  $y \geq 0$  consists of a dielectric medium and the region  $y < 0$  is a conductor. For the surface charge of  $4 \text{ nC/m}^2$  on the conductor and  $\epsilon_{r_1} = 3$  (for the dielectric medium). Find  $\vec{E}$  and  $\vec{D}$  at the points :
- (i) M(4, -2, 1) and
- (ii) N(-3, 1, 4).

- (c) Given  $\vec{E} = 60\vec{a}_x + 20\vec{a}_y - 30\vec{a}_z$  V/m at a point on the interface between air and a conducting surface. Find  $\vec{D}$  and  $\rho_S$  at that point. [6]

Or

8. (a) Derive the boundary conditions for the conductor-conductor interface. [8]
- (b) Given that : [10]

$$\vec{E}_1 = 2\vec{a}_x - 3\vec{a}_y + 5\vec{a}_z \text{ V/m}$$

at the charge free dielectric interface as shown in Fig. 3 below. Find  $\vec{D}_2$  and angles  $\theta_1, \theta_2$ .

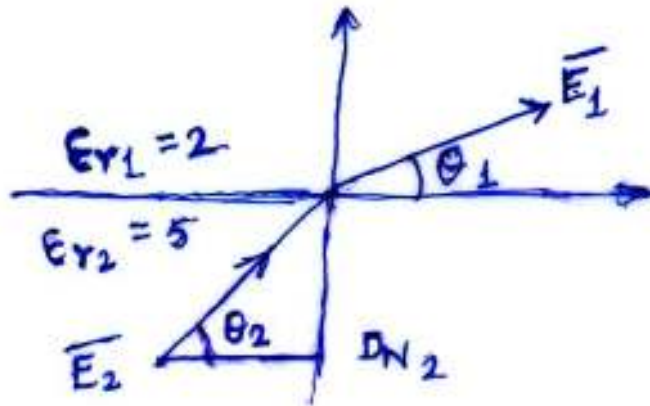


Fig. 3

9. (a) In free space  $\vec{E}(z, t) = 50 \cos(\omega t - \beta z) \vec{a}_x$  V/m. Find the average power crossing a circular area of radius 2.5 m in the plane  $z = \text{constant}$ . [8]
- (b) State Poynting's theorem. Derive the expression for the same. Also explain about Poynting vector. [8]

*Or*

10. (a) Write Maxwell's equations in both differential and integral forms. [8]

(b) In the charge free region, the magnetic field intensity is given by : [8]

$$\vec{H} = H_m \cos \beta z \cos \omega t \vec{a}_y \text{ A/m.}$$

Calculate  $\vec{E}$ ,  $\vec{D}$  and  $\vec{B}$ .

11. (a) Explain finite difference method in detail with suitable examples. [8]

(b) Explain method of images in detail. [8]

*Or*

12. (a) Discuss in detail about Method of Moments. What are its applications ? [8]

(b) Explain finite element method. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-159**

**S.E. (Electro./E&TC) (Second Semester) EXAMINATION, 2012**

**DATA STRUCTURES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a)** Sort the following table of numbers using :

(i) Bubble Sort

(ii) Insertion Sort

A    V    B    C    D    X    P

Show every pass in detail.

Define Time Complexity and write down Time Complexity for the above sorting methods. [8]

P.T.O.

- (b) Write pseudo 'C' algorithm for Binary search. [4]
- (c) Define ADT. Write down ADT of arrays. [4]

*Or*

- 2. (a) Write a function in 'C' to implement selection sort. [6]
  - (b) Define Recursive Function in 'C' and explain with example in detail. [6]
  - (c) Explain with example row major and column major storage representation in two-dimensional arrays. [4]
- 
- 3. (a) Differentiate static and dynamic memory allocation. [4]
  - (b) Explain bitwise operators each with example. [6]
  - (c) Write a function "sub\_poly" in 'C' to subtract two polynomials. [8]

*Or*

- 4. (a) Explain parameter passing by value and by reference with example of swapping of two variables. [8]

- (b) Write down only declaration in 'C' for : [4]  
A database of 100 students each with information as roll no,  
name, address and marks using :
- (i) Only Arrays  
(ii) Array of structures.
- (c) Write a function in 'C' to display length of string. [6]
- 5.** (a) Write pseudo 'C' algorithm to insert a node in Singly Linked List with all possible conditions. [6]  
(b) Define GLL with node declaration and represent the following polynomial using GLL : [6]  
$$9x^2y^2 + 6xy^2 + 6y^2 + y + x^2.$$
  
(c) Explain node structure of Doubly Linked List and explain its advantages. [4]

*Or*

- 6.** (a) Define Circular Linked List and compare with respect to SLL. [4]  
(b) Write a function in 'C' to delete a node in Doubly Linked List. [6]  
(c) Write down advantages of Linked list over arrays. [6]

## SECTION II

7. (a) Explain with example the concept of priority queue. [4]
- (b) Write an algorithm for the conversion of infix to postfix expression. [6]
- (c) Identify the expressions and convert them into remaining two forms : [6]
- (i)  $AB + C*DE - FG + \$$ , where  $\$$ -Exponent
- (ii)  $-A/B*C\$DE$ .

*Or*

8. (a) Convert the following infix expressions into postfix expression using stack : [6]
- (i)  $((A + B)* C - (D - E)) \$ (F + G)$ , where  $\$$ -Exponent
- (ii)  $A\$B*C - D + E/F/(G + H)$ .
- (b) Write PUSH and DISPLAY functions for STACK using LINKED LIST and also write node structure. [6]
- (c) Explain drawback of Linear QUEUE and how the drawback can be removed. [4]
9. (a) Write an algorithm for non-recursive in-order traversal of Binary tree. [8]



- (b) Create an AVL tree for the following elements. Show all steps with rotation : [6]

1 2 3 4 8 7 6 5.

- (c) Differentiate between linear and non-linear data structures. [4]

Or

10. (a) Write an algorithm for deleting leaf nodes and nodes with only one child from a Binary Search Tree. [8]

- (b) What are threaded trees ? Explain with example. [6]

- (c) Construct a Binary Search Tree for given numbers, show all steps : [4]

14, 15, 4, 9, 7, 18, 3, 5, 7.

11. (a) Write a function to create GRAPH using adjacency matrix method. [6]

- (b) For the graph given in Fig. 1, draw minimum cost spanning tree using Prim's algorithm, show all steps : [6]

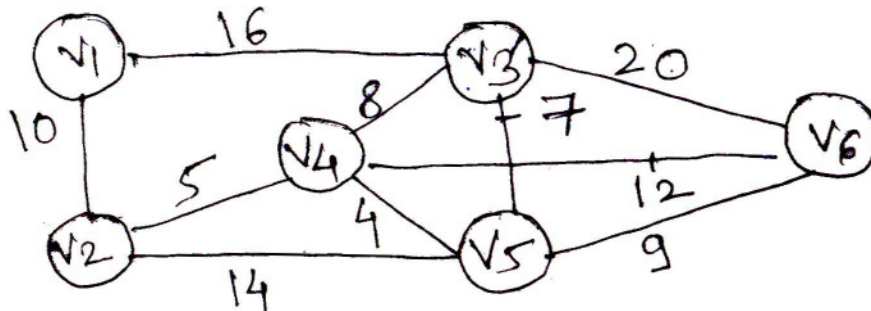


Fig. 1

- (c) What is in-degree, out-degree and degree of a vertex ? Explain with example. [4]

Or

12. (a) Write an algorithm for generating minimum cost spanning tree using Kruskal's method. [6]
- (b) Find the shortest path from vertex 1 to all other vertices in the graph of Fig. 2 using Dijkstra's algorithm : [6]

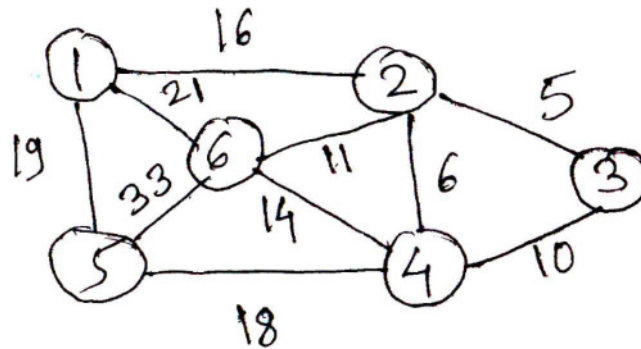


Fig. 2

- (c) Explain with example inverse adjacency list representation of graph. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-160**

**S.E. (E&TC) (Second Semester) EXAMINATION, 2012**

**COMMUNICATION THEORY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. Nos. 1 or 2; Q. Nos. 3 or 4;  
Q. Nos. 5 or 6 from Section I and Q. Nos. 7 or 8;  
Q. Nos. 9 or 10; Q. Nos. 11 or 12 from  
Section II.

(ii) Answer to the two Sections should be written in separate  
answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic  
pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

P.T.O.

## SECTION I

1. (a) With the help of neat block diagram explain high level AM transmitter. [8]
- (b) Explain the 'Third' method of SSB generation, also draw waveform and spectrum of SSB signal. [10]

*Or*

2. (a) Explain independent sideband system with block diagram. [8]
  - (b) The antenna current of an AM transmitter is 8 amperes when only carrier is sent, but it increases to 8.93 A when the carrier is modulated by single sine wave. Find the percentage modulation. Determine the antenna current when the percentage modulation changes to 0.8. [6]
  - (c) Derive the expression for modulation index with various methods. [4]
- 
3. (a) Explain basic reactance modulator for FM generation. [8]
  - (b) An Armstrong transmitter is to be used for transmission at 152 MHz in the VHF band, with a maximum deviation of 15 kHz at a minimum audio frequency of 100 Hz. The primary oscillator is to be a 100 kHz crystal oscillator and the initial

phase-modulation deviation is to be kept to less than  $12^\circ$  to avoid audio distortion. Find the amount by which the frequency must be multiplied to give proper deviation and specify a combination of doublers and triplers that will give this. Also specify the mixer crystal and multiplier stages needed. [8]

*Or*

4. (a) Compare FM and AM systems with their spectrums. [6]

(b) An angle-modulated signal with carrier frequency  $\omega_c = 2\pi \times 10^6$  is described by the equation :

$$\phi_{EM}(t) = 5 \cos(\omega_c t + 20 \sin 1000 \pi t + 10 \sin 2000 \pi t)$$

(i) Find the power of the modulated signal

(ii) Find the frequency deviation

(iii) Find the phase deviation  $\Delta\phi$ .

(iv) Estimate the bandwidth of . [10]

5. (a) For the receiver tuned from 550 to 1600 kHz with an 1F of 455 kHz, given a two section tuning capacitor with a maximum 350 pF/section. Find the required padder capacitor required in the oscillator section. Assume that tuning error is zero at the extreme ends of the tuning range. [8]

(b) Explain rectifier and envelope detection methods for AM. [8]

*Or*

6. (a) Define and explain : [8]
- (i) Sensitivity
  - (ii) Selectivity
  - (iii) Fidelity
  - (iv) IFRR.
- (b) With the help of block diagram explain superheterodyne FM receiver. [8]

## SECTION II

7. (a) What is noise factor ? Derive the noise factor for amplifiers in cascade. [8]
- (b) Given the resistors,  $R_1 = 10 \text{ k}\Omega$  and  $R_2 = 15 \text{ k}\Omega$ , calculate the thermal noise voltage generated by :
- (i)  $R_1$
  - (ii)  $R_2$
  - (iii)  $R_1$  in series with  $R_2$
  - (iv)  $R_1$  in parallel with  $R_2$ . [8]

*Or*

8. (a) State various sources of noise with examples. Explain the following types of noise in detail : [8]
- (i) Thermal noise
  - (ii) Shot noise.

(b) Three amplifiers 1, 2 and 3 have the following characteristics :

$$F_1 = 9 \text{ dB} \quad G_1 = 48 \text{ dB}$$

$$F_2 = 6 \text{ dB} \quad G_2 = 35 \text{ dB}$$

$$F_3 = 4 \text{ dB} \quad G_3 = 20 \text{ dB}$$

The amplifiers are connected in tandem. Determine which combination gives the lowest noise factor referred to the input. [8]

9. (a) Derive the expression for signal-to-noise ratio in a DSB-SC system. [8]

(b) In a DSB-SC system, the carrier frequency  $f_c = 500$  kHz, and the modulating signal  $m(t)$  has a uniform PSD band-limited to 4 kHz. The modulated signal is transmitted over a distortionless channel with a noise PSD :

$$S_n(\omega) = 1/(\omega^2 + a^2), \text{ where } a = 10^6 \pi.$$

The useful signal power at the receiver is 1  $\mu$ W. The received signal is bandpass filtered, multiplied by  $2 \cos \omega_c t$ , and then low-pass filtered to obtain the output  $S_0(t) = n_0(t)$ . Determine the output SNR. [8]

*Or*

- 10.** (a) Derive the expression for signal-to-noise ratio in a SSB-SC system. [8]
- (b) Explain pre-emphasis and de-emphasis in FM. [8]
- 11.** (a) Explain sampling theorem showing the help of sampled signal in time and frequency domain. Also explain how to reconstruct the signal. [8]
- (b) Explain DPCM system with the help of transmitter and receiver block diagrams. Compare it with PCM. [10]

*Or*

- 12.** (a) What is non-uniform quantization ? Describe A-law and  $\mu$ -law companding. [8]
- (b) Draw and explain a PAM-TDM signal. [2]
- (c) A television signal (video and audio) has a bandwidth of 4.5 MHz. This signal is sampled, quantized and binary coded to obtain a PCM signal :
- (i) Determine the sampling rate if the signal is to be sampled at a 20% rate above the Nyquist rate.



- (ii) If the samples are quantized into 1024 levels, determine the number of binary pulses required to encode each sample.
- (iii) Determine the binary pulse rate (bits per second) of the binary-coded signal, and the maximum bandwidth required to transmit this signal. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-160-A**

**S.E. (E&TC) EXAMINATION, 2012**

**CONTROL SYSTEMS**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

### **SECTION I**

1. (a) Explain the closed loop system giving some examples. List advantages and disadvantage of it. [8]

P.T.O.

- (b) Reduce the block diagram and obtain  $\frac{C(s)}{R(s)}$  in Fig. 1. [8]

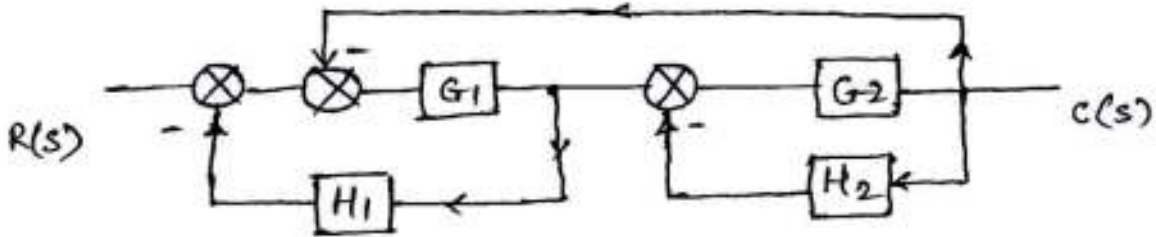


Fig. 1

Or

2. (a) Distinguish between open loop and closed loop control system. [6]
- (b) What is Mason's gain formula ? Explain it with an example. [10]
3. (a) What is steady state error ? Which factor control it ? How is it determined in feedback control system ? [6]
- (b) A second order control system has  $F(s) = s^2 + 2.4s + 9$ . If step input is applied to it, determine time domain specification. Sketch the response also. [10]

*Or*

4. (a) The feedback control system has

$$G(s) H(s) = \frac{K}{s(s+2)(s^2+6s+13)}.$$

Draw complete root locus and comment on stability of system. [10]

- (b) A unity feedback control system has

$$G(s) = \frac{K}{s(s^2+4s+5)(s+2)}.$$

Determine range of K so that system is stable. [6]

5. (a) Explain the terms phase margin and gain margin. State their importance. [6]

- (b) The feedback control system has

$$G(s) H(s) = \frac{s+160}{s(s+4)(s+40)}.$$

Sketching Bode plot determine closed loop stability. [12]

*Or*

6. (a) State the advantages and limitations of frequency response method. [8]

- (b) A unit step input is applied to a unity feedback control system having

$$G(s) = \frac{K}{s(1 + sT)}.$$

Determine the value of K and T to have  $M_p = 20\%$  and resonant freq.  $\omega_r = 6$  r/s. Calculate  $M_r$ . [10]

## SECTION II

7. (a) Define the following :

(1) State

(2) State variables

(3) State vector

(4) State space. [8]

- (b) Obtain state transition matrix for a system :

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} -3 & 1 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}. \quad [8]$$

*Or*

8. (a) What are the advantages of state space analysis over-conventional control system ? [8]

- (b) Obtain state transition matrix for system :

$$\begin{bmatrix} x_1 \\ x_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}. \quad [8]$$

- 9.** (a) What are thermistor ? Explain their construction. State the advantages, limitations and applications of thermistor. [10]  
(b) Explain the signal conditioning circuit used for thermistors. [6]

*Or*

- 10.** (a) Write a note on photoelectric tachometer. State its advantages. [8]  
(b) Explain the principle, operation of a synchroerror detector. [8]
- 11.** (a) What is PLC ? Compare it with hardwired relay logic. [8]  
(b) Draw the ladder diagram for elevator system and explain it. [10]

*Or*

- 12.** (a) Draw and explain the architecture of PLC. [8]  
(b) Draw the ladder diagram for an automatic washing machine and explain it. [10]

Seat No.	
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**[4162]-160-B**

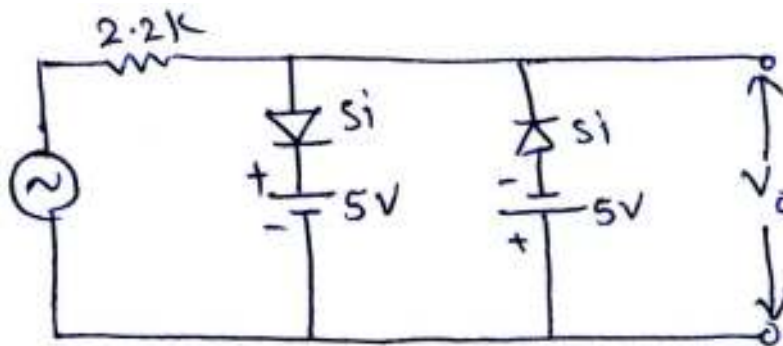
**S.E. (Elex/E&TC) EXAMINATION, 2012**  
**ELECTRONIC CIRCUIT AND APPLICATION**  
**(2003 PATTERN)**

**Time : Three Hours****Maximum Marks : 100**

- N.B. :-**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) For the combination clipper circuit, draw the output waveform if  $V_i = 20 \sin \omega t$ . [6]

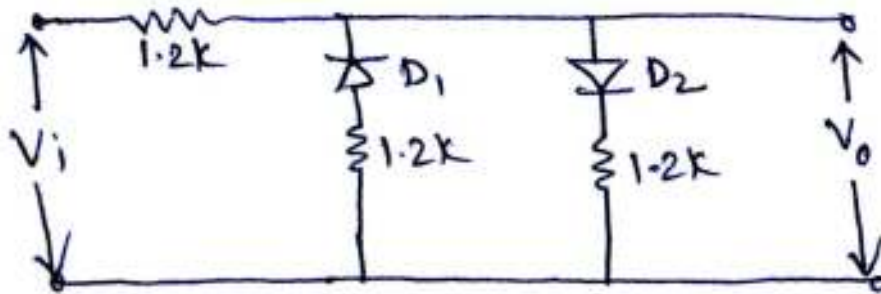


P.T.O.

- (b) Explain the effect of frequency on the performance of voltage multiplier circuit. [4]
- (c) Draw the circuit diagram of CMOS NOR gate and explain its operation. [6]

Or

2. (a) Draw neat diagram of half wave and full wave doubler. [6]
- (b) Sketch the transfer characteristics and output waveform for the circuit. Diodes are ideal. Assume  $V_i = 30 \sin \omega t$ . [6]



- (c) Give reason why a MOSFET is more suitable for VLSI than a BJT. [4]
3. (a) Explain with neat circuit diagram Anti-saturation control of BJT. [6]
- (b) The rated power of power BJT is  $P_D$  (rated) = 50 W, max. allowed junction temperature is  $T_{J \max} = 200^\circ\text{C}$  and ambient temperature is  $T_A = 25^\circ\text{C}$ . The thermal resistance between sink and air is  $Q_{SA} = 2^\circ\text{C/W}$  and between case and heat sink is  $Q_{CS} = 0.5^\circ\text{C/W}$ . Find max. safe power dissipation and temperature of case. [6]
- (c) State the advantages and disadvantages of power BJT. [4]



*Or*

4. (a) Write a short note on snubber circuit for power MOSFET. [6]  
(b) Explain SOA for power MOSFET. [4]  
(c) A power BJT has rated power of 20 W and  $T_{j \max} = 175^{\circ}\text{C}$ . The ambient temperature is  $25^{\circ}\text{C}$  and thermal resistance parameters are  $Q_{SA} = 5^{\circ}\text{C/W}$ ,  $Q_{CS} = 1^{\circ}\text{C/W}$ . Determine actual power that can be safely dissipated in transistor. [6]
5. (a) What are different distortions occurs in AF power Amplifier ? Explain how even harmonics get eliminated in class B push-pull amplifier. [8]  
(b) Transformer coupled class A power amplifier draws current of 200 mA from collector supply of 10 V, when no signal is applied to it. Determine :  
(i) max. output power  
(ii) max. collector efficiency  
(iii) power rating of transistor.  
If load connected across transformer secondary is of 2-2 and transformer turns ratio is 5 : 1, comment on impedance matching. [10]

*Or*

6. (a) Draw the circuit diagram of class B push-pull power amplifier and discuss in brief :  
(i) its operation  
(ii) its merits  
(iii) cross-over distortion. [10]

(b) Method of determination of harmonic component gives the following result :

$$D_2 = 0.1, D_3 = 0.03, D_4 = 0.015 \text{ with } I_1 = 5 \text{ A and } R_C = 10 \Omega.$$

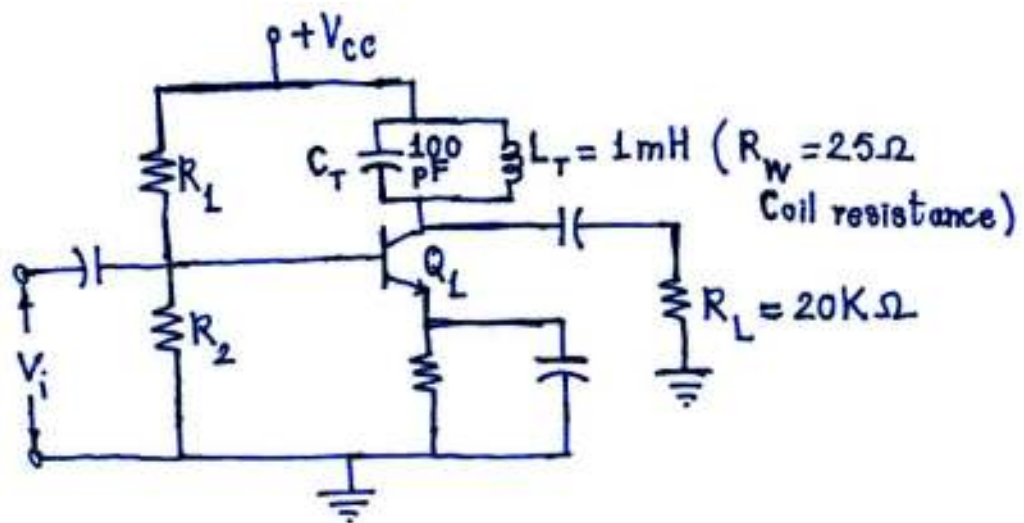
Determine :

- (i) Total distortion
- (ii) Fundamental power component
- (iii) Total power
- (iv) Percentage increase in power because of distortion. [8]

### SECTION II

7. (a) Draw the hybrid- $\pi$  model for a B.J.T. in Common-Emitter amplifier configuration. Explain the significance of each component appearing in this model. [8]

(b) Consider the Tuned amplifier shown below :

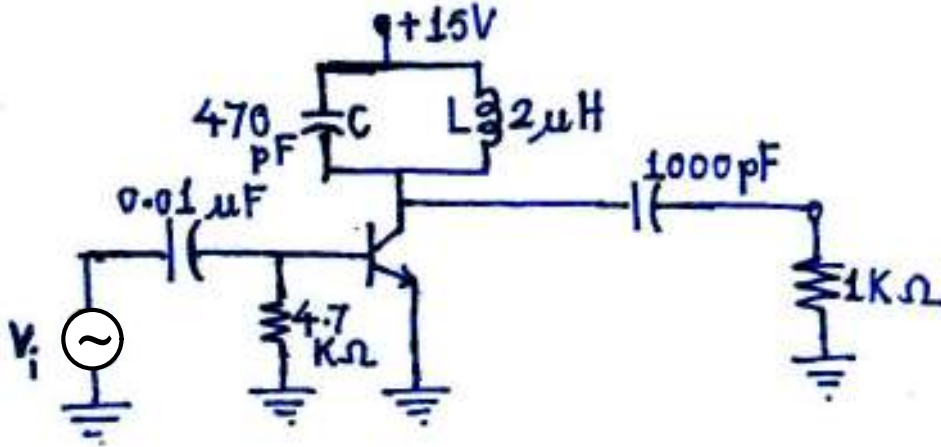


Find the following parameters :

- (i) Resonant frequency of the tuned (L-C tank) circuit.
- (ii) Q of the tuned (LC tank) circuit.
- (iii) Bandwidth of the Amplifier considering  $R_L = 20 \text{ k}\Omega$ . [8]

Or

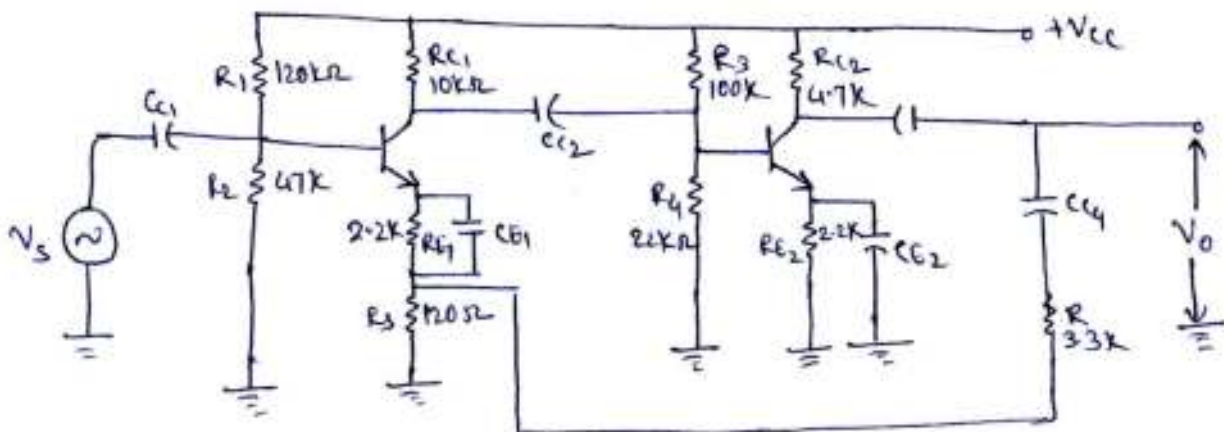
8. (a) Draw the B.J.T. T-model at high frequencies. What is the expression for the high frequency  $\alpha$  and with reference to this define the  $\alpha$  cut-off frequency ( $f_{\alpha}$ ). [8]
- (b) Consider the Tuned amplifier shown below :



Q of the inductance  $L = 50$ . Find the Resonant frequency and Bandwidth. [6]

- (c) Explain the effect of Q of the inductance, on the performance of the Tuned amplifier. [2]

9. (a) Consider the amplifier circuit shown below :

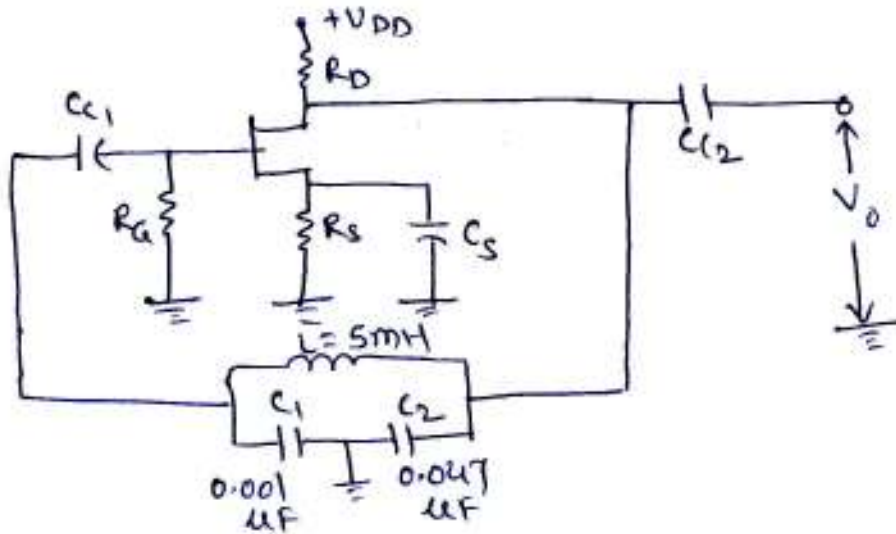


- (i) Identify the topology.
- (ii) Find  $B$ ,  $A_{vf}$ ,  $R_{if}$  and  $R_{of}$ . [10]

- (b) Draw equivalent circuit and frequency characteristics of crystal and explain crystal oscillator. [6]

Or

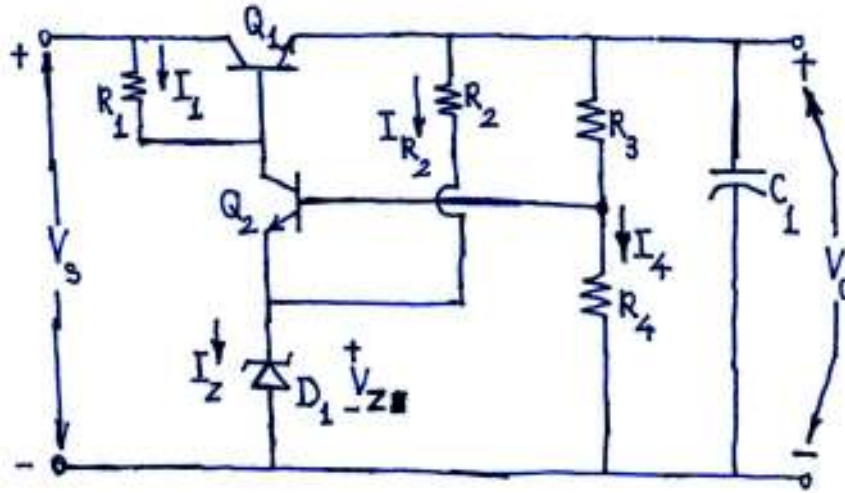
10. (a) Consider the Colpitt's oscillator circuit shown below :



Find the frequency of oscillation when :

- (i)  $Q = 20$
- (ii)  $Q = 8$ . [6]
- (b) Write a short note on current shunt feedback. [6]
- (c) An  $R_C$  coupled amplifier has mid frequency gain 400 and lower and upper 3 dB frequency 100 Hz and 15 kHz respectively. A negative feedback with  $B = 0.01$  is incorporated into amplifier circuit. Calculate gain with feedback and new bandwidth. [4]

11. (a) Consider the series voltage regulator circuit shown below :



Explain how the output voltage ( $V_o$ ) is maintained constant when :

- (i) the load current increases (due to which the output voltage will reduce.)
- (ii) the input voltage increases (due to which the output voltage will increase.)

What is the advantage of Error amplifier ? [10]

(b) With reference to the series voltage regulator, explain the following parameters in detail :

- (i) Line regulation
- (ii) Load regulation
- (iii) Ripple rejection ratio
- (iv) Long term stability. [8]

*Or*

- 12.** (a) Design a B.J.T. series regulator circuit to provide an output voltage of 12 V (Positive) with a maximum load current of 800 mA. The variation of input voltage is between 18 V and 24 V. [8]
- (b) Draw the block diagram of a linear series voltage regulator and explain the function of each block. [5]
- (c) Draw the circuit diagram of Foldback current limiting and explain its working. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—4

Seat No.	
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**[4162]-160-C**

**S.E. (E & TC) EXAMINATION, 2012**  
**ELECTRICAL CIRCUIT AND MACHINE**  
**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answers to the two Sections must be written in separate answer-books.
- (ii) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.
- (iii) Figures to the right indicate full marks.
- (iv) Use of non-programmable pocket size scientific calculator is permitted.
- (v) Neat diagrams must be drawn wherever necessary.
- (vi) Assume suitable additional data, if necessary.

**SECTION I**

1. (a) Draw a neat circuit diagram for carrying out O.C. and S.C. test on single-phase transformer in the laboratory. What useful information can be obtained from these tests ? [8]
- (b) Write a short note on three-phase transformer connections and their applications. [8]

P.T.O.

*Or*

2. (a) A 50 kVA, 230/400 V, 50 Hz single-phase transformer gave the following test results :

O.C. test (with H.V. winding open) 230 V 10 A 500 Watt.

S.C. test (L.V. shorted) 8 V 62.5 A 200 Watt.

Calculate :

(i) Parameters of the approximate equivalent circuit of transformer referred to primary.

(ii) Efficiency and voltage regulation at full load and 0.8 p.f. lagging. [12]

- (b) Sketch exact equivalent circuit of a single-phase transformer. [4]

3. (a) Explain with circuit diagram the speed control methods for D.C. series motor. [10]

- (b) With neat diagram explain working of THREE POINT STARTER. [8]

*Or*

4. (a) Sketch the D.C. shunt motor characteristics and state its applications. [8]

- (b) A d.c. series motor has arm resistance of 0.4 ohm and field resistance of 0.6 ohm. It drives a load for which the torque varies as the square of the speed. At 220 V it runs at 350 rpm and draws 25 amp current. The speed is to be raised to 600 rpm by increasing the voltage. Determine the necessary voltage assuming the field to be unsaturated. [10]



5. (a) With neat circuit diagram explain how two wattmeters can be used for measuring active power consumed by three-phase balanced load system. [10]
- (b) Write a short note on energy audit. [6]

*Or*

6. (a) Three impedances ( $6 + j8$ ) ohm each are connected in delta across three-phase 415 V, 50 Hz supply with phase sequence of R-Y-B. A current coil of wattmeter is inserted in line R. Its pressure coil is alternately connected across RY and RB. Determine the wattmeter readings and total power consumed. [10]
- (b) Only draw the circuit diagram for measurement of Power in a single-phase circuit using C.T. and P.T. [6]

## SECTION II

7. (a) State torque equation of three-phase induction motor. Obtain the condition for maximum torque and sketch the torque-slip characteristic of the motor. [10]
- (b) Sketch the rotor-resistance starter and explain its working. [8]

*Or*

8. (a) Compare squirrel cage and phase wound rotor construction for three-phase induction motor. [6]
- (b) Write short notes on : [12]
- (i) Power flow in 3-phase induction motor;
- (ii) V/F control method for controlling speed of 3-phase induction motor.

9. (a) What are the advantages of stationary armature and rotating field type construction of alternator. [6]
- (b) Define and derive expression for :
- (i) Pitch factor and
- (ii) Distribution factor. [10]

*Or*

10. (a) A 100 kVA, 3000 V, 50 Hz 3-phase star connected alternator has effective arm resistance of 0.2 ohm. The field current of 40 A produces short circuit current of 200 A and an open circuit emf of 1040 Volt. Calculate the full load voltage regulation at 0.8 p.f. lagging and 0.8 p.f. leading. [10]
- (b) Write a short note on hunting of a synchronous motor. [6]
11. (a) Why is a single-phase induction motor not self starting ? How is it made self starting ? [4]
- (b) Write short notes on : [12]
- (i) Universal motor and
- (ii) Reluctance motor;

*Or*

12. (a) Compare A.C. and D.C. Servo motor. [6]
- (b) Write a short note on stepper motors. [10]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-161**

**S.E. (Instrumentation) (First Semester) EXAMINATION, 2012**

**FUNDAMENTALS OF INSTRUMENTATION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Compare the following terms : [8]**

(i) Null type and deflection type instruments

(ii) Repeatability and reproducibility.

(b) The resistance of ammeter should be very small to avoid the loading effect. Justify this statement with derivation. [8]

P.T.O.

*Or*

2. (a) Why there is need of doing calibration of instruments ? Explain typical method of doing the calibration. [8]
- (b) Solve the following :
- (i) A dead zone in a certain pyrometer is 0.125 percent of the span. The span of pyrometer is 400°C to 1000°C. What temperature change should occur before it is detected ? [4]
- (ii) A digital voltmeter has read out range from 0 to 9.999 counts. Determine the resolution of instrument in volt when the full scale reading is 9.999 V. [4]
3. (a) Explain different operating forces needed for the satisfactory operation of an indicating instrument. [9]
- (b) With the help of neat diagram, explain duo range potentiometer. [9]

*Or*

4. (a) Show that in series type of ohmmeter : [9]

$$S = \frac{I_m}{I_{fs}} = \frac{R_h}{R_x + R_h}$$

where S — Fraction of full scale reading

$R_x$  — Unknown resistance

$R_h$  — Half scale resistance

$I_{fs}$  — Full scale current of basic movement

$I_m$  — Meter current while measuring unknown resistance.

- (b) Design an Ayrton shunt to provide multirange ammeter with current ranges of 1 A, 5 A and 10 A. A basic meter with internal resistance of  $50 \Omega$  and full scale deflection current of 1mA is to be used. [9]
5. (a) Select the A.C. bridge to measure the inductance of coil whose  $Q$  is less than 10. Also explain its working with suitable circuit diagram. [8]
- (b) A highly sensitive galvanometer can detect current as low as 0.1 nA. The galvanometer is used in a Wheatstone bridge as a detector. The resistance of galvanometer is negligible. Each arm of the bridge has resistance of 1 k $\Omega$ . The input voltage applied to the bridge is 20 V. Calculate the smallest change in resistance that can be detected. The resistance of galvanometer can be neglected. [8]

*Or*

6. (a) With the help of suitable diagram derive the balancing condition of Kelvin double bridge. [8]
- (b) Derive the balancing equations of Schering bridge with the help of suitable circuit diagram. [8]

## SECTION II

7. (a) With the help of neat block diagram explain the working of digital phase meter. [8]
- (b) With the help of neat block diagram explain the working of digital tachometer with typical specifications. [8]

*Or*

8. (a) Explain each block in detail involved in measurement of distance using ultrasonic principle. [8]
- (b) Write a short note on digital multimeter. [8]
9. (a) Explain block diagram of dual trace CRO. Explain the Alternate and Chop mode in detail. [10]
- (b) Explain how frequency can be measured X-Y mode using Lissajous patterns and Z modulation with diagrams. [8]

*Or*

10. (a) Explain the functions of the following controls on CRO front panel : [6]
- (i) Intensity
- (ii) Focus
- (iii) Y position.
- (b) Differentiate CRO and DSO. [8]

- (c) Assuming the vertical sensitivity control is set to 2 volts per division, and the time base control is set to 10  $\mu$ s per division, calculate the amplitude of this sawtooth wave (in volts peak and volts peak-to-peak) as well as its frequency : [4]

11. Write short notes on : [16]
- (a) Virtual Instrumentation
  - (b) Strip chart recorder.

*Or*

12. (a) Explain different marking mechanism used in Recorders. [8]
- (b) Explain in detail the block diagram of generation of sine, square and triangular waveforms. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-162**

**S.E. (Instrumentation & Control Engg.) (First Semester)**

**EXAMINATION, 2012**

**LINEAR INTEGRATED CIRCUITS—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10 and Q. No. 11 or Q. No. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Enlist any *five* characteristics of OP-AMP 741. [10]
- (b) Write the practical values of characteristics mentioned in Q. No. 1(a) above. [8]

P.T.O.



*Or*

- 2.** (a) Given are the absolute maximum ratings of IC741 you have to write name of the electrical characteristics in front of the value given below : [8]
- (i) + 18V
  - (ii) + 30V
  - (iii) + 15V
  - (iv) 500 mV.
- (b) What is the difference between industrial grade and commercial grade integrated circuits ? Explain. [6]
- (c) What is maximum current that Op-07 IC can source. [2]
- (d) How many op-amps are in IC324 ? [2]
- 3.** (a) Design a circuit using op-amp that will convert zero to 0.1 V, 10 kHz sine wave into zero to 5 volts output. Show the calculations. How will you choose resistor values for such application ? [8]
- (b) Draw a detailed circuit diagram for Q. 3(a) above. [4]
- (c) Also draw alternative circuit diagram for Q. 3(a). [4]

*Or*

- 4.** (a) Derive the equation for appropriate voltage gain for op-amp inverting configuration. [8]

- (b) What is loading effect ? How can it be avoided with non-inverting op-amp, explain with equation for input resistance with feedback. [8]
5. (a) A sensor output is given below. Design circuit using op-amp which will generate output from 1V D.C. to 2V D.C. pH electrode output =  $-0.05 \text{ V D.C.} + 0.07 \text{ V D.C.}$   
Show calculations. [8]
- (b) Draw circuit diagram with resistor values for Q.5(a) above. [8]

*Or*

6. Write short notes on :
- (a) Op-Amp integrator circuit [8]
- (b) Op-Amp differentiator circuit. [8]

## SECTION II

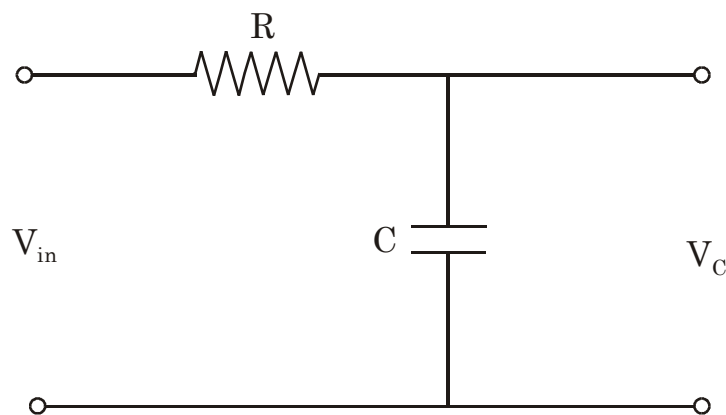
7. (a) How will you check the performance accuracy of comparator IC ? Given are two millivolt—generators, assume  $V_{CC} = + 5\text{V DC.}$  [8]
- (b) State practical application of ICDs. Explain how it works ? [8]
- (c) What is meant by op-amp with open collector output ? [2]

Or

8. (a) Design a Wien bridge or RC phase shift oscillator for an output frequency of 40 kHz. Show calculations (Do not draw circuit diagram). [8]
- (b) Design a precision full wave rectifier for an input signal of 500 mV peak to peak. Draw circuit diagram. (Do not draw input-output waveforms). [8]
- (c) Oscillator requires an external input. (True or False) [2]
9. (a) Design timer circuit using IC 555 which will generate on time of 1 sec. and off time of around 300  $\mu$ -seconds. Show calculations. [8]
- (b) Draw circuit diagram for Q.9(a). [8]

Or

10. (a) Write a short note on Monostable multivibrator. [8]
- (b) State the equation for voltage across a capacitor in a RC circuit. [8]



Assume  $V_{in}$  changes from 0 to 10 V, capacitor discharges when  $V_C$  reaches to 5 volts.

11. (a) Draw ideal frequency responses of active low pass, high pass, band pass and band reject filters. [8]
- (b) State parameters on X-axis and Y-axis in frequency response of a filter. [4]
- (c) Which components decides filter response sharpness ? [4]

*Or*

12. (a) Design active low pass filter of order 2. Let the cut-off frequency be 500 Hz. Show calculations. [8]
- (b) Draw circuit diagram for Q. 12(a) above. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-163**

**S.E. (Instrumentation) (First Semester) EXAMINATION, 2012**

**PRINCIPLES OF SENSORS AND TRANSDUCERS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from section I and *three* questions from section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.

**SECTION I**

1. (a) State the significance of performance characteristics of instruments. Distinguish between static and dynamic characteristics of instruments. [6]

(b) Define Measurement. Explain objectives of Engineering Measurement. [6]

P.T.O.

- (c) Define the following : [6]
- (i) Fidelity
  - (ii) Threshold
  - (iii) Speed of response
  - (iv) Resolution.

*Or*

- 2.** (a) Define Transducer. Distinguish between active transducers and passive transducers. [6]
- (b) Define dynamic error. Classify and explain errors in measurements. [6]
- (c) Define the following : [6]
- (i) Precision
  - (ii) Accuracy
  - (iii) Hysteresis
  - (iv) Linearity.
- 3.** (a) Explain with neat sketch cantilever beam and column type load cell for force measurement. [8]
- (b) Define pressure. Give units of pressure. Explain with neat sketch Bourdon element and manometer for pressure measurement. [8]

*Or*

4. (a) Define thermodynamic temperature scale. Explain with neat sketch fluid field expansion system for temperature measurement. [8]
- (b) Define torque. Draw and explain with principle the torsion bar for torque measurement. [8]
5. (a) Explain with neat sketch level to pressure convertor and viscosity to torque convertor. [8]
- (b) Define specific gravity. Explain with diagram Hydrometer for density measurement. [8]

*Or*

6. (a) State different units of flow. Explain with neat sketch Rotameter for flow measurement. [8]
- (b) Write short notes on : [8]
- (i) Air bubbler system
- (ii) Viscosity to displacement convertor.

