Total No. of Questions—**12**] [Total No. of Printed Pages—**8+1**

[3862]-101

S.E. (CIVIL) (I Semester) EXAMINATION, 2010

ENGINEERING MATHMATICS-III

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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*) Solve any *three* : [12]

(*i*) $(D^2 + 3D + 2)y = e^{e^x} + \cos e^x$

(*ii*) $(D^2 - 4D + 4)y = e^x \cos^2 x$

(*iii*) $\dfrac{d^2y}{dx^2} + 4y = \tan 2x$ [By variation of parameters]

(*iv*) $x^3 \dfrac{d^3y}{dx^3} + 2x^2 \dfrac{d^2y}{dx^2} + 2y = 10\left(x + \dfrac{1}{x}\right)$

(*b*) Solve : [5]

$$\frac{dx}{dt} + y = e^t$$

$$x - \frac{dy}{dt} = e^{-t},$$

given that $x = 1$, $y = 0$ at $t = 0$.

Or

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

(*i*) $(D^2 + 6D + 9)y = \dfrac{1}{x^3 e^{3x}}$

(*ii*) $(D^5 - D)y = 2x + 2^x$

(*iii*) $(D^2 - 4D + 4)y = e^{2x} \sec^2 x$

[By variation of parameters]

(*iv*) $(x + a)^2 \dfrac{d^2y}{dx^2} - 4(x + a)\dfrac{dy}{dx} + 6y = x$

(*b*) Solve : [5]

$$\frac{dx}{x(y^2 - z^2)} = \frac{dy}{-y(z^2 + x^2)} = \frac{dz}{z(x^2 + y^2)}$$

3. (*a*) The differential equation satisfied by a beam, uniformly loaded with one end fixed and second subjected to a tensile force P is given by :

$$\mathrm{EI}\frac{d^2y}{dx^2} - \mathrm{P}y = \frac{-\mathrm{W}x^2}{2}$$

Show that the elastic curve for the beam under conditions

$y = 0$ and $\frac{dy}{dx} = 0$.

when $x = 0$, is given by :

$$y = \frac{\mathrm{W}}{2\mathrm{P}}\left[x^2 + \frac{2}{n^2} - \frac{e^{nx}}{n^2} - \frac{e^{-nx}}{n^2}\right]$$

where, $\frac{\mathrm{P}}{\mathrm{EI}} = n^2$. [8]

(*b*) A homogeneous rod of conducting material of length 100 cm with ends kept at zero temperature satisfies the equation :

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

If the initial temperature is :

$$u(x, 0) = \begin{cases} x & ; 0 \le x \le 50 \\ 100 - x & ; 50 \le x \le 100. \end{cases}$$ [8]

Or

4. (*a*) It is found experimentally that a weight of 3 kg stretches a spring to 15 cm. If the weight is pulled down 10 cm below equilibrium position and then released

(*i*) find the amplitude, period and frequency of motion.

(*ii*) determine the position, velocity and acceleration as a function of time. [8]

(*b*) Solve the equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

subject to the following conditions :

(*i*) $u(x, \infty) = 0$

(*ii*) $u(0, y) = 0$

(*iii*) $u(1, y) = 0$

(*iv*) $u(x, 0) = x(1 - x)$ for $0 < x < 1$. [8]

5. (*a*) Solve the following system of equations by Gauss-Seidel iteration method : [9]

$$9x_1 + 2x_2 + 4x_3 = 20$$
$$x_1 + 10x_2 + 4x_3 = 6$$
$$2x_1 - 4x_2 + 10x_3 = -15$$

(*b*) Use Runge-Kutta method of fourth order to solve :

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

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

Or

6. (*a*) Solve the equation :

$$\frac{dy}{dx} = x^2 + y \quad ; \quad y\ (0) = 1$$

to find y at $x = 0.1$ using Euler's modified method taking $h = 0.05$. [9]

(*b*) Solve the following system of equations by Cholesky's method :

$$4x_1 - 2x_2 = 0$$
$$-2x_1 + 4x_2 - x_3 = 1$$
$$-x_2 + 4x_3 = 0.$$ [8]

SECTION II

7. (*a*) Compute the first four moments, coefficient of skewness and kurtosis for the following frequencies : [6]

No. of Jobs completed	**No. of Workers**
0—10	6
10—20	26
20—30	47
30—40	15
40—50	6