## **SECTION II**

7. (a) Explain with neat sketch how inductive and capacitive transduction principle is used for thickness measurement. [9]
- (b) Define gauge factor. Describe the primary transducers to be used along with strain gauge for force measurement. [9]

*Or*

8. (a) A capacitive transducer uses two quartz diaphragms of area  $750 \text{ mm}^2$  separated by distance of 3.5 mm. A pressure of  $900 \text{ KN/m}^2$  when applied to the top diaphragms produces a deflection of 0.6 mm. The capacitance is 370 Pf when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of  $900 \text{ KN/m}^2$ . [9]
- (b) Explain with neat sketch how resistive and capacitive transduction principle is used for displacement measurement. [9]
9. (a) State piezo-electric phenomena and piezo-electric materials. Explain with neat sketch piezo-electric transducer for acceleration measurement. [8]
- (b) State photo-electric phenomena. Explain with neat sketch linear digital encoder for displacement measurement. [8]

*Or*

10. (a) Explain with neat sketch the principle of operation of an electromagnetic flow meter and suggest the nature of fluids that can be used with them. [8]
- (b) Explain with neat sketch nuclear radiation transducers and how they are used for measurement of vacuum and pressure. [8]



11. (a) Enlist different digital input-output devices. Explain with neat sketch a servo operated manometer. [8]
- (b) Write short notes on : [8]
- (i) Magnetic tape recorder
- (ii) Feedback transducer system.

*Or*

12. (a) Explain with neat sketch Data logger. [8]
- (b) Write short notes on : [8]
- (i) Analog and Digital readout system
- (ii) Self balancing system.

Total No. of Questions—8]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-164**

**S.E. (Instrumentation & Control) (I Sem.) EXAMINATION, 2012**

**AUTOMATIC CONTROL SYSTEM**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer any *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Assume suitable data, if necessary.

**SECTION I**

- 1.**
- (a) What do you mean by control system ? Explain the block diagram of control system with suitable example. [10]
  - (b) Compare the following : [8]
    - (i) Open loop and closed loop control system
    - (ii) Feedback and feedforward control system
    - (iii) Causal and non-causal control system
    - (iv) Linear and non-linear control system.

P.T.O.

- 2.** (a) Define the transfer function of control system. Give advantages and disadvantages of the transfer function. [6]
- (b) Construct an equivalent signal flow graph for the block diagram shown in Fig. 1 and also evaluate the transfer function. [10]

Fig. 1

- 3.** (a) Define the following terms : [8]
- (i) Rise time
  - (ii) Peak overshoot
  - (iii) Settling time
  - (iv) Damping ratio.
- (b) Derive the expression for the step response of the standard second order control system for critically damped case ( $\xi = 1$ ). [8]
- 4.** (a) Write short notes on : [6]
- (i) Force to voltage analogy and
  - (ii) Force to current analogy.

- (b) Give Masson's gain formula. Give advantages and disadvantages of signal flow graph. [6]
- (c) Derive the expression for the unit step response of simple first order system given by :

$$\frac{C(s)}{R(s)} = \frac{K}{\tau s + 1}. \quad [6]$$

## SECTION II

5. (a) Define Bounded input Bounded output stability. Also test stability of a system whose characteristics equation is given by :

$$s^5 + 2s^4 + 2s^3 + 4s^2 + s + 2 = 0. \quad [8]$$

- (b) Sketch Root locus of a feedback system whose open loop transfer function is given by :

$$G(s) H(s) = \frac{K}{s(s+2)(s+3)}. \quad [10]$$

6. (a) Give definition of : [4]
- (i) Bandwidth
  - (ii) Phase margin
  - (iii) Gain margin
  - (iv) Frequency of oscillations.
- (b) Determine the stability of unity feedback system with open loop transfer function given by :

$$G(s) = \frac{10}{s(1+0.5s)(1+0.1s)}.$$

Use Bode plot method. [12]

7. (a) Sketch polar plot for unity feedback system with open loop function :

$$G(s) = \frac{1}{s(s+2)}. \quad [8]$$

- (b) Define the following terms : [8]
- (i) State
  - (ii) State variable
  - (iii) State space
  - (iv) State vector.
8. (a) For the electrical circuit as shown in Fig. 2 obtain state equations. [10]

Fig. 2

The input voltage source is  $u(t)$  and the output  $y(t)$  is taken across capacitor  $C_2$ .

- (b) Explain mapping theorem in detail. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-165**

**S.E. (Instrumentation & Control) (II Sem.) EXAMINATION, 2012**

**DIGITAL TECHNIQUES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Your answers will be valued as a whole.
  - (vi) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vii) Assume suitable data, if necessary.

**SECTION I**

1. (a) Convert the following Decimal number to binary : [4]
- (i)  $(12.0625)_{10}$
  - (ii)  $(41.375)_{10}$ .

P.T.O.

- (b) Convert  $(2AC5.D)_H$  to : [6]
- (i) Decimal
  - (ii) Octal and
  - (iii) Binary.
- (c) Determine the value of base 'x' if : [6]
- (i)  $(193)_x = (623)_8$
  - (ii)  $(211)_x = (152)_8$
  - (iii)  $(255)_x = (341)_8$ .

*Or*

2. (a) (i) Convert 10111011 in binary into its equivalent gray code. [2]
- (ii) Convert gray code 101011 into its equivalent binary code. [2]
- (iii) Represent "PASS" and "BINARY" in ASCII form. [4]
- (b) Perform each of the following decimal addition in excess-3 code : [6]
- (i) 
$$\begin{array}{r} 9 \\ + 2 \\ \hline \end{array}$$
  - (ii) 
$$\begin{array}{r} 17 \\ + 31 \\ \hline \end{array}$$
  - (iii) 
$$\begin{array}{r} 205 \\ + 569 \\ \hline \end{array}$$
- (c) Write short notes on application of Gray code. [2]

3. (a) Reduce the Boolean expression : [6]
- (i)  $XY + XYZ + XY\bar{Z} + \bar{X}YZ$
- (ii)  $\bar{A}BC\bar{D} + BC\bar{D} + B\bar{C}\bar{D} + B\bar{C}D$
- (iii)  $AB + \bar{A}\bar{C} + A\bar{B}C(AB + C)$ .
- (b) Reduce the following function using K-map technique : [12]
- (i)  $f(A, B, C, D) = \Sigma m(5, 6, 7, 12, 13) + \Sigma d(4, 9, 14, 15)$
- (ii)  $f(A, B, C, D) = \pi m(4, 5, 6, 7, 8, 12, 13) + d(1, 15)$ .

*Or*

4. (a) (i) Convert SR flip-flop to JK flip-flop.
- (ii) Convert JK flip-flop to T flip-flop. [10]
- (b) (i) Compare SRAM and DRAM.
- (ii) Compare PROM and PLA. [8]
5. (a) Design Non-sequential counter which goes through the states :
- 3, 4, 5, 7, 8, 9, 10, 3, 4, .....
- using JK flip-flop. Draw a Bush Diagram. [10]
- (b) Design a divide by 78 counter using 7493 and 7492 counter IC's. [6]



*Or*

6. (a) Design modulo 120 counter using IC's 7490 and 7492. [6]  
(b) (i) Compare Synchronous and Asynchronous counter. [6]  
(ii) The  $t_{pd}$  for each flip-flop is 50ns. Determine the maximum operating frequency for MOD-32 ripple counter. [4]

### SECTION II

7. (a) Implement the following Boolean function using 4 : 1 MUX :  
 $F(A, B, C, D) = \Sigma m(0, 1, 2, 4, 6, 9, 12, 14)$ . [8]  
(b) Design 1 : 8 Demultiplexer using two 1 : 4 demultiplexers. [8]

*Or*

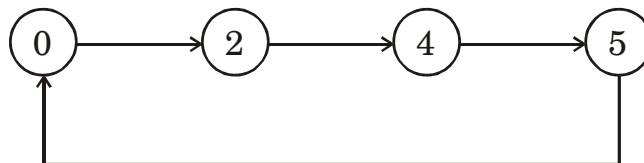
8. (a) Design common cathode 7-segment display/driver with the help K-map and Logic Diagram. [12]  
(b) What is multiplexed display system ? What are the advantages and limitations of it over a non-multiplexed system ? [4]
9. (a) Explain Interfacing of TTL family with CMOS family. [8]  
(b) Compare TTL and CMOS with respect to the following : [10]  
(i) Fan In  
(ii) Fan Out  
(iii) Propagation Delay  
(iv) Power Dissipation  
(v) Noise Margin.

*Or*

- 10.** (a) Explain the following terms used the following families : [8]
- (i) Figure of merit;
  - (ii) Profiles and Windows;
  - (iii) IOL and IOH;
  - (iv) VOL and VOH.
- (b) Explain what is wired AND ? What happens if gates with totem pole ? Output are connected in wired AND Manner. [10]
- 11.** (a) Design a sequence generator to generate the sequence 1101011 by shift register method. [8]
- (b) Write a short note on frequency counter. [8]

*Or*

- 12.** (a) Design sequence generator using T flip-flop.



- Check for lockout condition. [8]
- (b) Write a short note on Alarm Annunciator. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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**[4162]-166**

**S.E. (Instrumentation & Control) (Second Semester)**

**EXAMINATION, 2012**

**APPLIED ELECTRONICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the *two* sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Your answers will be valued as a whole.

(vi) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vii) Assume suitable data, if necessary.

**SECTION I**

1. (a) Draw basic analog switches using FET and NPN transistor. Explain how they can be used as a switch. [6]

(b) What is the speciality and drawbacks of Parallel-Comparator type ADC ? Explain this with neat diagram for 2-bit ADC. [6]

P.T.O.

- (c) What are the advantages of SAR type ADC ? Find out the digital equivalent output for 8-bit SAR ADC when analog input is 4.15V. [6]

*Or*

2. (a) How many and what type of switches are used in IC CD 4051 ? Explain how this IC can be used as Multiplexer and De-multiplexer. [6]
- (b) What are the drawbacks of counter-type of ADC ? Explain this ADC with neat diagrams. [6]
- (c) The input to a 8-bit dual-slope integration type ADC with a 5-V reference is 1.45 V. Find out :
- (1) Binary digital output
  - (2) If the output is found to be  $(10011100)_2$ , what is the input analog voltage ?
  - (3) Also find the Resolution of ADC. [6]
3. (a) What theorem is used to derive output equation for R-2R ladder type ADC ? Explain op-amp based 4-bit DAC with neat diagram. [8]
- (b) Solve the following :
- (1) For a 9-bit DAC the basic step is 10.5 mV. What analog output will be produced, if the input is  $(101101111)_2$  ?
  - (2) What output voltage will be produced by 8-bit DAC, whose output voltage range is 0 to 10 V and whose input binary number is  $(10111100)_2$ . [8]

*Or*

4. (a) Explain 4-bit binary weighted type DAC with neat diagram using op-amp. [8]
- (b) Explain the principle of PWM type DAC with suitable diagram. [8]
5. (a) Explain the following turn-on methods for SCR : [8]
- (1) Forward-voltage triggering
  - (2) Thermal-triggering
  - (3) Radiation triggering
  - (4) Gate triggering.
- Comment on preferred method of triggering for an SCR.
- (b) Draw and explain VI-characteristics of MOSFET for different  $V_{GS}$ . Also discuss any *one* gate-trigger method. [8]

*Or*

6. (a) How firing angle of the SCR can be changed ? Explain such a phase-control circuit with neat diagrams. [8]
- (b) Explain MOSFET with respect to the following features :
- (1) MOSFETs are voltage controlled
  - (2) High peak-current capability
  - (3) Wide safe operating area
  - (4) At high frequency MOSFETs are more efficient. [8]

## SECTION II

7. (a) Discuss the importance of batteries in today's world ? Also explain the electrochemical cell and the cell reaction during discharge phase. [6]
- (b) Discuss different charging and discharging constraints of batteries. [6]
- (c) Why are Lithium-ion batteries recently used ? Explain with safety circuit inside Li-ion battery. [6]

*Or*

8. (a) Explain any *one* of the following Battery-monitoring system in detail : [6]
- (1) Thyristor-controlled charger
- (2) Transistor controlled charger
- (3) Reverse polarity indication circuit using L-200
- (b) Discuss the following related to the batteries :
- (1) Memory effect in battery
- (2) Shelf life
- (3) Open circuit voltage and state of charge. [6]
- (c) Discuss any application of solar cells in daily-life related to battery. [6]
9. (a) What is the difference between grounded load and floating load ? Explain with neat circuit diagram. [8]
- (b) Explain frequency to voltage conversion with neat block diagram. [8]

*Or*

- 10.** (a) Design current-to-voltage conversion for the output of +1V to +5V, when input current varies between 4 to 20 mA. [8]
- (b) Explain with neat internal block diagram phase-locked loop IC 4046. [8]
- 11.** (a) What is the BW, LSB, USB and modulation index related to Amplitude Modulation. [8]
- (b) Compare FDM and TDM by their block diagram and other aspects. [8]

*Or*

- 12.** (a) Which modulation technique is used in Audio-signal transmission in radio-stations ? Explain with neat diagram. [8]
- (b) Explain the concept of ASK using binary wave in unipolar form, unmodulated carrier wave and binary ASK signal at output. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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**[4162]-167**

**S.E. (Instru. & Control) (Second Semester)**

**EXAMINATION, 2012**

**TRANSDUCERS AND SIGNAL CONDITIONING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) All questions are compulsory.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Your answer will be valued as a whole.
  - (vii) Assume suitable data, if necessary.

**SECTION I**

- 1. (a) Explain the following stages of signal conditioner : [8]**
- (i) Linearization
  - (ii) Signal conversions
  - (iii) Filtrng
  - (iv) Aanalogue to Digital Converters with examples.

P.T.O.



- (b) Explain different methods to convert resistance into voltage and current with neat sketch. [8]

*Or*

2. (a) Discuss different causes that generate error in temperature measurement with RTD. How these errors can be avoided ? [8]
- (b) It is required that the accuracy of the resistance thermometer should be  $2^{\circ}\text{C}$ . The power dissipation of the sensor is  $2\text{ mW}/^{\circ}\text{C}$  and the resistance coefficient at  $26^{\circ}\text{C}$  is  $0.004\ \Omega/^{\circ}\text{C}$  and resistance at  $26^{\circ}\text{C}$  is 110. Find the maximum excitation current required. Also design Wheatstone Bridge for same. [8]
3. (a) Prove that sensitivity increases if we use half and full bridge configuration over quarter bridge configuration. [8]
- (b) Explain semiconductor strain gauge with working principal, material, and applications. [6]

*Or*

4. (a) Explain piezoelectric sensor with neat diagram, working principal, material, and necessity of charge amplifier. [8]
- (b) Discuss different source of error in strain gauge and how they can be eliminated. [8]
5. (a) Explain working and signal conditioning of inductive proximity switch. [8]
- (b) Explain Absolute encoder with neat diagram and signal conditioning circuit. How resolution and sensitivity of encoder can be increase ? [10]

*Or*

6. (a) Explain signal conditioning of LVDT in respect to phase demodulation, phase detection. [8]
- (b) Explain working of optical tachometer with necessary signal conditioning circuit. [10]

## SECTION II

7. (a) Explain principle of working of capacitive level probe and explain any *two* methods to detect change in capacitance with neat diagram. Explain the following stages of signal conditioner. [8]

- (b) What are advantages of Nuclear transducer ? Explain different techniques to measure radiation intensity. [8]

*Or*

8. (a) Explain ultrasonic level sensing along with necessary signal conditioning. [8]
- (b) For certain level measurement system electromechanical level gauge is used to measure level. The output of sensor is 0 to 1 kohm for the level of 0 to 5 meter. Design suitable signal conditioning circuit for having output 4 to 20 mA. [8]
9. (a) Which sensor is used to measure differential pressure across differential head flow meter ? Explain it with necessary signal conditioning blocks. [8]
- (b) It is required to measure the flow rate and density of oil flow which sensor can be employed ? Explain it in detail along with its necessary signal conditioning blocks. [8]

*Or*

10. (a) Explain turbine flow meter along with necessary single conditioning blocks. [8]

(b) Explain electromagnetic flow meter along with necessary constructional design consideration. [8]

11. Write short notes on : [18]

(a) Conductivity meter

(b) pH meter.

*Or*

12. (a) List different types of microphones and explain any *one*. [9]

(b) Explain piezoelectric vibration sensors in detail. [9]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-168**

**S.E. (Instrumentation & Control)**  
**(Second Semester) EXAMINATION, 2012**  
**PHOTONICS AND INSTRUMENTATION**  
**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Draw electromagnetic spectrum of light and show different ranges of visible, infrared, ultraviolet regions etc. and state advantages of it. [12]

P.T.O.

- (b) A light source of wavelength  $\lambda = 0.53 \mu\text{m}$  is used in the laboratory. Calculate the energy in electron volts and propagation constant. [4]
- (c) State the Planck's equation. [2]

*Or*

2. (a) Explain interaction of light with matter and various properties of light by using diagram. [12]
- (b) Calculate the wavelength and frequency of the light if the energy contained by that light is 50 keV. [6]
3. (a) Explain construction and working principle of incandescent lamp. [8]
- (b) Explain types of spectra by giving examples and differentiate between radiometry and photometry. [8]

*Or*

4. (a) Explain working principle of any *one* gas discharge lamp with suitable diagram. Enlist its advantages, disadvantages and application. [10]

(b) For an incandescent lamp the rated m.s.c.p. is 0.145 and the design voltage is 5 V. If the lamp is operated at 4.5 V, calculate :

(i) Rated M.S.C.P.

(ii) Reduction factor of lamp

when M.H.S.C.P. = 0.725. [6]

5. (a) Explain working of Light emitting diode. Draw the LED characteristics. [8]

(b) Explain basic steps required for generation of laser beam. What are different properties of Laser ? State advantages and disadvantages of it. [8]

*Or*

6. (a) Explain working principle of semiconductor laser with the help of neat diagram and its application. [8]

(b) What do you understand by a term radiation pattern of light emitting diode ? Suggest experimental set up and procedure to draw it. [8]

## SECTION II

7. (a) Explain the following types of thermal detector with suitable diagram :

(i) Balometric

(ii) Thermovoltaic

(iii) Thermopneumatic

(iv) Pyroelectric. [14]

(b) Differentiate between PIN and avalanche photodiode. [4]

*Or*

8. (a) Explain the following photoeffects related to the Quantum detectors with suitable diagram :

(i) Photoconductive

(ii) Photovoltaic

(iii) Photoelectromagnetic

(iv) Photoemissive. [14]

(b) Differentiate between solar cells and CCD devices. [4]

9. (a) Explain diffraction grating equation with its application. Suggest experimental set up to determine the unknown wavelength. [12]

(b) Explain the types of filter with its applications. [4]

*Or*

10. Explain any *three* with suitable diagram : [16]

(i) Prism

(ii) Mirrors

(iii) Lenses

(iv) Polarizers

(v) Beam Splitter.



11. (a) Explain working principle of Abbe's refractometer with suitable diagram. [8]
- (b) Explain working principle of Astronomical telescope with suitable diagram. [8]

*Or*

12. Write notes on any *two* with suitable diagram : [16]
- (i) Cameras
- (ii) Optical Projection System
- (iii) Monochromator.

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-169**

**S.E. (Instrumentation & Control) (Second Semester)**

**EXAMINATION, 2012**

**DRIVES AND CONTROL**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Neat diagrams must be drawn wherever necessary.
  - (iii) Answers to the two Sections should be written in separate answer-books.
  - (iv) Use of non-programmable calculator is allowed.
  - (v) Assume suitable data wherever necessary.

**SECTION I**

1. (a) Write a short note on total loss in a D.C. generator. [8]
- (b) A 8-pole DC shunt generator with 778 wave connected armature conductors and running at 500 rpm supplies a load of  $12.6 \Omega$  resistance at terminal voltage at 50 V, the armature resistance is  $0.24 \Omega$  and the field resistance is  $250 \Omega$ . Find the armature current, the induced EMF and the flux per pole. [8]

P.T.O.

*Or*

- 2.** (a) Explain in detail the comparison of generator and the motor action. [8]
- (b) Write a short note on the speed control of shunt motors. [8]
- 3.** (a) Explain the squirrel cage rotor in case of induction motor. [8]
- (b) Derive the expression for the starting torque of induction motor. [8]

*Or*

- 4.** (a) Explain how the induction motor can be operated as a generator. [8]
- (b) Explain the working principle and the construction of alternators with neat diagram. [8]
- 5.** (a) Give the types of stepper motor. Explain any *one* in detail. [9]
- (b) Write short notes on : [9]
- (i) Servomotors
- (ii) Universal motors.

*Or*

- 6.** Write short notes on : [18]
- (i) Characteristics of single phase induction motor
- (ii) Synchronous motors.

## SECTION II

7. (a) If the latching current in the circuit shown in the figure is 4 mA, obtain the minimum width of the gating pulse required to properly turn ON the SCR. [8]

- (b) Give the different turn-ON methods of Thyristor. Explain any *one* in detail. [8]

*Or*

8. (a) Compare : Power MOSFET and Thyristors. [8]  
(b) Briefly explain the V-I characteristics of an IGBT. [8]
9. (a) Give the classification of choppers. Explain the basic chopper operation. [8]  
(b) Write short notes on commutation methods of chopper. [8]

*Or*

10. (a) Give the classification of inverters. Explain any *one* in detail. [8]  
(b) Write short note on single phase half wave controlled rectifier. [8]

- 11.** (a) Write a short note on speed control of DC motor. [9]
- (b) Explain the tracking operation of rectifier controlled separately excited DC motor. [9]

*Or*

- 12.** (a) List out the various methods of speed control of induction motors. Explain any *one* in detail. [9]
- (b) Write a short note on chopper controlled DC drives. [9]

Total No. of Questions—12]

[Total No. of Printed Pages—8

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**[4162]-160-B**

**S.E. (Elex/E&TC) EXAMINATION, 2012**  
**ELECTRONIC CIRCUIT AND APPLICATION**  
**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) For the combination clipper circuit, draw the output waveform if  $V_i = 20 \sin \omega t$ . [6]

P.T.O.

- (b) Explain the effect of frequency on the performance of voltage multiplier circuit. [4]
- (c) Draw the circuit diagram of CMOS NOR gate and explain its operation. [6]

*Or*

- 2.** (a) Draw neat diagram of half wave and full wave doubler. [6]
- (b) Sketch the transfer characteristics and output waveform for the circuit. Diodes are ideal. Assume  $V_i = 30 \sin \omega t$ . [6]

- (c) Give reason why a MOSFET is more suitable for VLSI than a BJT. [4]

- 3.** (a) Explain with neat circuit diagram Anti-saturation control of BJT. [6]
- (b) The rated power of power BJT is  $P_D$  (rated) = 50 W, max. allowed junction temperature is  $T_{J \max} = 200^\circ\text{C}$  and ambient temperature is  $T_A = 25^\circ\text{C}$ . The thermal resistance between sink and air is  $Q_{SA} = 2^\circ\text{C/W}$  and between case and heat sink is  $Q_{CS} = 0.5^\circ\text{C/W}$ . Find max. safe power dissipation and temperature of case. [6]
- (c) State the advantages and disadvantages of power BJT. [4]

*Or*

4. (a) Write a short note on snubber circuit for power MOSFET. [6]  
(b) Explain SOA for power MOSFET. [4]  
(c) A power BJT has rated power of 20 W and  $T_{j \max} = 175^{\circ}\text{C}$ . The ambient temperature is  $25^{\circ}\text{C}$  and thermal resistance parameters are  $Q_{SA} = 5^{\circ}\text{C/W}$ ,  $Q_{CS} = 1^{\circ}\text{C/W}$ . Determine actual power that can be safely dissipated in transistor. [6]
5. (a) What are different distortions occurs in AF power Amplifier ? Explain how even harmonics get eliminated in class B push-pull amplifier. [8]  
(b) Transformer coupled class A power amplifier draws current of 200 mA from collector supply of 10 V, when no signal is applied to it. Determine :  
(i) max. output power  
(ii) max. collector efficiency  
(iii) power rating of transistor.  
If load connected across transformer secondary is of 2-2 and transformer turns ratio is 5 : 1, comment on impedance matching. [10]

*Or*

6. (a) Draw the circuit diagram of class B push-pull power amplifier and discuss in brief :  
(i) its operation  
(ii) its merits  
(iii) cross-over distortion. [10]



- (b) Method of determination of harmonic component gives the following result :

$$D_2 = 0.1, D_3 = 0.03, D_4 = 0.015 \text{ with } I_1 = 5 \text{ A and } R_C = 10 \ \Omega.$$

Determine :

- (i) Total distortion
- (ii) Fundamental power component
- (iii) Total power
- (iv) Percentage increase in power because of distortion. [8]

## SECTION II

7. (a) Draw the hybrid- $\pi$  model for a B.J.T. in Common-Emitter amplifier configuration. Explain the significance of each component appearing in this model. [8]
- (b) Consider the Tuned amplifier shown below :

Find the following parameters :

- (i) Resonant frequency of the tuned (L-C tank) circuit.
- (ii) Q of the tuned (LC tank) circuit.
- (iii) Bandwidth of the Amplifier considering  $R_L = 20 \text{ k}\Omega$ . [8]

Or

8. (a) Draw the B.J.T. T-model at high frequencies. What is the expression for the high frequency  $\alpha$  and with reference to this define the  $\alpha$  cut-off frequency ( $f_\alpha$ ). [8]
- (b) Consider the Tuned amplifier shown below :



Q of the inductance  $L = 50$ . Find the Resonant frequency and Bandwidth. [6]

- (c) Explain the effect of Q of the inductance, on the performance of the Tuned amplifier. [2]
9. (a) Consider the amplifier circuit shown below :

- (i) Identify the topology.
- (ii) Find  $B$ ,  $A_{vf}$ ,  $R_{if}$  and  $R_{of}$ . [10]

- (b) Draw equivalent circuit and frequency characteristics of crystal and explain crystal oscillator. [6]

*Or*

10. (a) Consider the Colpitt's oscillator circuit shown below :

Find the frequency of oscillation when :

- (i)  $Q = 20$
- (ii)  $Q = 8$ . [6]
- (b) Write a short note on current shunt feedback. [6]
- (c) An  $R_C$  coupled amplifier has mid frequency gain 400 and lower and upper 3 dB frequency 100 Hz and 15 kHz respectively. A negative feedback with  $B = 0.01$  is incorporated into amplifier circuit. Calculate gain with feedback and new bandwidth. [4]

11. (a) Consider the series voltage regulator circuit shown below :

Explain how the output voltage ( $V_o$ ) is maintained constant when :

- (i) the load current increases (due to which the output voltage will reduce.)
- (ii) the input voltage increases (due to which the output voltage will increase.)

What is the advantage of Error amplifier ? [10]

(b) With reference to the series voltage regulator, explain the following parameters in detail :

- (i) Line regulation
- (ii) Load regulation
- (iii) Ripple rejection ratio
- (iv) Long term stability. [8]

*Or*

- 12.** (a) Design a B.J.T. series regulator circuit to provide an output voltage of 12 V (Positive) with a maximum load current of 800 mA. The variation of input voltage is between 18 V and 24 V. [8]
- (b) Draw the block diagram of a linear series voltage regulator and explain the function of each block. [5]
- (c) Draw the circuit diagram of Foldback current limiting and explain its working. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—3

<b>Seat No.</b>	
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**[4162]-170**

**S.E. (Instru.) EXAMINATION, 2012**

**MATERIALS AND PROCESSES FOR SENSORS**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain the properties and applications of Tungsten. [8]
- (b) Enlist the guidelines for material selection of Thermocouple. [8]

*Or*

2. (a) Explain the properties and applications of Copper. [8]
- (b) Enlist the guidelines for material selection of mercury filled thermometer. [8]

P.T.O.

3. (a) Explain the effect of frequency on dielectric material. [8]  
(b) Enlist the applications of piezoelectric material. [8]

*Or*

4. (a) Explain the applications of dielectric material. [8]  
(b) Explain the properties of elastic materials. [8]

5. (a) Explain the types of Corrosion. [8]  
(b) What is corrosion rate ? Explain its significance in engineering application. [6]  
(c) Which are the factors affecting the protectiveness of the oxide film. [4]

*Or*

6. (a) List various methods of corrosion control and explain any *two* of them in detail. [10]  
(b) Explain the term service performance of ceramic. [8]

## **SECTION II**

7. (a) Explain the magnetic field and magnetic induction. [8]  
(b) Give properties and applications of soft magnetic materials. [8]

*Or*

8. (a) Discuss the effect of temperature on ferromagnetism. [8]  
(b) Discuss the material selection criteria for LVDT. [8]

- 9.** (a) Enlist various materials used for Laser and compare the performance of Lasers based on spectral response and optical power. [8]
- (b) Write a note on materials for fiber-optic cables. [10]

*Or*

- 10.** (a) What are the various requirements of fiber optic materials. [8]
- (b) Write a note on Bio-materials. [10]

- 11.** (a) Explain Ion-plating. [8]
- (b) What is electroplating ? Explain its use and any *one* technique in detail. [8]

*Or*

- 12.** (a) Compare thick and thin film technology. [8]
- (b) Write a note on types of stainless steels. [8]



Total No. of Questions—10]

[Total No. of Printed Pages—4+2

Seat No.	
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**[4162]-170-A**

**S.E. (Instru. & Control) EXAMINATION, 2012**

**NETWORK THEORY**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Question Nos. 5 and 10 are compulsory. Out of the remaining attempt 2 questions from Section I and 2 questions from Section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain the following rules :

(i) Kirchhoff's voltage law [4]

(ii) Voltage division and current division. [4]

(b) Determine the reactance of a 50  $\mu$ F capacitor in a d.c. supply and also in an a.c. supply of 100 Hz. [8]

P.T.O.

*Or*

2. (a) Determine the current through resistnace  $R_3$  in the circuit shown in Fig. 1. [8]

Fig. 1

- (b) For the circuit shown in Fig. 2, find current equation when the switch is opened at  $t = 0$ . [8]

Fig. 2

3. (a) A driving point function is given by :

$$z(s) = \frac{s^2 + 6s + 8}{s^2 + 4s + 3}$$

Find RC first Cauer form. [8]

- (b) List the properties of an LC immittance function. [8]

Or

4. (a) (i) State properties of Hurwitz polynomials. [4]  
(ii) Check whether the following polynomials are Hurwitz : [4]
- (1)  $s^4 + 3s^2 + 6s + 20$   
(2)  $2s^6 + 4s^5 + 4s^4 - 2s^3 + s^2 + s + 3$ .
- (b) List properties of  $R_L$  driving point impedance function. [8]
5. (a) State and prove superposition theorem. [10]  
(b) What resistance should be connected across X-Y in the circuit shown in Fig. 3 such that maximum power is developed across this load resistance ? [8]

Fig. 3

## SECTION II

6. (a) Find the driving point impedance  $Z(s)$  for the network shown in Fig. 4 [8]

Fig. 4

- (b) Define network functions for one port and two port networks with diagrams. [8]

*Or*

7. (a) The pole-zero plot of R-L-C circuit, driving point admittance is shown in Fig. 5. Find values of R, L and C. [8]

Fig. 5

- (b) Obtain the pole-zero diagram of given function and obtain the time domain response : [8]

$$V(s) = \frac{3s}{(s + 2)(s^2 + 2s + 2)}$$

8. (a) Write short notes on 'Z' and 'Y' parameters :

(i) Network diagram [2]

(ii) Basic equations [2]

(iii) Conditions of symmetry and reciprocity. [2]

(iv) Relationship between Z and Y parameters. [2]

- (b) In the network shown in Fig. 6, find Z and Y parameters. [8]

Fig. 6

*Or*

- 9.** (a) Explain ABCD parameters with formula. [8]
- (b) Mention H parameters and draw equivalent network of two port network in terms of  $h$ -parameters. [8]
- 10.** (a) Explain basic types of filters. [10]
- (b) Explain Butterworth Approximation to low-pass filter. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8+4

<b>Seat No.</b>	
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**[4162]-171**

**S.E. (Printing) (First Semester) EXAMINATION, 2012**

**STRENGTH OF MACHINE ELEMENTS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- Instructions :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Use of logarithmic tables, slide rules, Mollier charts, electronic pocket calculators and steam tables is allowed.
  - (v) Assume suitable data, if necessary.
  - (vi) Figures to the right indicate full marks.

**SECTION I**

**UNIT I**

1. (a) A steel bar of square cross section 35 mm × 35 mm, 500 mm long stretches 0.2 mm under a pull of 100 kN. The same bar in a single shear test under a shear force of 122.5 kN shows a distortion of original right angle corners by 0.00125 radians. Determine the values of E, G and K for the material.

[6]

P.T.O.

- (b) A steel rod 30 mm in diameter, 1 m long is heated through  $100^{\circ}\text{K}$  and at the same time subjected to a pull of 'P'. If the total extension of the rod is 2 mm, calculate the value of 'P'. Take  $E = 200 \text{ GPa}$  and  $\alpha = 12 \times 10^{-6}$  per  $^{\circ}\text{K}$ . [6]
- (c) Explain the terms : [4]
- (i) Hardness
  - (ii) Resilience
  - (iii) Creep
  - (iv) Toughness.

Or

2. (a) A bar is subjected to an axial force as shown in Fig. 1. Determine : [6]
- (i) Forces in portion LM, MN and NP.
  - (ii) Displacements of points M and N.
- Take  $E = 200 \text{ GN/sq.m}$

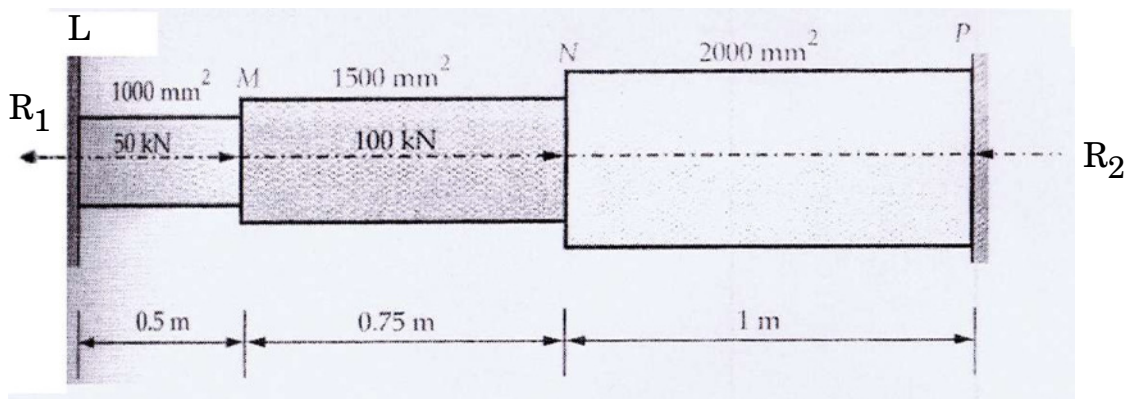


Fig. 1.



- (b) Rails of 10 m length each are laid on the track in the morning when the atmospheric temperature was  $12^{\circ}\text{C}$ . A gap of 3 mm was kept between two consecutive rails. At what maximum temperature will the rails will remain stress free ? If the temperature is further raised by  $10^{\circ}\text{C}$ , what will be the magnitude of the stress induced in the rails ?

Take  $E = 200 \text{ GPa}$  and  $\alpha = 12 \times 10^{-6}$  per  $^{\circ}\text{C}$ . [6]

- (c) Explain the following terms : [4]

- (i) Factor of safety
- (ii) Margin of safety
- (iii) Bulk modulus
- (iv) Proportional limit.

## UNIT II

3. (a) Draw the shear force and bending moment diagram indicating the principal values, for the beam shown in the Fig. 2. [10]

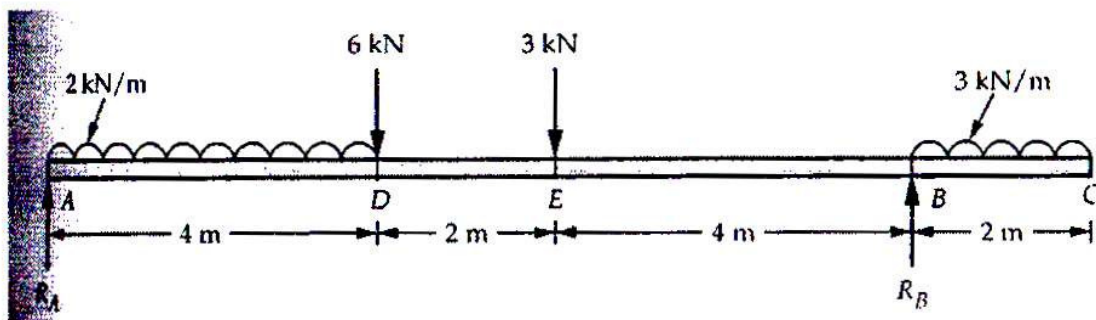


Fig. 2.

- (b) Draw SFD and BMD for the cantilever beam shown in the Fig. 3. [8]

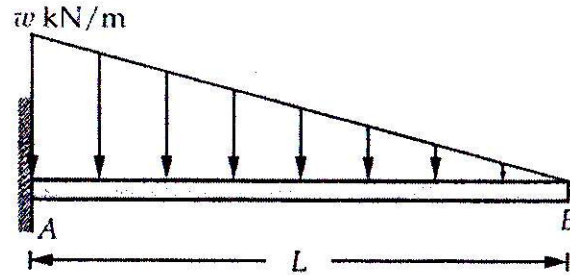


Fig. 3.

Or

4. (a) The BMD of a simply supported beam is linear in the 1.5 m long portion  $AC$  and parabolic in the 3 m long portion  $CDEB$ . There is no slope discontinuity anywhere in the BMD. The moments of  $D$  and  $E$  are 28.125 kNm and 22.5 kNm respectively. Draw the SFD and loading diagram for the beam showing all significant values. (refer Fig. 4). [10]

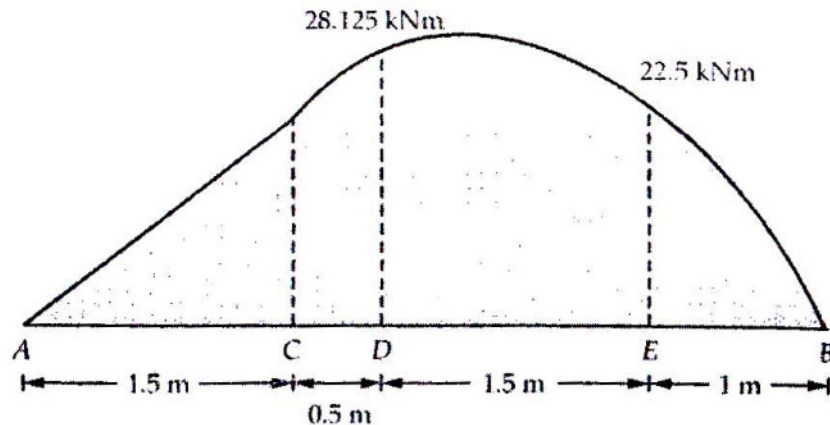


Fig. 4.

- (b) Draw SFD and BMD for the beam shown in Fig. 5 showing all significant values on them. [8]

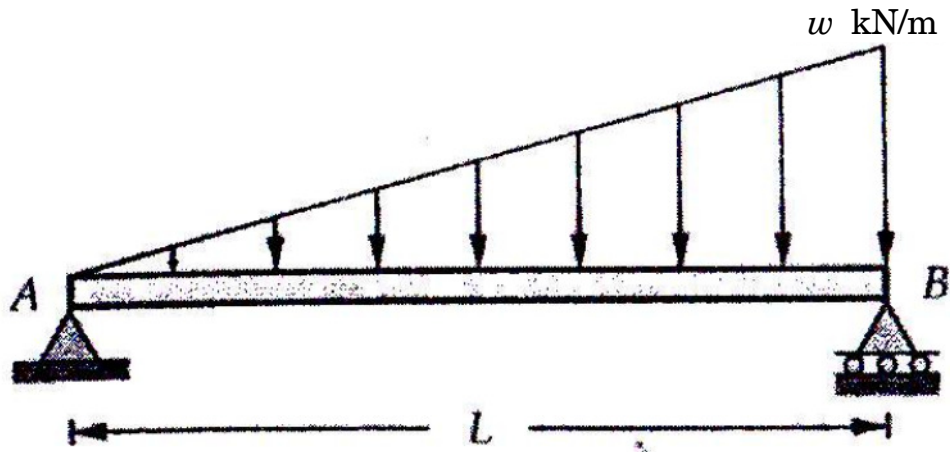


Fig. 5.

### UNIT III

5. (a) The cross section of beam is as shown in Fig. 6. Determine maximum tensile and compressive stresses when the beam is subjected to U.D.L. of  $2$  kN/m and the length of span is  $3$  m for :
- (i) Cantilever
- (ii) Simply supported. [10]

The beam resists bending moment about neutral horizontal axis.

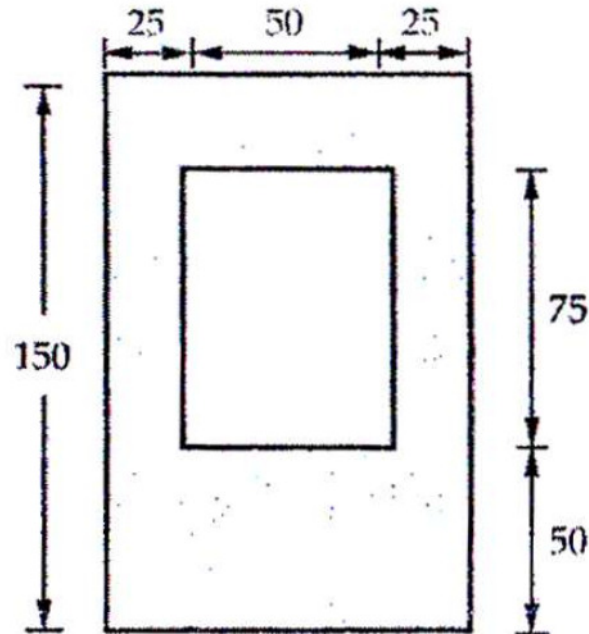


Fig. 6.

- (b) Draw the shear stress distribution diagram for C, T and Circular Section. [6]

*Or*

6. (a) A symmetric I-Section has flanges of size 180 mm  $\times$  10 mm and its overall depth is 500 mm. The thickness of the web is 8 mm. It is strengthened with a plate of size 240 mm  $\times$  12 mm on the compression side. Find the moment of resistance of the section,  $A = 10320$  sq.mm, if permissible

stress is 150 N/sq.mm. How much U.D.L. it can carry, if it is used as a cantilever of span 3 m ? (Refer Fig. 7.) [8]

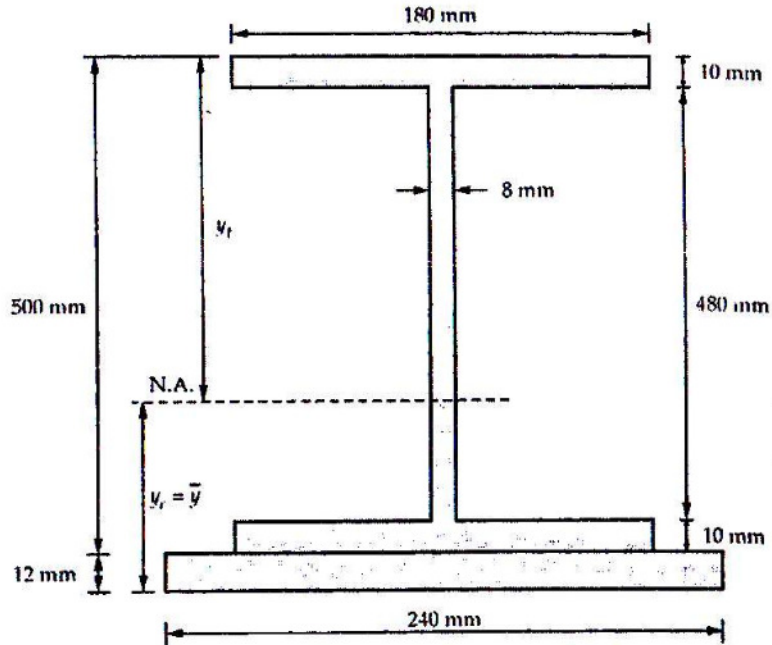


Fig. 7.

- (b) A steel section as shown in the Fig. 8 is subjected to shear force of 200 kN. Determine the shear stress at key points and show the shear stress distribution. [8]

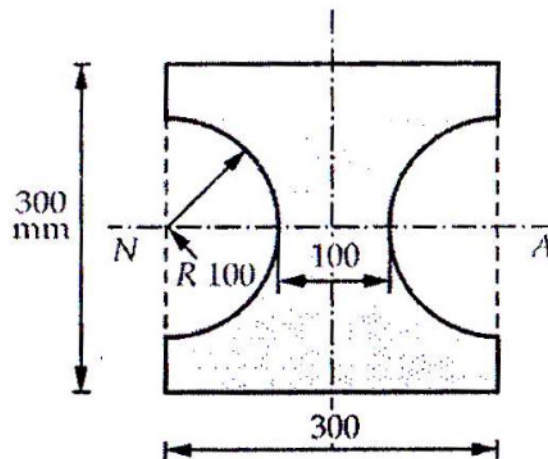


Fig. 8.

## SECTION II

### UNIT IV

7. (a) A solid circular shaft of diameter 'd' is subjected to a bending moment of 'M' and torsional moment of 'T'. Prove that according to maximum shear stress theory : [8]

$$T_{\max} = 16/\pi d^3 \left[ \sqrt{M^2 + T^2} \right]$$

- (b) A solid steel shaft is subjected to torque of 45 kN-m. If the angle of twist is 0.5° per meter length of shaft and shear stress should not exceed 90 N/mm<sup>2</sup>. Find.
- (i) Suitable diameter of shaft
  - (ii) Final maximum shear stress and angle of twist for the diameter of shaft selected.
  - (iii) Maximum shear strain in shaft.

Take modulus of rigidity as 80 GPa. [8]

*Or*

8. (a) Derive Rankine formula for long as well as short columns to overcome the limitations of Euler's formula. [8]

- (b) Compare the crippling load given by Euler's and Rankine's formula for a tubular steel strut 2.3 m long having external diameter = 38 mm and internal diameter = 33 mm, strut is fixed at one end and hinged at other end. Take  $\sigma_C = 335$  MPa,  $E = 205$  GPa and Rankine's constant =  $1/7500$ . [8]

### UNIT V

9. (a) Explain the concept of principal plane and principal stress. [4]
- (b) A point in a strained material is subjected to a tensile stress of  $65 \text{ N/mm}^2$  and a compressive stress of  $45 \text{ N/mm}^2$ , acting on two mutually perpendicular planes and a shear stress of  $10 \text{ N/mm}^2$  are acting on these planes.
- Find the normal stress, tangential stress and resultant stress on a plane inclined to  $30^\circ$  with the plane of the compressive stress. [6]
- (c) Show that in a bar subjected to an axial load the instantaneous stress due to sudden application of a load is twice the stress caused by the gradual application of load. [6]

*Or*

- 10.** (a) Discuss Von Mises criteria for failure in ductile materials. [4]
- (b) A square pin is required to resist a pull of 40 kN and shear force at 15 kN. Derive a suitable section according to strain energy theory. Maximum tensile stress is 350 MPa and Poisson's ratio is 0.3. Take factor of safety of 2.5. [6]
- (c) A rod 10 mm diameter is stretched by 2.5 mm under a steady load of 8000 N. What would be stress produced in a rod by weight of 550 N falling through a height of 50 mm before commencing the stretching of the rod, which is initially in the unstretched condition.
- Take  $E = 2.1 \times 10^5 \text{ N/mm}^2$ . [6]

## UNIT VI

- 11.** (a) Derive equation for slope and deflection at free end of cantilever beam of span L and subjected to u.d.l. 'W' over its entire length. [8]



(b) A simply supported beam of span 4 meters is loaded as shown in Fig. 9 below. Using Maculey's method, determine :

- (i) deflection at C
- (ii) Maximum deflection
- (iii) Slope at A.

Use  $E = 200 \times 10^6$  kPa,  $I = 20 \times 10^{-6}$  m<sup>4</sup>. [10]

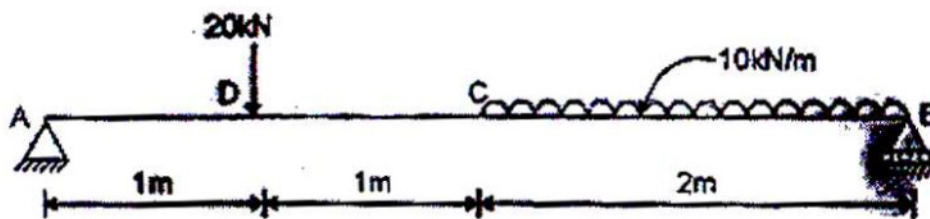


Fig. 9.

Or

12. (a) Derive the expression for deflection at a point of application of couple for the simply supported beam shown in Fig. 10 below : [8]

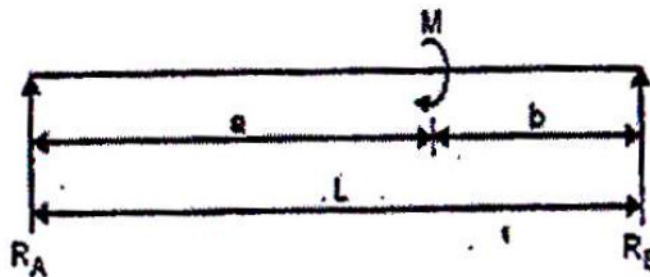


Fig. 10.

- (b) For a beam AE loaded and supported as shown in Fig. 11 below. Find slope and deflection at point C and E. Take  $E = 200 \text{ kN/mm}^2$ ,  $I = 2000 \text{ cm}^4$ . [10]

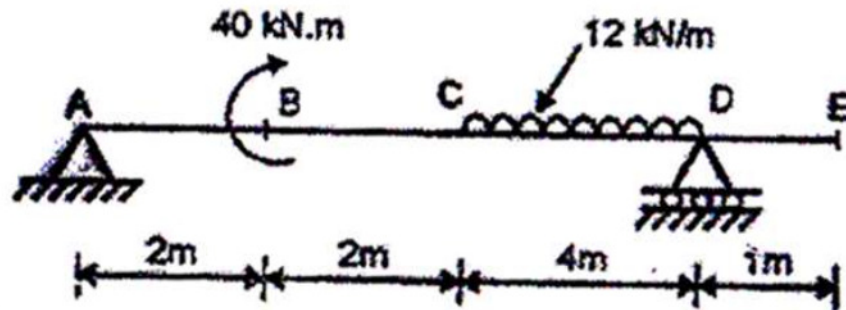


Fig. 11.

Total No. of Questions—6]

[Total No. of Printed Pages—3

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**[4162]-172**

**S.E. (Printing) (First Sem.) EXAMINATION, 2012**

**BASIC ELEMENTS OF PRINTING TECHNOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**Instructions :—** (i) Solve *three* questions from each Section.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (i) Explain the 2D and 3D type faces along with family type and series of type. [18]

*Or*

(ii) Draw and explain the Horizontal Camera and label the parts.

2. (i) Explain the machine configuration of offset printing process with schematic diagram. [16]

*Or*

(ii) Explain the Pad Printing Technique with schematic diagram.

P.T.O.

3. (i) Explain the following binding techniques : [16]
- (a) Hard binding
  - (b) Paper back binding
  - (c) Mechanical loose leaf binding.

*Or*

- (ii) Explain the various finishing techniques used in post press operation.

## SECTION II

4. (i) Explain the fundamentals of design. [16]

*Or*

- (ii) Explain the following divisions design :
- (a) Natural
  - (b) Decorative
  - (c) Conventional
  - (d) Geometric
  - (e) Abstract.

5. (i) Explain the following stages of layout : [16]
- (a) Thumbnail
  - (b) Rough layout
  - (c) Comprehensive layout
  - (d) Artwork.

*Or*

(ii) What is color ? Explain additive and subtractive theory of color.

**6.** (i) Explain the advertising agency, structure, functions and services. [18]

*Or*

(ii) Write short notes on the following (any *three*) :

(a) Vector Images

(b) Raster Images

(c) Typographical logo

(d) Color symbolism

(e) Software's used for print designing.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-173**

**S.E. (Printing) (First Semester) EXAMINATION, 2012**

**PRINTING DIGITAL ELECTRONICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer questions 1 or 2, 3 or 4 and 5 or 6 from Section I and questions 7 or 8, 9 or 10 and 11 or 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Perform the following conversions : [9]
- (i)  $(153)_8$  to Binary, Decimal and Hexadecimal.
- (ii)  $(CCD)_{16}$  to Binary, Decimal and Octal.
- (iii)  $(11010001)_2$  to Decimal, Octal and Hexadecimal.

P.T.O.

(b) Solve : [9]

(i) Add  $(ABBI)_{16} + (111)_8$ . Express the result in hexadecimal.

(ii) Add  $(215)_8 + (215)_{10}$ . Express the result in octal.

(iii) Add  $(45)_{10}$  and  $(66)_{16}$ . Express the result in BCD.

*Or*

2. (a) Solve : [9]

(i) Convert  $(11001100)_2$  into Gray.

(ii) Convert  $(100100)_{\text{GRAY}}$  into Binary.

(iii) Convert  $(456)_{10}$  into Excess-3 Code.

(b) Write brief notes on : [9]

(i) Bar Codes

(ii) ASCII Code

(iii) BCD Codes.

3. (a) The outputs of a gadget are given below. Simplify using Boolean laws and implement simplified expressions using NAND-NAND logic : [8]

(i)  $Y = (A + B) \cdot (A + B + C)$

(ii)  $Y = AB + A\bar{C} + C + AD + A\bar{B}C + ABC + D.$

(b) The functionality of a hand held machine is expressed as : [8]

$$f(A, B, C, D) = \sum m(2, 3, 4, 6, 7, 10, 13, 14)$$

Minimize using k-map and draw the simplified diagram using NOR-NOR logic.

*Or*

4. (a) With reference to Logic families, define the following terms : [8]

(i) Propagation Delay

(ii) Fan out

(iii) Power Dissipation

(iv) Noise Margin.

(b) A section of the digital block of a machine used in printing field is shown below. Find expression for output Y. Prepare its truth table. Simplify the expression using Boolean algebra. Draw the AND-OR-INVERT logical diagram for the simplified expression. [8]

A

Y
---



5. Solve the following : [16]
- (a) Consider a Half Subtractor. Draw its truth table. Write the output expressions. Draw its circuit.
- (b) Explain One bit comparator. Draw its truth table. Write the output expressions. Draw its circuit.
- (c) Using 2's complement technique, subtract :
- $$(10100101)_2 - (01011010)_2$$
- (d) Multiply  $(11011)_2 \times (1101)_2$  and divide  $(1111101)_2 / (110)_2$ .

*Or*

6. (a) Explain Full adder circuit. Prepare truth table. Draw K-Maps. Obtain a simplified expression for the full adder. Draw the simplified diagram using Universal NAND gates. [8]
- (b) State the rules for BCD addition. Draw a neat diagram of one digit BCD adder. Perform BCD addition and express result in BCD form :  $(5337)_{10} + (7538)_{10}$ . [8]

## SECTION II

7. Solve : [18]
- (i) Draw a neat diagram of clocked SR flip-flop using NAND gates. Draw a neat truth table for it. Draw neat self explanatory timing diagrams for the same.

- (ii) Draw a neat diagram of 4-bit Universal shift left register. Draw its truth table. Draw neat self explanatory timing diagrams for it.
- (iii) Draw a neat diagram of application of counter in roller speed measurement. Explain its operation.

*Or*

8. Solve : [18]
- (i) Classify counters. Draw a neat diagram of Mod-6 counter. Draw neat self explanatory timing diagrams for it.
  - (ii) Draw a neat diagram of application of counter for 'paper counting.' Explain its operation.
  - (iii) Draw a neat diagram of clocked MS-JK flip-flop using NAND gates. Draw a neat truth table for it. Draw neat self explanatory timing diagrams for the same.
9. (a) What is the need of ADC ? State the different types of ADCs. Draw a neat diagram of any *one* type of ADC. State the various specifications of ADC. [8]
- (b) Explain common anode and common cathode LED displays. Explain the need of decoder driver ICs. How does LCD differ from LED display ? [8]

*Or*

- 10.** (a) Draw a neat diagram of a Programmable Logic Array. Explain the advantages of programmable logic devices. [8]
- (b) Give a neat and detailed classification of memories. Explain any *one* type of memory in brief. [8]
- 11.** (a) Elaborate on technical grounds 'The role of Digital Electronics' in the field of Printing Engineering. Explain the same with suitable examples. [8]
- (b) Write short notes on (any *two*) : [8]
- (i) Processing Unit of Digital Computers.
- (ii) Serial and Parallel Ports.

*Or*

- 12.** With neat diagrams and specifications, explain : [16]
- (i) Digital scanner
- (ii) Mouse
- (iii) Joystick
- (iv) Digital Camera.

Total No. of Questions—6]

[Total No. of Printed Pages—2

<b>Seat No.</b>	
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**[4162]-174**

**S.E. (Printing) (First Semester) EXAMINATION, 2012**

**TECHNOLOGY OF PRINTING MATERIALS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) All questions are compulsory.
  - (ii) Assume suitable data, if necessary.
  - (iii) Answers to the two Sections should be written in separate answer-books.
  - (iv) Neat diagrams must be drawn wherever necessary.
  - (v) Figures to the right indicate full marks.

**SECTION I**

1. Suggest a suitable metal as a material for Offset plate with justification. [16]

*Or*

Differentiate between PET and PVC type of plastics. [16]

2. Explain photographic film in detail with diagram. [16]

*Or*

Explain the procedure of manufacturing the Silver Halide film. [16]

P.T.O.

3. Explain conventional printing principles with diagrams. [18]

*Or*

Explain the Rheological properties of the printing inks. [18]

## **SECTION II**

4. Explain surface tension property of the ink. [16]

*Or*

Explain the method of measuring the viscosity of paste inks.[16]

5. Explain the importance of paper products in printing industry. [16]

*Or*

Explain various machines used for paper manufacturing. [16]

6. State the importance of GSM and Caliper thickness properties of paper. [18]

*Or*

State the importance of Gloss and Opacity properties of paper. [18]

Total No. of Questions—12]

[Total No. of Printed Pages—7

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[4162]-175

**S.E. (Printing Engineering) (Second Semester)**

**EXAMINATION, 2012**

**ELECTRICAL MACHINES AND UTILIZATION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the *two* sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain commutation process in d.c. motors. [8]

P.T.O.

- (b) In a 120 V compound generator the resistances of the armature, shunt and series windings are  $0.06 \Omega$ ,  $25 \Omega$  and  $0.04 \Omega$  respectively. The load current is 100 A at 120 V. Find the induced e.m.f. and armature current when the machine is connected :
- (i) Long shunt
- (ii) Short shunt
- (iii) How will the ampere turns of the series windings be changed if in (a) a diverter of  $0.1 \Omega$  be connected in parallel with the series windings. Ignore armature reaction. [8]

*Or*

2. (a) Develop back e.m.f. and torque equation for d.c. motor. [8]
- (b) A shunt motor with a field resistance of  $350 \Omega$  and an armature resistance of  $0.2 \Omega$  connected to a 250 V supply. At a speed of 1000 r.p.m. the armature current is 55 A. Calculate the additional resistance required in the field circuit to increase the speed to 1110 r.p.m. for the same armature current. Also calculate the speed in r.p.m. with the original field current and an armature current of 100 A. [8]

3. (a) Explain with neat diagram, construction, working and application of shaded pole induction motor. [8]
- (b) A 3-phase I.M. has efficiency of 0.9 when the output is 50 H.P. At this load the stator and rotor copper loss each equals the iron loss. The windage and friction losses are one-third of no load losses. Calculate the slip. [8]

*Or*

4. (a) Explain any *two* starters for 3-phase induction motor. [8]
- (b) A 3-phase, 4 pole, 50 Hz induction motor runs at a speed of 1440 r.p.m. when the total torque is 70 Nm. Calculate : [8]
- (i) The total input to the rotor and
- (ii) The total rotor copper loss.

5. (a) Explain reluctance type stepper motor in detail. [8]
- (b) Explain advantages of electrical drives in detail. [10]

*Or*

6. (a) Explain with neat diagram and operation of single-phase universal motor in detail. [8]
- (b) Explain selection of motors depending on load characteristics. [10]



## SECTION II

7. (a) Explain the equation for reactive power and derive it with the help of one wattmeter method. [8]
- (b) A 3-phase, 230 V, 50 Hz, 11.2 kW I.M. has a full-load efficiency of 88% and draws a line current of 38 A under full load, when connected in the circuit to measure the input to the motor. Determine the power factor at which the motor is operating. [8]

*Or*

8. (a) Explain in detail contactor, Electric, Encoders and Relays. [8]
- (b) A 400 V, 3-phase star connected Induction motor draws a line current of 20 A and an input power of 12 kW. The phase sequence is RYB. A wattmeter has its currents coil in Line Y and the pressure coil connected across Line B and Line R. Sketch the connection diagram and phasor diagram. Hence find the reading on wattmeter. [8]
9. (a) What do you mean by arc heating ? Explain in detail the types of arc heating. [8]

- (b) A 20 kW 1-phase, 220 V resistance oven uses a circular nichrome wire for its heating element. If the wire temperature is not to exceed 1100°C and the temperature of the charge to be 400°C, calculate the size and length of the wire required. Assume – Radiating Efficiency = 0.6, Emmissivity = 0.9 and specific resistivity of wire material is  $1.09 \times 10^{-6} \Omega\text{m}$ . [8]

*Or*

10. (a) Explain Dielectric Heating in detail. [8]
- (b) A low frequency induction furnace operating at 10 V in the secondary circuit takes 500 kW at 0.5 power factor when the hearth is full. If the secondary voltage be maintained at 10 V, estimate the power absorbed and the power factor when the hearth is half full. Assume the resistance of the secondary circuit to be there by halved and reactance to remain same. [8]
11. (a) Explain in detail Inverse square law and Lambert's Cosine Law. [8]

- (b) A hall  $30 \times 24$  m is to be illuminated with illumination of 50 lux. Five types of lamps with their lumen outputs as given below are available :

<b>W</b>	<b>Lumen</b>
100	1620
200	3660
300	4700
500	9900
1000	21000

The depreciation factor is 1.3 and utilization factor is 0.5. Calculate the number of lamps in each case. Assume suitable type design scheme, mounting height and calculate space to height ratio. [10]

*Or*

- 12.** (a) Explain in detail safety and maintenance procedures used in printing industry. [8]

(b) A 500 W lamp having MSCP of 800 is suspended 3 m above the working plane.

Calculate :

(i) Illumination directly below the lamps at the working plane;

(ii) Lamp efficiency;

(iii) Illumination at a point 2.4 m away on the horizontal plane from vertically below the lamp. [10]

Total No. of Questions—6]

[Total No. of Printed Pages—2

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**[4162]-176**

**S.E. (Printing) (Second Semester) EXAMINATION, 2012**

**REPRODUCTION TECHNIQUES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** Solve *three* questions from each Section.

**SECTION I**

1. Explain basic properties of an ideal original. [16]

*Or*

Compare Bitmap and Vector originals. [16]

2. Why is a continuous tone image converted to halftone ? [16]

*Or*

Describe process of creating halftone detail (electronic process). [16]

3. What is color separation ? State the need of K in the process. [18]

*Or*

Discuss color theories associated with print production. [18]

P.T.O.

## SECTION II

4. Describe structure and working of a transmission densitometer. [18]

*Or*

Discuss analysis of press sheet using a densitometer and control strip. [18]

5. Discuss various input devices for bitmap images in detail. [16]

*Or*

Describe various applications of a flatbed scanner. [16]

6. What is dot gain ? Explain dot gain compensation method. [16]

*Or*

Describe control strip elements in detail. [16]

Total No. of Questions—6]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-177**

**S.E. (Printing) (Second Semester) EXAMINATION, 2012**

**PRINT FINISHING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) *All questions are compulsory.*

(ii) *Assume suitable data, if necessary.*

(iii) *Answers to the two Sections should be written in separate answer-book.*

(iv) *Neat diagrams must be drawn wherever necessary.*

(v) *Figures to the right indicate full marks.*

**SECTION I**

**1. (a) Explain the following binding methods in detail : [9]**

(i) Full Bound

(ii) Half Bound

(iii) Quarter Bound.

**(b) Explain the various binding tools in detail. [9]**

P.T.O.

*Or*

Explain the following binding equipments in detail. [18]

- (i) Nipping Press
- (ii) Sewing Frame
- (iii) Glue Pot
- (iv) Laying Press/Backing Press.

2. Describe the use of various Adhesives in Binding. Also state the requirements of adhesive in binding. [16]

*Or*

Write short notes on the following material used in Book-binding : [16]

- (a) Reinforcing material
- (b) Covering material
- (c) Securing material
- (d) Book-decorating material.

3. Explain the following binding methods with suitable diagram : [16]

- (a) Spiral binding
- (b) Comb binding
- (c) Wire-O wire binding.



*Or*

Explain the step-by-step pre-forwarding and forwarding operation. [16]

## SECTION II

4. Draw a plant layout for medium size bindery. What are the aspects on which plant layout will be decided ? [18]

*Or*

- (a) Explain the knife folding principle with suitable diagram. [12]
- (b) List down the merits and demerits of hand-folding. [6]
5. (a) Calculate number of boards required of 45 Dkg of 22" × 28" for binding of 1000 books in A5 size. [6]
- (b) Calculate papers for endpapers in RA1 (595 × 841) size with 80 gsm @ Rs. 70 per kg. for 2000 books in A5 size having 240 pages with 2% wastage allowance. [10]

*Or*

Estimate boards of 45 Dkg in RA1 size and cloth rolls of 85 cm wide and 15 meter long for full bound 5000 books in A5 size having 10 mm thickness. [16]

6. (a) Explain the various lamination techniques used in print finishing. [8]
- (b) Explain the structure and working of wire stitching machine. [8]

*Or*

Explain the selection of material handling equipments according to the following criteria : [16]

- (a) Nature of operations
- (b) Material to be handled
- (c) Distance over which the material is to be moved
- (d) Installation and operating costs
- (e) Plant facilities.

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-178**

**S.E. (Printing) (II Sem.) EXAMINATION, 2012**

**MICROPROCESSOR AND MICROCONTROLLER**

**TECHNIQUES IN PRINTING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Assume suitable data, if necessary.

**SECTION I**

- 1. (a) Explain the following pins of 8085 microprocessor : [8]**
- (i) Multiplexed Address/data bus AD0-AD7
  - (ii) INTR
  - (iii) READY
  - (iv)  $\bar{R}D$ .

P.T.O.

- (b) Explain the flag register, program counter and stack pointer of 8085 in detail. [10]

*Or*

2. (a) Differentiate between the following : [10]
- (i) I/O mapped I/O and memory mapped I/O
  - (ii) Software and hardware interrupts.
- (b) Explain 3 : 8 decoder IC 74138. [8]
3. (a) Explain stack memory concept. Explain the difference between stack memory and program memory. [8]
- (b) Write a program for multiplication of 2 numbers. Assume that 2 numbers are stored at memory locations 2000 and 2001 respectively. [8]

*Or*

4. (a) Explain what operation will take place when the following instructions are executed : [8]
- (i) CMP B
  - (ii) MOV B,C
  - (iii) DCR C
  - (iv) RAL.

(b) Explain all events taking place when CALL instruction is executed.  
Explain with example. [8]

5. (a) Draw pin diagram of 8051 microcontroller and explain different pins in detail. [10]  
(b) Explain program status word (PSW) in 8051 microcontroller. [6]

*Or*

6. (a) Explain the difference between 8085 microprocessor and 8051 microcontroller. [8]  
(b) Explain TMOD (Timer/Counter mode control register) and TCON (Timer/Counter Control/Status register) in 8051 microcontroller. [8]

## SECTION II

7. (a) Explain different addressing modes in 8051 microcontroller. [10]  
(b) Explain the concept of register bank in microcontroller 8051. [6]

*Or*

8. (a) Explain the following instructions in 8051 : [8]  
(i) MOV A, Rn  
(ii) MUL AB  
(iii) ADD A, @ Rn  
(iv) SWAP A.

- (b) Write short notes on : [8]  
(i) RS 232  
(ii) IEEE 488.

9. (a) Draw and explain block diagram of 8255 programmable peripheral interface IC 8255. [10]  
(b) Explain control word for BSR and active mode in programmable peripheral interface IC 8255. [8]

*Or*

10. (a) Draw and explain block diagram of interrupt controller IC 8259. [10]  
(b) Explain control word in programmable interval timer IC 8253. Explain mode 0 of 8253 programmable interval timer in detail. [8]
11. (a) Explain concept of PLC. [8]  
(b) Explain printer interfacing with 8085. [8]

*Or*

12. (a) Explain application of microprocessor in field of printing in detail. [8]  
(b) Write program for stepper motor interface with 8085 micro-processor. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8+3

<b>Seat No.</b>	
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**[4162]-179**

**S.E. (Printing) (Second Semester) EXAMINATION, 2012**

**THEORY OF PRINTING MACHINES**

**(2008 PATTERN)**

**Time : Four Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer to the two Sections should be written in separate answer-books.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables are allowed.

(v) Assume suitable data, if necessary

**SECTION I**

**Unit I**

1. (a) Explain with sketches all the inversions of single slider crank mechanism. Where are these inversions used ? [10]

P.T.O.

- (b) Distinguish between the following :
- (i) Machine and structure
  - (ii) Turning Pair and sliding Pair. [6]

*Or*

2. (a) What do you mean by inversion of a mechanism ? Explain with sketches all the inversions of double-slider crank mechanism. [10]
- (b) What do you understand by degree of freedom ? A five links chain with five joints is as shown in Fig. 1. Prove that it is an unconstrained chain : [6]

Fig. 1

## Unit II

3. Fig. 2 shows the mechanism in which member OA rotates anticlockwise with an angular velocity of 100 rad/s and angular acceleration of



10,000 rad/s<sup>2</sup>. Link BD is a continuation of the rigid link AB. The links have the following lengths. OA = 30 mm; BC = 90 mm; AD = 168 mm; AB = 120 mm.

Determine the following :

- (i) The velocities of points A, B and D.
- (ii) The absolute linear accelerations of points A and B. [16]

Fig. 2

*Or*

4. A horizontal single cylinder reciprocating engine has a crank OC of radius 40 mm and a connecting rod PC 140 mm. The crank rotates at 3,000 rev/min clockwise. For the configuration as shown in

Fig. 3, determine the velocity and acceleration of piston : [16]

Fig. 3

**Unit III**

5. Fig. 4 shows a crank and slotted lever quick return mechanism which the distance between the fixed centers O and C is 210 mm. The driving crank CP is 105 mm and rotates clockwise at 90 r.p.m. The length of the slotted link OD is 420 mm and DE is 165 mm. Line of stroke of the ram E is horizontal, 210 mm above fixed center C. At the instant when the angle OCP is  $110^\circ$ , find acceleration of ram E. [18]

Fig. 4

*Or*

6. Fig 5 shows a mechanism in which crank OA is rotating clockwise at 20 rad/s. Determine angular velocity and acceleration of link BC and DE at instant shown : [18]

$$OA = 75 \text{ mm}$$

$$OE = 60 \text{ mm}$$

$$OC = 100 \text{ mm}$$

$$BD = 190 \text{ mm}$$

$$BC = 270 \text{ mm.}$$

Fig. 5

## SECTION II

### Unit IV

7. (a) Describe with a neat sketch working of cone clutch. [6]
- (b) The plate clutch consist of two pairs of contacting surface with asbestos friction lining. The maximum engine torque is 250 Nm. The coefficient of friction is 0.35. The inner and outer diameters of friction lining are 175 and 250 mm respectively. There are total 9 springs, each compressed by 5 mm to give alone force of 800 N, when the clutch is new :
- (i) What is factor safety with respect to slippage when the clutch is brand new ?
- (ii) What is factor safety with respect to slippage after initial wear has occurred ? [12]

*Or*

8. (a) Derive the equation for torque transmitting capacity of a single plate clutch for :
- (i) Uniform pressure
- (ii) Uniform wear. [8]
- (b) Distinguish between a single plate and multi plate clutch. [4]

- (c) A multiple disc wet clutch is required to provide a torque capacity of 800 Nm. Values of  $p_{\max} = 1$  MPa and  $\mu = 0.1$  are to be used. Disc inside and outer diameter are 90 mm and 150 mm resp.
- (i) What total number of discs to be used ?
- (ii) Using the same number of discs what is the smallest value axial clamping force that would provide the necessary torque capacity ?
- (iii) Assuming that your solution was (approximate) based on uniform rate of wear across friction surfaces, explain what will happen when the clutch is new and pressure distribution is uniform. [6]

### Unit V

9. (a) With a neat sketch describe a single shoe brake. What are advantages of double shoe brake over a single shoe brake. [6]
- (b) Fig. 6 shows simple band brake which is applied to a shaft carrying flywheel of mass 250 kg and of radius of gyration 300 mm. The flywheel is rotating at 200 r.p.m. (clockwise). The brake drum dia. is 250 mm and coefficient of friction is 0.20. The angle of lap of the band on the drum is  $210^\circ$  if the braking torque is 40 Nm, find :
- (i) The force applied at the lever end.

- (ii) The no. of turns of the flywheel before it comes to rest.
- (iii) The time taken by the flywheel to come to rest :[10]

Fig. 6

*Or*

- 10.** (a) Write a short note on band and block brake. [4]
- (b) The arrangement of an internal expanding friction brake in which the brake shoe is pivoted at 'C' is as shown in Fig. 7. The dist. 'CO' 60 mm, O being the center of the drum. The internal radius of the brake drum is 80 mm for friction lining extends over an arc AB such that the angle AOC is  $135^\circ$  and the BOC is  $45^\circ$ . The brake is applied by means of the force at point Q, perpendicular to the line CQ, the distance CQ being

120 mm. The local rate of wear on the lining may be taken as proportional to normal pressure on an element at angle of ' $\Theta$ ' with OC and taken as equal to  $P_1 \sin \Theta$ , where  $P_1$  is max intensity of normal pressure. The coefficient of friction may be taken as 0.4 and the braking torque required is 21 Nm. Calculate the force Q required to operate the brake when : [12]

- (i) The drum rotates clockwise
- (ii) The drum rotates anticlockwise.

Fig. 7

### Unit VI

11. (a) Compare flat belt drive with V-belt drive. [4]

(b) In a horizontal belt drive for a centrifugal blower, the blower is belt driven at 600 r.p.m. by a 15 kW, 1750 r.p.m. electric

motor. The centre distance is twice the diameter of the larger pulley.

The density of the belt material =  $1500 \text{ kg/m}^3$ ;

Maximum allowable stress =  $4 \text{ MPa}$

$m_1 = 0.5$  (motor pulley),  $m_2 = 0.4$  (blower pulley)

Peripheral velocity of the belt =  $20 \text{ m/s}$ .

Determine the following :

- (i) Pulley diameters and belt length
- (ii) Cross-sectional area of the belt
- (iii) Minimum initial tension for operation without slip and 5. Resultant force in the plane of blower when operating with an initial tension 50 percent greater than the minimum value. [12]

*Or*

12. (a) State advantages and disadvantages of a chain drive. [4]
- (b) An open belt connects two flat pulleys. The pulley diameters are  $300 \text{ mm}$  and  $450 \text{ mm}$  and the corresponding angles of lap are  $160^\circ$  and  $210^\circ$ . The smaller pulley runs at  $200 \text{ r.p.m.}$  The coefficient of friction between the belt and pulley is  $0.25$ .



The belt is on the point of slipping when 3 kW is transmitted. Just to increase the power transmitted two alternatives are suggested :

- (i) increasing the initial tension by 10% and
- (ii) increasing the coefficient of friction by 10% by the application of a suitable dressing to the belt. Which of these two methods would be more effective ? Find percentage increase in power possible in each case. [12]

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

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**[4162]-181**

**S.E. (Chemical/Printing/Poly.) (I Sem.) EXAMINATION, 2012**

**ENGINEERING MATHEMATICS—III**

**(Printing, Chemical, Poly., Petroleum, Petrochem. and B.Tech.)**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Figures to the right indicate full marks.
- (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

**SECTION I**

**1. (a) Solve the following (any *three*) :** [12]

(i)  $(D^2 - 1)y = \cos e^{-x} + e^{-x} \sin e^{-x}$

P.T.O.

$$(ii) \quad (D^2 + 2D + 1) y = x e^{-x} \sin x$$

$$(iii) \quad \frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} + 2y = e^x \tan x \quad (\text{by variation of parameters})$$

$$(iv) \quad x^3 \frac{d^3 y}{dx^3} + 2x^2 \frac{d^2 y}{dx^2} + 2y = 10 \left( x + \frac{1}{x} \right).$$

(b) Solve the simultaneous equations : [5]

$$\frac{dx}{dt} + y = e^t$$

$$\frac{dy}{dt} - x = -e^{-t}.$$

Or

2. (a) Solve the following (any three) : [12]

$$(i) \quad (D^2 - 9D + 18) y = e^{-3x}$$

$$(ii) \quad (D^2 - D + 1) y = x^3 - 3x^2 + 1$$

$$(iii) \quad y'' - 6y' + 9y = \frac{e^{3x}}{x^2} \quad (\text{by variation of parameters})$$

$$(iv) \quad (x + 1)^2 \frac{d^2 y}{dx^2} + (x + 1) \frac{dy}{dx} + y = 2 \sin [\log(x + 1)].$$

(b) Solve : [5]

$$\frac{dx}{mz - ny} = \frac{dy}{nx - lz} = \frac{dz}{ly - mx}.$$

3. (a) The deflection of a strut with one end built in ( $x = 0$ ) and other supported and subjected to end thrust  $P$ , satisfies the equation :

$$\frac{d^2y}{dx^2} + a^2y = \frac{a^2R}{P}(l - x).$$

Given that  $\frac{dy}{dx} = 0$  when  $x = 0$  and  $y = 0$  when  $x = l$ ; prove that :

$$y = \frac{R}{P} \left[ \frac{\sin ax}{a} - l \cos ax + l - x \right]. \quad [8]$$

- (b) The temperature at any point of the insulated metal rod of one meter length governed by the differential equation :

$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}.$$

Find  $u(x, t)$  subject to the conditions :

(i)  $u(0, t) = 0^\circ\text{C}$

(ii)  $u(1, t) = 0^\circ\text{C}$

(iii)  $u(x, 0) = 50^\circ\text{C}.$  [8]

Or

4. (a) In a heat exchange, the temperatures  $u$  and  $v$  of two liquids, satisfy the equations :

$$4 \frac{du}{dx} = v - u = 2 \frac{dv}{dx}.$$

Determine  $u$  and  $v$ , given that  $u = 20$  and  $v = 100$  when  $x = 0$ . [8]

- (b) Solve the partial differential equation :

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

subject to the conditions :

(i)  $u(x, \infty) = 0$

(ii)  $u(0, y) = 0$

(iii)  $u(10, y) = 0$

(iv)  $u(x, 0) = 100 \sin\left(\frac{\pi x}{10}\right); 0 \leq x \leq 10$ . [8]

5. (a) Find the Fourier cosine integral representation for the function :

$$f(x) = \begin{cases} x^2 & , \quad 0 < x < a \\ 0 & , \quad x > a \end{cases} \quad [6]$$

(b) Solve the integral equation :

$$\int_0^{\infty} f(x) \sin \lambda x \, dx = \begin{cases} 1, & 0 \leq \lambda < 1 \\ 2, & 1 \leq \lambda < 2 \\ 0, & \lambda \geq 2 \end{cases} \quad [6]$$

(c) Find the Fourier sine transform for the function :

$$f(x) = e^{-x} - e^{-2x}, \quad x > 0. \quad [5]$$

Or

6. (a) Using Fourier integral representation, show that :

$$\int_0^{\infty} \left( \frac{1 - \cos \pi \lambda}{\lambda} \right) \sin \lambda x \, d\lambda = \begin{cases} \frac{\pi}{2}, & 0 < x < \pi \\ 0, & x > \pi \end{cases} \quad [5]$$

(b) Find the Fourier cosine transform for the function :

$$f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2 - x, & 1 \leq x \leq 2 \\ 0, & x > 2 \end{cases} \quad [5]$$

(c) Using finite Fourier sine transform, solve :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < \pi, \quad t > 0$$

subject to the conditions :

(i)  $u(x, 0) = 1, \quad 0 < x < \pi$

(ii)  $u(0, t) = u(\pi, t) = 0, \quad 0 < x < \pi, \quad t > 0. \quad [7]$

## SECTION II

7. (a) Find Laplace transform (any *three*) : [12]

(i) 
$$\frac{\cos at - \cos bt}{t}$$

(ii)

(iii) 
$$f(t) = \begin{cases} \frac{t}{T}, & 0 \leq t < T \\ 1, & t > T \end{cases}$$

(iv) 
$$F(t) = t^2 H(t - \pi) + \cos t \delta(t - \pi).$$

(b) Evaluate using Laplace transform :

$$\int_0^{\infty} e^{-2t} \frac{\sinh t}{t} dt. \quad [4]$$

*Or*

8. (a) Find Inverse Laplace Transform (any *three*) : [12]

(i) 
$$\frac{e^{-\pi s}}{\sqrt{7s + 6}}$$

(ii) 
$$\log \sqrt{\frac{s^2 + 4}{s^2 + 9}}$$

(iii) 
$$\frac{s^2 + 2s + 3}{(s^2 + 2s + 2)(s^2 + 2s + 5)}$$

(iv) 
$$\frac{1}{s\sqrt{s+1}}$$
 (use convolution theorem).

(b) Find Laplace transform of the periodic function :

$$\begin{aligned} f(t) &= \sin \phi t, & 0 < t \leq \frac{\pi}{\omega} \\ &= 0, & \frac{\pi}{\omega} \leq t < \frac{2\pi}{\omega} \end{aligned}$$

where

$$f\left(t + \frac{2\pi}{\omega}\right) = f(t). \quad [4]$$

9. (a) Find the directional derivative of  $\phi(x, y, z) = 4e^{2x} - y - z$  at the point  $(1, 1, -1)$  in the direction towards the point  $P(-3, 5, 6)$ . [6]

(b) Show that :

$$\text{curl curl curl curl} = \nabla^4 \{(y+z)\bar{i} + (z+x)\bar{j} + (x+y)\bar{k}\}$$

where

$$\bar{F} = (y+z)\bar{i} + (z+x)\bar{j} + (x+y)\bar{k}. \quad [5]$$

(c) Evaluate :

$$\int_C \frac{x dx + y dy}{(x^2 + y^2)^{3/2}}$$

along the curve :

$$\bar{r}(t) = e^t \cos t \bar{i} + e^t \sin t \bar{j}$$

from  $A(1, 0)$  to  $B(e^{2\pi}, 0)$ . [6]



Or

10. (a) Establish the vector identities (any two) : [6]

$$(i) \quad \nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$$

$$(ii) \quad \nabla \left( \frac{\bar{a} \cdot \bar{r}}{r^n} \right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a} \cdot \bar{r})}{r^{n+2}} \bar{r} \quad (\bar{a} \text{ is const. vector})$$

(iii)

(b) By using Stokes' theorem evaluate :

$$\iint_S \nabla \times \bar{F} \cdot \hat{n} \, ds$$

over the surface  $z = 1 - x^2 - y^2$  ( $z \geq 0$ )

where  $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$ . [6]

(c) Use Gauss's divergence theorem to evaluate :

$$\iint_S (x^3\bar{i} + y^3\bar{j} + z^3\bar{k}) \cdot d\bar{s}$$

over the surface of sphere  $x^2 + y^2 + z^2 = 9$ . [5]

11. (a) Solve by using Laplace transform method :

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + y = te^{-t}$$

with  $y(0) = 1, y'(0) = -2.$  [5]

(b) If the velocity potential of the fluid motion is given by

$\phi = 109(xyz).$  Find the equation of stream lines. [6]

(c) The transfer function of a second order system (undamped)

( $\xi < 1$ ) is given by :

$$G(s) = \frac{Y(s)}{X(s)} = \frac{6}{s^2 + 1.8s + 1}.$$

Find overshoot, decay ratio, period of oscillation

and  $Y(t)_{\max}.$  [6]

*Or*

12. (a) Solve by using Laplace transform method :

$$\frac{dy}{dt} + 2y(t) + \int_0^t y(t) dt = \sin t$$

with  $y(0) = 1.$  [6]

- (b) In steady motion of an incompressible homogeneous fluid under No force, the velocity at any point is  $ax\bar{i} + ay\bar{j} - 2az\bar{k}$ . Find the surfaces of equipressure. [6]
- (c) Show that the ultimate change in  $H(t)$  for a unit change in  $Q(t)$  is  $R$  in liquid level system. [5]

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-182**

**S.E. (Chemical) (I Sem.) EXAMINATION, 2012**

**CHEMISTRY—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer any *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

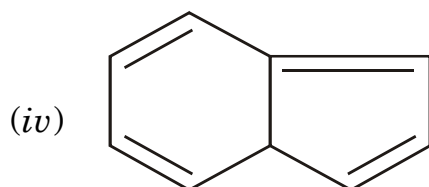
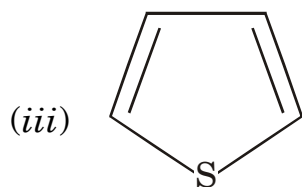
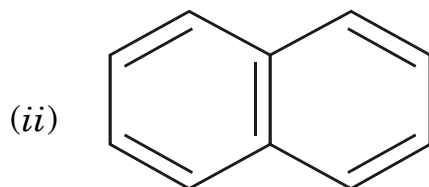
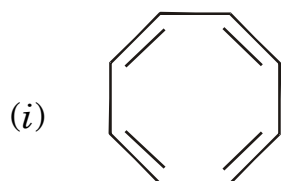
**SECTION I**

1. (a) Discuss the conditions for resonance and draw the resonating structure for :
- (i) Phenol
  - (ii) Aniline
  - (iii) Nitrobenzene.

[6]

P.T.O.

- (b) Sketch the shapes of the molecular orbitals formed by overlap of different atomic orbitals. [6]
- (c) Using Hückel's rule classify the following as aromatic and non-aromatic : [6]



*Or*

2. (a) Write a note on LCAO approximation. Draw the MO diagram for nitrogen molecule and deduce its bond order. [6]
- (b) Discuss the orbital structures of carbocation, carbanion and free radical. [6]

(c) Give reasons :

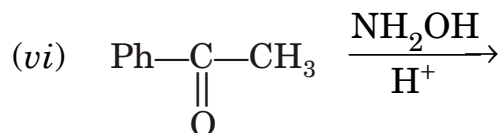
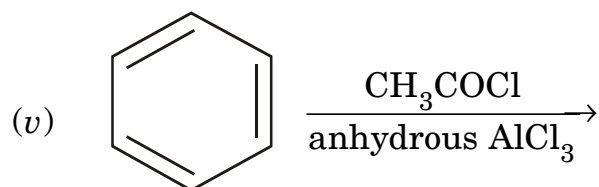
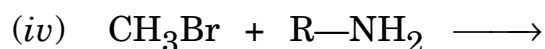
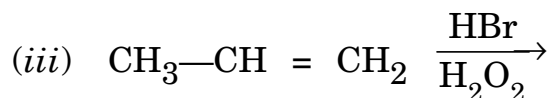
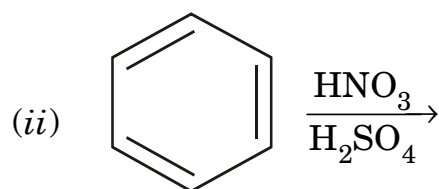
(i) Pyrrole is a weak base

(ii) Formic acid is stronger than acetic acid. [6]

3. (a) Discuss the mechanism of E1 and E2 elimination reactions. [6]

(b) Write a note on Claisen rearrangement reaction. [4]

(c) Predict the product : [6]

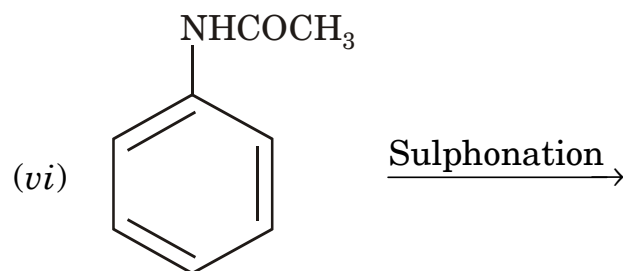
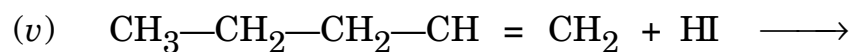
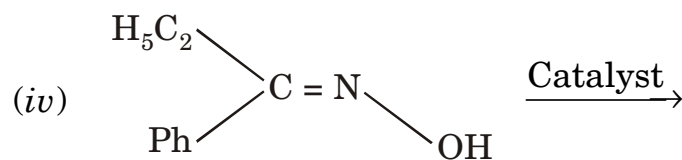
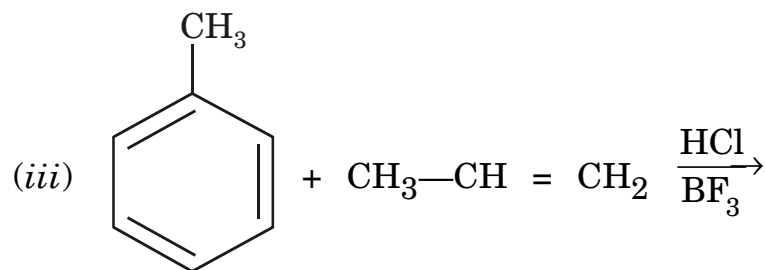
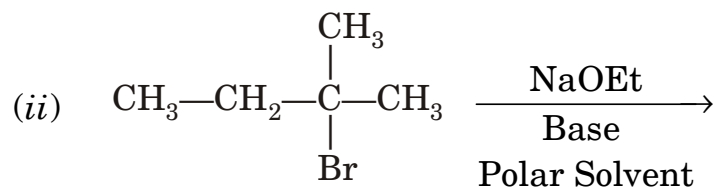
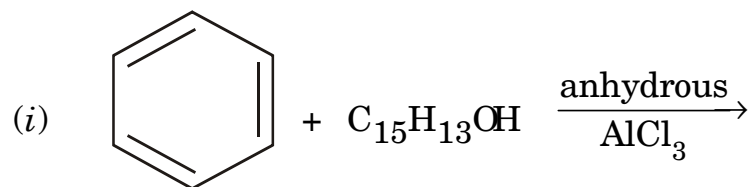


Or

4. (a) Discuss the mechanism of and stereochemical changes taking place in the  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  mechanism. [6]

(b) Complete the following reactions :

[6]



(c) Write a note on mechanism of Nitration of benzene.