(*b*) Compute the coefficient of correlation between the supply and price : [6]

x	y	f
5	7	6
9	9	9
15	14	13
19	21	20
24	23	16
28	29	11
32	30	7

(*c*) There are 6 married couples in a room. It two persons are chosen at random, find the probability that :

(*i*) they are of different sex

(*ii*) they are married to each other. [5]

Or

8. (*a*) Obtain the correlation between population density (per square mile) and death rate (per thousand persons) from the data related to 5 cities. [6]

Population Density	**Death Rate**
200	12
500	18
400	16
700	21
300	10

(*b*) If two lines of regressions are $9x + y - \lambda = 0$ and $4x + y = \mu$ and the means of x and y and 2 and –3 respectively, find the values of λ and μ and coefficient of correlation between x and y. [6]

(*c*) Number of road accidents follows a Poisson's distribution with mean 5, find the probability that in a certain month number of accidents on the highway will be : [5]

(*i*) less than 3

(*ii*) between 3 and 5

(*iii*) more than 3.

9. (*a*) A particle describes the straight line $r = a \sec \theta$ with constant angular velocity ω. Find the radial and transverse components of velocity and acceleration. [5]

(*b*) If the directional derivatives of $\phi = a(x + y) + b(y + z) + c(x + z)$ has maximum value 12 in the directional parallel to the line

$$\frac{x-1}{1} = \frac{y-2}{2} = \frac{z-1}{3}$$

find the values of a, b, c. [5]

(*c*) Establish any *two* : [6]

(*i*) If $\rho\overline{\mathrm{E}} = \nabla\phi$, prove that $\overline{\mathrm{E}}$. curl $\overline{\mathrm{E}} = 0$.

(*ii*) Show that curl curl curl curl $\overline{\mathrm{E}} = \nabla^4\overline{\mathrm{E}}$, where $\overline{\mathrm{E}}$ is solenoidal.

(*iii*) $\nabla \cdot (r^3\bar{r}) = 6r^3$.

Or

10. (*a*) A particle moves along the curve $x = a \cos t$, $y = a \sin t$; $z = bt$ with constant angular velocity ω. Find the radial and transverse components of its linear velocity and acceleration at any time t. [5]

(*b*) Find the directional derivatives of ∇f at $(1, 2, -1)$ where $f(x, y, z) = x^2y + xyz + z^3$ along normal to the surface $x^2y^3 = 4xy + y^2z$ at the point $(1, 2, 0)$. [5]

(*c*) Establish any *two* :

(*i*) $\nabla^4 e^r = e^r + \dfrac{4}{r}e^r$

(*ii*) $\overline{\mathrm{F}} = \dfrac{\bar{a} \times \bar{r}}{r^n}$ is solenoidal field

(*iii*) $\nabla \times [\bar{a} \times (\bar{b} \times \bar{r})] = \bar{a} \times \bar{b}$

where $\bar{a}$ and are constant vectors. [6]

11. (*a*) Verify Green's theorem for $\overline{F} = xi + y^2j$ over first quadrant of the circle $x^2 + y^2 = 1$. [6]

(*b*) Evaluate $\iint_S (x\hat{i} + y\hat{j} + z^2\hat{k}) \cdot dS$

where S is the curved surface of the cylinder $x^2 + y^2 = 4$ bounded by planes $z = 0$ and $z = 2$. [6]

(*c*) Evaluate using Stokes' theorem $\int_C (ydx + zdy + xdz)$, where C is intersection of $x^2 + y^2 + z^2 = a^2$, $x + z = a$. [5]

Or

12. (*a*) Evaluate $\iint_S (2xy\overline{i} + yz^2\overline{j} + xz\overline{k})\, d\overline{S}$ over the surface of the region bounded by $x = 0$, $y = 0$, $y = 3$, and $x + 2z = 6$. [6]

(*b*) Obtain the equation of streamlines in case of steady motion of fluid defined by $\overline{q} = (y - xz)\overline{i} + (yz + x)\overline{j} + (x^2 + y^2)\overline{k}$. [6]

(*c*) Evaluate $\int_C \overline{F} \cdot d\overline{r}$ for $\overline{F} = (2y + 3)\overline{i} + xz\overline{j} + (4z - x)\overline{k}$ along the path $x^2 = 2t^2$; $y = t$; $z = t^3$ from $t = 0$ to $t = 1$. [5]

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

[3862]-102

S.E. (CIVIL) (I Semester) EXAMINATION, 2010

BUILDING MATERIALS AND CONSTRUCTION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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*) You are advised to attempt not more than **6** questions.