[4]

5. (a) Explain the following terms : [6]
- (i) Cell constant
  - (ii) Specific conductance
  - (iii) Equivalent conductance.
- (b) Discuss the redox titration of  $\text{Ce}^{4+}$  ion solution against  $\text{Fe}^{2+}$  ion solution. [4]
- (c) Describe the principle and applications of flame photometry. [6]

*Or*

6. (a) What are ion selective electrodes ? Describe any *one* in detail. [6]
- (b) State and explain Kohlrausch's law. Calculate the equivalent conductance at infinite dilution for  $\text{CH}_3\text{COOH}$  from the following data :
- $$\begin{aligned}\lambda_0 \text{ CH}_3\text{COONa} &= 91 \text{ ohm}^{-1} \text{ cm}^2 \text{ per eq} \\ \lambda_0 \text{ HCl} &= 426.16 \text{ ohm}^{-1} \text{ cm}^2 \text{ per eq} \\ \lambda_0 \text{ NaCl} &= 126.45 \text{ ohm}^{-1} \text{ cm}^2 \text{ per eq.} \quad [6]\end{aligned}$$
- (c) Explain the conductometric titration curve for neutralization of a strong acid with a strong base. [4]



## SECTION II

7. (a) Derive an integrated rate equation for first order reaction and give its characteristics. [6]
- (b) Define and explain : [6]
- (i) Rate constant
- (ii) Order and molecularity of reaction
- (iii) Pseudomolecular reaction.
- (c) In a second order reaction, the initial concentration of reactants is 0.1 mole per liter. The reaction is found to be 20% complete in 40 min. Calculate rate constant and half-life period. [4]

*Or*

8. (a) Derive Arrhenius equation and explain energy of activation. How is it calculated graphically ? [6]
- (b) Explain concept of steady state approximation with suitable example. [6]
- (c) Explain any *two* methods for rate determination of reaction. [4]
9. (a) Explain the principle, technique and applications of thin layer chromatography. [6]

- (b) Explain construction, working and applications of  $H_2-O_2$  fuel cell. [6]
- (c) Explain any *one* detector used in gas chromatography. [4]

*Or*

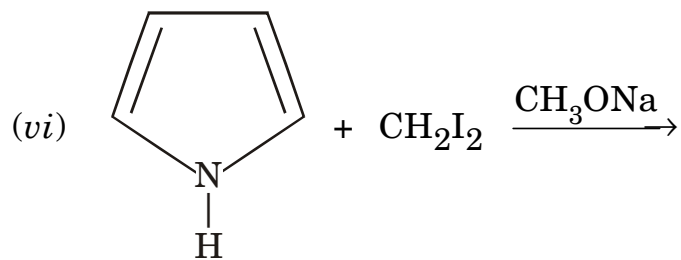
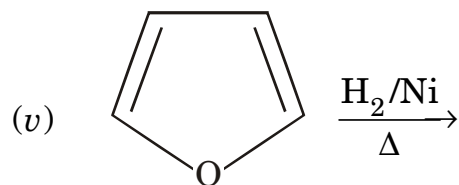
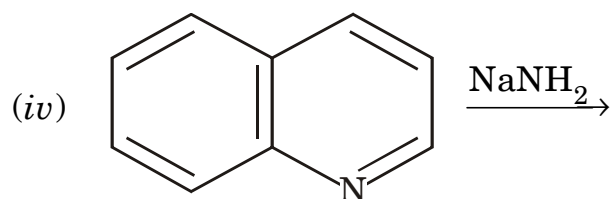
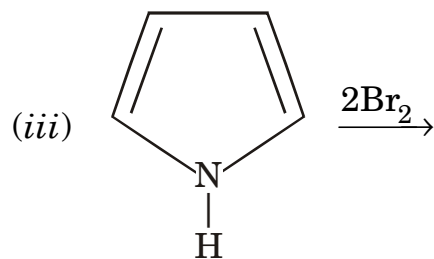
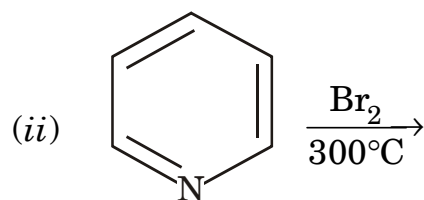
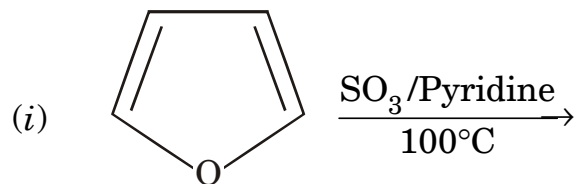
10. (a) Give the instrumentation of HPLC. [6]
- (b) Explain construction, working and applications of polymer electrolyte membrane fuel cell. [6]
- (c) Explain applications of column chromatography. [4]
11. (a) Write a short note on diazotisation and coupling in azo dyes. [6]
- (b) Write *one* method of synthesis and use of the following dyes : [6]
- (i) Crystal violet
- (ii) Phenolphthalein.
- (c) Write any *two* methods of synthesis of : [6]
- (i) Pyrrole
- (ii) Furan.

*Or*

12. (a) How is pyridine prepared ? What are its physical and chemical properties ? [6]

(b) Explain the classification of dyes on the basis of methods of application. [6]

(c) Complete the reaction : [6]



Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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[4162]-183

**S.E. (Chemical Engg.) (First Semester) EXAMINATION, 2012**

**CHEMICAL ENGINEERING FLUID MECHANICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answers to the two Sections should be written in separate answer-books.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(v) Assume suitable data, if necessary.

### **SECTION I**

1. (a) Discuss the following : [6]

(i) Stream line and stream tube

(ii) Streak line and path line.

(b) Give any *two* equations to present non-Newtonian behaviour of fluids and explain the terms involved. [6]

(c) Define density and specific weight, specific volume and specific gravity. [4]

P.T.O.

Or

2. (a) Two plates are placed at a distance of 0.15 mm apart. The lower plate is fixed while the upper plate having surface area  $1.0 \text{ m}^2$  is pulled at 0.3 cm/s. Find the force and power required to maintain this speed, if the fluid separating them is having viscosity 1.5 poise. [4]
- (b) A mass of gasoline equal to 450 kg is stored in a tank. What is its weight in Newton on earth's surface ? What would be its mass and weight on moon's surface where the local acceleration due to gravity is one sixth of that of the earth's surface ? [4]
- (c) Draw Shear stress-Shear rate diagram and explain rheological behaviour of different fluids. Give *one* example of each. [8]
3. (a) Derive an equation of hydrostatic equilibrium. [8]
- (b) Water is pumped from a reservoir to a height of 1000 m from the reservoir level, through a pipe of 15 cm I.D. at an average velocity of 4 m/s. The pipe is 2000 m long and the overall efficiency of pump is 70%, what is the energy required for pumping ? Friction factor  $f = 0.046 \text{ Re}^{-0.2}$ . [8]

*Or*

4. (a) A differential mercury manometer is used to measure the pressure difference between two pipes at A and B containing liquids of specific gravity 0.8 and 0.7 respectively. Center to center distance between pipes A and B is 50 cm, A being above B. The mercury level in the leg of manometer connected to pipe A is 0.3 m below its center while that in the leg connected to pipe B is 0.6 m below its center. Find the differential pressure between pipes A and B in terms of water column. [8]
- (b) By applying energy balance to the steady flow of an incompressible fluid in a stream-tube, derive Bernoulli equation. [8]
5. (a) Crude oil is pumped at a rate of 80 liters/sec from a harbor to a refinery at a distance of 10 km through a 0.3 m I.D. pipeline. The crude oil has a density of 0.8 gm/cc and a viscosity of 5 cP. Calculate the power required for the motor driving the pump, assuming an overall efficiency of 60% at full capacity. [8]
- (b) Write Darcy-Weisbach equation and explain the terms. [2]
- (c) Show that the average velocity of the fluid flowing through a circular pipe under laminar conditions is half that of the maximum velocity. [8]

*Or*

6. (a) What is friction factor ? Give equation of friction factor for laminar flow. [2]
- (b) For laminar flow of a Newtonian fluid in circular pipe, obtain the following relations from first principles : [16]
- (i) Frictional pressure drop and wall shear stress
  - (ii) Velocity distribution in the radial direction
  - (iii) Average velocity and maximum velocity
  - (iv) Pressure drop and average velocity.

## SECTION II

7. (a) Pressure drop of a homogeneous fluid in a straight smooth pipe ( $\Delta P$ ) is a function of the pipe geometry (diameter  $d$ , and length  $l$ ), the physical properties of the fluid (density  $\rho$  and viscosity  $\mu$ ) as well as its velocity  $v$  : [8]

$$\Delta P = f(d, l, \rho, \mu, v).$$

Using Rayleigh's method of dimensional analysis, find out the relationship between dimensionless groups, defining the above fluid flow process.

- (b) What is boundary layer ? Discuss the growth of hydrodynamic boundary layer over a flat plate. [8]

*Or*

8. (a) Calculate the displacement thickness and momentum thickness for the following boundary layer velocity flow : [8]

- (b) With suitable example explain the Buckingham's method of dimensional analysis. [8]

9. (a) Draw a neat sketch and explain the working of a packed bed column. [8]
- (b) A thin plate is moving in still atmospheric air at a velocity of 5 m/sec. The length of the plate is 0.6 m and width 0.5 m. Calculate (i) The thickness of the boundary layer at the end of the plate and (ii) Drag force on one side of the plate. Take density of air as  $1.24 \text{ kg/m}^3$  and kinematic viscosity 0.15 stokes. [8]

Or

10. (a) Discuss different types of fluidization. [4]
- (b) A plate of 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity  $10^{-4} \text{ m}^2/\text{sec}$ . The fluid is moving with a velocity of 6 m/sec. [12]
- Determine :
- (i) Boundary layer thickness
- (ii) Shear stress at the end of the plate, and
- (iii) Drag force on one side of the plate.

11. (a) An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take  $C_d = 0.98$ . [8]
- (b) With a neat sketch explain the working of a rotameter. [6]
- (c) What do you understand by the terms : [4]
- Major energy losses and Minor energy losses ?



*Or*

12. (a) An orifice meter having an inside diameter of 2.5 cm is located in a 8 cm pipe. Water is flowing through the line and the mercury manometer measures the differential pressure over the instrument. The leads are filled with water. When the manometer reading is 35 cm, what is the flow rate of water per minute ? [8]
- (b) Using Bernoulli's equation, derive an equation for the estimation of flow rate through venturimeter. [6]
- (c) Discuss priming and NPSH in operation of centrifugal pump. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-184**

**S.E. (Chemical) (First Semester) EXAMINATION, 2012**

**CHEMICAL ENGINEERING MATERIALS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.

(ii) Answers to the two sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Your answers will be valued as a whole.

(vi) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

### **SECTION I**

**1. (a)** Draw stress-strain curves for the following materials :

(i) Mild steel

(ii) Rubber

P.T.O.

(iii) Polymers

(iv) Soft metal

(v) Aluminium. [10]

(b) Explain necking in brief. [6]

*Or*

2. (a) Define Poisson's ratio and its applications. [6]

(b) Define the term 'Resilience' and Modulus of Resilience. [6]

(c) Define factors of safety and give its applications. [4]

3. Give in detail the classification of Hardness test and explain impact test and types of impact test. [16]

*Or*

4. (a) Explain Brinell Hardness Test in detail. [10]

(b) Explain the factors that affect fatigue life of Engineering Materials. [6]

5. (a) Draw Iron-Iron carbide equilibrium diagram and explain various reactions involved. [12]

(b) Write down the various applications of steels. [6]

*Or*

6. (a) Give the classification of steels with examples. [10]  
(b) Discuss various methods of welding. [8]

## SECTION II

7. (a) Define corrosion and explain in detail its any *two* types. [12]  
(b) Write a short note on factor affecting corrosion. [6]

*Or*

8. (a) Give the methods for prevention of corrosion. [8]  
(b) Write short notes on :  
(i) Dry corrosion  
(ii) Wet corrosion. [10]

9. Write short notes on :  
(i) Vulcanization of rubber  
(ii) Teflon in engineering  
(iii) Applications of polymers  
(iv) Nylon-6. [16]

*Or*

- 10.** (a) Define polymers. Explain different applications of polymers. [6]  
(b) Define polymerization and explain its types. [10]
- 11.** (a) Define ceramic materials and write the applications of ceramic materials. [8]  
(b) Write a short note on vitrification process. [6]  
(c) Give the applications of ceramics. [2]

*Or*

- 12.** (a) Define the Glass material and its types. [8]  
(b) Write short notes on :  
(i) Refractories  
(ii) Clays. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-185**

**S.E. (Chemical) (First Semester) EXAMINATION, 2012**

**PROCESS CALCULATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answers to the two sections should be written in separate answer-books.

(ii) Draw neat sketches wherever necessary.

(iii) Use of logarithmic tables, calculator and steam table is permitted.

(iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) The diameter and height of a cylindrical storage tank are 5 m and 7 m respectively. It is used horizontally and filled up to 75% height with carbon tetrachloride, the density of which is  $1600 \text{ kg/m}^3$ . Find the mass in kilograms. [5]
- (b) Convert 98.3 kPa absolute in terms of bar, psi, mm Hg,  $\text{N/m}^2$ . [5]

P.T.O.

- (c) Carburetted water gas has the following composition by mole : Hydrogen 35%, Methane 15%, Ethylene 12%, Carbon dioxide 2%, Carbon monoxide 34% and Nitrogen 2%. The gas is available at NTP. Find the molar volume of the gas mixture. [6]

Or

2. (a) Nitric acid and water mixture contains 62.2 mole % water. Find the weight of nitric acid in 1000 kg of mixture. [3]
- (b) 17.2 gm of  $N_2O_4$  gas, when heated to  $100^\circ C$  at 725 mm Hg pressure undergoes 90% dissociation according to the reaction  $N_2O_4 \rightarrow NO_2$ . Calculate the volume occupied by the gas mixture. [9]
- (c) Make the following conversions :
- (i) 294 gm/lit  $H_2SO_4$  to Normality
- (ii) 5 N NaOH to gm/lit. [4]
3. (a) Soyabean seeds are extracted with *n*-hexane in batch extractors. The flaked seeds contain 18.6% oil, 69.0% solids and 12.4% moisture. At the end of the extraction process, de-oiled cake (DOC) is separated from the *n*-hexane-oil mixture. 96.0% of oil is recovered. If DOC contains 11.5% moisture, determine the % of oil in DOC. [6]
- (b) The average molar mass of a flue gas sample is calculated by two different engineers. One engineer use the correct molar mass of 28 for  $N_2$  and determines the average molar mass

to be 30.08, the other engineer, using an incorrect value of 14, calculate the average molar mass to be 18.74.

(i) Calculate the volume % of  $N_2$  in the flue gases.

(ii) If the remaining components of the flue gases are  $CO_2$  and  $O_2$ .

Calculate the volume percentage of each of them. [10]

*Or*

4. (a) Mixed acid is prepared by blending :

(i) 125 kg, spent acid containing 11.3%  $HNO_3$ , 44.4%  $H_2SO_4$  and 44.3%  $H_2O$

(ii) 475 kg, aqueous 92%  $HNO_3$  and

(iii) 900 kg, aqueous 97%  $H_2SO_4$ .

All percentages are by mass. Calculate the quantity and composition of the mixed acid. [8]

(b) The feed to an absorption column consists of 20%  $H_2S$  and the balance inert. Only  $H_2S$  is removed from the gas by absorbing in an alkaline solution. The gas enters the absorber at 600 kPa and 310 K and leaves at 500 kPa and 290 K containing 2%  $H_2S$ . If  $H_2S$  is removed at the rate of 100 kg/hr, calculate the volume of gas (in  $m^3/hr$ ) entering and leaving the absorption column. [8]



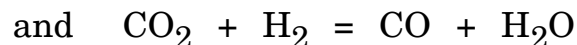
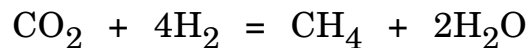
5. Pure sulphur is burnt in a burner at the rate of 0.3 kg/sec. Fresh dry air is supplied at 303 K and 100 kPa. The gases from the burner contain 16.5% SO<sub>2</sub>, 3.5% O<sub>2</sub> and rest N<sub>2</sub> on SO<sub>3</sub>-free volume basis. The gases leave the burner at 1073 K and 101.3 kPa absolute. Calculate :

- (a) the fraction of sulphur burnt into SO<sub>3</sub>
- (b) the percentage excess air over the amount required to oxidise the sulphur to SO<sub>2</sub> and
- (c) the volume of dry air in m<sup>3</sup>/sec. [18]

*Or*

6. A mixture of pure carbon dioxide and hydrogen is passed over a nickel catalyst. The temperature of the catalyst bed is 588 K and the reactor pressure is 2 MPa g. The analysis of the gases leaving the reactor showed CO 57.1%, H<sub>2</sub> 41.1%, CH<sub>4</sub> 1.68% and CO 0.12% (by volume) on a dry basis.

The reactions taking place in the reactor are :



Find :

- (a) the conversion of CO<sub>2</sub> per pass
- (b) yield of CH<sub>4</sub> in terms of CO<sub>2</sub> reacted and
- (c) the composition of the feed. [18]

## SECTION II

7. (a) Hot hydrocarbon liquid, flowing at the rate of 1.50 kg/sec is cooled from 425 K to 240 K using cooling water flowing at the rate of 16.60 kg/min. If the cooling water enters the heat exchanger at 294 K, calculate the outlet temperature. The heat capacity of hydrocarbon can be taken as 2510 J/kgK. [6]
- (b) Calculate the standard heat of reaction at 298.15 K when gaseous ammonia is dissolved in water to form 2% by weight of solution.

Given Data :

Component	Std Heat of Formation kJ/mol	
NH <sub>3</sub> (g)	-49.95	
NH <sub>4</sub> OH (l)	-361.20	
H <sub>2</sub> O (l)	-285.85	[6]

(c) Define :

(i) Heat of Reaction and

(ii) Adiabatic Reaction Temperature. [4]

*Or*

8. Chlorobenzene is nitrated using a mixture of nitric acid and sulphuric acid. During pilot plant studies, a charge consisted of 110 kg chlorobenzene (CB), 106 kg (65.5% by mass) nitric acid, and 108 kg 93.6% (by mass) sulphuric acid.

After 2 hrs of operation the final mixture was analyzed. It was found that the final product contained 2% unreacted chlorobenzene. Also the product distribution was found to be 66% *p*-nitrochlorobenzene, (*p*-NCB) and 34% *o*-nitrochlorobenzene (*o*-NCB). Calculate the analysis of charge, the percentage conversion of chlorobenzene and the composition of the product mixture. [16]

9. (a) The dry bulb temperature and dew point of ambient air were found to be 302 K and 291 K respectively. The barometer reads 100 kPa.

Compute :

(i) the absolute molar humidity

(ii) the % RH

(iii) the % saturation

(iv) the humid heat and

(v) the humid volume. [10]

- (b) Define the following terms :

(i) Wet bulb temperature

(ii) Relative humidity

(iii) Absolute humidity

(iv) Dew point. [8]

Or

10. (a) A solution of ethyl alcohol containing 9.6% alcohol is fed at the rate of 1500 kg/hr to a continuous distillation column. The top product (distillate) contains 95.5% alcohol. The bottom product (waste) from the column carries 0.1% of alcohol. All percentages are by mass. Calculate the mass flow rates of top and bottom products in kg/hr and the percentage loss of alcohol. [10]

(b) A crystallizer is charged with 10000 kg of an aqueous solution at 377 K, 30% by mass of which is anhydrous sodium sulphate. The solution is cooled. During the cooling operation 5% of the initial water is lost by evaporation. As a result, crystals of  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  crystallize out. The mother liquor is found to contain 18.5% (by mass) anhydrous  $\text{Na}_2\text{SO}_4$ .

Calculate the yield of crystals and the quantity of mother liquor. [8]

11. Explain briefly :

(a) Types of fuels. Calorific values of fuels.

(b) Tests for Proximate Analysis.

(c) Calorific values of fuels.

(d) Adiabatic Flame Temperature. [16]

*Or*

- 12.** (a) 100 kg/hr of coke containing 90% carbon and 10% ash (by wt.) is burnt with 30% excess air. 95% of the carbon is burnt, out of which 98% is burnt to carbon dioxide and rest to carbon monoxide. Determine flue gas composition. [8]
- (b) The Orsat analysis of the flue gases from a boiler house chimney gives contain 11.4% CO<sub>2</sub>, 4.2% O<sub>2</sub>, and 84.4% N<sub>2</sub> on mole basis. Assuming that the complete combustion has taken place :
- (i) Calculate the % excess air used
- (ii) Find the carbon : hydrogen ratio in the fuel. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8

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**[4162]-186**

**S.E. (Chemical) (II Sem.) EXAMINATION, 2012**

**CHEMISTRY—II**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain adsorption theory for heterogenous catalysis. [6]
- (b) Give the mechanism of metal coordination compound catalysed reactions :
- (i) In Wacker process
  - (ii) Photolysis of water. [6]

P.T.O.

- (c) Define activation energy. Give the Arrhenius equation and state its meaning. [6]

*Or*

2. (a) Explain the role of metal complex catalyst with the help of any *two* examples. [6]
- (b) Give the B.E.T. theory of multilayer adsorption. [6]
- (c) Give a note on "Catalysis by enzymes". [6]
3. (a) What is peptide bond ? Describe briefly the parallel and antiparallel  $\beta$ -sheets of proteins. [6]
- (b) Write a short note on oxidation of carbohydrates by :
- (i) Fehling and Tollen's reagents
- (ii) Nitric acid. [6]
- (c) What is the effect of the following factors on the enzyme activity ?
- (i) Concentration of substrate
- (ii) Effect of temperature. [4]

*Or*

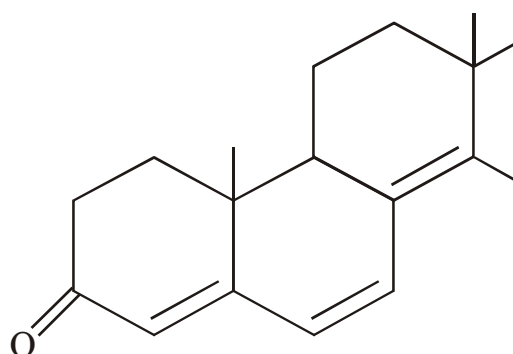
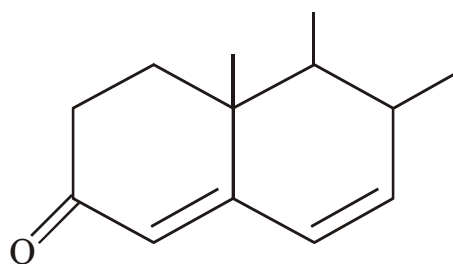
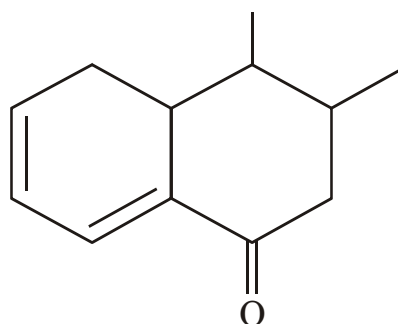
4. (a) What happens when glucose is treated with the following :
- (i) Bromine water
- (ii) Sodium borohydride
- (iii) Phenyl hydrazine. [6]

(b) What is a Zwitterion ? Describe in general the classification of amino acids. [6]

(c) What are vitamins and hormones ? What are the types of vitamins and hormones ? Give examples. [4]

5. (a) State Lambert and Beer's law and derive the combined law equation. [6]

(b) The following polyenes have  $\lambda_{\max}$  at 284 m $\mu$ , 315 m $\mu$  and 348 m $\mu$  in ethanol, which is which ? [6]



(c) Give the various applications of UV spectroscopy. [4]



Or

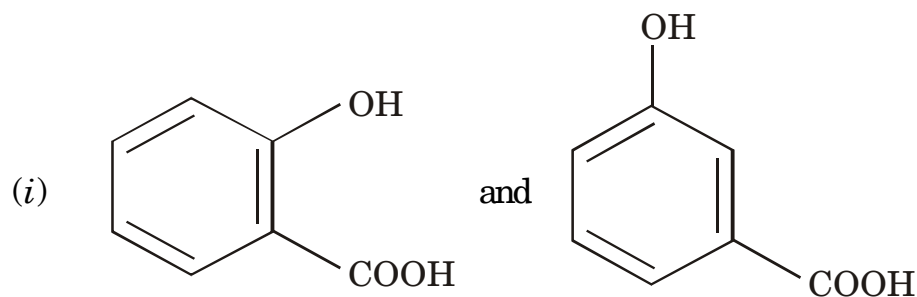
6. (a) Define and explain the following terms :

(i) Auxochrome

(ii) Bathochromic shift

(iii) Hypsochromic shift. [6]

(b) How will you differentiate between the following pairs of compounds using I.R. spectroscopy ? [6]



(ii)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$  and  $\text{CH}_3\text{CH}_2\text{COOCH}_3$

(iii)  and

The structure is 3-buten-1-ol, showing a four-carbon chain with a double bond between the second and third carbons, and a hydroxyl group (-OH) attached to the first carbon.

(c) Explain the 'Fingerprint' and 'functional group' regions in IR spectra of organic molecules. [4]

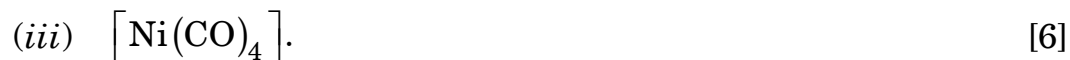
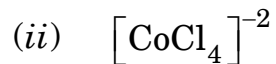
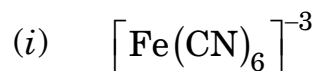
## SECTION II

7. (a) Explain giving reasons why :

(i) Most of the transition metals are paramagnetic.

(ii) All transition metals exhibit variable valency. [6]

(b) Calculate E.A.N. of the following complex :



(c) With the help of V.B.T., explain the diamagnetic nature of

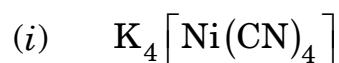


*Or*

8. (a) Give a brief account of C.F.T. with reference to an octahedral complex in strong and weak ligand field. [6]

(b) Calculate C.F.S.E. for the octahedral complex containing  $d^5$ ,  $d^6$ ,  $d^7$  electrons in high spin state. [6]

(c) Using I.U.P.A.C. nomenclature, name the following complexes :



9. (a) Explain any *three* principles of green Chemistry from the following :

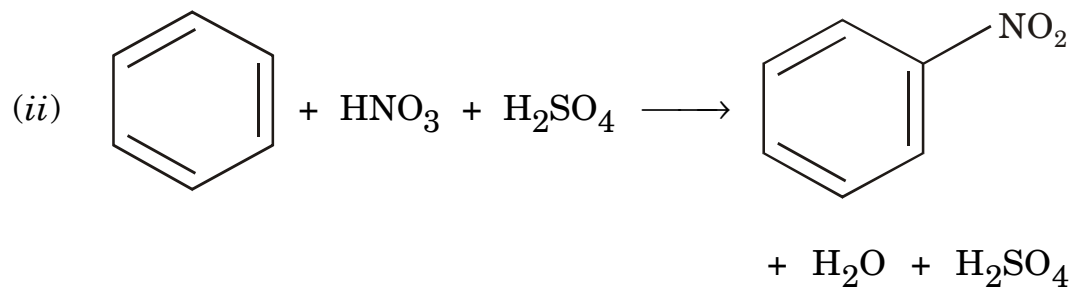
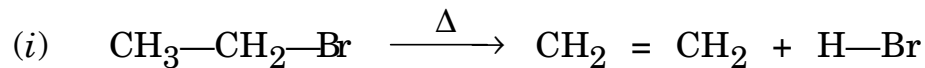
(i) Prevention of waste

(ii) Design for energy efficiency

(iii) Use of renewable feed stock

(iv) Catalysis. [6]

(b) Calculate atom economy and environmental load factor for the following reactions :



(Atomic weight of H = 1, C = 12, N = 14, O = 16, S = 32, Br = 80) [4]

(c) Give the traditional and greener routes for the synthesis of :

(i) Indigo dye

(ii) Polycarbonate. [6]

Or

10. (a) Explain any *three* types of fermentation from the following :

(i) Solid state fermentation

(ii) Submerged fermentation

(iii) Immobilized cell bioreactor fermentation

(iv) Immobilized enzyme bioreactor fermentation. [6]

- (b) Explain chemical synthesis of the following through biotechnology :
- (i) Ethanol synthesis
  - (ii) *n*-Butanol synthesis. [6]
- (c) Explain the term bioremediation in brief. [4]
- 11.** (a) Write a note on biochemical oxygen demand. Deduce an expression for the first stage B.O.D. [6]
- (b) Explain with sketch the application of reverse osmosis process in industrial water purification. State its advantages and limitations. [6]
- (c) Explain the terms :
- (i) Disposal of hazardous waste
  - (ii) Electrodialysis. [6]

*Or*

- 12.** (a) A 5 days B.O.D. at 30°C of a waste water sample is 440 mg/lit. Calculate its 5 days B.O.D. at 20°C. Take reaction constant at 20°C  $K_0 = 0.1$  per day. [6]

- (b) What are the sources of waste water generation in textile industry ? Explain the treatment of textile industry waste water with flow sheet. [6]
- (c) Comment on or give reasons :
- (i) Biological methods for the treatment of waste water are effective and economical.
- (ii) Waste minimization and waste recycling are the indeed steps in industrial waste water management. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—7

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[4162]-187

**S.E. (Chemical) (Second Semester) EXAMINATION, 2012**

**HEAT TRANSFER**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of logarithmic table slide rule, Millier charts, electronic pocket calculator and steam tables is allowed.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Give significance of Reynolds number and Nusselt Number. [4]  
(b) Explain Rayleigh's method of dimensional analysis. [6]  
(c) By dimensional analysis derive the following relationship for free convection heat transfer process

$$\text{Nu} = C[\text{Gr}^a \text{Pr}^b]$$

P.T.O.

where

$Nu$  = Nusselt number

$Gr$  = Grashoff number

$Pr$  = Prandtl number

$a$ ,  $b$  and  $c$  are numerical constants. [8]

*Or*

- 2.** (a) State and explain :
- (i) Fourier law of heat conduction
  - (ii) Newton's law of cooling
  - (iii) Stefan-Boltzmann's law of radiation. [9]
- (b) Explain 'Buckingham's  $\pi$  theorem for dimensional analysis. [6]
- (c) Explain in detail 'Modes of heat transfer'. [3]
- 3.** (a) Derive the relation for steady state conduction through composite (concentric) cylinder bounded by fluids at different temperatures. [8]
- (b) Calculate the critical radius of insulation for asbestos ( $K = 0.17 \text{ W/m}^\circ\text{K}$ ) surroundings a pipe and exposed to room air at  $20^\circ\text{C}$  with  $h = 3.0 \text{ W/m}^2\text{k}$ . Calculate to heat loss from a  $200^\circ\text{C}$ , 5.0 cm diameter pipe when covered with the critical radius of insulation. [8]

*Or*

4. (a) An aluminium rod 25 mm in diameter and 100 mm long protrudes from a wall which is maintained at 250°C into the environment maintained at 15°C.

Estimate the heat loss by rod assuming that the rod end is insulated.

Data :

$k$  for aluminium = 200 W/(m°k)

$h$  between rod surface and environment = 15 W/m<sup>2</sup>°K. [8]

- (b) What are fins ? Draw neat diagrams of four different types of fins ? [5]
- (c) What is thermal conductivity ? Discuss the mechanism of thermal conduction in gases and solids ? [3]

5. Write short notes :

- (i) Heat transfer in agitated vessels
- (ii) Variable thermal conductivity
- (iii) Pool boiling
- (iv) Individual and overall heat transfer coefficient. [16]

*Or*

6. (a) A tube of outside diameter 7.6 cm and thickness 2.6 mm covered with an insulation material of thickness 1.8 cm. A hot gas



at temperature  $320^{\circ}\text{C}$  with a heat transfer coefficient  $100\text{ W/m}^2\text{K}$  flows inside the tube. The outer surface of insulation is exposed to air at  $20^{\circ}\text{C}$  with heat transfer coefficient of  $30\text{ W/m}^2\text{K}$ . Thermal conductivity of insulating material is  $0.2\text{ W/mK}$ . Calculate :

- (i) The rate of heat loss per meter of pipe to air
  - (ii) The temperature of the interface between metal wall and the insulation. [8]
- (b) Derive expression for temperature profile and heat flow for straight rectangular fin of uniform cross-section. [8]

## SECTION II

7. (a) Explain 'Weins Displacement Law'. [4]
- (b) State and explain 'Kirchhoffs Law'. [4]
- (c) Two very large parallel planes with emissivities 0.8 and 0.7 exchange the heat. Estimate the percent reduction in heat transfer when a polished aluminium radiation shield with emissivity 0.03, is placed between them. [8]

*Or*

8. (a) Explain specular and diffuse reflection. [4]
- (b) Write short notes on :
- (i) Emissive power and emissivity
  - (ii) Shape factor. [4]

- (c) Calculate the heat flux emitted due to thermal radiation from a black surface at  $5700^{\circ}\text{C}$ . At what wavelength is the monochromatic emissive power maximum ? [ $\sigma = 5.67 \times 10^{-8} \text{ W/m}^2\text{K}^4$ ]
- [6]
- (d) Explain concept of an artificial black body. [2]
9. (a) Explain tripple effect evaporator with forward feed arrangement. [6]
- (b) A shell and tube heat exchanger is to be provided with tubes 4 m long, 3.1 cm O.D. and 2.7 cm I.D. the heat exchanger is required for heating water from  $22^{\circ}\text{C}$  to  $45^{\circ}\text{C}$  with the help of condensing steam at  $100^{\circ}\text{C}$  on the outside of tubes. Calculate the number of tubes required if the water flow rate through tubes is 10 kg/S and heat transfer coefficients on vapour and water sides are 5500 and 850  $\text{W/m}^2\text{K}$  respectively. Neglect all other resistances. Assume  $C_p$  water = 4186  $\text{J/kgK}$ . Also, calculate the rate of steam consumption if latent heat is 2200  $\text{kJ/kg}$ . [10]
- (c) Draw shell and tube heat exchanges and show different parts. [2]

*Or*

10. (a) 20 kg/s of water at 360 K entering a heat exchanger is to be cooled at 340 K by using cold water at 300 K, flowing at a rate of 25 kg/s. If the overall heat transfer coefficient is 1500 W/m<sup>2</sup>K. Calculate the heat transfer area required in :
- (i) Co-current flow concentric pipe heat exchanger and
  - (ii) Counter-current flow concentric pipe heat exchanger. [10]
- (b) Derive equation for log mean temperature difference for co-current flow double pipe heat exchanger. [6]
- (c) Draw neat sketch of double pipe heat exchanger and show different parts. [2]
11. (a) An evaporator is to be fed with 5000 kg/hr. of solution containing 10% solute by weight. The feed at 40°C is concentrated to a solution containing 40% by weight of solute under atmospheric pressure. Steam is available at an absolute pressure 3 atmosphere. (The saturation temperature of 134°C). The heat transfer coefficient is 1500 kcal/hr.m<sup>2</sup>°C. Calculate :
- (i) The heat transfer area that should be provided
  - (ii) The steam requirement.

Treat the solution as per pure water for enthalpy calculators.

Data :

Temperature (°C)		40	100	134
Enthalpy	Vapour	613.5	639.2	651.4
(kcal/kg)	Liquid	40.5	100	134.4

(b) Explain with diagram 'Calendria type evaporator'. [8]

*Or*

**12.** Write short notes :

(a) Applications of heat exchanger in dairy industry

(b) Vapour recompression in evaporators

(c) Radiosity

(d) NTU-effectiveness method for heat exchanger. [16]

Total No. of Questions—12]

[Total No. of Printed Pages—8+4

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**[4162]-188**

**S.E. (Chemical) (Second Semester) EXAMINATION, 2012**

**PRINCIPLES OF DESIGN**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer any *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Define :**

- (i) Young's modulus of elasticity
- (ii) Bulk modulus of elasticity
- (iii) Rigidity modulus of elasticity
- (iv) Poisson's ratio
- (v) Elasticity
- (vi) Factor of safety.

[6]

P.T.O.

(b) A bar of 2 m length, 20 mm width and 15 mm thickness is subjected to a tensile load of 30 kN. Find change in length, width, thickness and volume of the bar.

Take  $E = 2 \times 10^5 \text{ N/mm}^2$ ,  $\mu = 0.25$ . [6]

(c) A force of 30 kN is required to punch a circular hole of 14 mm diameter in a metal plate of 2 mm thickness. Calculate shear stress induced in the metal plate and compressive stress induced in the punching rod. [6]

*Or*

2. (a) Sketch stress-strain curve for ductile materials and define the following terms :

(i) Proportionality limit

(ii) Elastic limit

(iii) Yield stress

(iv) Ultimate stress

(v) Breaking stress.

Show these stresses on the curve. [6]

- (b) A steel punch can be worked to a compressive stress of 800 MPa. Find the least diameter of the hole which can be punched through a steel plate 10 mm thick if its ultimate shear strength is 300 MPa. [6]
- (c) A metal bar 30 mm in diameter is subjected to a pull of 50 kN. For the gauge length of 100 mm the extension was found to be 0.045 mm and change in diameter was 0.004 mm. Find the values of elastic constants E, G, K and  $\mu$  of the material of the bar. [6]
- 3.** (a) At a point in a strained material, the principal stresses are 100 MPa and 50 MPa (both tensile). Find the normal, tangential and resultant stress intensities on a plane inclined at  $60^\circ$  to the direction of major principal stress. [6]
- (b) Draw S.F.D. and B.M.D. for the beam shown in Fig. 1 below. Find maximum B.M. values and point of contraflexure if any. [10]

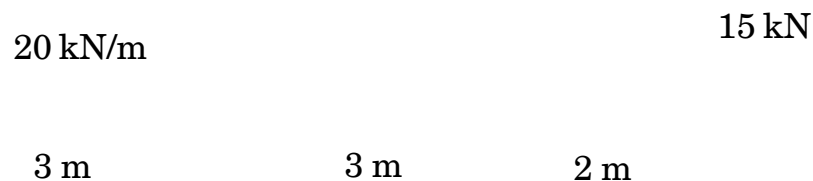


Fig. 1

*Or*

4. (a) A simply supported beam of length 4 m carries u.d.l. of 10 kN/m over entire length. The beam has hollow cross-section having 100 mm  $\times$  100 mm outside and 80 mm  $\times$  80 mm inside. Find maximum bending stress in tension and compression along with their positions in the sections. [6]
- (b) A beam has rectangular cross-section 100 mm  $\times$  200 mm, which is subjected to a shear force of 50 kN. Find maximum shear stress induced in the section. Also find shear stress induced at 50 mm from the N.A. Sketch shear stress distribution diagram over the cross-section. [6]
- (c) A solid shaft having 60 mm diameter is subjected to torque of 8 kN-m. Find maximum shear stress induced in the shaft section. If shaft runs at 200 r.p.m., find the power transmitted by the shaft. [4]
5. (a) A line shaft is supported in the bearings 4 m apart. A 1 m diameter pulley is mounted on the shaft at midspan,



which carries belt having tight and slack side tensions 5 kN and 2 kN respectively. Find :

- (i) Torque transmitted by shaft
- (ii) Power transmitted by shaft if it rotates at 300 r.p.m.
- (iii) Maximum bending moment along the shaft.
- (iv) Equivalent bending moment ( $M_e$ ).
- (v) Equivalent twisting moment ( $T_e$ ).
- (vi) Diameter of the shaft based on both  $M_e$  and  $T_e$  if maximum permissible stresses are 40 MPa in shear and 80 MPa in tension/compression. [10]

- (b) Design a rectangular sunk key for a 60 mm diameter shaft transmitting 20 kW power at 200 r.p.m., using standard proportions. With these dimensions of the key, calculate shear stress and crushing stress induced in the key. If the limiting strength of the key in shearing and crushing are 40 MPa and 80 MPa respectively, check safety of the key in shear and crushing. [6]

*Or*

**6.** (a) A split muff coupling is used to connect two shafts which transmit 30 kW power at 300 r.p.m. The ultimate stresses for the material of shaft and key in shear and crushing are 120 MPa and 240 MPa with F.S. = 3, while the ultimate shear stress for material of the coupling is 60 MPa with F.S. = 4. Six bolts are used to connect two halves of the couplings. The material of the bolt has permissible tensile stress of 60 MPa. The coefficient of friction between shaft surface and muff is 0.28. Find :

(i) Torque transmitted.

(ii) Diameter of shaft.

(iii) Diameter and length of sleeve using standard proportions.

Calculate normal and shear stress induced and check safety.

(iv) Dimensions of key using standard proportions calculate shear and crushing stresses induced and check safety.

(v) Root diameter of bolt.

[10]

- (b) With neat sketch explain construction and applications of bushed-pin type flexible coupling. [6]

## SECTION II

7. (a) A V-belt drive is used to run a compressor at 40 kW, 400 r.p.m. The groove angle of pulley is  $40^\circ$  and angle of lap of belt on the pulley is  $160^\circ$ . If each belt has cross-sectional area  $200 \text{ mm}^2$  and density  $1000 \text{ kg/m}^3$  with allowable tensile stress 2 MPa, find number of belts required. Take  $\mu = 0.28$ . [8]
- (b) A journal bearing is used for a centrifugal pump running at 1440 r.p.m. The diameter of the journal is 100 mm and load on each bearing is 20 kN. The bearing is running at  $70^\circ\text{C}$  and the atmospheric temperature is  $30^\circ\text{C}$ .

Data —

Energy dissipation coefficient =  $875 \text{ W/m}^2\text{-}^\circ\text{C}$

$$\frac{c}{d} = 0.0018, \quad \frac{ZN}{p} = 28, \quad K = 0.002$$

$$\frac{l}{d} = 1.5, \quad P_{\max} = 1.5 \text{ N/mm}^2,$$

$$(\Delta t)_{\text{coolant}} = 10^\circ\text{C}, \quad Z = 0.009 \text{ kg-m/s.}$$

Find :

- (i) Length of bearing.
- (ii) Actual bearing pressure.
- (iii) Operating value of  $ZN/p$ .
- (iv) Minimum value of  $ZN/p$  at which oil film breaks.
- (v) Coefficient of friction.
- (vi) Heat generated in the bearings.
- (vii) Heat dissipated in the bearings.
- (viii) Mass of lubricating oil required. [8]

*Or*

8. (a) A leather belt weighing 1.5 kg/m is used to drive a cast iron pulley 600 mm in diameter at 300 r.p.m. The angle of contact of belt on the pulley is  $150^\circ$  and maximum tension in belt is limited to 4 kN.

Find :

- (i) Linear velocity of the belt
- (ii) Centrifugal tension in the belt
- (iii) Tensions on tight and slack side of the belt
- (iv) Power transmitted by the belt. [8]

- (b) A ball bearing subjected to a radial load of 4 kN is expected to have life of 10,000 hours at 1440 r.p.m. with a reliability of 95%. Calculate the dynamic load capacity of the ball bearing so that it can be selected from the catalogue based on 90% reliability.

Take  $b = 1.17$ . [8]

9. (a) Sketch and explain construction, applications of the following pipe joints :

(i) Socket joint

(ii) Nipple joint

(iii) Union joint

(iv) Socket and spigot joint. [8]

- (b) A plate 60 mm wide and 15 mm thick is joined with another plate by a single transverse weld and a double parallel fillet weld as shown in Fig. 2. If maximum tensile and shear stress in weld are 80 MPa and 60 MPa respectively, find :

(i) Maximum tensile load which plates can withstand.

- (ii) Effective length of transverse weld
- (iii) Loads carried by transverse and parallel fillet welds
- (iv) Length of each parallel fillet weld. [8]



Fig. 2

*Or*

10. (a) With neat sketch explain construction and applications of Knuckle joint. [8]
- (b) A seamless steel pipe carries  $1000 \text{ m}^3$  of steam per hour at a pressure of  $1.5 \text{ N/mm}^2$  with velocity of  $25 \text{ m/s}$ . Find :
- (i) The inner pipe diameter and wall thickness of pipe if tensile stress in the material of pipe is  $40 \text{ MPa}$  and take  $C = 9 \text{ mm}$ .

(ii) The dimensions of a circular flanged pipe joint (flange thickness, flange width, flange OD, nominal bolt diameter, number of bolts, pcd of bolts). [8]

11. (a) A cast iron pipe has 200 mm inner diameter and thickness of 40 mm which is subjected to internal pressure of 3 N/mm<sup>2</sup>. Calculate the tangential and radial stresses at :

(i) the inner pipe surface

(ii) the middle pipe surface

(iii) the outer pipe surface. [8]

(b) With neat sketch explain construction and applications of

(i) Gate valve

(ii) Butterfly valve. [10]

*Or*

12. (a) A thick pipe of 200 mm inner diameter carries fluid at a pressure of 10 MPa. Determine :

(i) Thickness of pipe using Lame's equation.

(ii) Thickness of pipe using maximum shear stress equation,  
if permissible shear stress in the material is 9 MPa.

(iii) State whether pipe can carry the pressure of 10 MPa  
safely. If not, state the safe maximum fluid pressure  
that pipe can withstand. [8]

(b) With neat sketch explain construction and working of

(i) Spur gear pumps

(ii) Internal gear pumps. [10]



Total No. of Questions—12]

[Total No. of Printed Pages—7

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[4162]-189

**S.E. (Chemical Engineering) (Second Semester) EXAMINATION, 2012**

**THERMODYNAMICS-I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) A steel casting is in thermal equilibrium with a copper casting. The composite system of steel and copper casting undergoes adiabatic change. Show that under adiabatic conditions heat lost by one casting is equal to heat gained by the other casting if no work is exchanged between two castings. [8]

P.T.O.

- (b) A spherical balloon of diameter 0.5 m contains a gas at 1 bar and 300K. The gas is heated and the balloon is allowed to expand. The pressure inside the balloon is directly proportional to the square of the diameter. What would be the work done by the gas when the pressure inside reaches 5 bar ? [8]

*Or*

2. (a) An elevator with a mass of 2500 kg rests at a level 10 m above the base of an elevator shaft. It is raised to 100 m above the base of the shaft, where the cable holding it breaks. The elevator falls freely to the base of the shaft and strikes a strong spring. The spring is designed to bring elevator to rest and by means of a catch arrangement to hold the elevator at the position of maximum spring compression. Assuming the entire process to be frictionless and taking  $g = 9.8 \text{ m/s}^2$ , calculate :
- (i) Potential energy of elevator in its initial position;
  - (ii) The work done in raising the elevator;
  - (iii) The potential energy of elevator in its highest position relative to the base of shaft;
  - (iv) The velocity and kinetic energy of the elevator just before it strikes the spring;
  - (v) The potential energy of compressed spring. [10]

- (b) Explain :
- (i) Intensive and extensive properties;
  - (ii) Steady state and equilibrium state. [6]

3. (a) An ideal gas undergoes the following sequence of mechanically reversible processes in a closed system : [12]

- (i) From an initial state of 343K and 1 bar, it is compressed adiabatically to 423 K;
  - (ii) It is then cooled from 423 K to 343 K at constant pressure;
  - (iii) Finally it is expanded isothermally to its original state.
- Calculate W, Q,  $\Delta E$  and  $\Delta H$  for each process and for the entire cycle.

Take  $C_v = (\frac{3}{2})R$ ,  $C_p = (\frac{5}{2})R$ .