(*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 the various classification of buildings as per National Building Code (NBC) of India, 2005. Explain the educational building. [6]

(*b*) Differentiate between dry rubble masonry and ashlar chamfered masonry. [6]

(*c*) What are the points to be considered while supervising brick masonry ? [4]

P.T.O.

Or

2. (*a*) Explain : [6]

(*i*) Uncoursed random rubble masonry

(*ii*) Ashlar fine masonry.

(*b*) Explain the residential building as per National Building Code (NBC) of India, 2005. [6]

(*c*) Differentiate between stone masonry and brick masonry. [4]

3. (*a*) What are the types of composite masonry ? Explain in detail stone composite masonry. [6]

(*b*) What do you understand by joints in concrete work ? Explain the expansion and contraction joint in concrete work. [6]

(*c*) Explain the casting procedure for the reinforced concrete column. [4]

Or

4. (*a*) What are the important features of the cavity walls ? [6]

(*b*) Explain the curing of concrete. [6]

(*c*) What are the merits and demerits of precast concrete ? [4]

5. (*a*) Enlist the materials used for the flooring. Explain marble flooring. [6]

(*b*) What are the types of roofs ? Explain queen post roof truss. [6]

(*c*) Write a short note on asphalt flooring. [6]

Or

6. (*a*) Enlist the types of steel sloping roof truss. Explain north light roof truss. [6]

(*b*) Write a short note on mosaic flooring. [6]

(*c*) Explain in detail laying of A.C. sheets. [6]

SECTION II

7. (*a*) Show clearly the following parts with a sketch of window :

(*i*) Horn

(*ii*) Holdfast

(*iii*) Head

(*iv*) Sill

(*v*) Meeting style

(*vi*) Panel [6]

(*b*) Enlist the types of windows. Explain louvered window. [6]

(*c*) Explain R.C.C. lintel. What are the merits of lintel over the arch ? [6]

Or

8. (*a*) Enlist the types of doors. Explain rolling door. [6]

(*b*) Explain the installation of the door frame. [6]

(*c*) Show clearly the following parts with a sketch of arch :

(*i*) Span

(*ii*) Rise

(*iii*) Crown

(*iv*) Key

(*v*) Voussiors

(*vi*) Extrados [6]

9. (*a*) Design a R.C.C. dog-legged staircase and draw a detailed plan for an office building, a staircase room available is 5m × 3m with the outer wall thickness of 230 mm. Floor to floor height of room is 3000 mm. The thickness of R.C.C. slab is 150 mm. [6]

(*b*) Write a short note on Escalators. [4]

(*c*) What are the general measures of fire safety in buildings ? [6]

Or

10. (*a*) Write a short note on Elevators. [6]

(*b*) What are the requirements of a good stair ? [4]

(*c*) What are the classification of stairs ? Explain R.C.C. staircase. [6]

11. (*a*) Explain in detail water closets. [6]

(*b*) Write a short note on plastic. [6]

(*c*) Explain cork flooring. [4]

Or

12. (*a*) Write a short note on glass. [4]

(*b*) What do you understand by the Linoleum flooring ? [6]

(*c*) What is seasoning of timber ? What are the methods of seasoning ? [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-103

S.E. (Civil) (First Semester) EXAMINATION, 2010

STRENGTH OF MATERIALS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

Answer Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4** and Q. **5** *or* Q. **6** from Section I and Q. **7** *or* Q. **8**, Q. **9** *or* Q. **10** and 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*) Write short notes on : [4]

(*i*) Factor of safety

(*ii*) Single and double shear.

(*b*) Draw and explain stress-strain diagram for mild steel. [5]

(*c*) A reinforced concrete column of 300 mm diameter is reinforced with 6 bars of 16 mm diameter. Allowable stress in concrete is 7 MPa and allowable stress in steel is 140 MPa. Modular ratio is 13. Find out the load carrying capacity of the column. [8]

Or

2. (*a*) Write short notes on : [9]

(*i*) Poisson's ratio

(*ii*) Bulk modulus

(*iii*) Modulus of rigidity

(*iv*) Young's modulus

State relation between any *three* of these.

(*b*) A steel rod 2 m long is at 30°C. The temperature of this rod is increased to 150°C. Find : [8]

(*i*) free expansion of the rod

(*ii*) temperature stress produced if expansion is prevented and nature of stress.

(*iii*) stress produced if 2 mm expansion is permitted and nature of stress

if a = 12×10^{-6} /°C and E = 200 GPa, Bar diameter = 16 mm.