- (b) Explain PV diagram for a pure substance. [6]

*Or*

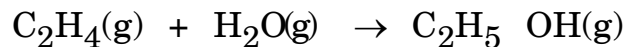
4. An ideal gas is changed from  $P_1 = 1$  bar and  $V_1 = 12$  m<sup>3</sup> to  $P_2 = 12$  bar and  $V_2 = 1$  m<sup>3</sup> by the following mechanically reversible processes :

- (a) Isothermal compression;
- (b) Adiabatic compression followed by cooling at constant pressure;
- (c) Adiabatic compression followed by cooling at constant volume.
- (d) Heating at constant volume followed by cooling at constant pressure.

Calculate Q, W,  $\Delta E$  and  $\Delta H$  for each of these processes and sketch the paths of all processes on a single PV diagram.

Take  $C_p = (5/2)R$  and  $C_v = (3/2)R$ . [18]

5. (a) Dry methane is burned with dry air. Both are at 25°C initially. The flame temperature is 1300°C. If the complete combustion is assumed, how much excess air is being used? The reaction is  $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O}$ . The standard heat of reaction is  $-8.028 \times 10^5$  J/mol of methane reacted. Mean molal specific heats of gases between 25°C and 1300°C are (J/mol.K)  $\text{CO}_2 = 51.66$ ,  $\text{H}_2\text{O} = 40.45$ ,  $\text{O}_2 = 34.01$ ,  $\text{N}_2 = 32.21$ . [8]
- (b) It is required to calculate the standard enthalpy change of the reaction :



at several temperatures. For this purpose develop a general expression to calculate  $\Delta H^\circ_T$  as a function of temperature. Standard heat of reaction at 298 K is  $-44.337$  kJ.

Use the following data :

Compound	$a$	$b \times 10^3$	$c \times 10^6$	
$\text{C}_2\text{H}_4$	4.196	154.565	-81.076	
$\text{H}_2\text{O}$	28.850	12.055	—	
$\text{C}_2\text{H}_5\text{OH}$	20.691	205.346	-99.793	[8]

Or

6. (a) Calculate the heat of the following gas phase reaction :



if the reactants are at 473 K and the product is at 993 K. The specific heat  $C_p = \alpha + \beta T + \gamma T^2$  J/mol.K may be evaluated using the data given below :

	$\alpha$	$\beta$	$\gamma$
H <sub>2</sub>	29.09	$- 8.374 \times 10^{-4}$	$2.0139 \times 10^{-6}$
O <sub>2</sub>	25.74	$12.987 \times 10^{-3}$	$- 3.864 \times 10^{-6}$
H <sub>2</sub> O	30.38	$9.621 \times 10^{-3}$	$- 1.185 \times 10^{-6}$

- (b) Explain different methods for rough estimation of latent heats of vaporisation for pure liquids. [6]

### Section II

7. (a) A Carnot engine operates between temperature levels of 600 K and 300 K. It drives a Carnot refrigerator, which provides cooling at 250 K and discards heat at 300 K. Determine a numerical value for the ratio of heat extracted by the refrigerator (cooling load) to the heat delivered to the engine (heating load). [9]
- (b) Write a note on Clausius inequality. [7]

Or

8. (a) A steel casting of mass 10 kg at 800°C is quenched in 100 kg water at 30°C in an insulated container. The heat capacities of steel and water are 0.461 and 4.23 kJ/kg.K respectively. Calculate the change in entropy of steel and water. [7]

(b) Air an ideal gas with  $\gamma = 1.4$ , enters an adiabatic compressor at 25°C and 0.1 MPa and leaves at 1 MPa and 330°C. Calculate the isentropic efficiency of the compressor. [9]

9. (a) Discuss residual properties. [8]

(b) Show that :

$$dH = C_v dT + \left[ V dP - T \frac{(\partial V / \partial T)_P}{(\partial V / \partial P)_T} dV \right] \quad [8]$$

Or

10. (a) Derive Clausius-Clapeyron equation. [8]

(b) Prove that  $C_p - C_v = \frac{TV\beta^2}{K}$ . [8]

11. (a) In northern states of India, the ambient atmosphere temperature greatly varies from season to season leading to uncomfortable conditions for living. In summer the temperature rises to as high as 42°C and in winter it drops to as low as 0°C. An engineer designs a device which can be used as refrigerating unit in summer and as a heat pump in winter to maintain the temperature of 25°C inside the house in all seasons. The rate of energy losses as heat from the windows, walls and roof is estimated as 0.5 kW per degree Celsius temperature difference between the ambient atmosphere and the conditions inside the room. Estimate the minimum power required to operate the device in winter and in summer. [10]

- (b) With neat sketch explain the absorption refrigeration cycle. [8]

*Or*

- 12.** (a) In a vapor compression refrigeration system water is used as a refrigerant. Given that the evaporation temperature 277 K, the condensation temperature 307 K, efficiency of compressor 76% and the refrigeration rate = 1200 kW, determine the circulation rate of the refrigerant, the heat transfer rate in the condenser, the power requirement, the coefficient of performance of the cycle and the coefficient of performance of a Carnot refrigeration cycle operating between the same temperature levels. [14]
- (b) Write a note on heat pump. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-190**

**S.E. (Chemical Engg.) (Second Semester) EXAMINATION, 2012**

**MECHANICAL OPERATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer any *three* questions from Section I and any *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) A quartz mixture having analysis shown in table is screened through a standard 10 mesh screen. Calculate mass ratios of

P.T.O.



overflow and underflow of feed and overall effectiveness of screen : [16]

Mesh Number	Dp, mm	Mass Retained in Grams		
		Feed	Overflow	Underflow
4	4.699	0	0	—
6	3.327	25	49.7	—
8	2.362	125	251.3	0
10	1.651	320	294	58.5
14	1.168	260	84	115.5
20	0.833	155	15.4	75
28	0.589	55	7	24
35	0.417	20	—	9
65	0.218	20	—	6
Pan	—	20	—	12

(b) Give the advantages of wet grinding. [2]

*Or*

2. (a) Draw a neat sketch of a blake jaw crusher and explain its operation. [6]

(b) Explain the influence of different factors on the size of the product in ball mill. [6]

(c) Explain open circuit and close circuit grinding with its flow sheet. [6]

3. (a) Describe the working of belt conveyor with neat sketch and list advantages and disadvantages of belt conveyors. [8]
- (b) Explain with neat sketch construction of screw conveyor and its advantages and disadvantages. [8]

*Or*

4. (a) Describe in detail elements of pneumatic conveying systems. What are the merits and demerits of pneumatic conveyors ? [8]
- (b) Explain close pneumatic conveying system with its flow diagram. [8]
5. (a) Explain the necessity of mixing in chemical industries. [8]
- (b) With the help of neat sketch distinguish between axial flow and radial flow impellers. [8]

*Or*

6. (a) What are the various types of mixers used for paste and plastic materials ? Explain any *two* in brief. [8]
- (b) Write short notes on :
- (1) Mixing index
- (2) Sigma mixer. [8]

## SECTION II

7. (a) A sludge is filtered in a plate and frame press filtered with 25 mm frames. For the first 600 sec, the slurry pump runs at maximum capacity. During this period, the pressure rises to 415 kN/m<sup>2</sup> and 25% of the total filtrate is obtained. The filtration takes a further 3600 sec to complete at constant pressure and 900 secs is required for emptying and resetting the press. It is found that if the cloths are precoated with filter aid to a depth of 1.6 mm, the cloth resistance is reduced to 25% of its former value. What will be the increase in the overall throughput of the press if the precoat can be applied in 180 sec. ? [10]
- (b) Explain construction working and applications of rotary drum vacuum filter. [8]

*Or*

8. (a) Explain the operating cycle of centrifuge filter. [5]
- (b) What are the various factors which affect the rate of filtration ? Derive an expression to calculate the rate of filtration. [8]
- (c) What are filter aids ? How do they function ? [5]
9. (a) Describe with neat sketches and examples :
- (i) Aggregate fluidization
- (ii) Particulate fluidization. [8]

- (b) A slurry containing 5 kg of water/kg of solids is to be thickened to a sludge containing 1.5 kg of water/kg of solids in a continuous operation. Laboratory tests using five different concentrations of the slurry yielded the following data :

<b>Concentration</b> (kg water/kg solid)	<b>Rate of Sedimentation</b> (mm/s)
5.0	0.20
4.2	0.12
3.7	0.094
3.1	0.070
2.5	0.050

Calculate the minimum area of a thickener required to effect the separation of a flow of 1.33 kg/s of solids. [8]

*Or*

10. (a) What is minimum fluidization ? Derive an expression for minimum fluidization. [6]
- (b) Explain spouted bed with neat sketch. [6]
- (c) Distinguish between free settling and hindered settling. [4]
11. (a) Explain Jigging separation technique with neat diagram. [6]
- (b) Explain the construction and working of fabric filters. [6]
- (c) Explain capacity and effectiveness of screen. [4]

*Or*

**12. (a)** Describe 'Froth flotation cell'. [4]

(b) Write short notes on : [12]

(i) Cyclone separator

(ii) Gravity settling tank

(iii) Electrostatic precipitator.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-191**

**S.E. (Polymer/Petro/Petrochem Engg.) (I Sem.) EXAMINATION, 2012**

**ENGINEERING CHEMISTRY—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is hyperconjugation ? How does it influence the stability of primary, secondary and tertiary carbonium ions ? [6]
- (b) Describe the aromaticity exhibited by five membered heterocycles and annulenes. [6]

P.T.O.

- (c) Explain why : [6]
- (i)  $\alpha$ -chlorobutyric acid is a stronger acid than  $\gamma$ -chlorobutyric acid.
  - (ii) Picric acid is strongest acid.
  - (iii) Trichloroacetic acid is stronger than acetic acid.

*Or*

2. (a) Describe in brief the generation, stability and geometry of carbanions. [6]
- (b) Discuss inductive effect and its effects on the strength of various bases. [6]
- (c) Explain the following terms with suitable examples : [6]
- (i) Electrophile
  - (ii) Nucleophile
  - (iii) Conjugation.
3. (a) Discuss the reaction mechanism of addition of :
- (a) HI and
  - (b) HOCl to propene. [6]
- (b) Discuss the mechanism of the following reactions : [6]
- (i) Aldol condensation
  - (ii) Claisen condensation.
- (c) Explain why halogens are Ortho and Para directing. [4]

Or

4. (a) How will you convert benzene in the following : [6]
- (i) Benzene sulphonic acid
  - (ii) Nitrobenzene
  - (iii) Toluene
  - (iv) Bromobenzene.
- (b) Write the detailed mechanism of the following reactions : [6]
- (i) Ethyl iodide  $\xrightarrow[\text{KOH}]{\text{Alcoholic}}$  Ethylene
  - (ii) Tert. butyl alcohol  $\xrightarrow[\Delta]{15\% \text{H}_2\text{SO}_4}$  Isobutylene.
- (c) Give the mechanism of Beckmann reaction with suitable examples. [4]
5. (a) Draw the chair and boat conformation of cyclohexane pointing out the axial and equatorial bonds and explain their stability. [6]
- (b) Explain in short any *two* methods for the preparation of quinoline. [6]
- (c) Which of the following compounds shows geometrical isomerism ? Why ? [4]
- (i)  $\text{CH}_3\text{CH} = \text{C}(\text{CH}_3)_2$
  - (ii)  $\text{CH}_3\text{CH} = \text{CHCH}_3$ .



Or

6. (a) Discuss the electrophilic and nucleophilic substitution reaction of pyridine. [6]
- (b) Give reasons : [6]
- (i) The conformation of axial-*t*-butyl cyclohexane is practically nil.
- (ii) Eclipsed conformation of *n*-butane have higher energy than the staggered conformation.
- (c) Predict the products : [4]
- (i) Quinoline  $\xrightarrow[\text{KMnO}_4]{\text{Alkaline}}$  ?
- (ii) Pyrrole  $\xrightarrow[\text{KOH}]{\text{CHCl}_3}$  ?
- (iii) Furan  $\xrightarrow[\text{SnCl}_4]{\text{RCl}}$  ?
- (iv) Thiophene  $\xrightarrow[\text{AC}_2\text{O}]{\text{CH}_3\text{COONO}_2}$  ?

## SECTION II

7. (a) Derive kinetic gas equation. [7]
- (b) Explain the experimental method of determination of critical constant. [6]

- (c) If Trouton's constant for acetone is 91.63 and heat of vaporisation at B.P. is 30,250.30 J/mole, find B.P. of Acetone. Also find B.P. of acetone at 3.5 atm pressure.  
[R = 8.314 JK<sup>-1</sup> mol<sup>-1</sup>] [4]

*Or*

8. (a) Define :
- (i) Boiling point
  - (ii) melting point.
- Also explain the process of evaporation. [7]
- (b) State Boyle's law and Charle's law. Define them from kinetic gas equation. [6]
- (c) Find volume of 10 g of O<sub>2</sub> at 25°C and pressure of 650 mm (R = 0.0821 lit.-atm). [4]
9. (a) What is meant by galvanic cell ? Explain reversible and irreversible cells with proper example. [7]
- (b) Write a short note on fuel cell. [6]
- (c) Give applications of batteries in modern era. [4]

*Or*

10. (a) Give reaction for discharging and charging mechanism in lead acid battery. [7]

- (b) Write a note on Lithium ion rechargeable cell. [6]
- (c) What is need for storage of electrical energy ? [4]
- 11.** (a) What are colloids ? Discuss in brief *four* techniques for preparation of colloids. [6]
- (b) Explain experimental determination of osmotic pressure. [6]
- (c) Calculate osmotic pressure of 2.5% solution of cane sugar at 27°C (R = 0.082 lit. atm). [4]

*Or*

- 12.** (a) State Raoult's law. Derive relation between vapour pressure lowering and molecular wt. of solute. [6]
- (b) Explain any *three* characteristic properties of colloidal solutions. [6]
- (c) Calculate vapour pressure of solution containing 6.84 g cane sugar in 180 g of water at 100°C. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-192**

**S.E. (Poly/Petro.) (First Semester) EXAMINATION, 2012**  
**ENGINEERING MATERIALS SCIENCE AND TECHNOLOGY**  
**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer any *three* questions from Section I and any *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Use of electronic pocket calculator is allowed.
- (v) Figures to the right indicate full marks.

**SECTION I**

1. (a) Classify and explain engineering materials on the basis of their properties and structures. [8]
- (b) Explain three types of primary bonds in the materials. [8]

P.T.O.

*Or*

2. (i) What are polymorphic materials ? Explain the property change in materials due to change in its crystal structure. [8]
- (ii) What is glass transition temperature ? Explain its effect on non-crystalline materials. [8]
3. (a) Explain with an example 'Gibbs Phase Rule'. [8]
- (b) Explain in brief a eutectic, eutectoid and a peritectic reaction with the help of any phase equilibrium diagram. [8]

*Or*

4. (i) Differentiate between homogeneous and heterogeneous nucleation in the diffusional phase transformations in materials. [8]
- (ii) What is the difference in 'hardness' and 'hardenability' of a material ? Explain Jominy end quench test. [8]
5. Explain (any *three*) : [18]
- (a) Rockwell hardness test
- (b) Mobility of electrical charge carriers
- (c) Specular reflection of light beam
- (d) Hysteresis loop in hard and soft magnets.

Or

6. (i) Consider three cylindrical specimens each with a diameter of 10 mm and length of 1 m. One specimen is of aluminium ( $E = 70$  GPa), second specimen is alumina  $\text{Al}_2\text{O}_3$  ( $E = 380$  GPa) and the third specimen is polystyrene ( $E = 3.1$  GPa). A force of 2000 N is applied along the axis of each specimen. Assuming that the deformation is elastic, calculate the elongation in each specimen. [6]
- (b) A polycarbonate rod of 1 m length is heated from  $25^\circ\text{C}$  to  $125^\circ\text{C}$ , its length is increased due to heating by 6.6 mm. Calculate its linear coefficient of thermal expansion. [6]
- (c) An electric field is applied on an electron cloud in Ni (nickel) material. The following are the observations, the number of charge centres displaced per unit volume is  $2.68 \times 10^{30}$  e/m<sup>3</sup>; displacement between the poles is  $10^{-9}$  nm, electronic charge is  $1.6 \times 10^{-19}$  C/e. Calculate the polarization. [6]

## SECTION II

7. (a) Differentiate between the 'reinforcement' and 'matrix' materials in composites. [8]
- (b) What is fibre architecture ? With sketches explain different types of fibre arrangements. [8]

*Or*

8. (i) Suggest the suitable composites for the following applications and justify your selection (any *four*) : [12]

(1) Magnetic resonance imaging in medical field.

(2) Brake components

(3) Piston heads for automotive engines

(4) Sports goods

(5) Robotic arm.

(ii) What are aggregate composites ? Explain manufacturing and application of any *one* aggregate composite. [4]

9. (a) Discuss the similarities and differences between direct dissolution and electrochemical corrosion. [8]

(b) Explain different applications and ways in which environmental interactions can be beneficial if it is used as a part of a materials fabrication or processing operation. [8]

*Or*

10. (i) Discuss the Pilling Bedworth ratio for the oxidation of aluminium to aluminium oxide  $\text{Al}_2\text{O}_3$ . The density of aluminium is  $2.7 \text{ gm/cm}^3$  and that of  $\text{Al}_2\text{O}_3$  is  $3.7 \text{ gm/cm}^3$  (Atomic weight of Aluminium is 26.98). Comment on its oxide film. [6]

(ii) Define and explain the following terms (any *two*) : [10]

(1) Activation polarization

(2) Wear

(3) Sacrificial anode.

**11.** Explain the following materials processing methods with sketches (any *three*) : [18]

(a) Case hardening

(b) Deep drawing

(c) Chemical vapour deposition

(d) Sintering.

*Or*

**12.** Select proper processing technique for the following materials and explain the process (any *three*) : [18]

(1) Cylindrical parts from polymer matrix composites

(2) Fibres of polyacrylonitrile

(3) Joining of refractory metal alloys to ceramics

(4) Stainless steel glass for drinking water.



Total No. of Questions—12]

[Total No. of Printed Pages—7

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[4162]-193

**S.E. (Petrochemical/Petroleum/Polymer) (First Semester)**

**EXAMINATION, 2012**

**CHEMICAL PROCESS CALCULATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section A and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10 and Q. No. 11 or Q. No. 12 from Section B.
- (ii) Figures to the right indicate full marks.
- (iii) Use of electronic calculators, steam table is allowed.
- (iv) Draw neat sketch wherever necessary.

**SECTION I**

1. (a) The flow rate of water through a pipe is reported as 20 cubic feet per minute. Taking density of water as 1 g/cm<sup>3</sup>. Calculate the mass flow rate in kg/s. [4]
- (b) 2000 m<sup>3</sup> of a mixture of H<sub>2</sub>, N<sub>2</sub> and CO<sub>2</sub> at 150 °C was found to have the following ratio of the partial pressures of the gases : [8]
- $$P_{H_2} : P_{N_2} : P_{CO_2} :: 1 : 4 : 3.$$

P.T.O.

If the total pressure is 4 atm, absolute, find :

- (1) mole fraction of each of these gases
  - (2) Wt% of these gases
  - (3) Average molecular weight
  - (4) Wt. of CO<sub>2</sub> in kg.
- (c) What is weight of 4 litres of Ethane under NTP conditions ? [4]

*Or*

- 2.** (a) Explain with proper sketch the use of principles of stoichiometry in Distillation, Absorption and Liquid Extraction unit operations. [9]
- (b) Solubility in B of A is 60 kg per 100 kg B at 298 K. If a saturated solution is made at 298 K, express its composition in mole percent and weight percent. [5]
- Mol. wt. of B is 79.93.
- (c) What is °API ? [2]
- 3.** (a) A vent stream from an ethyl benzene plant has a composition : 60% H<sub>2</sub>, 39% CH<sub>4</sub> and 1% other components (CO + C<sub>2</sub>H<sub>6</sub> + C<sub>2</sub>H<sub>6</sub> etc.) it is passed through a adsorption unit where hydrogen is recovered a 94% pure stream with 6% CH<sub>4</sub> as an impurity. Recovery of hydrogen is 85% at feed pressure of 50 bar. Calculate the composition of reject stream. [8]

- (b) Explain Bypass, Recycle and Purging operations with the help of block diagrams and define the terms associated with it. [8]

*Or*

4. (a) The feed to a distillation column is 10,000 kg/hr of 40% benzene, 30% toluene and 30% xylene. The fractionating system consists of two towers No. I and No. II. The feed enters tower I. The overheads product of tower I is a  $x$  kg/hr of 90% benzene, 6% toluene and 4% xylene. The bottom of tower I is given as feed to tower II resulting in an overhead product of  $y$  kg/hr of 3% benzene, 95% toluene and 2% xylene while the bottom from tower II is  $z$  kg/hr of 1% benzene, 4% toluene and 95% xylene. Find  $x$ ,  $y$  and  $z$ . [8]
- (b) Express the percentage recovery and percentage loss of a key component in the following unit operations : [8]
- (1) Distillation
  - (2) Gas Absorption
  - (3) Solid-liquid extraction
  - (4) Filtration.

5. (a) The manufacture acetylene, pure oxygen and pure methane are fed to the acetylene burner. The cracked gas from the burner has the following composition  $H_2$  : 56.5%,  $CH_4$  : 5.2%,  $C_2H_4$  : 0.3%,  $C_2H_2$  : 7.5%,  $C_3H_6$  : 0.5%,  $CO$  : 25.8%,  $CO_2$  : 4% and  $O_2$  : 0.2% (mole 5 on dry basis). Assume that formation of other compounds such as aromatics is negligible. For 100 kmol cracked gas. [10]

Calculate :

- (1) Methane requirement
  - (2) Oxygen requirement
  - (3) Production of water
  - (4) Conversion of methane and yield of acetylene production.
- (b) Define the following : [8]
- (1) Limiting and excess reactants
  - (2) Fractional conversion and extent of reaction
  - (3) Selectivity
  - (4) Yield.

*Or*

6. (a) The Pollution Board Authority files a report against a factory owner charging him that the  $CO_2$  content of the gases leaving the chimney rises above 15% being dangerous to health and against city code. The factory owner burns natural gas containing 100%  $CH_4$  and the air supply adjusted to provide 110% excess air. Is the inspector's charge correct ? [8]

- (b) Pure sulfur is burnt in a sulfur burner with dry air. Oxygen is used 20% excess above that required for the complete combustion for sulfur to  $\text{SO}_3$ . The efficiency of burner is such that only 30% of the sulfur burns to  $\text{SO}_3$  and remainder goes to  $\text{SO}_2$ . Calculate the product mixture composition in mole % and find the weight of gas per kg of sulfur burnt. [10]

## SECTION II

7. (a) Explain the construction of the boiling point diagram and equilibrium diagram. Give its significance. Define the terms involved. [10]
- (b) What do mean by Flash Vaporization ? Give the procedure to find the fraction of the key component vaporized. [8]

*Or*

8. (a) *n*-Heptane and toluene form ideal solution. At 373 K, their vapor pressures are 106 and 74 kPa respectively. Determine the composition of the liquid and vapor in equilibrium at 373 K and 101 kPa. [8]
- (b) Write a note on Henry's Law of Gas solubility. [4]
- (c) The Henry's Gas constant for oxygen in water at 298 K is  $4.4 \times 10^4$  bar. Estimate the solubility of oxygen in per kg of water at 298 K for a partial pressure of oxygen at 0.25 bar. [6]

9. (a) Explain the enthalpy concentration diagram and give its utility. [8]
- (b) Define the following giving suitable example : [4]
- (1) Sensible Heat
- (2) Latent Heat.
- (c) Explain the construction of a steam table and give its utility. [4]

*Or*

10. (a) What is enthalpy of vaporization ? Water is to be boiled at 150°C. Calculate the pressure required by using Clapeyron equation. [8]
- (b) Express the following, define the terms involved and give its utility : [8]
- (1) Antoine equation
- (2) Clausius-Clapeyron equation.
11. (a) A theoretical producer gas (34.7% CO, 65.3% N<sub>2</sub>) at 25°C is burnt with 100% excess air (preheated to 250°C). Conversion of CO to CO<sub>2</sub> is 90%. Calculate the theoretical flame temperature. Data : heat of formation, kcal/gm mole at 25°C of CO<sub>2</sub> = - 94.052, CO = - 26.412. Specific heat as a function of temperature is given as, Cal/gm mole °K of O<sub>2</sub> = 6.935 + .0.000677 T, CO<sub>2</sub> = 9.085 + 0.0048 T, N<sub>2</sub> = 6.499 + 0.001413 T and CO = 6.350 + 0.00018 T. [12]

- (b) Define the following with example : [4]
- (1) Standard Heat of Formation
  - (2) Standard Heat of Combustion.

*Or*

12. (a) A stream flowing at a rate of 1000 mol/hr containing 40 mole % A and 60 mole % B is to be heated from 25°C to 200°C. Calculate the heat to be transferred.  $C_p$  data is as follows : [10]

Gas	$a$	$,b * 10^3$	$,c * 10^6$	$,d * 10^9$
A	25.5909	-5.41	13.1829	-4.968
B	28.6105	1.0194	-0.1476	0.769

- (b) What is Adiabatic Flame Temperature ? Give the procedure to find the adiabatic flame temperature. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-194**

**S.E. (Poly, Petro-Petrochem.) (I Sem.) EXAMINATION, 2012**

**MOMENTUM TRANSFER**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Draw Rheological diagram and show various types of fluids on it. Explain variation of viscosity with temperature and time graphically.

[5+3]

P.T.O.



- (b) Explain the basic principle underlying the lubrication mechanics in Newtonian fluids. Determine the torque necessary to rotate a shaft of diameter 400 mm and length 600 mm in a sleeve of diameter 403 mm at an r.p.m. of 350. The viscosity of the fluid used as a lubricant is 400 cP. [2+4]
- (c) Explain the importance of vapour pressure in any *two* applications. [4]

*Or*

2. (a) Differentiate between compressible and incompressible fluids on the basis of their MACH Nos. [6]
- (b) Explain continuum hypothesis with an example. [4]
- (c) For the velocity distribution given by :

$$u = 3y^2 - 6y + 8,$$

determine the Drag force on one side of a flat plate of dimensions 4 m × 3 m if the fluid viscosity is 300 cS. Consider specific gravity of fluid as 0.6. Draw a neat sketch of the above system showing the velocity profile. [6+2]

3. (a) Starting from basic principles derive the hydrostatics equation. [8]
- (b) Explain working of U-tube simple manometer and micro-manometer with neat labelled sketches. [8]

*Or*

4. (a) On a diagram show absolute pressure, +ve and -ve gauge pressures, standard atmospheric pressure and hence write the formula which relates the absolute pressure with the gauge pressure. Explain how the standard pressure is determined. [6+2]
- (b) Explain working of inverted U tube differential manometer and single-column manometer with neat labelled sketches. [8]
5. (a) State the statement of the law of the conservation of mass and derive the continuity equation along a streamline for steady, compressible fluid flow. [1+7]
- (b) For  $\phi = 8xy$ , determine  $\psi$  and the equation of the streamline passing through the point (1, 1). [8]

*Or*

6. (a) Define the following types of flows and give their examples :
- (i) Unsteady flow
  - (ii) Laminar flow
  - (iii) Irrotational flow
  - (iv) Uniform flow. [8]
- (b) For  $\psi = 3(y^2 - x^2)$  determine  $\phi$  and hence the velocity vector at the point (2, 1). Check whether the  $\psi$ ,  $\phi$  function satisfy Laplace's equation. [8]

## SECTION II

7. (a) Derive Euler's equation of motion and hence obtain the Bernoulli equation. Explain the various corrections/modifications done to the Bernoulli equation. [6+4+4]
- (b) Draw H.G.L. and E.G.L. for the diverging cone of the venturimeter, conceptually. [4]

*Or*

8. (a) Starting from fundamentals derive the expressions for shear stress, velocity distribution, discharge, pressure drop and friction factor  $f$ , for steady laminar flow through circular pipes. [14]
- (b) Explain principle, construction and working of a pitot tube. [4]

9. (a) Explain importance of dimensional analysis in experimental work and explain the procedure for using the Buckingham's Pi theorem. [4+8]
- (b) Draw neat sketch of H.S.B. [4]

*Or*

10. (a) Draw the Moody diagram and explain importance in turbulent flow regime. [6]
- (b) Draw neat sketch of H.R.B. [4]
- (c) Explain how any *one* equation is dimensionally homogeneous and how any *one* equation is not dimensionally homogeneous. [3+3]

11. (a) Explain the effect of curvature on the boundary layer growth with the help of at least 4 velocity profiles. Explain its importance in drag studies. [8+2]
- (b) Explain the working of a syphon with a neat sketch. [6]

*Or*

**12.** (a) Define, explain formulae and importance of :

(i) Displacement thickness

(ii) Momentum thickness

(iii) Laminar sub-layer

(iv) Nominal thickness

(v) Relative roughness. [10]

(b) Explain Stokes' law, its assumptions and its practical applications. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-195**

**S.E. (Petroleum/Petro-Chem./Polymer) (I Sem.) EXAMINATION, 2012**

**STRENGTH OF MATERIALS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6 from Section I and Q. Nos. 7 or 8, Q. Nos. 9 or 10, Q. Nos. 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Your answers will be valued as a whole.

(vi) Use of electronic pocket calculator is allowed.

(vii) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Define :**

(i) Modulus of elasticity

(ii) Shear modulus

(iii) Bulk modulus.

[3]

P.T.O.

(b) Derive the expression :

$$E = \frac{9KC}{3K + C}$$

where :

E → Modulus of elasticity

C → Shear modulus

K → Bulk modulus. [7]

(c) A load of 300 kN is applied on a short concrete column 250 mm × 250 mm. The column is reinforced by steel bars of total area 5600 mm<sup>2</sup>. If the modulus of elasticity of steel is 15 times that of concrete, find the stresses in concrete and steel. [8]

*Or*

2. (a) Define thermal stresses and state the condition when it is developed in elastic member. [3]
- (b) If a composite section made up of two different materials, derive the relationship between their thermal stresses. [7]
- (c) A bar of steel is 40 mm × 40 mm in cross-section and is 120 mm long. It is subjected to a tensile load of 200 kN along the longitudinal axis and tensile loads of 500 kN and 400 kN on the lateral faces. Find the change in dimensions of the bar and the change in volume. Take  $E = 2 \times 10^5$  N/mm<sup>2</sup>,  $\mu = 0.3$ . [8]

3. (a) A solid shaft is of 100 mm diameter. It transmits 120 kW at 200 r.p.m. Find the maximum intensity of shear stress induced and angle of twist for a length of 6 metres. Take shear modulus =  $8 \times 10^4$  N/mm<sup>2</sup>. [8]
- (b) The principal tensile stresses at a point across two perpendicular planes are 80 N/mm<sup>2</sup> and 40 N/mm<sup>2</sup>. Find the normal, shear stresses and the resultant stress and its obliquity on a plane at 20° with the major principal plane. [8]

*Or*

4. (a) Two shafts of the same material are subjected to the same torque. If the first shaft is of solid circular section and second shaft is of hollow section whose internal diameter is 2/3 of the outside diameter, compare the weights of the two shafts. [8]
- (b) At a point in a material, there are normal stresses of 60 MPa and 30 MPa, both tensile, together with a shearing stress of 22.5 MPa. Find the value of principal stresses and the inclination of principal planes to the direction of 60 MPa stress. Use Mohr's method. [8]



5. (a) Derive the expressions for longitudinal stress, circumferential stress and maximum shear stress for thin cylinder. [8]
- (b) A thick spherical shell of 150 mm lateral diameter is subjected to an internal fluid pressure of  $20 \text{ N/mm}^2$ . If the permissible tensile stress is  $100 \text{ N/mm}^2$ , find the thickness of the shell. [8]

*Or*

6. (a) A vessel in the shape of a spherical shell 800 mm in diameter, 10 mm shell thickness is completely filled with a fluid at atmospheric pressure. Additional fluid is then pumped in till the pressure increases by  $5 \text{ N/mm}^2$ . Find the volume of this additional fluid. Given that  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\mu = 0.25$ . [8]
- (b) Find the thickness of metal necessary for a steel cylindrical shell of internal diameter 150 mm to withstand an internal pressure of  $50 \text{ N/mm}^2$ . The maximum hoop stress in the section is not to exceed  $150 \text{ N/mm}^2$ . [8]

## SECTION II

7. (a) A cantilever 1.5 m long is loaded with a udl of 2 kN/m over a length of 1 m from the free end. It also carries a point load of 3 kN at 0.25 m from the free end. Draw the SFD and BMD of the beam. [8]
- (b) Derive the flexure formula for pure bending. [9]

*Or*

8. (a) A simply supported beam of 5 m span carries a uniformly increasing load of 800 N/m at one end to 1600 N/m at the other end. Draw the SFD and BMD for the beam. Also calculate the position and magnitude of maximum BM. [8]
- (b) A cast iron cantilever bracket having an unequal I section as cross-section has the following dimensions for the flange and web :

Top flange : 200 mm × 50 mm

Web : 50 mm × 200 mm

Bottom flange : 130 mm × 50 mm

Overall depth : 300 mm.

If the maximum BM acting on the section is 40 MNmm, draw the bending stress distribution across the section. [9]

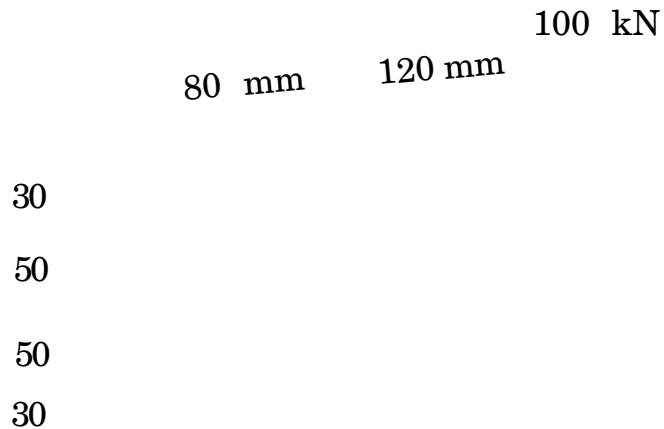
9. (a) From first principles, derive the expression for shear stress at any level for a rectangular section and hence sketch its distribution across the section giving important values. [8]
- (b) Derive the Euler's equation for the crippling load of a column when its both ends are hinged. [8]

*Or*

10. (a) A symmetrical I section 350 mm × 150 mm (overall depth) has a web thickness of 10 mm and flange thickness of 20 mm. If the shear force on the section is 40 kN, sketch the shear stress distribution across the section. [8]
- (b) Calculate the safe compressive load on a hollow cast iron column (one end rigid fixed and the other hinged) of 150 mm external diameter, 100 mm internal diameter and 10 m in length. Use Euler's formula with a factor of safety of 5 and  $E = 95 \text{ kN/mm}^2$ . [8]
11. (a) What is middle quarter rule for circular sections ? Derive it. [8]
- (b) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at 1 m and 3 m respectively from left support. Find the deflection under each load. [9]

*Or*

- 12.** (a) Starting from bending formula and torsion formula, derive the expressions for major and minor principal stresses developed in a solid circular shaft subjected to combined bending and torsion. Also develop the formula for maximum shear stress. [8]
- (b) Determine the maximum stress developed in the rivets for the bracketed connection shown in figure below. Assume dia. of rivets as 18 mm. [9]



Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-196**

**S.E. (Petroleum/Petro-Chem./Polymer) (II Sem.) EXAMINATION, 2012**

**ENGINEERING CHEMISTRY—II**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Discuss the cyclic structure of glucose and D-fructose. [6]
- (b) Explain the various factors affecting enzyme activity. [6]
- (c) Write a short note on 'Polysaccharides'. [4]

P.T.O.

*Or*

- 2.** (a) Discuss the physical and chemical properties of amino acids. [6]
- (b) Explain the following terms : [6]
- (i) Isomerization
- (ii) Mutarotation.
- (c) Explain the reaction of glucose with the following reagents : [4]
- (i)  $\text{HIO}_4$  and
- (ii)  $\text{Br}_2/\text{H}_2\text{O}$ .
- 3.** (a) Give the synthesis of : [6]
- (i) Alkane from ketone
- (ii) Alkene from alkyl halide
- (iii) Aldehyde from acid chloride.
- (b) Explain the synthesis of amide from : [6]
- (i) Acid chloride
- (ii) Nitrile
- (iii) Acid anhydride
- (iv) Carbodiimides.
- (c) Explain in brief 'Gabriel synthesis of amines'. [4]

Or

4. (a) Give the balance equations for each of the following reactions : [6]

(i) Carboxylic acid is treated with :

(a)  $\text{SOCl}_2$

(b) LAH.

(ii) Toluene is treated with :

(a)  $\text{Cl}_2/\Delta$

(b)  $\text{CrO}_2/\text{CCl}_4$ .

(iii) Ketone is treated with :

(a)  $\text{NaBH}_4$

(b) Hydrazine.

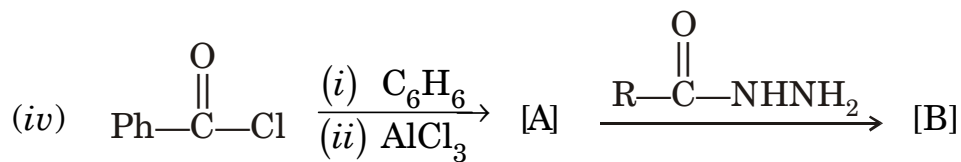
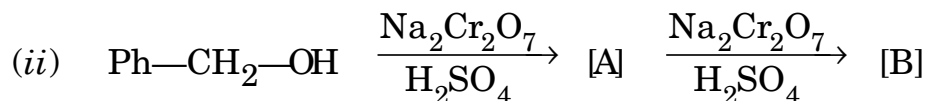
(b) Write the possible reaction pathways for the synthesis of each of the following compounds from benzene : [6]

(i) P-bromobenzoic acid

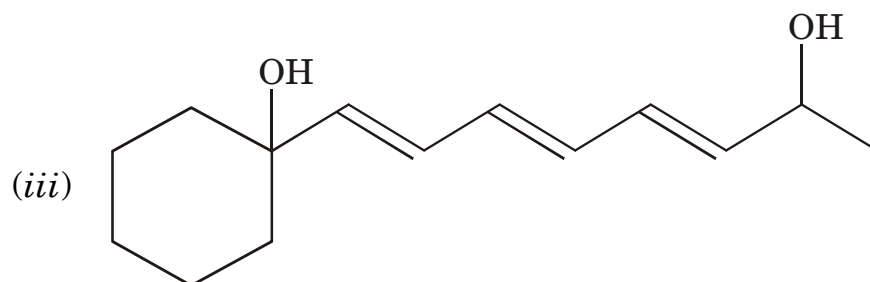
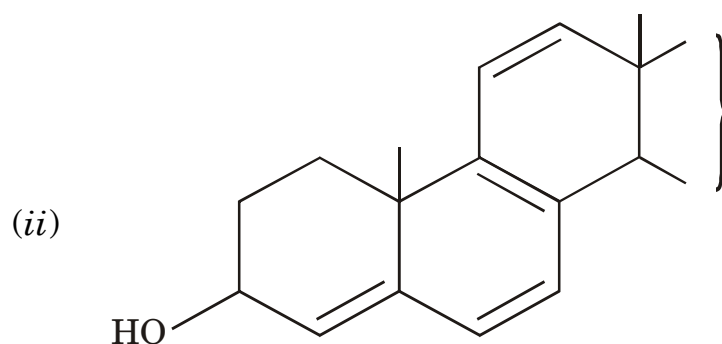
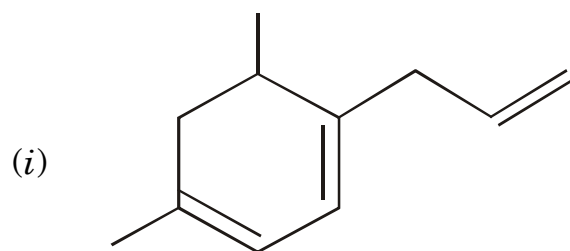
(ii) Aniline

(iii) Styrene.

(c) Predict the products : [4]



5. (a) Calculate the  $\lambda_{\text{max}}$  for each of the following compounds : [6]



(b) What are different types of vibrations ? How fundamental modes of vibrations are calculated for linear and non-linear molecules ? [6]

(c) Discuss the principle and applications of NMR spectroscopy. [6]



*Or*

6. (a) Using infrared spectroscopy how would you differentiate the carbonyl group of the following compounds with justification : [6]
- (i) Aldehyde
  - (ii) Ketone
  - (iii) Carboxylic acid.
- (b) Give reasons : [6]
- (i) Trans-stilbene absorbs at higher wavelength than its cis-isomer.
  - (ii) UV spectra are relatively broad as compare to IR spectra.
  - (iii) Phenol shows bathochromic shift on addition of alkali.
- (c) How many peaks would you expect in the NMR spectrum of : [6]
- (i) Acetaldehyde
  - (ii) Ethylmethylether
  - (iii) 2-butyne.

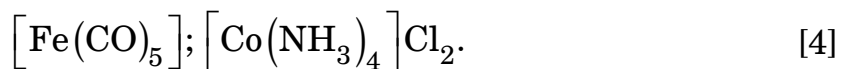
## SECTION II

7. (a) Explain the concept of quantum numbers in case of electron of an atom. Find quantum numbers for last electron of Mn. [6]

- (b) Explain triple bonding in nitrogen molecule on the basis of M.O.T. [6]
- (c) Bond angle in ammonia molecule is  $<109^\circ$ . Explain with the help of V.B.T. [4]

*Or*

8. (a) What is meant by 'partial hybridisation' ? Explain it in case of carbon dioxide molecule. [6]
- (b) Explain paramagnetic property of oxygen molecule on the basis of M.O.T. [6]
- (c) Explain Hund's rule and Pauli's exclusion principle with proper example. [4]
9. (a) Explain magnetic properties of  $[CoF_6]^{3-}$  and  $[Cu(NH_3)_4]^{2+}$  on the basis of C.F.T. [7]
- (b)  $[Cu(NH_3)_4]^{2+}$  is square planar, explain on the basis of V.B.T. [6]
- (c) Find C.N., E.A.N. of the metal ion for the following complexes :

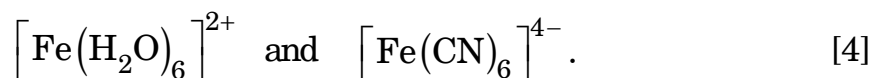


Or

10. (a) With the help of diagram explain 'crystal field splitting' in case of octahedral complexes. [7]

(b) Draw different 'd' orbitals for the electron of an atom. What is difference between  $d^2sp^3$  and  $sp^3d^2$  hybridised octahedral complexes. [6]

(c) Calculate CFSE for the following complexes :



11. (a) Explain the term 'chromatography'. Give different types of chromatographic methods on the basis of operating principle. [7]

(b) Give experimental setup of paper chromatography. How  $\text{Co}^{2+}$ ,  $\text{Cr}^{3+}$  and  $\text{Cu}^{2+}$  ions can be identified using paper chromatographic technique ? [6]

(c) Among  $\text{Na}^+$  and  $\text{F}^-$ -ionic radius of  $\text{Na}^+$  is smaller than that of  $\text{F}^-$  though both are isoelectronic. Explain. [4]

*Or*

12. (a) What is meant by thermal analysis ? Explain TGA of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ . [7]
- (b) Explain working of atomic absorption spectroscope (AAS). [6]
- (c) Ist ionisation potential of an element in a period increase with increase in atomic number. Explain. [4]

Atomic numbers for :

	C	N	O	Cr	Mn	Fe	Co	Ni	Cu
Z =	6	7	8	24	25	26	27	28	29

Total No. of Questions—12]

[Total No. of Printed Pages—8

<b>Seat No.</b>	
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**[4162]-197**

**S.E. (Petroleum/Petrochemical/Polymer Engineering)**

**(Second Semester) EXAMINATION, 2012**

**HEAT TRANSFER**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answers to the two Sections should be written in separate answer-books.
  - (ii) Draw neat diagrams wherever necessary.
  - (iii) Numbers to the right indicate full marks.
  - (iv) Assume suitable data, if necessary.
  - (v) Use of logarithmic table, electronic pocket calculators is allowed.

**SECTION I**

1. (a) A steam pipe 100 mm O.D. is to be insulated by two layers of insulations each of 25 mm thickness, the thermal conductivity of one being three times that of the other. Assuming that the inner and outer temperatures of composite insulation to be fixed. Find : [8]
- (i) Which arrangement would give less heat loss rate ?
  - (ii) What is the percentage reduction in heat loss rate ?

P.T.O.

- (b) Pin fins with insulated ends are provided to increase the heat transfer rate from a hot surface. Which of the following arrangement will give higher heat transfer rate ?

Case : (i) 6-fins of 10 cm length.

Case : (ii) 12-fins of 5 cm length.

Thermal conductivity  $k$  (fin material) = 200 w/m °C,  $h = 20$  W/m<sup>2</sup> °C, cross-section area of fin = 2 cm<sup>2</sup>, Perimeter of fin = 4 cm, fin base temperature = 230 °C and surrounding temperature = 30°C. [8]

- (c) Define the term Critical Thickness of Insulation. [2]

*Or*

2. (a) Discuss the term Thermal Conductivity of material. [6]
- (b) Find the critical radius of insulation for rubber ( $k = 0.155$  W/m°K) surrounding a cable and laid in atmosphere of 20°C with heat transfer coefficient  $h = 8.5$  W/m<sup>2</sup>°C. Calculate the heat loss from a 65°C, 10 mm cable when covered with critical radius of insulation. [6]
- (c) Discuss the term thermal resistance to heat conduction and derive the necessary expression for the thermal resistance to heat conduction through the given plane wall with thermal conductivity value  $K$ , thickness  $L$ , cross-section area  $A$ . [6]

3. (a) The effective temperature of black body having an area of  $0.12 \text{ m}^2$  is  $527^\circ\text{C}$ , calculate the following : [6]
- (i) Total rate of energy emission.
  - (ii) The Intensity of Normal Radiation.
  - (iii) The wavelength of maximum monochromatic emissive power.
- (b) Discuss any *three* laws of Radiation. [6]
- (c) Discuss the term Emissive power and emissivity. [4]

*Or*

4. (a) Calculate the rate of heat loss from 6 m long horizontal stem pipe, 60 mm O.D. at  $170^\circ\text{C}$  and the temperature of air is  $25^\circ\text{C}$ . Take emissivity = 0.85, heat transfer coefficient for heat loss by Natural convection  $h = 1.64 (\Delta T)^{0.25} \text{ W/m}^2\text{C}$ . [6]
- (b) Calculate the net radiant heat exchange in  $\text{W/m}^2$  between two large parallel steel plates of emissivities 0.8 and 0.5 held at temperatures of  $1000^\circ\text{K}$  and  $500^\circ\text{K}$  respectively, if a thin copper plate of emissivity 0.1 is placed as a radiant shield between the two plates. [6]
- (c) Define the term Solid angle and Intensity of Radiation. [4]

5. (a) Discuss the term Free Convection and explain the different parameters used in calculation of heat transfer analysis via Free Convection. [8]
- (b) A steam pipe 7.5 cm in diameter with surface emissivity 0.9 and the surface temperature is 80°C is placed in surrounding air at 20°C. Considering heat loss both by radiation and natural convection, find the heat loss from 6 m length of pipe. Properties of air at mean film temperature are as below :
- $\rho = 1.092 \text{ kg/m}^3$ ,  $C_p = 1007 \text{ J/kg } ^\circ\text{C}$ ,  
 $k = 27.81 \times 10^{-3} \text{ W/m}^\circ\text{C}$ ,  $\mu = 19.57 \times 10^{-6} \text{ kg/m}\cdot\text{sec}$ . [8]

*Or*

6. (a) 0.5 kg. of water per minute is passed through a tube of 20 mm diameter. Determine the length of the tube required for fully developed flow so that water to be heated from 20°C to 50°C. The heating is accomplished by condensing steam on the surface of tube and subsequently the surface temperature of the tube is maintained at 85°C. [8]
- Properties of Water at 60°C are as below :
- $\rho = 983.2 \text{ kg/m}^3$ ,  $C_p = 4.178 \text{ kJ/kg } ^\circ\text{K}$ ,  $K = 0.659 \text{ W/m}^\circ\text{C}$ ,



Kinematic viscosity  $\nu = 0.478 \times 10^{-6} \text{ m}^2/\text{sec}$ .

Average Nusselt Number is given by :

$$(N_{\text{Nu}})_{\text{Avg}} = 3.65.$$

- (b) Discuss in detail : [8]
- (i) Nusselt Number
  - (ii) Stanton Number
  - (iii) Peclet Number
  - (iv) Thermal Boundary layer.

## SECTION II

7. (a) Discuss with neat diagram Direct and Indirect type of heat exchangers. [4]
- (b) Derive the expression for logarithmic mean temperature difference for parallel type of heat exchanger. [10]
- (c) It is desired to heat 4450 kg/h of cold benzene from 27°C to 49°C by using hot toluene which is cooled from 71°C to 38°C. Benzene flows through the inner pipe in counter-current manner to toluene. Find the log mean temperature difference for the given case. [4]

*Or*

8. (a) A parallel flow heat exchanger has a hot and cold water streams flowing through it at 600 kg/hr and 1500 kg/hr with inlet temperatures at 90°C and 25°C on the hot and cold side respectively. The exit temperature on hot side is required to be 50°C. Calculate the area of heat exchanger if individual heat transfer coefficient on both sides is 1600 W/m<sup>2</sup>°C by LMTD approach and effectiveness—NTU approach.

$$C_p(\text{kJ/kg } ^\circ\text{C}) = 4.187. \quad [12]$$

- (b) Discuss the following : [6]

- (i) Temperature Ratio
- (ii) Capacity Ratio
- (iii) Heat Exchanger Effectiveness.

9. (a) Calculate the heat transfer coefficient during laminar film condensation of a pure stationary and saturated vapour on an isothermal vertical plate. [10]

- (b) Write short notes on : [6]

- (i) Flow Boiling in a vertical tube.
- (ii) Heat Pipe.

Or

10. (a) Steam saturated at 68.9 kPa, 89.44°C is condensing on a vertical tube 0.305 m long having an outside diameter of 0.0254 m and a surface temperature of 86.11 °C. Calculate the average heat transfer coefficient and the rate of heat transfer.

The properties of water film at mean temperature are :

$$\rho = 966.7 \text{ kg/m}^3, k = 0.675 \text{ W/m}^\circ\text{C},$$

$$\text{Dynamic viscosity } \mu = 324 \times 10^{-6} \text{ kg/m}\cdot\text{sec}.$$

Latent heat of condensation = 2283 kJ/kg. Assume vapour density is small compared to that of the condensate. Assume flow is laminar. [10]

$$N_{Nu} = 1.13(\rho^2 g h_{fg} L^3 / \mu k \Delta T)^{1/4}.$$

- (b) Explain film and drop wise condensation. [6]
11. (a) With neat diagram discuss the Calendria type evaporator. [8]
- (b) Discuss in detail Multiple Effect Evaporators. [8]

Or

12. (a) A solution containing 10% solids to be concentrated to a level of 20% solids by using single effect evaporator. Feed enters

at 30°C. Saturated steam is available at a pressure of 0.20 MPA and temperature 110°C (Latent heat of 540 kcal/kg). Feed rate of the evaporator is 10,000 kg/hr. Condensate leaves at saturation temperature. The solution boils at 45°C (Latent heat = 570 kcal/kg). Specific heat of all solutions may be taken as 1.0. The overall heat transfer coefficient is 1800 kcal/hr m<sup>2</sup>°C. Estimate steam consumption and heat transfer area required.

Enthalpy of feed = 30 kcal/kg, Total heat of vapour with respect to the saturation temperature of 50°C = 615 kcal/kg,  
Enthalpy of product = 45 kcal/kg. [12]

- (b) Define Evaporation with its the importance and state the classification of evaporators. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-198**

**S.E. (Polymer/Petroleum/Petrochemical)**  
**(Second Semester) EXAMINATION, 2012**  
**PARTICULATE TECHNOLOGY**  
**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of electronic pocket calculator is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What do you understand by “Single Particle” ? Explain the concept in brief. [6]
- (b) Write a short note on “Flow through Orifice”. [6]
- (c) Calculate the sphericity of cubical shape particle with cube side 2 cm. [4]

P.T.O.

*Or*

- 2.** (a) Explain in brief various mechanisms which give rise to agglomeration. [6]
- (b) What are the various techniques to measure particle size ? Explain any *one* method in detail. [8]
- (c) What is angle of Friction ? [2]
- 3.** (a) A material is crushed in Black Jaw Crusher, and the average particle size is reduced from 5 cm to 1.3 cm with consumption of 37 Watts-hr/ton. Calculate the energy required to crush the same material with average particle size from 8 cm to 3 cm by using Rittinger's and Kick's laws. Assume the mechanical efficiency remains constant. [8]
- (b) What are the *four* basic operating principles on which size reduction machine work ? [4]
- (c) Write a short note on nature of material to be crushed. [6]

*Or*

- 4.** (a) Enlist various size enlargement processes. Explain any *one* in brief. [8]

- (b) Calculate the power required to crush 100 ton/h of limestone if 80 percent of the feed passes a 2-in screen and 80 percent of the product a 1/8 in screen. [6]
- (c) Write a short note on Crushers used for size reduction operation. [4]
5. (a) A slurry containing 0.2 kg of solid per kg of water is to be thickened to sludge containing 0.70 kg of solid per kg of water in a continuous settling process. With five different concentration of slurry, the following results were obtained : [8]

<b>Slurry</b> (kg of solid/kg of water)	<b>Sedimentation Rate</b> (min/min)
0.2	0.01
0.235	0.0075
0.266	0.006
0.33	0.0042
0.4	0.0030

What should be the minimum area of thickener to effect a separation at rate of 0.625 kg of solid per second ?

- (b) With neat sketches, explain in detail the concept of Flocculation. [8]

*Or*

6. (a) Write a short note on Kynch's theory of sedimentation. [8]  
(b) What are the types of Thickeners ? Explain any *one* in detail. [8]

## SECTION II

7. (a) List out the various applications of fluidization and explain any *two* in detail. [8]  
(b) Obtain the relation for minimum fluidization velocity for free flowing particles. [8]

*Or*

8. (a) A packed bed of uniform spherical particles of diameter 2.5 mm and density  $4150 \text{ kg/m}^3$  is fluidized by means of liquid of density  $1000 \text{ kg/m}^3$  and dynamic viscosity  $0.001 \text{ pa.s}$ .  
Calculate :  
(i) Minimum fluidization velocity using Ergun equation  
(ii) Ratio of settling velocity to fluidization velocity in the bed.  
Take bed porosity = 0.4. [8]  
(b) With a neat diagram, discuss in detail various fluidization regimes. [8]



9. (a) Derive the Kozeny Carmann' equation for fluid flowing through a packed bed. [8]

(b) A sample of slurry was filtered at a constant rate of 0.00015 m<sup>3</sup>/s through a leaf filter covered with a single filter cloth. After 625 seconds the pressure across the filter was 360 mm of liquid. After a further 480 seconds the pressure was 600 mm of liquid.

The relation between pressure drop ( $\Delta P$ ) and volumetric flow rate ( $Q$ ) is given as :

$$(-\Delta P) = 7460 - (7460/0.0015)Q.$$

Find out how long it will take to produce 1 m<sup>3</sup> of filtrate. [10]

*Or*

10. (a) Derive the relation for constant rate and constant pressure filtration for the flow of filtrate through cloth and cake resistance combined. [8]

(b) Explain in brief : [10]

(i) Plate and Frame Filter

(ii) Rotary Drum Filter.

11. (a) Derive the equation for terminal settling velocity for a free flowing particle through a fluid. (Stokes' law and Newton's law region.) [8]
- (b) Describe in detail the classification of mechanical separation methods. [8]

*Or*

12. Write short notes on any *two* of the following : [16]
- (i) Froth floatation
- (ii) Venturi scrubber
- (iii) Cyclone separator.

Total No. of Questions—6]

[Total No. of Printed Pages—3

<b>Seat No.</b>	
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**[4162]-199**

**S.E. (Petroleum/Petro-Chemical/Polymer Engineering)**

**(Second Semester) EXAMINATION, 2012**

**ELEMENTS OF SOCIAL SCIENCES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) Explain the concept of Law of Demand with exceptions. [8]

(b) Economics is a science of scarcity. Explain. [8]

*Or*

(a) State and explain different types of Markets. [8]

(b) Discuss the importance of Engineering Economics. [8]

P.T.O.

2. (a) Explain the advantages and disadvantages of specialization. [8]  
(b) Explain the role of Government in Macro Economic growth of India. [8]

*Or*

- (a) Discuss the various functions of money. [8]  
(b) Explain the concept of Capital and Private Property. [8]

3. Discuss the concept of Globalisation and LPG model for economic development of India implemented after the year 1990. [18]

*Or*

Write short notes on : [18]

- (i) Vision of India 2020  
(ii) Industrial Policy of India  
(iii) 5 year plans for economic development.

## **SECTION II**

4. Explain the following in brief : [16]  
(a) Culture and society  
(b) Civilization.

*Or*

- (a) Explain the salient features of Modern Indian Family. [8]  
(b) Discuss the importance of Secular Polity in India. [8]

5. (a) Sustainable Development and Sustainable Consumption go hand in hand. Comment. [8]

(b) Discuss the impact of IT revolution of Indian Economy. [8]

*Or*

(a) Technology leads to social change. Explain. [8]

(b) Discuss the impact of Ecological Crisis faced by the modern world. [8]

6. (a) State and explain types and functions of Religion. [10]

(b) Discuss the problem of religious fundamentalism faced by modern world. [8]

*Or*

Write short notes on the following : [18]

(a) Distinctive features of Indian Philosophy

(b) Vivekananda's views on union of science and religion

(c) Harmonious coexistence of different religious faiths.

Total No. of Questions—12]

[Total No. of Printed Pages—8+2

Seat No.	
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[4162]-201

**S.E. (Comp + IT) (First Semester) EXAMINATION, 2012**

**DISCRETE STRUCTURES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answers to the two Sections should be written in separate answer-books.

(ii) Attempt from Section I Q. No. 1  $\sigma$  Q. No. 2, Q. No. 3  $\sigma$  Q. No. 4, Q. No. 5  $\sigma$  Q. No. 6.

(iii) Attempt from Section II Q. No. 7  $\sigma$  Q. No. 8, Q. No. 9  $\sigma$  Q. No. 10, Q. No. 11  $\sigma$  Q. No. 12.

(iv) Neat diagrams must be drawn wherever necessary.

(v) Figures to the right indicate full marks.

(vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Use mathematical induction to show that : [6]

$$\frac{1}{1.2} + \frac{1}{2.3} + \frac{1}{3.4} + \dots + \frac{1}{n(n+1)} = \frac{n}{n+1} \text{ for all } n \geq 1.$$

(b) Consider the following :

p : This system is good

q : This system is cheap

P.T.O.

Write each of the following sentences in symbolic form : [4]

(i) This system is good and cheap.

(ii) This system is not good but cheap.

(iii) This system is neither good nor cheap.

(iv) This system is good or cheap.

(c) Obtain the disjunctive normal form of the following : [4]

(i)  $p \vee (\sim p \Rightarrow (q \vee (q \Rightarrow \sim r)))$

(ii)

(d) Find the power set of :  $A = \{ a, b, c \}$  [2]

*Or*

2. (a) In a group of 70 cars tested by a garage in a city, 15 had faulty tyres, 20 had faulty brakes and 18 exceed the allowable emission limits. Also, 5 cars had faulty tyres and brakes, 6 failed on tyres and emission, 10 failed on brakes and emission, and 4 cars were unsatisfactory in all three aspects. How many cars had no faults in these three checks ? Draw an appropriate Venn diagram. [6]

(b) A survey has been taken on modes of travels. Each respondent was asked to check bus, train or automobile as a major modes of travelling for work. More than one answer was permitted. The result, reported outcome were as follows :

Bus-40 people, train-45 people, automobile-100 people, bus and train-20 people, bus and automobile-15 people, train and automobile-20 people and all three modes-5 people. How many people completed a survey form ? Apply principle of inclusion-exclusion. [6]

(c) Let  $p(x)$  :  $x$  is student,  $q(x)$  :  $x$  is clever. Express the following using quantifiers :

(i) There exists a student

(ii) Some students are clever. [2]

(d) Show that  $(p \wedge q) \Rightarrow (p \Rightarrow q)$  is a tautology [2]

3. (a) Define the following with example : [6]

(i) Monoid

(ii) Cyclic group

(iii) Abelian group

(b) Show that for any group  $(G, *)$ , if  $a^2 = e$  with  $a \neq e$ , then  $G$  is abelian. [6]

(c) Find the hamming distance between  $X$  and  $Y$  : [4]

(i)  $a(x) = 110110$ ,  $y = 000101$

(ii)  $b(x) = 001100$ ,  $y = 010110$



Or

4. (a) Consider the group  $(\mathbb{Z}, +)$ . Let  $H = \{3n : n \in \mathbb{Z}\}$ . Show that  $H$  is a subgroup of  $\mathbb{Z}$ . [6]
- (b) Define a ring. Give examples of the following : [4]
- (i) A commutative ring with identity
  - (ii) A non-commutative ring with identity
  - (iii) Neither commutative nor has a unit element
  - (iv) Integral domain but not a field
- (c) Let 'G' be a group. Show that the function  $f : G \rightarrow G$  defined by  $f(a) = a^2$  is a homomorphism iff  $G$  is abelian. [6]
5. (a) Let  $A$  is a set of factors of positive integer  $m$  and relation is divisibility on  $A$ . i.e.  $R = \{(x, y) | x, y \in A, x \text{ divides } y\}$  for  $m = 45$ , show that POSET  $(A, <)$  is a lattice. Draw Hasse diagram. Determine the chains and anti-chain. [6]
- (b) Find the transitive closure of  $R$  by Warshall's algorithm, [4]
- where  $A = \{(1, 3), (3, 1), (2, 4), (4, 2), (3, 5), (5, 3), (4, 6), (6, 4)\}$
- (c) Let  $A = \{a, b, c, d\}$ ,  $\pi = \{\{a, b\}, \{c\}, \{d\}\}$ . Find the equivalence relation induced by  $\pi$  and construct its digraph. [4]

- (d) Consider the following relation on  $\{1, 2, 3, 4, 5, 6\}$  : [4]

$$R = \{(i, j) : |i-j| = 2\}$$

Is 'R' transitive ? Is 'R' reflexive ? Is 'R' symmetric ?

*Or*

6. (a) Using Generating function, solve the following recurrence relation : [8]

$$y_{n+2} - 6y_{n+1} + 8y_n = 0, y_0 = 1, y_1 = 4$$

- (b) Let  $A = \{1, 2, 3\}$  and  $B = \{a, b, c, d\}$ . In each case state whether the given function (if defined) is injective, surjective, bijective. [4]

(i)  $f = \{(1, a), (2, d), (3, b)\}$

(ii)  $g = \{(1, a), (2, a), (3, d)\}$

(iii)  $h = \{(1, a), (1, b), (2, d), (3, c)\}$  D

(iv)  $j = \{(1, a), (2, b)\}$

- (c) Let  $A = \{6, 2, 1, 9\}$ ,  $B = \{7, 3, 5\}$ ,  $C = \{8, 4, 10\}$ . Obtain the composition of the following functions :

$$f : A \rightarrow B, g : B \rightarrow C \quad [6]$$

where  $f = \{(6, 7), (2, 3), (1, 5), (9, 3)\}$

$$g = \{(7, 4), (3, 8), (5, 10)\}.$$

## SECTION II

7. (a) Define Bipartite graph and Isomorphism graph. Show the isomorphism of two graphs with suitable example. [6]

- (b) Find the shortest path between the vertices  $a$  to  $z$  in the graph given below by using Dijkstra's algorithm (Fig. 1). [8]

Fig. 1

- (c) Show that a complete graph with  $n$  vertices consist of edges. [4]

*Or*

8. (a) Define planar graph. By using Euler's formula, show that if 'G' is connected planar graph with  $n$  vertices,  $e$  edges and  $r$  regions, then : [4]

$$n - e + r = 2$$

- (b) State whether the following statements are true or false. Justify your answer : [6]
- (i) Every tree with  $n > 2$  vertices is a bipartite graph.
  - (ii) A tree is any graph without cycle.
  - (iii) Every graph with  $n$  vertices and  $n - 1$  edges is a tree.
  - (iv) If any two vertices of a graph are connected by at least one path, then 'G' is a tree.

- (c) Find all cut-vertices and cut-edges in the graph 'G' shown below (Refer Fig. 2) : [4]

Fig. 2.

- (d) Draw a complete bipartite graph on 2 & 4 vertices  $K_{2,4}$  and on 2 & 3 vertices  $K_{2,3}$ . [4]
9. (a) Define the following terms with suitable example : [6]
- (i) Rooted tree
  - (ii) Spanning tree
  - (iii) Level of the tree
- (b) Find the minimum cost spanning tree of the following graph using Prim's algorithm. (Refer Fig. 3) [6]

Fig. 3.

- (c) Represent the expression  $((a + 5) \uparrow 4) + (b - (5 + 9))$  using a binary tree. [4]

*Or*

10. (a) Find maximal flow in the transport network using labelling procedure. Determine the corresponding minimum cut. [6]

Fig. 4

- (b) Use Kruskal's algorithm to find the minimum spanning tree (MST) of the graph given below (Fig. 5) [6]

*a*

Fig. 5.

- (c) Define optimal prefix code. Obtain an optimal prefix code for the tree of weights 3, 8, 13, 15. [4]

11. (a) If the probability for India to win a game against Australia is 0.4. If India has an option of playing either a “best of three” games or a “best of 5 games” against Australia, which option should India choose so that the probability of winning match is higher ? (Consider both the cases) [6]
- (b) A drawer contains 50 bolts and 150 nuts. Half of the bolts and half of the nuts are rusted. If one item is chosen at random, what is the probability that it is rusted or a bolt ? [3]
- (c) In how many ways can seven men and seven women sit down at a round table in such a way that no two men sit next to each other ? [3]
- (d) What is the conditional probability that a randomly generated bit string of length four contains at least two consecutive 0s, given that the first bit is 1 ? (Assume the probabilities of a 0 and a 1 are the same) [4]

*Or*

12. (a) An insurance agent sells five policies, one to each of five persons who are of the same age and in good health. According to the actuarial tables the probability that a man of this particular age will be alive 35 years hence is  $\frac{2}{3}$ . Find the probability that after thirty-five years, at most 3 men will alive. [6]

- (b) In how many ways can the letters of the word ABACUS be arranged such that :
- (i) The vowels always appear together.
  - (ii) Begins with A and end with S. [6]
- (c) Mohan has three shares in a lottery in which there are 3 prizes and 6 blanks. Rohan has one share in a lottery in which there is 1 prize and 2 blanks. Show that Mohan's chance of winning a prize of Rohan's chance is in the ratio 16 : 7. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

<b>Seat No.</b>	
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**[4162]-202**

**S.E. (Computer Engineering) (First Semester)**

**EXAMINATION, 2012**

**PROGRAMMING AND PROBLEM SOLVING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) In Section I, attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6.
- (ii) In Section II, attempt Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12.
- (iii) Answers to the two sections should be written in separate answer-books.
- (iv) Neat diagrams must be drawn wherever necessary.
- (v) Figures to the right indicate full marks.
- (vi) Assume suitable data if necessary.

**SECTION I**

1. (a) Define the data types of the following data items. Justify your answers : [6]
- (i) Sum of money

P.T.O.



(ii) Telephone number

(iii) Zip code.

(b) Write a short note on Top down design. [6]

(c) Explain the difference between variables and constants. [4]

*Or*

**2.** (a) What do you mean by Algorithmic solutions and heuristic solutions ? Describe the *six* steps in problem solving. [6]

(b) Construct a logical expression for the following policy on using a Departmental Store charge card for a customer to charge an item is that : [6]

(i) Customer must have a valid charge card and

(ii) Balance of less than Rs. 500 or charge of less than Rs. 50.

(c) What is function ? Explain any *two* types of functions. [4]

**3.** (a) What are different parameters passing methods ? Explain each method with suitable example. [6]

(b) Using Negative logic, write the algorithms and draw the flowcharts for the following set of conditions : [6]

$R = 50$  for  $S \leq 1000$

$R = 100$  for  $S = 1001 - 4000$

$R = 250$  for  $S = 4001 - 8000$

$R = 75$  for  $S > 8000$

- (c) What do you mean by cohesion and coupling ? How are these important to Programmers ? [6]

*Or*

4. (a) Broadband Internet connection charges the following rates for the use of Internet : [12]

First 1 GB : Free

Extra usage > 1 GB : Rs. 1

All customers are charged monthly rental of Rs. 250 and service tax of 12.5% on total bill amount. Describe and explain complete steps of Solution Development to read name of customer, tariff of Internet usage and print out the total amount to be charged.

- (b) Explain Decision tables in detail with example. [6]

5. (a) Design and explain an algorithm for GCD of two integers. [8]  
(b) Design and explain an algorithm for square root of a given number. [8]

*Or*

6. (a) Design and explain an algorithm for generation of the Fibonacci sequence for a given number. [8]  
(b) Design and explain an algorithm to compute n factorial of a given number. [8]

## SECTION II

7. (a) Write a pseudo algorithm for partition a randomly ordered array of  $n$  elements into two subsets such that elements less than equal to  $X$  are in one subset and elements are greater than  $X$  are in other subset. [8]
- (b) Write a pseudo algorithm for removal of duplicates from an ordered array. [8]

*Or*

8. (a) Write a pseudo algorithm that places the  $k$ th element of an array in position one, the  $(k + 1)$ th element in position 2, etc. The original 1st element is placed at  $(n - k + 1)$  and so on. [8]
- (b) Write a pseudo algorithm to find position of number  $X$  in array of  $n$  elements. [4]
- (c) Explain Lookup table technique. [4]
9. (a) Write a pseudo algorithm for text length adjustment so that no lines more than  $n$  characters are printed and no word should extends across two lines. [8]
- (b) Design and explain an algorithm to count the number of times a particular word occurs in a text. [8]

*Or*

- 10.** (a) Design and implement an algorithm that will efficiently search in a given text for a particular keyword or pattern and record the number of times the keyword or pattern is found. [8]
- (b) Write a pseudo algorithm for keyword searching in a text. [4]
- (c) Write a pseudo algorithm to count number of characters in each line. [4]
- 11.** (a) What do you mean by polymorphism ? Explain with suitable example. [7]
- (b) Write a program in C++ for a Video CD Library that need to track Customers, Video CD's and its rentals and late fees : [7]
- (i) Design classes you would create the application.
- (ii) Write what methods would be needed for the classes.
- (iii) Print the customer and its rentals.
- (c) Explain visibility modes in C++. [4]

*Or*

- 12.** (a) Explain the following concepts : [8]
- (i) Parameterized Constructors
- (ii) Copy Constructor
- (iii) Destructor
- (iv) Encapsulation and Data Abstraction.

(b) Define a class distance having : [6]

Data members :

Feet

Inches

Member functions :

Read data( ) — To read values

Print( ) — To display values

Add( ) — To add two objects of distance  
class.

Write a main program in C++ accordingly.

(c) Distinguish between Objects and Classes. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-203**

**S.E. (Computer Engineering) (First Semester)**

**EXAMINATION, 2012**

**(Common to I.T.)**

**DIGITAL ELECTRONICS AND LOGIC DESIGN**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answers to the two Sections should be written in separate answer-books.

(ii) In **Section I** attempt : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6.

In **Section II** attempt : Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Do the required conversions for the following numbers : [6]

(i)  $(1FFF)_{16} = (\quad)_{10}$

(ii)  $(1024)_{10} = (\quad)_{16}$

(iii)  $(36)_8 = (\quad)_{16}$ .

(b) Which gates are known as Universal Gates ? Justify using examples. [6]

(c) Solve the following equation using K map minimization technique. Draw the MSI design for the minimized output : [6]

$$Z = f(A, B, C, D) = \Sigma m(1, 3, 6, 7, 12, 13) + d(0, 2, 8, 9).$$

P.T.O.

*Or*

- 2.** (a) Perform the following operations : [8]
- (i)  $(8085)_{16} - (1000)_{10} = (\text{_____})_{10}$
- (ii)  $(777)_8 + (77)_8 = (\text{_____})_{16}$
- (iii)  $(888)_{16} + (999)_{16} = (\text{_____})_{16}$
- (iv)  $(1001.10)_2 = (\text{_____})_{10}$ .
- (b) Solve the following equation using corresponding minimization technique. Draw the MSI design for the minimized output : [6]
- $$Z = f(A, B, C, D) = \pi M(1, 3, 5, 6, 7, 10, 11) + d(2, 4).$$
- (c) State and prove any *two* theorems of Boolean Algebra. [4]
- 3.** (a) Define the following terms related to logic families. Mention typical values for standard TTL family : [8]
- (i) Power dissipation
- (ii) Fan-in
- (iii)  $V_{IL}$ ,  $V_{OH}$
- (iv) Noise margin.
- (b) Draw the structure of CMOS inverter gate. Explain its working. [4]
- (c) List differences between open drain and wired logic CMOS. [4]

*Or*

4. (a) Explain the working of two input TTL NAND gate with active pull up. Consider various input, output states for explanation. [8]
- (b) Which parameters are significant while interfacing TTL and CMOS ? Draw and explain TTL driving CMOS gate. [8]
5. (a) Design 4-bit binary to Gray code converter. State the applications of Gray code. [8]
- (b) Explain the working of magnitude comparator 7485. Discuss the truth table for the same. [8]

*Or*

6. (a) Design an 8 : 1 multiplexer using two 4 : 1 multiplexers. Explain with the help of the truth table. Implement the function  $f(A, B, C) = \Sigma m(1, 3, 7)$  using the same. [8]
- (b) Describe the working of BCD adder using 7483 with the help of diagram. [8]

## SECTION II

7. (a) What is SR-flip-flop ? Convert the basic SR-flip-flop (SR-FF) into : [10]
- (i) JK-FF
- (ii) T-FF
- (iii) D-FF.



- (b) Explain the internal diagram of IC 7490. Design MOD 7 and MOD 98 counter using 7490. [8]

*Or*

8. (a) What is the difference between synchronous counter and asynchronous counter ? Design 3-bit synchronous up-counter using MS JK-flip-flop. [10]

- (b) Design a sequence detector using D-FFs to detect the following sequence based on Mealy machine : [8]

1101.

9. (a) Explain ASM technique of designing the sequential circuits in detail. How does it differ from conventional flow chart ? [8]

- (b) Describe the different modeling styles of VHDL with suitable example. [8]

*Or*

10. (a) Give the features of ASM. Draw the ASM chart for 2-bit binary up-counter with an enable signal  $e$  such that : [8]

for  $e = 0$  disable counting

$e = 1$  enable counting.

- (b) With the help of suitable example, explain the data objects : [8]

Constant, variable, signal and file.

11. (a) Define PLD and mention different types of PLD. Implement the following function using PAL : [8]

$$F(A, B, C, D) = \Sigma m(0, 1, 3, 15).$$

- (b) Draw and explain the architectural diagram of 8085 microprocessor. [8]

*Or*

12. (a) What do you mean by FPGA ? Explain the details of internal architecture of FPGA. [8]

- (b) Draw the block diagram of simple microprocessor based system and explain the function of each block. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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**[4162]-204**

**S.E. (Computer) (First Semester) EXAMINATION, 2012**

**DATA STRUCTURES AND ALGORITHM**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

**SECTION I**

1. (a) What do you mean call by value and call by reference ? Explain with example. [6]

(b) Write a recursive function for the following. Explain it by taking  $x = 6$  :

$$f(x) = 5 + \frac{1}{5} + \frac{1}{5 + \frac{1}{5}} + \frac{1}{5 + \frac{1}{5 + \frac{1}{5}}} . \quad [10]$$

P.T.O.

*Or*

2. (a) What is recursive function ? How is stack used in recursive functions ? Explain with *one* example. [6]
- (b) What are different modes available in C to handle binary/text file ? Explain with example. [6]
- (c) Write 'C' function to display, total number of line, spaces, numbers and alphabets of given text file. [4]

3. (a) Explain the following with example :  
Persistent and ephemeral data structures, static and dynamic data structures. [4]
- (b) What is abstract data type ? Write an ADT string. [5]
- (c) What is the frequency count of the following : [7]

```
int fact (int n)
{
    if (n == 1)
    {
        Return (1);
    }
    Else
    Return (n * fact (n-1));
}
```

Find out time and space complexity.

*Or*

4. (a) Define algorithm. Explain the characteristics of an algorithm with an example. [5]
- (b) Write 'C' function to display magic square matrix. What is its time complexity ? [6]
- (c) Explain Big 'O', Sigma ( $\Omega$ ) and Theta ( $\theta$ ) notation with example. [5]
5. (a) Write an ADT for sparse matrix. Write pseudo code for adding two sparse matrices. Find out time complexity of it. [12]
- (b) Derive the address calculation formula for two-dimensional array in column major representation and calculate the address of an element  $X[2][3]$  in an array of integers  $X[5][4]$  using the same. [6]

*Or*

6. (a) What is sparse matrix ? What are advantages of fast transpose over simple transpose of sparse matrix ? [6]
- (b) Write pseudo code for multiplying two polynomials. [12]

## SECTION II

7. (a) Write a Binary search and Linear search algorithm and analyze the same to find out its worst case, average case and best case complexity. [10]
- (b) Write output of each pass of merge sort for the following list : [6]
- 26, 5, 77, 1, 61, 11, 59, 15, 48, 19

*Or*

8. (a) Sort the following data in ascending order using Radix sort : [6]
- 310, 32, 66, 29, 6, 12, 41, 40, 44, 20, 24
- (b) Explain stability in sorting. Name at least *two* stable and unstable sorting methods. [4]
- (c) Write a pseudo 'C' code to implement quick-sort. [6]
9. (a) Explain circular DLL with example. [4]
- (b) Write and explain node structure to represent GLL in C. Show the graphical representation of the following using GLL : [7]
- (a, b, ( ), c, (d, e, (f)), g)

- (c) Write a pseudo 'C' code to merge two sorted singly linked list. What is the complexity ? [5]

*Or*

10. (a) Write a pseudo 'C' code to delete given node from singly listed list. [4]
- (b) Explain node structure to represent polynomial using GLL in C. What are its advantages for polynomial representation over simple linked list ? [6]
- (c) Consider the following polynomials represented using linked lists :

$$P_1 = 5X^{12} + 2X^6 + 3$$

$$P_2 = 6X^{12} - 5X^8 + 12X^5$$

Show the addition process of the above polynomials diagrammatically. [6]

11. (a) Convert the given infix expressions in postfix form. Show step by step conversion and evaluate postfix expression with  $a = 5$ ,  $b = 2$ ,  $c = 10$ .
- $$c * (a - b * (c/a) + b) + c. \quad [8]$$

- (b) Write an ADT for Circular Queue. Explain its primitive functions with example. [6]
- (c) List any *four* applications of Queue and explain any *one*. [4]

*Or*

- 12.** (a) Write short notes on :
- (1) Multiple stacks
  - (2) Priority queue. [8]
- (b) Write a pseudo 'C' code to convert a given prefix expression into postfix expression. [5]
- (c) Write a pseudo 'C' code to evaluate postfix expression. Explain with example. [5]



Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-205**

**S.E. (Computer Engineering & I.T.) (I Sem.) EXAMINATION, 2012**

**HUMANITIES AND SOCIAL SCIENCES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) Define a family. What are its different types ? What are the features of different families ? Explain. [8]
- (b) Discuss the problem of regionalism in India in brief. [4]
- (c) State the important features of Indian Constitution. [4]

*Or*

2. (a) “India is a land of unity in cultural diversity.” Comment. [8]
- (b) Explain the components of Secularism in India. [8]

P.T.O.

- 3.** (a) Briefly explain the process of socio-economic development due to industrialization in India. [10]
- (b) What are the features of National Education Policy in India ? Explain in brief. [6]

*Or*

- 4.** (a) Explain the various characteristics of social change. [8]
- (b) Explain in brief the evolution of humans. [8]
- 5.** Write short notes on the following : [18]
- (i) Green revolution
- (ii) Consumer awareness
- (iii) Agricultural development in India.

*Or*

- 6.** (a) Explain in detail the role of private sector in development of economy of India. [10]
- (b) Explain the role of Government of India for providing employment to masses in rural and urban area. [8]

## SECTION II

7. (a) Explain the following : [10]
- (i) Hydropower energy
  - (ii) Biomass
  - (iii) Geothermal energy
  - (iv) Soil erosion
  - (v) Air pollution.
- (b) Explain in brief the human induced causes of Eco-System degradation. [6]

*Or*

8. (a) What are the different sources of non-conventional energy ? Explain in brief. [8]
- (b) What are the causes and effect of global warming ? [8]
9. (a) Explain the need for planned economic development of India. [8]
- (b) Discuss the importance of census of India in the process of planning socio-economic development of country. [8]

*Or*

10. (a) Explain in brief Law of Demand with exceptions. [8]
- (b) Explain the following : [8]
- (i) Inflation
  - (ii) National Income.

11. (a) Explain in brief the importance of ratio analysis. [8]  
(b) Explain the banking system in India. [5]  
(c) What is budget ? Explain budgetary control. [5]

*Or*

12. Write short notes on the following : [18]  
(i) Cost analysis  
(ii) Financial Institutions in India  
(iii) International aid for economic growth.

Total No. of Questions—12]

[Total No. of Printed Pages—4

Seat No.	
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**[4162]-206**

**S.E. (Computer Engg.) (Second Semester) EXAMINATION, 2012**

**MICROPROCESSOR AND INTERFACING TECHNIQUES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data if necessary.

### **SECTION I**

1. (a) Draw and explain functional block diagram of the 8086 microprocessor. [8]

(b) Explain the flag register of 8086 microprocessor in detail. [8]

*Or*

2. (a) Draw and explain the memory read timing cycle of 8086 microprocessor for minimum mode. [8]

P.T.O.

- (b) Compare memory mapped I/O and I/O mapped I/O. [6]
- (c) Explain the function of  $\overline{\text{TEST}}$ ,  $\text{IO}/\overline{\text{M}}$  pins of 8086 microprocessor. [2]
3. (a) Explain the different addressing modes of 8086 along with suitable example. [8]
- (b) Write an 8086 assembly language program to find average of block of  $n$ -bytes. [8]

*Or*

4. (a) Explain the following instruction for 8086 microprocessor : [6]
- (i) CALL
- (ii) RAR
- (iii) CMPS.
- (b) Explain any *four* assembler directives. [4]
- (c) Write an 8086 ALP to generate a delay of 200  $\mu$  sec. If 8086 system is running at 10 MHz. [6]
5. (a) Compare .COM files and .EXE files. Explain the procedure to generate .COM and .EXE files from ASM files. [8]
- (b) What is TSR ? Explain the structure of TSR in detail. [10]

*Or*

6. (a) What is IVT of 8086 ? Explain its structure in detail. [8]  
(b) Draw and explain complete interfacing diagram between 8086 and two 8259 PIC connected in master-slave configuration. [10]

## SECTION II

7. (a) Explain mode 0 and BSR mode of 8255 with appropriate control word formats. [8]  
(b) Interface a typical 8-bit DAC with 8255 and write a program to generate triangular waveform of period 10 m sec. The CPU runs at 10 MHz clock frequency. [10]

*Or*

8. (a) Write instruction sequence to program 8251 for asynchronous transmission with seven data bits, 1 stop bit and no parity with 6400 baud rate. [8]  
(b) With the help of timing diagram explain the functioning of 8255 group A in mode 1, input mode. [10]
9. (a) Explain different input modes and output modes available in 8279. [8]  
(b) Explain with the help of block diagram functioning of 8254. Explain its programmable modes mode 0 and mode 1. [8]

*Or*

- 10.** (a) Draw and explain functional block diagram of 8279. [8]  
(b) Explain the various modes of 8237 in detail. [8]
- 11.** (a) Draw and explain minimum mode configuration of 8086 microprocessor. [8]  
(b) Draw and explain the architecture of 8087 NDP (math coprocessor). [8]

*Or*

- 12.** (a) Design a 8086 based system with the following specifications : [10]  
(i) 8086 working with 10 MHz at maximum mode.  
(ii) 32 kB EPROM using 16 kB devices  
(iii) 256 kB RAM using IC 62512.  
(b) Draw and explain internal block diagram of 8284 in detail. [6]



Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-207**

**S.E. (Computer) (Second Semester) EXAMINATION, 2012**

**DATA STRUCTURES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) List and explain in brief applications of binary tree. [4]
- (b) What are properties for binary trees that distinguish them from general tree ? [6]
- (c) Write algorithm for traversal of binary tree and give suitable example for the same : [8]
  - (i) Inorder
  - (ii) Preorder
  - (iii) Postorder.

P.T.O.

*Or*

2. (a) Write algorithm to delete node from BST. [8]  
(b) Write algorithm for inorder traversal of a threaded binary tree and give its time complexity. Also give example for the same. [10]
3. (a) What are graph storage structures ? Explain in detail. [8]  
(b) Write algorithm for Depth First Traversal of the graph and give suitable example for the same. [8]

*Or*

4. (a) Write Prim's algorithm and explain stages of the algorithm for the following example : [8]

- (b) Write pseudo code to find the shortest path in weighted graph. Find the shortest path in the following graph from node 0 to node 4. [8]

5. (a) Write and explain algorithm to insert node into AVL tree. [8]  
(b) Explain with example LL, LR, RR, RL rotation for AVL tree. [8]

*Or*

6. (a) What is bucket hashing ? Explain with example. [8]  
(b) What is hash function ? Explain the following hash functions : [8]  
(i) Mid-square  
(ii) Modulo Division  
(iii) Folding Method  
(iv) Digit Analysis.

## SECTION II

7. (a) Write an ADT for a binary heap. Explain different operations on MAX heap in brief with example (any *three*). [10]  
(b) What is multiway tree ? State need of multiway trees. Explain B+ tree in brief. [8]

*Or*

8. (a) Construct a B tree of order 5 for the following data : [10]  
50, 85, 12, 10, 6, 60, 70, 80, 37, 100, 120, 65,  
150, 62, 30, 17, 15, 28, 75, 78.

- (b) Write an algorithm to arrange numbers in ascending order using heapsort. Arrange the following numbers in ascending order using heapsort : [8]

48, 0, -1, 82, 10, 2, 100.

9. (a) Write a C/C++ program to perform create, insert, display and search operations for sequential file organization. [8]
- (b) What is index sequential file organization ? State its advantages and disadvantages. [8]

*Or*

10. (a) List different file organizations. State the need of file organizations. List different primitive operations on files. Compare sequential file with index sequential file organization. [10]
- (b) Explain in brief direct access file organization with example. [6]
11. (a) Explain the following terms : [8]
- (i) Containers
  - (ii) Iterators
  - (iii) Algorithms
  - (iv) Generic programming.

- (b) State the use of the following functions w.r.t. STL stack-push, size, empty, top. Write a program in C++ to implement stack using STL. [8]

*Or*

- 12.** (a) What is STL ? What are the components of STL ? Explain each in brief. [8]
- (b) What is iterator ? List different types of iterators and explain each in brief. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-208**

**S.E. (Computer) (Second Semester) EXAMINATION, 2012**

**COMPUTER GRAPHICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-**
- (i) Answer any *three* questions from each Section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) Consider a line from (4, 9) to (7, 7). Use Bresenham's line drawing algorithm to rasterize this line. [10]
- (b) Explain the various character generation methods. [8]

*Or*

2. (a) Consider the line from (0, 0) to (-6, -6). Use the simple DDA algorithm to rasterize this line. [10]

P.T.O.

- (b) Write short notes on : [8]
- (i) Scanner
  - (ii) Flat panel displays.
3. (a) What is a polygon ? What are the different types of polygons ? [6]
- (b) What is scan line polygon filling algorithm ? Explain with an example. [10]

*Or*

4. (a) What is the need for clipping ? Explain Cohen-Sutherland outcode algorithm with the help of an example. [8]
- (b) What is viewing transformation ? [8]
5. (a) What is homogeneous co-ordinate system ? What is the need for this system in transformations ? [6]
- (b) Explain in detail rotation of an object about an arbitrary axis in 3D. [10]

*Or*

6. (a) Describe the following transformations with respect to 2D : [8]
- (i) Scaling

- (ii) Rotation
  - (iii) Translation
  - (iv) Shearing.
- (b) Write a short note on projections. [8]

## SECTION II

7. (a) Explain a segment table with an example. What are the data structures used to implement the segment table ? [8]
- (b) Compare and contrast conventional and computer based animation. [8]

*Or*

8. (a) Explain the features of computer graphics and animation software 3D studio or Maya. Enlist its applications. [10]
- (b) Explain in detail the operations performed on a segment table. [6]
9. (a) Why are hidden surface algorithms needed ? Explain any *two* algorithms used for removing hidden surfaces. [10]
- (b) Write short notes on : [8]
- (i) HSV color model
  - (ii) CMY color model.



*Or*

- 10.** (a) Explain the following with the help of an example : [8]
- (i) Backface algorithm
  - (ii) Painter's algorithm.
- (b) Explain the following : [10]
- (i) Gouraud method of shading
  - (ii) Color models
  - (iii) Ray tracing
  - (iv) CIE chromaticity diagram
  - (v) Diffused illumination.
- 11.** (a) What is interpolation ? Explain Lagrange interpolation method. [8]
- (b) What are fractals ? Explain how fractal line algorithm can be used for generating fractal surface. [8]

*Or*

- 12.** (a) Explain the term control points and order of connectivity in curve drawing. [8]
- (b) Write short note on fractal lines and fractal surfaces. Give 2 applications of each. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-209**

**S.E. (Computer Engineering) (Second Semester)**

**EXAMINATION, 2012**

**COMPUTER ORGANISATION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) Explain Booth's algorithm to multiply the following pair of signed two's complement numbers : [10]
- A = 15 multiplicand
- B = -6 multiplier.
- (b) Draw and explain Von Neumann Architecture. [8]

P.T.O.

*Or*

2. (a) Explain the single precision and double precision floating point format. Represent  $(17.125)_{10}$  in single precision and double precision floating point format. [12]
- (b) Draw and explain the flowchart for floating point addition. [6]
3. (a) Explain data hazards in instruction pipelining. [8]
- (b) Describe the following addressing modes along with suitable examples : [8]
- (i) Immediate
  - (ii) Register indirect
  - (iii) Autoincrement
  - (iv) Index.

*Or*

4. (a) How is the instruction execution done in 4-stage pipeline ? [8]
- (b) What are the advantages of pipelining ? [8]
5. (a) Draw and explain the single bus organization of the CPU. [8]
- (b) Draw and explain microprogram control unit. [8]

*Or*

6. (a) What are the different design methods for hardwired control units ? Explain any *one*. [8]
- (b) With the help of circuit diagram, explain how Zin and End signals are generated. [8]

## SECTION II

7. (a) Enlist the differences between SRAMs and DRAMs. [6]  
(b) What is the use of memory controller ? Explain with neat diagram. [8]  
(c) Define the terms seek time, rotational delay, access time and transfer time with reference to disk storage. [4]

*Or*

8. (a) Which techniques are used to perform the write operations in cache memory ? [6]  
(b) What are the advantages of virtual memory ? [4]  
(c) Explain the associative mapping technique with neat diagram. [8]
9. (a) How does the processor handle the simultaneous arrival of interrupt requests ? [8]  
(b) What is the use of interrupts in OS ? [8]

*Or*

10. (a) With the help of neat diagram explain the use of DMA controller in a computer. [6]  
(b) What are the differences between Synchronous and Asynchronous buses ? [4]  
(c) With the help of block diagram explain the serial port. [6]

11. (a) What are the ways of implementing parallel processors ?  
Explain. [6]
- (b) What are the characteristics of large register file and cache organization ? [4]
- (c) Enlist the characteristics of reduced instruction set architecture. [6]

*Or*

12. (a) Explain symmetric multiprocessors (SMP). [4]
- (b) Write short notes on any *three* : [12]
- (i) CISC V/s RISC
  - (ii) Superscalar architecture
  - (iii) Daisy chaining
  - (iv) Polling.