3. (*a*) A continuous beam ABCD is simply supported at A and C and is loaded as shown in Fig. 1. Draw SFD, BMD and AFD. Show all important points. [9]

Fig. 1

(*b*) Draw loading diagram and BMD from SFD given in Fig. 2. The beam is a simply supported beam supported at A and B. There is no moment applied as loading. [8]

Fig. 2

Or

4. (*a*) A simply supported beam ABCD is supported and loaded as shown in Fig. 3. Draw SFD and BMD and show all important points. Find out the value and location of maximum bending moment. [9]

Fig. 3

(*b*) Derive expression for shear force and bending moment at a distance 'x' from free end of a cantilever subjected to uniformly varying load with loading intensity 'w', at the fixed end. Span of the cantilever is 'L'. Also draw SFD and BMD for the cantilever. (Loading intensity at the free end is zero) [8]

5. (*a*) A simply supported beam of span 4 m uses a T section with flange 100×10 deep and web 150×10 wide. The section is symmetric @ vertical axis. The beam carries two point loads 5 kN each placed symmetrically at third point. Find out maximum shear stress in the beam. [8]

(*b*) A symmetric I section is 150 wide and 200 deep. The flange thickness and web thickness is 10 mm. This section is used for cantilever beam having a span of 3 m and subjected to uniformly distributed load. Find the maximum u.d.l. that can be supported if E = 200 GPa and maximum allowable stress is 180 MPa. [8]

Or

6. (*a*) Draw shear stress distribution on a T section with flange. 150 × 15 deep and flange 200 × 20 wide. The section is symmetric @ vertical axis. The shear force applied is 110 kN. [8]

(*b*) A wooden rectangular section 200 × 300 deep is strengthened by fixing two steel plates at the top and bottom of the section 200 wide and 10 thick. E_s/E_w = 20 and allowable stresses in steel and timber are 200 MPa and 20 MPa respectively. Find the moment of resistance of the section. [8]

SECTION II

7. (*a*) A 75 kW motor is driving a line shaft through gear 'A' at 26.5 r.p.m. Bevel gear at B and C drives cement mixtures. If the power requirement of mixer driven by gear B is 25 kW and that of C is 50 kW, what are the required shaft diameters d_1 and d_2. If the allowable shearing stress in the shaft is 40 MPa, (Refer Fig. 4). [9]

Fig. 4

(*b*) Determine the strain energy of the prismatic beam AB, subjected u.d.l. of 25 kN/m over total span AB of 10 m. Assume :

$$I = 195.3 \times 10^3 \ mm^4$$

$$E = 2 \times 10^5 \ MPa$$

The beam AB is simply supported. [8]

Or

8. (*a*) A steel shaft of 950 mm diameter is required to transmit 220 kW power at 225 r.p.m. and maximum torque is 40% greater than the mean torque. Find the maximum allowable shear stress in the shaft material. [8]

(*b*) Three round bars having same length but different shapes are shown in Fig. 5. All three bars are subjected to same load, P. Find the amount of strain energy stored in each bar, assuming linear elastic behaviour. [9]

Fig. 5

9. (*a*) A generator shaft of hallow circular cross-section with outside diameter = 200 mm and inside diameter = 160 mm, is subjected to a torque of 11.1 kNm and axial compressive load of 362 kN. Determine the maximum tensile stress, maximum compressive stress and maximum shear stress in the shaft. [8]

(*b*) For the element shown in Fig. 6, locate the planes on which magnitude of the shear stress and normal stress are equal. Show the results on properly oriented elements. Also find the principal stresses. [9]

Fig. 6

Or

10. (*a*) An element in plane stress is subjected to stresses σ_x = –50 MPa, σ_y = 10 MPa and τ_{xy} = –40 MPa as shown in Fig. 7, using Mohr's circle, determine : [8]

(*i*) Stresses acting on the element rotated through an angle θ = 45°.

(*ii*) Principal stresses.

Fig. 7

(*b*) A shaft of 100 mm diameter transmits 200 kW power at 200 r.p.m. At a section, bending moment is 5 kNm. Find the principal stresses, maximum shear stress and principal plane. [9]

11. (*a*) A hollow cast iron column, 5 m long is fixed at both end and has an external diameter of 300 mm. The column supports an axial load of 1200 kN. Find the internal diameter of the column. Assume $a = 1/1600$ and $f_c = 550$ MPa. [8]

(*b*) Determine the stress resultant at four corners of column subjected to eccentric load of P = 600 kN, shown in Fig. 8. [8]

Fig. 8

Or

12. (*a*) Two identical rolled steel 'I' sections are used to form a built up section for axially loaded column. The sections are placed side by side and connected together suitably to act as a one unit as shown in Fig. 9. [10]

Fig. 9

Calculate the distance, '*d*' between these sections for same load carrying capacity about both the axes. Also find safe load using factor of safely of 4. The column has one end hinged and other end fixed, with a height of 4 mm.