Total No. of Questions—12]

[Total No. of Printed Pages—8+3

<b>Seat No.</b>	
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**[4162]-210**

**S.E. (Comp/IT/Electrical/Instru.) (Second Semester)**

**EXAMINATION, 2012**

**ENGINEERING MATHEMATICS—III**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Figures to the right indicate full marks.
- (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- (v) Assume suitable data, if necessary.

**SECTION I**

**1. (a) Solve any three of the following : [12]**

(i) 
$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x \cos x$$

P.T.O.

$$(ii) \quad \frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = \sin(e^x)$$

$$(iii) \quad \frac{d^2y}{dx^2} + y = \operatorname{cosec} x \quad [\text{By Variation of Parameter}]$$

$$(iv) \quad x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left( x + \frac{1}{x} \right).$$

- (b) An uncharged condenser of capacity  $C$  charged by applying an e.m.f. of value  $E \sin\left(\frac{t}{\sqrt{LC}}\right)$  through the leads of Inductance  $L$  and of negligible resistance. The charge  $Q$  on the plate of condenser satisfies differential equation :

$$\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E}{L} \sin\left(\frac{t}{\sqrt{LC}}\right).$$

Prove that the charge at any time ' $t$ ' is given by :

$$Q = \frac{EC}{2} \left[ \sin\left(\frac{t}{\sqrt{LC}}\right) - \frac{t}{\sqrt{LC}} \cos \frac{t}{\sqrt{LC}} \right]. \quad [4]$$

*Or*

- 2.** (a) Solve any *three* of the following : [12]

$$(i) \quad \frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 3y = e^x \cdot \cos 2x$$

$$(ii) \quad (3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$$

$$(iii) \quad \frac{dx}{x(y^2 - z^2)} = \frac{dy}{y(z^2 - x^2)} = \frac{dz}{z(x^2 - y^2)}$$

$$(iv) \quad \frac{d^2y}{dx^2} + \frac{dy}{dx} = \frac{1}{1 + e^x}.$$

(b) Solve : [4]

$$\frac{dx}{dt} + 2x - 3y = t$$

$$\frac{dy}{dt} - 3x + 2y = e^{2t}.$$

3. (a) If

$$u = \frac{1}{2} \log(x^2 + y^2),$$

find  $v$  such that  $f(z) = u + iv$  is analytic. Also find  $f(z)$  in terms of  $z$ . [6]

(b) Evaluate :

$$\oint_C \frac{3z^2 + z}{z^2 - 1} dz$$

where 'C' is the circle  $|z - 1| = 1$ . [5]



- (c) Find the bilinear transformation, which maps the points  $1, i, -1$  from  $Z$ -plane into the points  $i, 0, -i$  in  $W$ -plane. [5]

*Or*

4. (a) Under the transformation  $w = \frac{1}{z}$ , find the image of  $|z - 2i| = 2$ . [6]
- (b) Show that analytic function  $f(z)$  with constant amplitude is constant. [5]
- (c) Evaluate by using Residue Theorem :

$$\int_C \frac{(2z - 1)}{z(z + 1)(z - 3)} dz,$$

where  $C : |z| = 2$ . [5]

5. (a) Find the Fourier transform of [7]

$$f(x) = \begin{cases} 1 - x^2 & ; |x| < 1 \\ 0 & ; |x| > 1 \end{cases}$$

and use it to evaluate :

$$\int_0^{\infty} \left( \frac{x \cos x - \sin x}{x^3} \right) \cos \frac{x}{2} \cdot dx.$$

(b) Solve the integral equation [5]

$$\int_0^{\infty} F(x) \cdot \cos px \cdot dx = \begin{cases} 1-p & ; \quad 0 \leq p \leq 1 \\ 0 & ; \quad p > 1 \end{cases}$$

and hence deduce that :

$$\int_0^{\infty} \frac{\sin^2 t}{t^2} dt = \frac{\pi}{2}.$$

(c) Find the  $z$ -transform of the following functions (any two) : [6]

(i)  $f(k) = \frac{a^k}{k!} \quad ; \quad k \geq 0$

(ii)  $f(k) = \frac{\sin ak}{k} \quad ; \quad k > 0$

(iii)  $f(k) = ka^k \quad ; \quad k \geq 0.$

Or

6. (a) Find the Inverse  $z$ -transform of the following functions (any two) : [8]

(i)  $F(z) = \frac{z^2}{\left(z - \frac{1}{4}\right)\left(z - \frac{1}{5}\right)}; \quad \frac{1}{5} < |z| < \frac{1}{4}$

(ii)  $F(z) = \frac{(z+1)}{z^2 - 2z + 1}; \quad |z| > 1$

(iii)  $F(z) = \frac{10z}{z^2 - 3z + 2}$  [By Inversion Method].

(b) Solve :

$$f(n + 2) - 3f(n + 1) + 2f(n) = 0;$$

$$f(0) = 0 \text{ and } f(1) = 1, \text{ using } z\text{-transform.} \quad [4]$$

(c) Find the Fourier sine transform of  $e^{-|x|}$ . Hence evaluate :

$$\int_0^{\infty} \frac{x \cdot \sin mx}{1 + x^2} \cdot dx. \quad [6]$$

## SECTION II

7. (a) Calculate the first four moments about mean for the following data. Also find  $\beta_1$  and  $\beta_2$ . [9]

Variable	Frequency
1	1
2	6
3	13
4	25
5	30
6	22
7	9
8	5
9	2

- (b) Given  $\bar{x} = 20$ ,  $\bar{y} = 25$ ,  $\sigma_x = 5$  and  $\sigma_y = 4$  and correlation coefficient between X and Y is 0.6. Find the regression lines. [8]

*Or*

8. (a) A bag contains 5 white and 4 black balls. If 3 balls are drawn at random, what are the probabilities of the following :

- (i) 2 of them are white  
(ii) at most one of them is white. [6]

- (b) An automatic machine makes paper clips from coils of wire and on the average, one in 400 clips is defective. If 100 paper clips are packed in each box, what are the probabilities that any box of clips will contain :

- (i) no defective  
(ii) at least one defective. [6]

- (c) If the weekly wages of 10000 workers in a factory follows normal distribution with mean and S.D. as Rs. 70 and Rs. 5 respectively, find the expected number of workers whose weekly wages are between Rs. 66 and Rs. 72 :

$$\text{Area} = 0.1554 \text{ when } z = 0.4$$

$$\text{Area} = 0.2881 \text{ when } z = 0.8. [5]$$

9. (a) Find the angle between the tangents to the curve :

$$\text{at } t = 1 \text{ and } t = 2. \quad [5]$$

(b) Find the values of the constants  $a, b, c$  so that the directional derivative :

$$\phi = axy^2 + byz + cz^2x^2$$

at  $(2, 1, 1)$  has a maximum magnitude 12 in the direction parallel to  $x$ -axis. [6]

(c) If

$$\bar{F} = (x^2 - y^2 + 2xz)i + (xz - xy + yz)j + (z^2 + x^2)k,$$

then show that  $\text{curl } \bar{F}$  at  $(1, 2, -3)$  and  $(2, 3, 12)$  are orthogonal. [5]

*Or*

10. (a) Attempt any *two* : [6]

Prove that

$$(i) \quad \bar{a} \cdot \nabla \left[ \bar{b} \cdot \nabla \left( \frac{1}{r} \right) \right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{\bar{a} \cdot \bar{b}}{r^3}$$

$$(ii) \quad \nabla^2 (r^2 e^r) = e^r [r^2 + 6r + 6]$$

$$(iii) \quad \nabla \left( \frac{\bar{a} \cdot \bar{r}}{r^n} \right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a} \cdot \bar{r})}{r^{n+2}} \bar{r}.$$

(b) Show that the vector field given by

$$\bar{F} = (y^2 \cos x + z^2)i + (2y \sin x)j + 2xz\hat{k}$$

is conservative and find scalar field such that  $\bar{F} = \nabla\phi$ . [5]

(c) If

$$\bar{r}(t) = t^2i + tj - 2t^3k,$$

then evaluate :

$$\int_1^2 \bar{r} \times \frac{d^2\bar{r}}{dt^2} dt. \quad [5]$$

11. (a) If

$$\bar{F} = 2xyz i + (x^2z + 2y) j + x^2y k,$$

then find the work done in moving a particle under this force field from (0, 1, 1) to (1, 2, 0). [5]

(b) Evaluate :

$$\iint_S [xz^2 i + (x^2y - z^2)j + (2xy + y^2z)k] \cdot d\bar{S}$$

where S is the surface enclosing a region bounded by hemisphere  $x^2 + y^2 + z^2 = 4$  above  $xy$ -plane. [6]

(c) Evaluate :

$$\iint \nabla \times \bar{F} \cdot \hat{n} dS$$

for the surface of the paraboloid  $z = 4 - x^2 - y^2$  ( $z \geq 0$ )  
and

$$\bar{F} = y^2 i + z j + xy \hat{k}. \quad [6]$$

*Or*

12. (a) A vector field is given by

$$\bar{F} = \tan y i + x(1 + \sec^2 y) j,$$

evaluate :

$$\int_C \bar{F} \cdot d\bar{r}$$

where C is the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, z = 0.$  [6]

(b) Show that :

$$\iint_S \bar{r} \cdot \hat{n} dS = 4\pi,$$

where S is the surface of the sphere of radius 1 with centre  
at origin. [6]

(c) Equations of electromagnetic wave theory are given by :

$$\nabla \cdot \bar{\mathbf{D}} = \rho, \nabla \times \bar{\mathbf{H}} = \frac{1}{C} \left[ \frac{\partial \bar{\mathbf{D}}}{\partial t} + \rho \bar{\mathbf{V}} \right] \quad \nabla \times \bar{\mathbf{D}} = \frac{-1}{C} \cdot \frac{\partial \bar{\mathbf{H}}}{\partial t}$$

where C is constant. Prove that :

$$\nabla^2 \bar{\mathbf{D}} - \frac{1}{C^2} \frac{\partial^2 \bar{\mathbf{D}}}{\partial t^2} = \nabla \rho + \frac{1}{C^2} \frac{\partial}{\partial t^2} (\rho \bar{\mathbf{V}}). \quad [5]$$



Total No. of Questions—12]

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**[4162]-210-A**

**S.E. (Computer Engg.) EXAMINATION, 2012**  
**FINANCIAL AND INDUSTRIAL MANAGEMENT**  
**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What are the responsibilities of a successful manager in managing a manufacturing organisation ? Explain the qualities essential for a good manager. [8]
- (b) State and explain the principles of scientific management. [8]

P.T.O.

*Or*

- 2.** (a) What is management ? Explain different functions of management in brief. [8]
- (b) Explain Henry Fayol's principles of management. [8]
- 3.** (a) What is ERP ? How does enterprise resources planning help the organisation for resources integration ? [8]
- (b) Explain the following with an example : [8]
- (i) Patents
- (ii) Copyrights.

*Or*

- 4.** (a) Define 'Economics' and state its importance. [8]
- (b) What is demand ? Explain the Law of Demand with its assumptions. [8]
- 5.** (a) Define the term 'organisation'. What steps should be taken in developing an organisation ? [9]
- (b) Draw and explain line and staff organisation. State and explain its relative advantages and disadvantages. [9]

*Or*

- 6.** (a) Distinguish between Partnership and Joint Stock Company with their relative merits and demerits. [10]
- (b) Differentiate in between project and matrix organisation. [8]

## **SECTION II**

- 7.** (a) Define manpower planning. Explain the process and factors affecting manpower planning. [8]
- (b) Differentiate between McGregor's theory X and theory Y with suitable examples. [8]

*Or*

- 8.** (a) "Communication makes an organisation live." Discuss emphasising the importance of communication in an organisation. [8]
- (b) Explain with a neat diagram Maslow's need priority model. [8]
- 9.** (a) What is capital market ? Explain the functioning of capital market in India. [10]
- (b) What is a balance sheet ? Illustrate the forms and contents of balance sheet. [6]

*Or*

- 10.** (a) What is an overhead cost ? Explain different types of overhead costs. [6]
- (b) State and explain different sources of capital available to an enterprise under short and long-term. [10]
- 11.** (a) Define the following and list out merits and demerits of each : [8]
- (i) Accounting rate of return method
- (ii) Pay-back method.
- (b) A concern is manufacturing a product which is sold for Rs. 10 per unit and fixed cost of the asset is Rs. 50,000 and variable cost of Rs. 6 per unit. How many units must be produced to earn a profit of Rs. 10,000 and what would be the profit for sales volume of 20,000 units. [10]

*Or*

- 12.** (a) Define Break-even point. What are the assumptions underlying Break-even analysis ? Construct a CVP graph and highlight its importance to industry. [12]
- (b) Explain the following : [6]
- (i) Liquidity ratio
- (ii) Activity ratio
- (iii) Debt-equity ratio.

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-210-B**

**S.E. (Computer) (Second Semester) EXAMINATION, 2012**

**ELECTRONIC DEVICES AND CIRCUITS**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer questions 1 or 2, 3 or 4 and 5 or 6 from Section I and questions 7 or 8, 9 or 10 and 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Define quiescent point (Q) and state different biasing circuits in BJT and explain any *one* in detail. [8]
- (b) What is bias compensation and why is it required ? Explain *one* bias compensation technique in detail. [8]

P.T.O.

*Or*

- 2.** (a) Define and explain the term Thermal runaway and Thermal resistance. [8]
- (b) Fixed bias silicon BJT circuit,  $V_{cc} = 12\text{ V}$ ,  $R_B = 220\text{ k ohms}$ ,  $R_C = 2.7\text{ kohms}$ ,  $\beta = 50$ . Determine the operating point (Q). [8]
- 3.** (a) State and explain Miller's theorem. Derive equation for input and output resistance. [8]
- (b) Explain with neat diagram the Darlington emitter follower circuit. [8]

*Or*

- 4.** (a) By using approximation hybrid analysis of BJT, obtain the equation for  $A_i$ ,  $R_{in}$  and  $A_v$ . [8]
- (b) Explain, why CE configuration is used as an amplifier in comparison with CB and CC configuration of BJT ? [8]
- 5.** (a) List various types of coupling in Multistage amplifier and explain *one* type in detail. [10]
- (b) Compare large signal amplifier and small signal amplifier in BJT. [8]

*Or*

6. (a) Explain harmonics and crossover distortion in large signal amplifier. [8]
- (b) What do you understand by Class A, Class B and Class C power amplifier ? Compare them with the Q point on the d.c. load line. [10]

## SECTION II

7. (a) With the help of neat diagram explain construction, drain and transfer characteristics of n-channel JFET. [8]
- (b) Compare common drain, Common gate and Common source configuration in JFET. [8]

*Or*

8. (a) Give the comparison between DMOSFET and EMOSFET. [8]
- (b) Define the JFET parameters and establish the relationship between them. [8]
9. (a) Define op-amp. Draw and explain the block diagram of op-amp. [8]
- (b) Draw the inverting amplifier using op-amp and derive the expression for its voltage gain. [8]

*Or*

- 10.** (a) Draw and explain with neat diagram a square wave generator using op-amp. [8]
- (b) Draw and explain an integrator circuit using op-amp, also draw input and output waveforms. [8]
- 11.** (a) Draw a block diagram of SMPS. State its various applications. [8]
- (b) Explain the construction, operation and V-I characteristics of SCR. [10]

*Or*

- 12.** (a) Compare Linear power supply and Switch mode power supply (SMPS) and explain. [10]
- (b) Draw and explain structure of IGBT. [8]



Total No. of Questions—12]

[Total No. of Printed Pages—4+1

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**[4162]-211**

**S.E. (Information Technology) (First Semester)**

**EXAMINATION, 2012**

**COMPUTER ORGANIZATION**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-**
- (i) Answer question 1 or 2, 3 or 4, and 5 or 6 from Section I and question 7 or 8, 9 or 10, and 11 or 12 from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Draw flow chart for restoring division algorithm and perform division of the following numbers using restoring division algorithm :  
Dividend = 1100, Divisor = 11. [10]

P.T.O.

- (b) Describe the IEEE standards for single precision floating point numbers. Represent  $-(307.1875)_{10}$  in single precision format. [8]

*Or*

2. (a) Draw the flowchart for Booth's multiplication algorithm and solve the following using Bit Pair Recoding method : [10]

Multiplicand = 110101 Multiplier = 011011

- (b) Explain IAS (Von Neumann) Architecture with the help of a neat diagram and list the instructions supported by IAS computer. [8]
3. (a) What do you mean by programmers model of 8086 ? Explain the same with the help of neat diagram. [8]
- (b) Explain the following addressing modes of 8086 with *one* example of each : [8]
- (i) Immediate
  - (ii) Register Indirect
  - (iii) Direct
  - (iv) Based Index with displacement.

*Or*

4. (a) Draw Timing diagram for memory read cycle of 8086 and list operations in each T state. [8]
- (b) Sketch block diagram showing basic 8086 minimum mode system. Explain functions of 8282 latches and 8286 transceiver. [8]
5. (a) Draw and explain Single Bus Organization of the CPU, showing all the registers and data paths. [8]
- (b) Explain the design of Multiplier Control unit using Delay Element Method. [8]

*Or*

6. (a) In microprogrammed control what is the necessity of the grouping of control signals ? Also explain the procedure of control signals with the help of suitable example. [8]
- (b) Explain the sequence of operations needed to perform processor functions : [8]
- (i) Fetching a word from memory
- (ii) Performing an arithmetic or logical operation.

## SECTION II

7. (a) State cache mapping techniques. Draw and discuss them with their merits and demerits [10]
- (b) List and explain write policies used with cache memory and state write policy used for virtual memory with justification. [8]

*Or*

8. (a) Explain the terms virtual and physical address. How virtual address is converted into physical address when paging is enabled. [10]
- (b) Write short notes on : [8]
- (i) DVD
- (ii) CDROM.
9. (a) Draw control word format of 8255 and give significance of each bit in it. List operating modes of 8251. [8]
- (b) Explain the working principle of the following : [8]
- (i) Display Devices
- (ii) Scanner.

*Or*

- 10.** (a) State and explain different data transfer techniques. [8]  
(b) State features of 8251 and explain difference between synchronous and asynchronous serial communication. [8]
- 11.** (a) Compare closely and loosely coupled multiprocessor system. [8]  
(b) Write notes on : [8]  
(i) Symmetric multiprocessors  
(ii) Multiple processor organization.

*Or*

- 12.** (a) State and explain goals of RISC design. [8]  
(b) Write notes on : [8]  
(i) Clusters  
(ii) Vector Processors.

Total No. of Questions—12]

[Total No. of Printed Pages—4+2

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[4162]-212

**S.E. (I.T.) (First Semester) EXAMINATION, 2012**

**FUNDAMENTAL OF DATA STRUCTURE**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answers to the two Sections should be written in separate answer-books.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data wherever necessary.

**SECTION I**

1. (a) What is similarity between structure, union and enumeration ? [6]
- (b) What do you understand by precedence of arithmetic operators ? How does it work in C program ? Give suitable example. [6]
- (c) Differentiate while, do-while and for loop structures. [6]

*Or*

2. (a) Define pointers. How do we declare pointers ? Give its advantages. [6]

P.T.O.

- (b) Explain the use of break and continue statements in C with suitable example. [6]
- (c) Compare macro and function. [6]
- 3.** (a) What do you mean by type definition ? Explain with suitable example. [4]
- (b) Write a C program to interchange two variables without using third variable. [6]
- (c) Write output of the following C code : [6]

(i) # include <stdio.h>

```
main( )  
  
{  
  
    int x=3;  
  
    float y=3.0;  
  
    if(x==y)  
  
        printf (“\nx and y are equal”);  
  
    else  
  
        printf (“\nx and y are not equal”);  
  
}
```

```
(ii) # include <stdio.h>

void main( )
{
    int i=0;
    for (; i ;)
        printf ("\nHere is some mail for you");
}
```

```
(iii) # include <stdio.h>

main( )
{
    int x=4;
    while (x==1)
    {
        x = x-1;
        printf ("\n%d", x);
        --x;
    }
}
```

*Or*

4. (a) Differentiate between malloc and calloc. [4]
- (b) Explain various bitwise operators in C. Give example of each operator. [6]



- (c) Explain the following with example :
- (i) call by value
  - (ii) call by reference. [6]
5. (a) What do you mean by frequency count ? Explain its importance in the analysis of algorithm. [6]
- (b) Define the following terms :  
data object, data type, data structure. [6]
- (c) What is an abstract data type ? Explain with an example. [4]
- Or*
6. (a) Explain different Asymptotic notations. [4]
- (b) Explain primitive and non-primitive, linear and non-linear, static and dynamic, persistent and ephermal data structure. [8]
- (c) Write a non-recursive C function to generate Fibonacci series. [4]

## SECTION II

7. (a) Compare the Selection sort and Insertion sort with respect to :
- (i) Time complexity
  - (ii) Passes
  - (iii) Storage requirement
  - (iv) Sort stability. [8]

- (b) Write a non-recursive pseudo C routine to sort the numbers using Merge sort. Show all passes to sort the values using Merge Sort in ascending order : [8]

21, 5, 7 11, 35, 76, 0, 9, 27, 45.

*Or*

8. (a) What is Bubble sort ? Explain with example. [4]  
(b) Sort the following data to ascending order using Quick sort. Show all passes with pivot : [6]  
17, 8, -9, 2, 0, -5, 7, 20, 11, 15.  
(c) Write pseudo code for Binary search with recursion. [6]

9. (a) What is sparse matrix. List the applications. [4]  
(b) Explain with example simple and fast transpose. [8]  
(c) Write a pseudo C code for performing the following string operations without using library functions :  
(i) Reverse of a string  
(ii) Concatenation of two strings. [6]

*Or*

10. (a) Represent sparse matrix using suitable data structure. Write pseudo C algorithm for addition of two sparse matrices. Analyze its time complexity. [12]  
(b) Explain sequential memory organization with example. [6]

11. (a) Write an algorithm for polynomial addition, where polynomials are represented using linked lists. [6]
- (b) Write function that removes all duplicate elements from a linear singly linked list. [6]
- (c) Write C pseudo code to insert and delete an element from singly linked list. [4]

*Or*

12. (a) Compare linked list to the arrays with reference to the following aspects :
- (i) Accessing any element randomly
- (ii) Insertion and deletion of an element
- (iii) Utilization of computer memory. [6]
- (b) Discuss the application of circular linked list in detail. [6]
- (c) Represent the following GLL :
- (i)  $((a, b), (c, d), e)$
- (ii)  $(a, (b, c), d)$ . [4]

Total No. of Questions—12]

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**[4162]-213**

**S.E. (Information Technology) (Second Semester) EXAMINATION, 2012**

**COMPUTER GRAPHICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :-** (i) Answer Q. Nos. 1 or 2, 3 or 4, 5 or 6 from Section I and Q. Nos. 7 or 8, 9 or 10 and 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Explain Vector Generation principal for gentle and sharp slope lines. [4]

(b) What is aliasing ? Explain different anti-aliasing techniques. [8]

P.T.O.

- (c) Explain display file structure. Why is display file interpreter used ? Which are the commands used in display file interpreter ? [6]

*Or*

2. (a) Explain DDA line generation algorithm. Rasterize the line segment with starting point as A(1, 0) and end point as B(5, 7). [8]
- (b) Differentiate between Raster scan and Vector scan display systems. [4]
- (c) Explain various methods for character generation with example. [6]
3. (a) Explain homogeneous coordinate system. What is the need of homogeneous coordinates ? Give the homogeneous coordinates matrices for the 2D transformation : translation, rotation and scaling. [8]
- (b) Translate the polygon A(5, 7), B(7, 11) and C(12, 15) by 4 units in  $x$ -direction and 6 units in  $y$ -direction. [4]
- (c) Explain even-odd method for testing a pixel inside or outside the polygon. [4]

*Or*

4. (a) Define polygon. Explain different types of polygon with example. [4]
- (b) Find out the final coordinates of a figure bounded by coordinates A(1, 1), B(3, 4), C(5, 7) and D(10, 3) when rotated about a point (8, 8) by 30 in clockwise direction and scaled by two units in  $x$ -direction and three units in  $y$ -direction. [8]
- (c) Give the pseudocode for boundary fill algorithm for polygon filling. [4]
5. (a) Which are the different types of projections ? Explain any *one* in detail with mathematical treatment. [8]
- (b) What is meant by quadric surfaces ? Explain any *two* quadric surfaces with diagram and equations in both implicit and parametric form. [8]

*Or*

6. (a) Explain how an object is rotated about an arbitrary axis. [10]

- (b) Write short notes on (any *two*) : [6]
- (i) Polygon Meshes
  - (ii) Polygon Tables
  - (iii) Plane Equation.

## SECTION II

7. (a) What is animation ? Explain the basic rules required for animation. [8]
- (b) What are the different steps in animation sequence ? Explain each step in brief. [6]
- (c) Differentiate between RGB and CMYK color model. [4]

*Or*

8. (a) Explain the terms tints, tones and shades in the terminology of color mixing. [4]
- (b) Explain YIQ color model. Explain how YIQ to RGB conversion is done. [6]
- (c) What are the different animation languages that are used ? Explain each with an example. [8]

9. (a) Explain Ray tracing with a proper figure for the following : [8]
- (i) Ray tracing to solve hidden surface problem for every pixel
  - (ii) Ray tracing to find shadows
  - (iii) Ray tracing to find reflections.
- (b) Define shading. What are the different methods used for shading.  
Explain Gouraud Shading method used for shading. [8]

*Or*

10. (a) Explain the principle of pinhole camera. Which are the various secondary rays that are generated while viewing an object ? [8]
- (b) What is ray tracing ? Explain how the ray is represented in its parametric form. [4]
- (c) Explain Specular reflection with figure in detail. [4]
11. (a) Define Fractal with example. Give various methods in which fractals are classified. [8]
- (b) Explain Bezier curve generation using Midpoint subdivision algorithm. Also give the properties of Bezier curve. [8]



*Or*

- 12.** (a) Explain how fractal line algorithm can be used for generating fractal surface. [8]
- (b) Write short notes on any *two* : [8]
- (i) Hilbert's Curve
  - (ii) Rendering Equation
  - (iii) GPU
  - (iv) Texture Mapping.

Total No. of Questions—12]

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**[4162]-214**

**S.E. (Information Technology) (Second Semester) EXAMINATION, 2012**

**PROCESSOR ARCHITECTURE AND INTERFACING**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4 and Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, and Q. No. 11 or Q. No. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data if necessary.

**SECTION I**

1. (a) Draw and explain non-pipelined read cycle of 80386 processor. [10]
- (b) What is Machine Status Word (MSW) of 80386 ? Draw its format. [6]

P.T.O.

*Or*

- 2.** (a) With the help of block diagram explain the architecture of 80386 processor. [10]
- (b) What is the function of BE0 to BE3 signal ? Explain Memory Bank of 80386 processor. [6]
- 3.** (a) What are the components of MS-DOS ? [8]
- (b) Explain the addressing modes of 80386 showing physical address generation with example : [8]
- (i) Direct
- (ii) Register indirect
- (iii) Based indexed
- (iv) Scaled indexed with displacement.

*Or*

- 4.** (a) Draw and explain control word format for I/O and BSR mode of 8255. [8]
- (b) Compare and contrast : [8]
- (i) Procedure and Macro
- (ii) .COM and .EXE.
- 5.** (a) What is DPL, RPL and CPL ? Write privilege checks performed by 80386 while accessing data or stack segment in protection mechanism. [10]
- (b) Write down the steps to switch from RM to PM. [8]

*Or*

- 6.** What is logical address, linear address and physical address in 80386 ? Explain the process by which 80386 translates logical address into physical address when paging is enabled. Explain necessary registers and memory areas used. [18]

## **SECTION II**

- 7.** (a) How does 80386 do a Task Switch ? Explain the significance and format of TSS descriptor and TSS. [10]
- (b) What is Virtual mode ? How to switch from protected mode to virtual 86 mode ? [6]

*Or*

- 8.** (a) What is Call Gate ? Explain how call gate can be used to call a function with a higher privilege level. [8]
- (b) What is Interrupt Gate Descriptor ? Explain the process of interrupt handling in protected mode with the help of IDT and IDTR. [8]
- 9.** (a) Explain the physical structure and significance of all the I/O ports of the 8051 microcontroller. [8]
- (b) Explain interrupt structure of 8051 microcontroller with their priority structure. [6]
- (c) Explain IP register format and program IP register to assign the highest priority to INT1. [4]

*Or*

- 10.** (a) Design and draw a 8051 based microcontroller system with the following specifications. Also draw memory map for given memory devices : [10]
- (i) 8051 working at 12 MHz frequency.
  - (ii) 32 kB program memory.
  - (iii) 32 kB data memory.
- (b) Draw and explain internal memory organization of 8051 microcontroller. [8]
- 11.** (a) Write a program that continuously gets 8 bit data from P0 and send it to P1 while simultaneously creating a square wave of 200 microseconds period on pin P2.1. Use timer 0 interrupt with mode 2 to create the square wave. Assume crystal frequency = 11.0592 MHz. [10]
- (b) List the features of PIC 16F8XX. [6]

*Or*

- 12.** (a) Explain any *two* operating modes of Timer of 8051. [8]
- (b) Explain SCON, SBUF and PCON special function registers and their utility. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—7

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**[4162]-215**

**S.E. (I.T.) (Second Semester) EXAMINATION, 2012**

**DATA STRUCTURES AND FILES**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is static and dynamic hashing ? Show that the hash function  $h(k) = k \% 17$  does not satisfy the one way property, weak collision resistance or strong collision resistance. [8]
- (b) Differentiate between sequential and index sequential file. Write a pseudocode to read and write contents using index sequential file. [8]

P.T.O.

*Or*

- 2.** (a) Assume a hash table of size 15 and hash function  $H(X) = X \text{ Mod } 15$  performs linear probing with and without replacement for the given set of values. [8]

0, 1, 2, 4, 72, 65, 85, 87, 90, 58, 52, 53, 42, 44, 91.

- (b) Write a program in 'C' for sequential file and perform the following operations : [8]

(i) Copying all data from one file to another

(ii) Count number of characters in a file

(iii) Count number of words in file

(iv) Search a particular word in a file.

- 3.** (a) What is stack ? Give application of stack in computer organization. [4]

- (b) Imagine we have two empty stacks of integers, S1 and S2. Draw a picture of each stack after the following operations : [6]

Pushstack(S1, 3);

Pushstack(S1, 5);

Pushstack(S1, 7);

Pushstack(S1, 9);

```

Pushstack(S1, 11);

Pushstack(S1, 13);

While(!emptystack(S1))

{

Popstack(S1, x);

Popstack(S1, x);

Puphstack(S2, x);

}

```

(c) Change the following infix expression to postfix using stack.

Clearly indicate the content of stack.

(i)  $D-B+C$

(ii)  $A*B+C*D$

(iii)  $(A+B)*C-D*F+C$

(iv)  $(A-2)*(B+C-D*E)*F$  [8]

*Or*

4. (a) What is importance of stack in recursion. Explain with suitable example. [4]

(b) Implement stack as an ADT using linked organization. [6]



(c) If the values of A, B, C and D are 2, 3, 4 and 5 respectively.

Calculate the value of the following prefix expressions and clearly indicate the content of stack. [8]

(i)  $+ -*ABCD$

(ii)  $-*A+BCD$

(iii)  $+ -/ABCD$

(iv)  $- +/ABCD$

5. (a) Write an ADT for Queue and write pseudocode for circular queue using array organization. [8]

(b) Write a pseudocode for simple queue using linked organization and represent each pseudocode step diagrammatically. [8]

*Or*

6. (a) What is application of Queue in computers ? Explain the concept of multi-queue and *d*-queue with example. [8]

(b) Write a pseudocode for priority queue using sequential organization and represent each pseudocode step diagrammatically. [8]

## SECTION II

7. (a) Define the following with examples : [8]
- (i) Complete Binary Tree
  - (ii) Predecessor and Successor
  - (iii) Graph
  - (iv) OBST.
- (b) What is the necessity of converting a tree into binary tree ? Convert the following tree into a binary tree and list down the steps for the same. [8]

*Or*

8. (a) Write functions for non-recursive pre-order and in-order traversal algorithms for a in-order threaded binary tree. [8]
- (b) Construct a binary tree from the given traversals : [4]
- Pre-order : \* + a - b c / - d e - + f g h
- In-order : a + b - c \* d - e / f + g - h
- (c) Write a function for creating binary search tree. [4]

- 9.** (a) Write an algorithm to perform DFS traversal for a graph.  
Perform DFS & BFS for the following graph : [10]

- (b) Write short notes on Dijkstra's algorithm. [4]  
(c) Define Minimum Spanning Tree with an example. [2]

*Or*

- 10.** (a) Write an algorithm for Prim's method.  
Find minimum spanning tree using Prim's and Krushal's  
method. [10]

(b) Describe the different ways of graph storage structure with an example. [6]

11. (a) Construct an AVL search tree by inserting the following elements in the order of their occurrence. Show the balance factor and type of rotation at each stage : [12]

148	153	158	1000	112	145	120	149	128	146
-----	-----	-----	------	-----	-----	-----	-----	-----	-----

(b) Explain symbol table with its applications. [6]

*Or*

12. (a) Draw a Huffman tree for the given data set and find the corresponding Huffman codes : [8]

Character	Weight	Character	Weight
A	10	M	3
C	3	N	6
D	4	O	8
D	15	R	7
G	2	S	5
I	4	T	12
K	2	U	5

(b) Sort the following numbers in ascending order using heap sort :

77	62	14	9	30	21	80	25	70	55.
----	----	----	---	----	----	----	----	----	-----

Show the sorting stepwise. [10]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-216**

**S.E. (Information Tech.) (Second Semester) EXAMINATION, 2012**

**DATA COMMUNICATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answers to the two Sections should be written in separate answer books.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4 and Q. No. 5 or Q. No. 6 from Section I, Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, and Q. No. 11 or Q. No. 12 from Section II.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data if necessary.

**SECTION I**

1. (a) Explain various addresses in TCP/IP protocol suit. [8]
- (b) Explain the various transmission impairments in data communications. [4]
- (c) What is PCM ? Describe with the help of diagram. [4]

P.T.O.

*Or*

- 2.** (a) What is serial transmission ? Explain synchronous and asynchronous transmission. [8]
- (b) Explain block coding with 8B/10B as an example. [8]
- 3.** (a) An analog signal has a bit rate of 8000 bps and a baud rate of 1000 baud. How many data elements are carried by each signal element ? How many signal elements do we need ? [8]
- (b) Explain FHSS and DSSS. [8]

*Or*

- 4.** (a) Explain FDM and statistical TDM. [8]
- (b) Explain the following shift keying techniques with suitable diagram : [8]
- (i) ASK
- (ii) FSK
- (iii) PSK
- (iv) QAM.

- 5.** Write short notes on :
- (i) Co-axial cable and fiber optic cable [6]
- (ii) Unguided media [6]
- (iii) Virtual circuit networks. [6]

*Or*

- 6.** (a) Explain different modem standards. [6]  
(b) Explain the terms ADSL, ADSL lite and HDSL. [6]  
(c) Explain structure of circuit switches. [6]

## SECTION II

- 7.** (a) Explain error detection and error correction in block coding. [8]  
(b) What is Hamming distance ? What is the minimum hamming distance ? [4]  
(c) What is CRC ? Explain with figure CRC encoder and decoder. [6]

*Or*

- 8.** (a) What is checksum ? Describe in detail internet checksum method with suitable example. [8]  
(b) Explain stop-and-wait ARQ protocol. [6]  
(c) What is piggybacking in Go-Back-N ARQ. [4]
- 9.** (a) Discuss CSMA/CD random access technique. How is collision avoidance achieved in the same ? [8]  
(b) Explain FDMA, TDMA and CDMA. [8]

*Or*

- 10.** (a) Describe different controlled access protocol mentioned below :
- (i) Reservation
  - (ii) Polling. [8]
- (b) Describe gigabit ethernet with reference to the following :
- (i) MAC sublayer
  - (ii) Frame bursting
  - (iii) Topology. [8]

- 11.** Attempt any *two* questions from the following : [16]
- (a) Draw and explain SONET layers in detail.
  - (b) Explain two-layer and three-layer switches.
  - (c) Write a short note on bridges.

*Or*

- 12.** (a) Write a short note on “Backbone network”. [6]
- (b) Explain the terms : [6]
- (i) Passive hubs
  - (ii) Repeaters
  - (iii) Active hub.
- (c) Discuss the working of VLAN ? [4]



Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-217**

**S.E. (I.T.) EXAMINATION, 2012**

**MANAGEMENT AND FINANCE**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer *three* questions from Section I and *three* questions from Section II.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is meant by Management ? Explain the different functions of management. [8]
- (b) Compare and contrast Traditional management and Scientific management. [8]

P.T.O.

*Or*

- 2.** (a) Explain Henry Fayol's "Principles of Management". [8]  
(b) What is "Management by Objectives ?" Enumerate the basic steps in MBO process. [8]
- 3.** (a) What is "Law of demands" ? What are the exceptions to the law of demand. [8]  
(b) Explain the following : [8]  
(i) E-Commerce  
(ii) E-Governance.

*Or*

- 4.** (a) What are patents ? State the conditions for patents ? Also state the role of patents in explaining inventions. [8]  
(b) What is ERP ? How does enterprise resource planning helps the organization for resource integration ? [8]
- 5.** (a) State and explain how functional organization is an improvement over line and staff organization. [9]  
(b) Define the term Organization. What steps should be taken in developing an organization. [9]

*Or*

- 6.** (a) Explain the following : [9]
- (i) Co-operatives
  - (ii) Public sector undertaking.
- (b) What are the advantages and disadvantages of : [9]
- (i) Functional type organisation
  - (ii) Matrix type organisation ?

## **SECTION II**

- 7.** (a) Explain with a neat diagram Maslow's need priority model. [8]
- (b) Discuss the various guidelines for effective communication. [8]

*Or*

- 8.** (a) Compare McGregor's theory X and theory Y. [8]
- (b) Define recruitment. State and explain various sources of recruitment. [8]
- 9.** (a) Define capital. What are the methods of raising capital ? [8]
- (b) Explain the terms : [8]
- (i) Balance Sheet
  - (ii) Budgetary Control.

*Or*

- 10.** (a) Differentiate between : [10]
- (i) Shares and Debentures
  - (ii) Capital Market and Money Market.
- (b) What is overhead cost ? Explain different types of overhead costs. [6]
- 11.** (a) Define break-even analysis. What are its assumptions ? Construct a CVP graph and highlight its importance to industry. [12]
- (b) Explain the following : [6]
- (i) Liquidity ratio
  - (ii) Activity ratio
  - (iii) Debt-equity ratio.

*Or*

- 12.** (a) What do you mean by capital budgeting ? Explain : [12]
- (i) Pay-back method
  - (ii) Net present value method of capital budgeting.
- (b) Explain in brief : [6]
- (i) Credit Rating
  - (ii) Depreciation.

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

<b>Seat No.</b>	
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**[4162]-218**

**S.E. (Information Technology) (Second Semester)**

**EXAMINATION, 2012**

**PROGRAMMING PARADIGM AND METHODOLOGY**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer *three* questions from each Section.  
(ii) Answers to the two Sections should be written in separate answer-books.  
(iii) Neat diagrams must be drawn wherever necessary.  
(iv) Figures to the right indicate full marks.  
(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) What do you mean by syntax and semantics of a programming language ? [4]  
(b) Compare functional, imperative and object-oriented programming paradigm with respect to the following issues : [8]  
(i) Syntactic structure  
(ii) Type system and semantics.  
(c) What are the different expression notations used in programming languages ? Explain each with suitable example and advantages of each type. [6]

P.T.O.

*Or*

- 2.** (a) State and explain challenges of programming languages design. [8]
- (b) What do you mean by syntax of programming languages ? Syntax affects the usability of programming languages. Justify your answer. [6]
- (c) Differentiate between compiler and interpreter. [4]
- 3.** (a) Demonstrate early binding and late binding with an example. [6]
- (b) What are the advantages of user defined enumeration types ? [4]
- (c) Compare the scalar data type and composite data type. [6]

*Or*

- 4.** (a) Explain the case statement, goto statement and sequencing statement in programming. [6]
- (b) Why do we need to do declaration in program ? [4]
- (c) What is structured programming ? What is need for structured programming ? [6]
- 5.** (a) What are the general characteristics of a subprogram ? What do you mean by subprogram to be active ? [8]

- (b) Define and discuss the following terms over the others : [8]
- (i) Function
  - (ii) Procedure
  - (iii) Macro.

*Or*

6. (a) Explain the following parameter passing methods with simple program fragment : [8]
- (i) Call by value
  - (ii) Call by reference
  - (iii) Call by name
  - (iv) Call by value result.
- (b) Define the terms function and macro. How do they differentiate from each other ? [8]

## SECTION II

7. (a) What is meant by constructor and destructor ? What are the different types of constructors ? For what purpose ? [10]
- (b) Explain the distinction between private, protected and public members and same distinction for base class in C++. [8]

*Or*

8. (a) What do you mean by inheritance in Object-oriented programming ? What is its purpose to use for programming ? Explain with various types of inheritance with suitable example. [10]

- (b) Explain the following terms in C++ : [8]
- (i) Friend function
  - (ii) This pointer
  - (iii) Virtual function
  - (iv) Copy constructor.

9. (a) What are the different components of PROLOG program ? [8]
- (b) Define the following terms with respect to OOP : [8]
- (i) Object
  - (ii) Class
  - (iii) Subclass
  - (iv) Instance
  - (v) Method
  - (vi) Messages.

*Or*

10. (a) Write LISP code for appending string and to find length of string. [8]
- (b) How is the file handling in C++ different than file handling in C ? [8]
11. (a) Discuss about how we can achieve modularity in C, C++, LISP and PROLOG. [10]
- (b) Explain how a variable declaration is done in functional programming and logic programming. [6]



*Or*

- 12.** (a) Explain the following with respect to C++ : [6]
- (i) Primitive data types
  - (ii) User defined data types
  - (iii) Storage representation
  - (iv) Standard input-output function.
- (b) Explain the advantages of structured programming design. [4]
- (c) Explain the data objects in LISP and PROLOG. [6]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-219**

**S.E. (Information Technology) EXAMINATION, 2012**

**MICROPROCESSOR SYSTEMS**

**(2003 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :-** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No.4, and Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, and Q. No. 11 or Q. No. 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Assume suitable data if necessary.

**SECTION I**

1. (a) Give the features of 8086 and explain concept of segmentation and pipelining in detail. [10]
- (b) Draw and explain timing diagram of memory. Write cycle for 8086 in minimum mode. [8]

P.T.O.

*Or*

- 2.** (a) Draw functional diagram of 8086 in maximum mode. Describe signals/pins used in maximum mode. [12]
- (b) Give differences between 8086 and 8088 processor. What is the significance of  $\overline{\text{BHE}}$  ? [6]
- 3.** (a) How to generate .obj, .lst, .exe and .map file ? Give significance of these files. [8]
- (b) Explain the following directives : [8]
- (i) DB
  - (ii) DQ
  - (iii) EXTRN
  - (iv) EVEN

*Or*

- 4.** (a) Explain difference between : [8]
- (i) Macro and Procedure
  - (ii) Far and Near Procedure.
- (b) Explain structure of DOS in detail. [8]
- 5.** (a) Write a short note on IVT of 8086. [8]
- (b) What is master-slave connection in 8259 ? How many no. of slaves can be connected to one master ? [8]

*Or*

6. (a) Explain mode 0 and mode 1 of 8254 with timing diagram. [8]  
(b) Explain response of 8086 to an interrupt signal INTR. [8]

## SECTION II

7. (a) With the help of internal block diagram explain IC 8255. Explain its control word and various modes of operation. [10]  
(b) What is DMA ? Why is it necessary ? Explain the internal block of the DMA 8237. [8]

*Or*

8. (a) Draw and explain block diagram of USART 8251. Give format of 'Command Word Register' and 'Mode Word Register' of 8251 (USART). [10]  
(b) What is RS 232 interface ? What is null modem ? Explain various signals associated with RS 232 interface. [8]
9. (a) What is TLB ? Why is it necessary ? With the help of block diagram explain the role of TLB of processor 80386. [8]  
(b) What are various types of descriptors ? How are these descriptors used to access the operand ? Explain with suitable example. [8]

*Or*

- 10.** (a) What is interrupt descriptor ? What is interrupt descriptor table ? Explain the processing of interrupt handling in protected mode. [8]
- (b) What is the difference between Real and Protected mode of 80386 ? How will you switch from Real mode to Protected mode ? Explain the steps in short. [8]
- 11.** (a) What is IDT ? Which are different descriptors present in IDT ? Explain. [8]
- (b) What is the use of TSS in task switching ? Explain the details of TSS. [8]

*Or*

- 12.** (a) Explain various architectural changes that are made in Pentium processor with respect to processor 80386. [8]
- (b) What is Multitasking ? Explain the process of task switching in processor 80386. [8]

Total No. of Questions—12]

[Total No. of Printed Pages—8

Seat No.	
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[4162]-221

**S.E. (Biotechnology) (First Semester) EXAMINATION, 2012**

**APPLIED CHEMISTRY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—**
- (i) Answer any *three* questions from each section.
  - (ii) Answers to the two Sections should be written in separate answer-books.
  - (iii) Neat diagrams must be drawn wherever necessary.
  - (iv) Figures to the right indicate full marks.
  - (v) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (vi) Assume suitable data, if necessary.

**SECTION I**

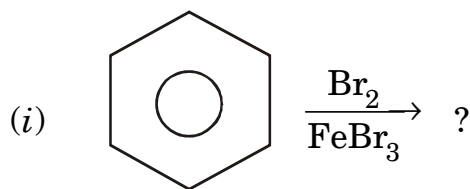
1. (a) Give reasons : [6]
- (i) Pyrrole is weaker base than Pyridine.
  - (ii) *p*-methoxy phenol is weaker acid than phenol.
  - (iii) Acetic acid is weaker acid than monochloroacetic acid.

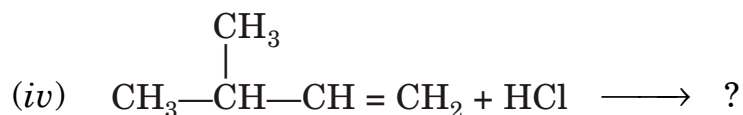
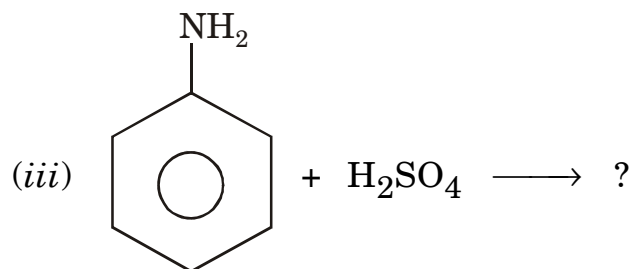
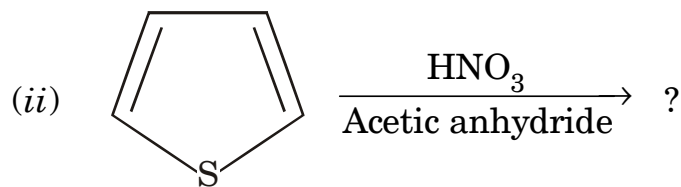
P.T.O.

- (b) Draw resonance structure of the following compounds  
(any *three*) : [6]
- (i) Phenoxide ion
  - (ii) Naphthalene
  - (iii) Aniline
  - (iv) Nitrobenzene.
- (c) What is tautomerism ? Give keto-enol system of ethyl acetoacetate. [4]

*Or*

2. (a) What is Hückel's Rule ? State which of the following compounds are aromatic : [6]
- (i) Anthracene
  - (ii) Cycloheptatriene.
- (b) Discuss relative stability of primary, secondary and tertiary carbanion. [6]
- (c) Explain the concept of hyperconjugation. [4]
3. (a) What is elimination reaction ? Explain the mechanism of E1 & E2 reaction. [7]
- (b) Predict the products (any *three*) : [6]





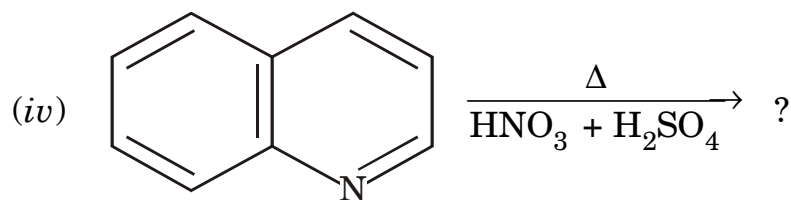
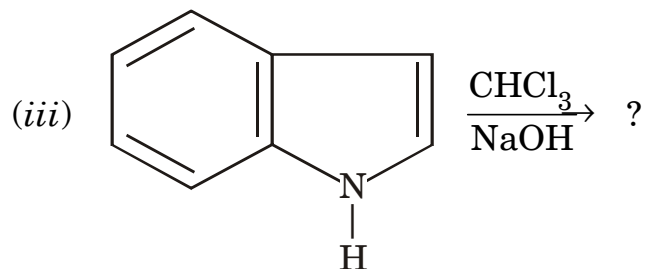
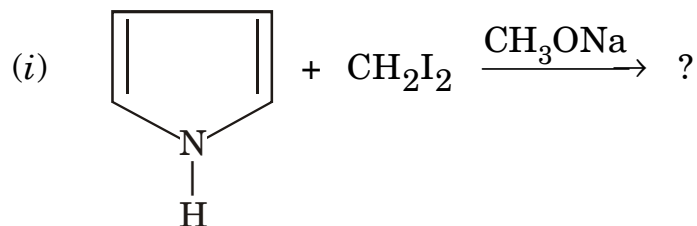
- (c) Explain ethyl iodide gives ethylene by alcoholic KOH while it gives ethyl alcohol by action of aq. KOH. [4]

Or

4. (a) What is Nucleophilic substitution reaction ? Give effect of nature of substrate, nature of nucleophile and solvent on rate of S<sub>N</sub>1 & S<sub>N</sub>2 reactions. [7]
- (b) Give mechanism of Beckmann rearrangement reaction. [6]
- (c) Write a note on Aldol condensation. [4]
5. (a) Discuss conformations of cyclohexane with the help of energy profile diagram. [7]
- (b) Give Diels-Alder reaction by Furan. Explain only Furan undergoes Diels-Alder reaction. [6]



(c) Predict the product (any *two*) : [4]



Or

6. (a) What is optical isomerism ? Explain it for one chiral centre for : [7]

(i) Erythro

(ii) Threo

(iii) Meso.

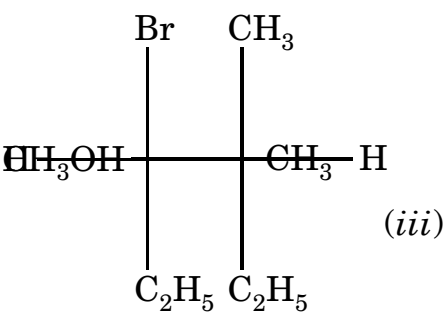
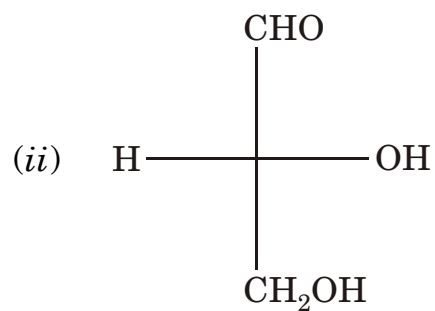
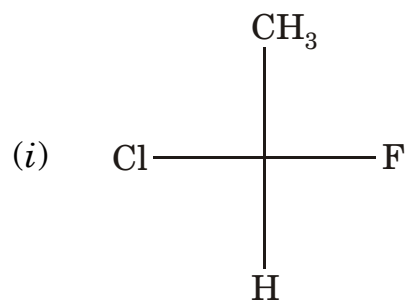
(b) Give *one* method of preparation for each of the following : [6]

(i) Quinoline

(ii) Pyridine

(iii) Thiophene.

(c) Assign R and S configuration to each of the following : [4]



(iv)

## SECTION II

7. (a) Explain concept of parachor. How is it related with the surface tension of liquids ? Define atomic heat and molar heat of solids. [7]
- (b) Define viscosity, viscosity coefficient and fluidity. Explain method of measurement of viscosity by using Ostwald's viscometer. [7]
- (c) The diffraction of crystal of barium with X-rays ( $\lambda = 2.42 \text{ \AA}$ ) gives third order reflection at  $25.4^\circ$ . Calculate inter-planar distance. [4]

*Or*

8. (a) Derive the Bragg's equation. What is the physical significance of  $n$  ? [7]
- (b) Define surface tension. Explain the capillary rise method for the determination of surface tension. [7]
- (c) The time required to flow through Ostwald's viscometer is 2.52 minutes for water and for same volume of organic liquid having density 0.7 g/cc is 4.25 minutes. Find the viscosity of the liquid relative to that of water. (Given :  $\eta_w = 1.002 \text{ Centipoise}$ ) [4]

9. (a) State the postulates of Kinetic theory and derive a kinetic gas equation. [6]
- (b) Explain heat capacities of gases. What is specific heat ratio ? Explain how it helps in determination of atomicity of gases. [6]
- (c) Calculate the critical constants of  $C_2H_2$  gas using van der Waals' constants,  $a = 3.390 \text{ dm}^6 \text{ atm mol}^{-2}$  and  $b = 0.03136 \text{ dm}^3 \text{ mol}^{-1}$ . [4]

*Or*

10. (a) Derive an expression for collision diameter. [6]
- (b) Discuss the experimental method of determination of critical constants. [6]
- (c) Calculate the kinetic energy of hydrogen molecule at  $0^\circ\text{C}$ . [4]
11. (a) Show that the elevation in boiling point is a colligative property. Explain how to find the molecular weight by using elevation in boiling point. [6]
- (b) Give thermodynamic derivation for depression in freezing point. [6]

- (c) Find the molal boiling point elevation constant for water if heat of vaporization at boiling point is 3500 J/g.  
( $R = 8.314 \text{ J}$ ) [4]

*Or*

- 12.** (a) Explain osmosis and osmotic pressure. [6]
- (b) Explain abnormal colligative properties of solution. [6]
- (c) 1.5 g of a substance when dissolved in 50 g of water, lowered the freezing point of solution by  $0.126^\circ\text{K}$ . The molal depression constant for 1000 g of water is 1.86. Calculate the molecular weight of the solute. [4]

Total No. of Questions—12]

[Total No. of Printed Pages—7

<b>Seat No.</b>	
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**[4162]-222**

**S.E. (Biotechnology) (First Semester) EXAMINATION, 2012**

**FLUID FLOW AND UNIT OPERATIONS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of electronic pocket calculator is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) What is Newton's law of viscosity ? Classify the various types of fluids based on the Newton's law. [6]
- (b) A pipe 450 mm in diameter branches into two pipes of diameters 300 mm and 200 mm respectively. If the average velocity in the 450 mm diameter pipe is 3 m/s, find : [6]
- (i) Discharge through the 450 mm diameter pipe
- (ii) Velocity in 200 mm diameter pipe if the average velocity in the 300 mm diameter pipe is 2.5 m/s.

P.T.O.

- (c) A venturimeter placed in 75 mm diameter horizontal pipe has a throat diameter of 25 mm. Determine the flow rate through the pipe in lit/min, when the venture head is 41.2 cm of water. Assume the meter constant to be 0.77. [4]

*Or*

2. (a) Derive the continuity equation for incompressible fluid : [8]

$$\nabla V = 0.$$

- (b) A U-tube manometer is used to measure to pressure of oil of specific gravity 0.85 flowing in a pipeline. Its left end is connected to the pipe and the right limb is open to the atmosphere. The centre of the pipe is 100 mm below the level of mercury (specific gravity 13.6) in the right limb. If the difference of mercury level in the two limbs is 160 mm, determine the absolute pressure of oil in the pipe. [4]
- (c) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine : [4]
- (i) The dynamic viscosity of oil
- (ii) The kinematic viscosity of oil if the specific gravity of oil is 0.95.

3. (a) For a laminar flow through circular pipe, prove that the average velocity is half the maximum velocity. [8]
- (b) A pipeline is 15 cm in diameter and it is at an elevation of 100 m at section A. At section B, it is at an elevation of 107 m and has a diameter of 30 cm. When a discharge of 50 lit/sec of water is passed through this pipeline, pressure at A is 35 kPa. The energy loss in pipe is 2 m of water. Calculate the pressure at point B. [5]
- (c) A horizontal pipe 150 mm in diameter is joined by sudden enlargement to a 225 mm diameter pipe. Water is flowing through it at rate of 0.05 m<sup>3</sup>/s. Find :
- (i) Loss of head due to sudden enlargement
- (ii) Pressure difference in the two pipes. [5]

*Or*

4. (a) Write notes on : [6]
- (i) Friction factor chart
- (ii) Minor energy losses in flow through pipe.
- (b) An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. If the pressure drop in 100 m length of the pipe is 1800 kN/m<sup>2</sup>, determine : [8]
- (i) Maximum velocity
- (ii) Rate of flow of oil.
- (iii) If the shear stress at the wall is 270 N/m<sup>2</sup>, find velocity and shear stress at 8 mm from the wall.



- (c) Water flows through a pipe of diameter 300 mm with a velocity of 5 m/s. If the coefficient of friction is given by :

where  $Re$  is the Reynolds' Number, find the head lost due to friction for a length of 10 m. Take kinematic viscosity of water as 0.01 stokes. [4]

5. (a) What is swirling and why is it undesirable in the industry ? Enlist different methods of preventing swirling. [5]
- (b) What is power curve and how does it help in determining power consumed during agitation ? [5]
- (c) Write notes on : [6]
- (i) Valves
- (ii) NPSH.

*Or*

6. (a) Explain the various flow patterns which are generated in liquid during agitation. [6]
- (b) Write notes on the following : [6]
- (i) Banbury mixers
- (ii) Reciprocating pumps.
- (c) What are the standard design considerations used for agitation systems ? [4]

## SECTION II

7. (a) With the help of a neat sketch, explain the principle, construction and working of a cyclone. [4]
- (b) Explain the Sink and Float method. [4]
- (c) Calculate the minimum area and diameter of a thickener with a circular basin to treat  $0.1 \text{ m}^3/\text{s}$  of slurry of solids concentration  $150 \text{ kg/m}^3$ . Results of batch settling tests are as follows : [10]

Solid conc. ( $\text{kg/m}^3$ )	Settling Vel. ( $\mu\text{m/s}$ )
100	148
200	91
300	55
400	33
500	21
600	14
700	10
800	7

A value of  $1290 \text{ kg/m}^3$  of underflow concentration was selected from a retention time test. Estimate the underflow volumetric flow rate assuming total separation of all solids and a clear overflow is obtained.

*Or*

8. (a) What is meant by terminal settling velocity of a solid particle ? Derive an expression for calculating this velocity for a spherical particle in laminar regime. [8]

- (b) Determine the velocity of fall of rain drops of 0.3 mm diameter in atmospheric air having density  $12 \text{ kg/m}^3$  and kinematic viscosity 0.15 stokes. Assume Stokes' law holds good. [5]
- (c) State the Kynch's theory of sedimentation along with its assumptions. [5]

9. Write notes on the following : [16]

- (i) Formation of spouted beds  
(ii) Applications of fluidized bed system  
(iii) Rotary drum filter  
(iv) Minimum fluidization velocity.

*Or*

10. (a) Derive the Kozeny Carmen equation for determination of pressure drop across a packed bed. [8]

(b) A bed consists of uniform spherical particles of diameter 3 mm and density  $4200 \text{ kg/m}^3$ . Calculate the minimum fluidization velocity in a liquid of viscosity 3 mPas and density  $1100 \text{ kg/m}^3$ . Take porosity of bed as 0.4. [4]

(c) What is meant by a filter aid ? Give examples. Also enlist desirable characteristics of a filter aid. [4]

11. (a) Write notes on the following : [9]

- (i) Trommels  
(ii) Coarse crusher  
(iii) Open and closed circuit grinding.

- (b) A crushing roll 1 m in diameter is set so that the crushing surfaces are 12.5 mm apart and the angle of nip is  $31^\circ$ . What is the maximum size of particles which should be fed to the mill ? [4]
- (c) Explain in brief the Kick's law of crushing. [3]

*Or*

12. (a) Write notes on the following : [6]
- (i) Differential screen analysis
- (ii) Factors affecting screen capacity.
- (b) What is the principle of operation of a Ball mill ? Derive an expression for calculating the critical speed of a ball mill. [6]
- (c) Calculate the power required to crush  $150 \times 10^3$  kg of feed if 80% of the feed passes through 2.5 inches screen and 80% of the product passes through 1/8 inch screen ( $K_b = 4.784$ ). [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-223**

**S.E. (Biotechnology) (First Semester) EXAMINATION, 2012**

**MICROBIOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, Q. No. 11 or Q. No. 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

**SECTION I**

1. Describe with a neat labelled diagram the ultrastructure of a typical gram positive bacterial cell. [18]

*Or*

2. Discuss the disproving of “Theory of Abiogenesis”. Add a note on contribution made by Edward Jenner towards the development of microbiology. [18]

P.T.O.

3. An *E. coli* strain is grown in minimal medium containing glucose and lactose in equimolar concentrations, as the only carbon source. Comment on the growth profile of the strain, when growth is estimated using turbidometric analysis. [16]

*Or*

4. Write short notes on the following : (8 each) [16]
- (a) Enrichment media and selective media
  - (b) Batch and continuous culture.

5. Explain the following : (8 each) [16]
- (a) Penicillin inhibits the growth of microorganisms and is thus “bacteriostatic”.
  - (b) Use of filtration is advantageous over dry/moist heat sterilization for some media.

*Or*

6. Write short notes on (any *four*) : (4 each) [16]
- (a) Fumigation
  - (b) Pilli
  - (c) Water activity
  - (d) MIC
  - (e) Actinomycetes.

## SECTION II

7. Discuss in detail the structure of a typical Bacteriophage. [18]

*Or*

8. Describe the different strategies/criteria used for virus classification. [18]

9. "Rhizosphere is rich source of nitrogen fixing bacteria." Justify. [16]

*Or*

10. Answer the following : (8 each) [16]

(a) Define and explain in brief : Antagonism and Commensalism.

(b) Domestic or industrial waste-water cannot be directly released in natural water bodies. Explain.

11. Answer the following : (8 each) [16]

(a) An individual infected with HIV may not necessarily be suffering from AIDS. Justify.

(b) Give causative agents and at least *two* symptoms, of the following diseases :

(i) Cholera

(ii) Typhoid

(iii) Leprosy

(iv) Tuberculosis.

*Or*

**12.** Write short notes on (any *four*) : (4 each) [16]

- (a) Thermophiles
- (b) Reverse transcriptase
- (c) Psychrotrophs
- (d) Symbiosis
- (e) MPN.



Total No. of Questions—12]

[Total No. of Printed Pages—3

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**[4162]-224**

**S.E. (Biotechnology) (First Semester) EXAMINATION, 2012**

**BIOCHEMISTRY—I**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer question No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6 from Section I and answer Q. No. 7 or 8, Q. No. 9 or 10, Q. No. 11 or 12 from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams must be drawn wherever necessary.

**SECTION I**

1. Write short notes on : [18]
- (i) Fitness of aqueous environment for living organisms.
- (ii) First by-pass reaction in the synthesis of glucose.

*Or*

2. Answer the following : [18]
- (i) Buffering system in blood

P.T.O.

(ii) What are the concentrations of HOAc and OAc in a 0.2 M acetate buffer, pH 5.00 ? The  $K_a$  for acetic acid is  $1.70 \times 10^{-5}$  ( $pK_a = 4.77$ ).

3. Draw the following : [16]

(i) TCA cycle

(ii) Cori cycle.

*Or*

4. Write short notes on : [16]

(i) Role of glycogen synthase in glycogen synthesis.

(ii) Draw a neat and labelled diagram showing flow of electrons and protons through the four complexes of the respiratory chain.

5. Write short notes on : [16]

(i) Cysteine and cystine

(ii) Transamination and deamination.

*Or*

6. Explain the following : [16]

(i) Affinity chromatography

(ii) Digestion and absorption of protein.

## SECTION II

7. Answer the following : [18]

(a) Explain in detail about biosynthesis of phosphoglycerides.

(b) Depict the flow chart for  $\beta$ -oxidation of fatty acids.

*Or*

8. Write in detail about : [18]

(i) Ketone bodies

(ii) Classification of lipids.

9. Answer the following : [16]

(i) Draw and explain about the covalent structure of nucleic acids.

(ii) Explain about nucleic acid protein supramolecular complex.

*Or*

10. Describe the synthesis of pyrimidine rings by any *one* pathway (salvage or de novo). [16]

11. Explain in short about : [16]

(i) Rickets

(ii) Osteomalacia

(iii) Osteoporosis

(iv) Bitot's spots.

*Or*

12. Write down about sources, absorption and metabolism, functions and deficiency of any *two* water soluble vitamins. [16]

Total No. of Questions—12]

[Total No. of Printed Pages—4

<b>Seat No.</b>	
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**[4162]-225**

**S.E. (Biotechnology) (Second Semester) EXAMINATION, 2012**

**BIOCHEMISTRY—II**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Question Nos. 1 or 2, 3 or 4 and 5 or 6 from Section I and Question Nos. 7 or 8, 9 or 10 and 11 or 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams should be drawn wherever necessary.

**SECTION I**

1. Explain in detail about the experiment which elucidate that 'Amino acid sequence of a protein determines its three-dimensional structure.' [18]

*Or*

2. Describe the following : [18]

(i) Myoglobin

(ii) Beta pleated sheet.

P.T.O.

3. Describe in detail : [16]

(i) Proteolytic activation

(ii) Isozyme.

Or

4. Answer the following : [16]

(i) Enlist the six major classes of enzyme. Mention the type of reaction catalyzed by each class of enzyme. Give the example of each.

(ii) The following data was recorded for the enzyme catalyzed reactions

S P, estimate  $V_{\max}$  and  $K_m$  :

[S] Moles	V nmoles/lit/min
$6.25 \times 10^{-6}$	15.0
$7.50 \times 10^{-5}$	56.25
$1.0 \times 10^{-4}$	60
$1.0 \times 10^{-3}$	74.9
$1.0 \times 10^{-2}$	75

5. An enzyme has a  $K_m$  of  $4.7 \times 10^{-5}$  M. If the  $V_{\max}$  of the preparation is  $22\mu\text{M} \times \text{Lit}^{-1} \times \text{min}^{-1}$ , what velocity would be observed in the presence of  $2 \times 10^{-4}$  M substrate and  $5 \times 10^{-4}$  M of :

(i) Competitive inhibitor

(ii) Non-competitive inhibitor

(iii) Uncompetitive inhibitor

$K_i$  in all three cases is  $3 \times 10^{-4}$  M. [16]

*Or*

6. Write the role of the following coenzymes in any one enzyme catalyzed reaction : [16]

(i) Thiamine diphosphate

(ii) Biotin.

## SECTION II

7. Draw and explain the flow chart for reactions which occur in hepatocyte in response to epinephrine molecule. [18]

*Or*

8. Write short notes on : [18]

(i) 7TM receptor

(ii) Functions of thyroid and growth hormone.

9. Answer the following : [16]

(i) Draw a neat and labelled figure of flagellar motor.

(ii) Describe Na/K pump with suitable diagram.

*Or*

**10.** Write short notes on : [16]

- (i) Myosin and actin
- (ii) Bacterial chemotaxis.

**11.** Answer the following : [16]

- (i) What is the biochemical parameters used for diagnosis of liver diseases ?
- (ii) Define the following terms :  
Keratomalacia, Rickets, Osteomalacia, Termatitis, Dementia,  
Pernicious anemia and Scurvy.

*Or*

**12.** Explain in detail about the causes of : [16]

- (i) Hyperglycemia
- (ii) Hypoglycemia.

Total No. of Questions—12]

[Total No. of Printed Pages—8+4+2

<b>Seat No.</b>	
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**[4162]-226**

**S.E. (Biotechnology) (Second Semester) EXAMINATION, 2012**

**MATERIAL BALANCE AND STOICHIOMETRY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

(v) Use of scientific calculator is allowed.

(vi) Figures to the right indicate full marks.

**SECTION I**

1. (a) The analysis of a sewage gas sample from a municipal sewage treatment plant is given below on a volume basis :

Methane	68%
Carbon dioxide	30%
Ammonia	2%
H <sub>2</sub> S, SO <sub>2</sub> , etc.	Traces.

P.T.O.



Find :

(i) the average molar mass of the gas and

(ii) the density of the gas at NTP. [6]

(b) Calculate the available nitrogen in the following nitrogenous compound which are used as nitrogen source in various growth medium :

(i) pure  $(\text{NH}_4)_2\text{SO}_4$

(ii)  $\text{NaNO}_3$  (50% pure)

(iii) pure  $\text{NH}_4\text{NO}_3$ . [6]

(c) A microalgae sample *S. platensis* weighing 13 g on dry basis contains crude protein 9.1 g, lipids 1.2 g, carbohydrates 1.4 g, crude fibre 0.2 g and rest ash. Find the % weight composition and mass fraction of each component. [6]

Or

2. (a) Ethanol is present in the aqueous solution to the extent of 2000 mg/L. Find the TOC and ThOD of the solution in mg/L. [6]

(b) In a fermentation process it is desired to add 20 g of carbon for 1 L. Glucose is used as a source of carbon (substrate).

Calculate the amount of glucose to be added to 1 L of fermentation medium so as to maintain the desired amount of carbon.

[4]

(c) Calculate the average molar mass of air if it contains  $O_2$  -21%,  $N_2$  -78% and Ar -1%. (Molar mass of Argon = 40).

[4]

(d) Calculate :

(i) the amount of  $H_3PO_4$  required to prepare one litre of 5 N  $H_3PO_4$  solution

(ii) the amount of NaOH required to prepare two litre of 2 M NaOH solution.

[4]

3. (a) For carrying out nitration reaction, it is desired to have a mixed acid containing 39%  $HNO_3$ , 42%  $H_2SO_4$  (mass). Nitric acid of 68.3% (mass) is readily available (azeotropic composition).

Calculate the required strength of sulphuric acid to obtain above mixed acid.

[8]

(b) In biological process water with minimum total dissolved solids is required. Reverse osmosis is used to reduce total dissolved

solids. The feed water to the reverse osmosis plant has dissolved solids to the extent of 5000 mg/L. The feed-to-product ratio (on mass basis) is 4 : 3. The treated water (product) from the plant contains 600 mg/L of solids. Find the dissolved solids in the reject stream. [4]

- (c) It is desired to prepare a salt solution containing 24% salt by weight for an electrolysis purpose and the following plan has been decided upon : a part of the inflow water stream is to be introduced into a vessel containing salt, where it becomes saturated. The saturated stream would contain 36.3 g of NaCl/100 g of water and would be mixed with the bypass pure water stream so as to have a combined stream containing exactly 24% salt by weight. Calculate the ratio in which the two streams are to be mixed. [4]

*Or*

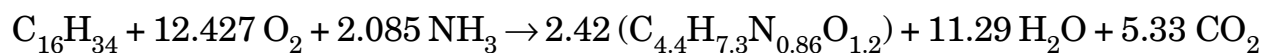
4. (a) The manufacture of such products as penicillin, tetracycline, vitamins and other pharmaceuticals, usually requires separating

the suspended solids from their mother liquor by centrifuging, and then drying the wet cake. A closed loop system for centrifuge unloading, drying, conveying and solvent recovery is comprised of equipment especially designed for handling materials requiring sterile and contamination-free conditions. Given the experimental measurements on the pilot plant equipment outlined in the following figure, what is the lb/hr of the recycle stream R ? [10]

(b) A boiler is operated according to the following scheme. Of the steam raised 50% is utilized as process steam and is not returned to the system. The rest is returned as condensate carrying 50 ppm solid though the steam raised is substantially free from solids. To keep the solid content in the boiler water within 1500 ppm, a part of the boiler water is blown down continuously. To make up for the blowdown as well as for the water lost as the process steam, feed water containing 450 ppm solids is fed to the boiler. Calculate the feed to blowdown ratio. [6]

5. (a) In a bio-process, two different carbon sources (hexadecane and glucose) are tested. Case I uses only hexadecane and Case II uses only glucose.

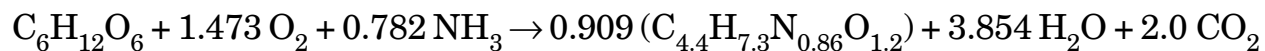
**Case I : Hexadecane as carbon source**



Hexadecane

Biomass

**Case II : Glucose as carbon source**



Glucose

Biomass

Calculate the yield coefficient (i)  $Y_{X/S}$  (g dw cell/g substrate)

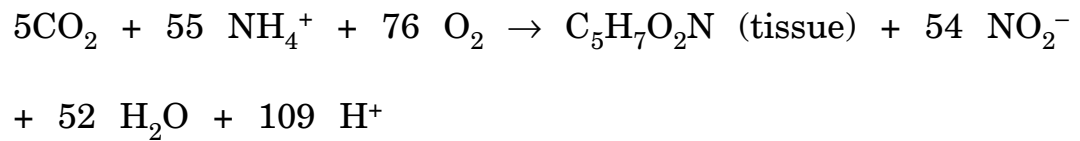
and (ii)  $Y_{X/O_2}$  (g dw cell/g  $\text{O}_2$ ) for both the cases. [10]

- (b) The gaseous reaction  $A = 2B + C$  takes place isothermally in a constant pressure reactor. Starting with a mixture of 75% A and 25% inert (by volume), in a specified time the volume double. Calculate the conversion achieved. [6]

Or

6. (a) The most economic method of sewage wastewater treatment is bacterial digestion. As an intermediate step in the conversion of organic nitrogen to nitrates, it is reported that the *Nitrosomonas* bacteria cells metabolize ammonium compounds

into cell tissue and expel nitrite as a by-product by the following overall reaction :



If 20,000 kg of wastewater containing 5% ammonium ions by weight flows through a septic tank inoculated with the bacteria, how many kilograms of cell tissue are produced, provided that 95% of  $\text{NH}_4^+$  is consumed ? [6]

(b) The analysis of the gas entering the secondary converter in a contact sulphuric acid plant is 4%  $\text{SO}_2$ , 13%  $\text{O}_2$  and 83%  $\text{N}_2$  (on volume basis). The gas leaving the converter contains 0.45%  $\text{SO}_2$  on  $\text{SO}_3$ -free basis (by volume). Calculate the percentage of  $\text{SO}_2$  entering the converter getting converted to  $\text{SO}_3$ . [6]

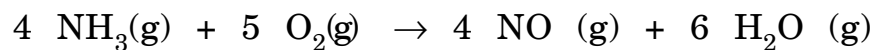
(c) Tallow is essentially glyceryl tristearate. It is desired to saponify the tallow with caustic soda. For 100 kg tallow, calculate :  
(i) the theoretical requirement of caustic soda and  
(ii) the amount of glycerine liberated. [4]

## SECTION II

7. (a) How much heat must be added in order to raise the temperature of a 20% (w/w) caustic soda solution from 280 K (7°C) to 360 K (87°C) ?

(For 20% NaOH solution, heat capacity are  $C_1 = 3.56$  kJ/kg K at 280 K and  $C_2 = 3.71$  kJ/kg K at 360 K). [6]

- (b) Calculate the standard heat of reaction for the following reaction of 4 g mol of  $\text{NH}_3$



Heat of formation per mole at 25°C and 1 atm are as follows :

$\text{NH}_3 = -46.191$  kJ/g mol,  $\text{O}_2(\text{g}) = 0$  kJ/g mol,  $\text{NO}(\text{g}) = + 90.374$  kJ/g mol,  $\text{H}_2\text{O}(\text{g}) = -241.826$  kJ/mol. [6]

- (c) When 0.5 kg of caustic soda is dissolved to form a 25 per cent solution 100 Joule are evolved. The specific heat of the 25 per cent solution is 0.84. Calculate the number of kg of solution, heat evolved per kg of solution and the rise in temperature of the solution neglecting radiation loss. [6]



Or

8. (a) A mixture of aniline and water containing 11.8 (wt %) aniline is subcooled in the overhead condenser of the distillation column from 373 K to 313 K (100 to 40°C) with the help of cooling water at the rate of 8000 kg/h. Find the heat removal rate of the subcooling zone of the condenser. [12]

Data given (on molar basis) :

	<b>Aniline</b>	<b>Water</b>
a	206.27	50.845
b × 10 <sup>3</sup>	-211.5065	213.08
c × 10 <sup>6</sup>	564.2902	-631.398
d × 10 <sup>9</sup>	—	648.746

- (b) Calculate the standard heat of reaction at 298.15 K (25°C) when gaseous ammonia is dissolved in water to form 2% by mass its solution for the regeneration of weak anion exchanger of a water treatment plant.

Heat of formation of  $\text{NH}_4\text{OH} (l) = -361.20 \text{ kJ/mol}$

Heat of formation of  $\text{H}_2\text{O} (l) = -285.83 \text{ kJ/mol}$

Heat of formation of  $\text{NH}_3 = -45.94 \text{ kJ/mol.}$  [6]

9. (a) A distillation column separates, 10,000 kg/h of a 50% benzene –50% toluene mixture. The product D recovered from the condenser at the top of the column contains 95% benzene, and the bottom W from the column contains 96% toluene. The vapor stream V entering the condenser from the top of the column is 8000 kg/h. A portion of the product from the condenser is returned to the column as reflux, and the rest is withdrawn for use elsewhere. Assume that the compositions of the streams at the top of the column (V), the product withdrawn (D), and the reflux (R) are identical because the V stream is condensed completely. Find the ratio of the amount refluxed R to the product withdrawn (D). [10]

(b) In an evaporation system a weak liquor containing 4% (by wt) caustic soda is concentrated to produce a lye containing 25% solids (by wt.) Calculate the evaporation of water per 100 kg of feed in the evaporator. [6]

*Or*

10. (a) What will be the yield of Glauber salt ( $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ ) if a pure 32% solution is cooled to 293 K without any loss due to evaporation ?

Data : Solubility of  $\text{Na}_2\text{SO}_4$  in water at 293 K is 19.4 kg per 100 kg water. [10]

- (b) A solid material with 15% by weight of water is dried to 7% by weight of water, under the following conditions : fresh air is mixed with recycled air and is blown over the solid. The fresh air contains 0.01 kg water per kg of dry air and the recycled air which is part of the air leaving the drier, contains 0.1 kg water per kg of dry air. The proportions of fresh and recycled air are adjusted so that the mixture entering the drier contains 0.05 kg water per kg of dry air.

- (i) How many kg of water are removed from 100 kg of wet material fed to the drier ?
- (ii) How many kg of dry air are recycled per 100 of wet material ? (Amount of fresh dry air is 95.6 kg). [6]

11. (a) The ultimate analysis of a residual fuel oil is given below :  
Carbon –88.4%, hydrogen –9.4% and sulphur –2.2% (mass). It is used as a fuel in a power generating boiler with 25% excess air. Find :
- (i) theoretical dry air requirement
  - (ii) actual dry air supplied
  - (iii) Orsat composition of flue gases. [12]
- (b) The GHV of gaseous propane is 2219.71 kJ/mol at 298.15 K (25°C). Calculate its NHV. [4]

*Or*

12. (a) Fuel oil having the following ultimate analysis is desired to be fired in a boiler. Carbon –85%, Hydrogen –9%, Sulphur –3%, oxygen–2% and nitrogen –1% (by mass). Assume negligible steam requirement for atomization of fuel oil. GCV of the fuel oil is measured to be 43,540 kJ/kg at 298.15 K. Calculate :
- (i) NCV of the fuel
  - (ii) Theoretical air requirement in kg/kg fuel oil. [8]

- (b) What are the parameters measured in proximate and ultimate analysis ? Also, mention the method of measurement for at least *two* parameters. [4]
- (c) In the combustion of heptane,  $\text{CO}_2$  is produced. Assume that you want to produce 500 kg of dry ice per hour and that 50% of the  $\text{CO}_2$  can be converted into dry ice, as shown below. How many kilograms of heptane must be burned per hour ? [4]

Total No. of Questions—12]

[Total No. of Printed Pages—4

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**[4162]-227**

**S.E. (Biotechnology) (Second Semester) EXAMINATION, 2012**

**CELL BIOLOGY AND TISSUE CULTURE**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4 and Q. No. 5 or Q. No. 6 from Section I and Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10, and Q. No. 11 or Q. No. 12 from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

### **SECTION I**

1. A eukaryotic cell is a complex mixture of different chemicals. Justify. [18]

*Or*

2. Differentiate between typical plant and animal cells. Add a note on structure and functions of mitochondria. [18]

P.T.O.

- 3.** Explain the mechanism of endocytosis and exocytosis with a neat labelled diagram. Add a note on significance of both in cellular metabolism. [16]

*Or*

- 4.** Answer the following :

(a) Draw a detailed diagram of the typical structure of a eukaryotic cell membrane. Add a note on different types of proteins associated with it. [8]

(b) Define and explain in brief : [8]

(i) Symport

(ii) Antiport.

- 5.** Write notes on :

(a) Cell signalling. Add a note on GPCR as a signalling mediator. [8]

(b) Ion channels and their role in cell to cell signalling. [8]

*Or*

- 6.** Write short notes on (any *four*) : [4 each]

(a) Extracellular matrix

(b) Action potential in a cell

(c) Lysosomes

(d) Golgi complex

(e) Enzyme coupled cell surface receptor.

## SECTION II

7. Compare and contrast Mitosis and Meiosis. Add a note on gamete formation. [18]

*Or*

8. Apoptosis and Necrosis are different mechanisms of cell death. Explain with respect to their stages, induction and significance. [18]

9. Describe structure of a typical nerve cell. Add a note on role of neurotransmitters in transmitting impulses through nerve cells. [16]

*Or*

10. Answer the following :

(a) Blood is a fluid connective tissue. Elaborate. [8]

(b) What are Haversian systems ? Describe with the help of a neat labelled diagram. [8]

11. Answer the following :

(a) Compare and contrast Adhesion cell lines and suspension cell lines. [8]

(b) Define the following and mention its significance in Animal Tissue Culture : [8]

(i) Trypsinisation

(ii) Passaging

(iii) Cryopreservation

(iv) Confluency.



*Or*

**12.** Write short notes on (any *four*) :

[4 each]

- (a) Callus culture
- (b) DMEM
- (c) Haematopoietic stem cells
- (d) Correlation between cancer and cell cycle
- (e) Plant growth hormones.

Total No. of Questions—12]

[Total No. of Printed Pages—7

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[4162]-228

**S.E. (Biotechnology) (Second Semester) EXAMINATION, 2012**

**THERMODYNAMICS**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

- N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.
- (ii) Answers to the two Sections should be written in separate answer-books.
- (iii) Neat diagrams should be drawn wherever necessary.
- (iv) Figures to the right indicate full marks.
- (v) Use of programmable pocket calculator is allowed.
- (vi) Assume suitable data, if necessary.

**SECTION I**

1. (a) Differentiate between the following terms : [6]
- (i) Extensive and Intensive properties
- (ii) State and Path functions
- (iii) Closed and Open systems.

P.T.O.

- (b) When a system is taken from state 'a' to state 'b' along path 'acb', 100 J of heat flows into the system and the system does 40 J of work
- (i) How much heat flows into the system along path 'aeb' if the work done by the system is 20 J ?
- (ii) The system returns from 'b' to 'a' along path 'bda'. If the work done on the system is 30 J, does the system absorb or liberate heat ? How much ? [6]
- (c) An inventor claims to have designed a heat engine which absorbs 1000 kJ/s of energy as heat from a source at 500°C and delivers 650 kW power. He further states that the ambient atmosphere is at 25°C and used as sink for the engine. Is this claim theoretically feasible ? [6]

*Or*

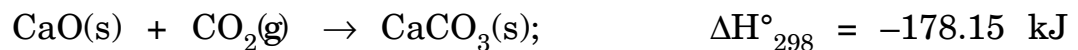
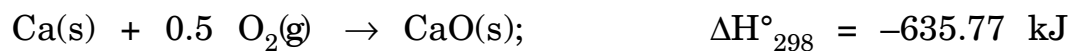
2. (a) State and explain the Clausius statement of the second law of thermodynamics. How does it remove the drawbacks of the first law of thermodynamics ? [6]
- (b) A piston-cylinder assembly contains 1 kg saturated liquid water at 100°C. The cylinder is brought into contact with a body

at 500°C till all the water is converted into saturated steam at the same pressure. Calculate the change in entropy of water. The enthalpy of vaporization of water at 100°C is 2256.94 kJ/kg. [6]

(c) State the Clausius inequality and explain its significance. [6]

3. (a) Using Hess's law, evaluate the heat of formation of solid CaCO<sub>3</sub>.

The following data is available : [8]



(b) The standard heat of combustion of graphite at 298 K is -393.778 kJ/mol. Determine the heat of combustion at 800 K.

The heat capacities in J/molK are : [8]

$$\text{Carbon} : 11.19 + 1.096 \times 10^{-2}T - 4.894 \times 10^{-5}T^{-2}$$

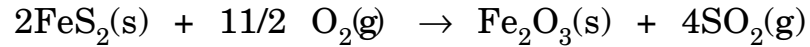
$$\text{Oxygen} : 36.42 + 1.08 \times 10^{-3}T - 7.859 \times 10^{-5}T^{-2}$$

$$\text{Carbon dioxide} : 43.29 + 1.147 \times 10^{-2}T - 8.815 \times 10^{-5}T^{-2}$$

*Or*

4. (a) Derive the expression to demonstrate the dependence of standard heat of reaction on the temperature. [8]

- (b) Calculate the standard heat of reaction for the following reaction : [8]



The standard heat of formation at 298 K are  $-178.02 \text{ kJ/mol}$  for  $\text{FeS}_2(\text{s})$ ,  $-822.71 \text{ kJ/mol}$  for  $\text{Fe}_2\text{O}_3(\text{s})$  and  $-297.10 \text{ kJ/mol}$  for  $\text{SO}_2(\text{g})$ .

5. (a) What are partial molar properties ? What is the physical meaning of partial molar property ? [8]
- (b) Write short notes on the following : [8]
- (i) Activity coefficient
- (ii) Chemical potential.

*Or*

6. (a) A 30% by mole methanol-water solution is to be prepared. How many cubic meters of pure methanol (molar volume :  $40.727 \times 10^{-6} \text{ m}^3/\text{mol}$ ) and pure water (molar volume :  $18.068 \times 10^{-6} \text{ m}^3/\text{mol}$ ) are to be mixed to prepare  $2 \text{ m}^3$  of the desired solution ? The partial molar volumes of methanol and water in a 30% solution are  $38.632 \times 10^{-6} \text{ m}^3/\text{mol}$   $17.165 \times 10^{-6} \text{ m}^3/\text{mol}$  respectively. [6]

- (b) Write short notes on the following : [10]
- (i) Phase equilibrium
  - (ii) Fugacity in gaseous mixture.

## SECTION II

7. (a) State and derive the phase rule for non-reacting systems. [5]
- (b) With the help of a neat sketch explain the bubble point diagram. [8]
- (c) n-Heptane and toluene form ideal solution. At 373 K, their vapour pressures are 106 and 74 KPa respectively. Determine the composition of liquid and vapour in equilibrium at 373 K and 101.3 KPa. [5]

*Or*

8. (a) 100 grams each of ethanol and methanol are mixed at 20°C to prepare an ideal mixture. The vapour pressure of pure methanol is 88.7 mm and that of ethanol is 44.5 mm at 20°C. Calculate : [9]
- (i) the vapour pressure of the solution
  - (ii) the partial vapour pressures of ethanol and methanol in solution
  - (iii) the vapour phase composition.

(b) Describe in brief : [9]

(i) Difference between equilibrium and steady state

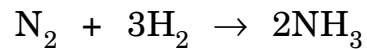
(ii) Tie line

(iii) Duhem's theorem.

9. (a) Define equilibrium constant with respect to reacting systems.

Derive expression for the same in terms of the standard free energy of the reaction. [10]

(b) A mixture containing 2 moles of nitrogen, 7 moles of hydrogen and 1 mole ammonia initially is undergoing the following reaction :

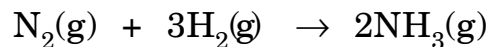


Derive the expressions for the mole fractions of various components in the reaction mixture in terms of the extent of reaction. [6]

*Or*

10. (a) With the help of a neat sketch, explain the concept of equilibrium for a reversible reaction in terms of the Gibbs' free energy. [8]

- (b) Estimate the standard free energy change and equilibrium constant at 700 K for the reaction



given that the standard heat of formation and standard free energy of formation of ammonia at 298 K to be  $-46,100$  J/mol and  $-16,500$  J/mol respectively. The specific heat data as a function of temperature in J/mol are :

$$\text{Nitrogen} : C_p = 27.27 + 4.93 \times 10^{-3}T$$

$$\text{Hydrogen} : C_p = 27.01 + 3.51 \times 10^{-3}T$$

$$\text{Ammonia} : C_p = 29.75 + 25.11 \times 10^{-3}T \quad [8]$$

11. (a) Explain the relationship between thermodynamics and biological systems. [8]
- (b) Describe any *one* application of Gibbs' free energy to biological systems. [8]

*Or*

12. Describe in detail the different types of bio-chemical reactions giving suitable examples for each type. [16]



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**[4162]-229**

**S.E. (Biotechnology) (Second Semester) EXAMINATION, 2012**

**GENETICS AND MOLECULAR BIOLOGY**

**(2008 PATTERN)**

**Time : Three Hours**

**Maximum Marks : 100**

**N.B. :—** (i) Answer *three* questions from Section I and *three* questions from Section II.

(ii) Answers to the two Sections should be written in separate answer-books.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

**SECTION I**

1. (a) State and explain the following inheritance : [8]

(i) Law of segregation

(ii) Law of independent assortment.

(b) Hemophilia is a sex-linked trait where  $X^H$  gives normal blood clotting and is dominant to the hemophilia allele  $X^h$ . [8]

(i) Give the genotype of (1) a woman with normal blood clotting whose father had hemophilia and (2) a normal man whose father had hemophilia.

P.T.O.

- (ii) What is the probability that a mating between these two individuals will produce a child, regardless of sex, that has hemophilia ?
- (iii) If this couple has a daughter, what is the probability that the daughter will be a carrier of the hemophilia trait ?
- (iv) If this couple has a son, what is the probability he will have hemophilia ? [8]

*Or*

2. Explain the following experiments with their importance to development in field of molecular biology : [8 marks each] [16]
- (a) Avery, MacLeod and MacCarty's Experiment
- (b) Hershey and Chase's Experiment.
3. Which forms of DNA exists as natural form in living cells ? Describe all the forms of DNA in detail. [16]

*Or*

4. (a) Represent a melting curve of a double helix DNA and explain it in detail. [8]
- (b) What are the main functions of DNA in a living cell ? Write a note on mitochondrial DNA. [8]

5. (a) Discuss the various enzymes involved in DNA replication. [10]  
(b) What is meant by 'end replication problem' in DNA synthesis ?  
Discuss the role of telomerase in it. [8]

*Or*

6. (a) Write a note on the famous Messelson and Stahl experiment on proving semi-conservative mode of DNA replication. [8]  
(b) What is Mutation ? Explain the types of mutation in detail. [10]

## SECTION II

7. (a) Discuss about types of RNA and the RNA polymerase which are involved in synthesizing them. [8]  
(b) Explain the term 'Post-transcriptional modifications' in detail. [8]

*Or*

8. Write short notes on : [16]  
(a) Ribozymes  
(b) Introns and Exons  
(c) Reverse Transcriptase  
(d) RNA as a genetic material.

9. Describe the process of transcription in prokaryotes in detail. [16]

*Or*

10. What is a concept of 'Operon' ? Explain with *one* example. [16]

11. (a) Elaborate the statement "Genetic code is a triplet, redundant, non-overlapping and comma free code". [9]

(b) What is meant by 'genetic disorder' ? Explain with *one* example. [9]

*Or*

12. Explain how the genetic information present in the *mRNA* is decoded in amino acid sequence during the process of translation. [18]