Use Rankine's formula with f_c = 320 MPa, a = 1/7500.

Properties of single I section are as follows :

Area = 6133 mm^2

$I_{XX} = 98.21 \times 10^6 \text{ mm}^4$, $K_{XX} = 126.6$ mm

$I_{YY} = 9.9 \times 10^6 \text{ mm}^4$, $K_{YY} = 40.2$ mm

(*b*) Explain with neat sketches the stable, unstable and neutral equilibrium related to column subjected to axial load and critical load. [6]

Total No. of Questions—6 + 1 fig. Attac.] [Total No. of Printed Pages—4

[3862]-104

S.E. (Civil) (First Semester) EXAMINATION, 2010

ENGINEERING GEOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

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

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) *All* questions are compulsory.

SECTION I

1. (*a*) Distinguish between plutonic and volcanic rocks and describe any *two* rocks from each category. [8]

(*b*) Describe Hardness as a physical property of mineral. [3]

(*c*) Explain the process of decomposition of rocks in detail. [5]

Or

(*a*) How parallel structures in metamorphic rocks are developed ? Explain the process in detail. [8]

(*b*) How variation in length of transportation leads to development of different sedimentary rocks ? Explain it. [8]

P.T.O.

2. Write notes on :

(*a*) Climatic changes during Gondwana period. [5]

(*b*) Youthful stage of a river. [5]

(*c*) Field characters of Deccan Trap Basalt. [6]

Or

(*a*) Give a comparative account of Peninsula and extra Peninsula divisions of India. [6]

(*b*) Gondwana coal. [4]

(*c*) Two features developed due to river erosion. [6]

3. (*a*) Explain the different features resulted due to action of compressional type of tectonic forces. [8]

(*b*) Write a note on angular and non-conformity. [6]

(*c*) Explain Sill and Phaccolith as igneous intrusions. [4]

Or

(*a*) How are rocks faulted ? Describe various types and parts of a fault. [12]

(*b*) Explain the terms conformable series and Inlier and Outlier. [6]

SECTION II

4. Write notes on :

(I) (*a*) Fracture surfaces of drill cores. [6]

(*b*) Quality and Quantity of returning drill water. [5]

(II) With the help of figure-1 (attached) answer :

(*a*) Identify the feature as shown by an arrow. [1]

(*b*) Number of series of beds and their sequence. [4]

Or

(*a*) Remote sensing Techniques. [4]

(*b*) Explain the methods of surface and subsurface survey as a part of geological investigations at a project site. [12]

5. Write notes on :

(*a*) Focus, Epicentre and Isoseismal lines. [6]

(*b*) Types of volcanic eruptions. [5]

(*c*) Vertical distribution of Groundwater. [5]

Or

(*a*) Will you align a road along the slope of a hill where dip and slope are in the same direction ? Explain it. Also add a note on preventive measures against landslides. [12]

(*b*) Contact springs in Deccan trap area. [4]

6. (*a*) Feasibility of tunnelling in tectonic areas. [9]

(*b*) Relationship between type of dam and local geology. [5]

(*c*) Treatment to be given to a fracture crossing dam alignment. [4]

Or

(*a*) Dams on Limestones and Marbles. [6]

(*b*) Will you align a tunnel in E $\leftrightarrow$ W direction of dipping sedimentary beds exhibiting true dip towards North ? Give reasons. [5]

(*c*) Geological features leading to leakage below a dam. [7]

Total No. of Questions—**6**] [Total No. of Printed Pages—**8**

[3862]-105

S.E. (Civil)(First Semester) EXAMINATION, 2010

GEOTECHNICAL ENGINEERING

(2008 COURSE)

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*) Clearly explain the use of knowledge of geotechnical engineering in the construction of :

(*i*) embankment for road or railway

(*ii*) earth retaining wall. [6]

(*b*) Define the terms : water content, void ratio, degree of saturation, specific gravity and state different methods to find water content of a given soil with their suitability to different types of soil. [6]

(*c*) Draw a neat sketch of particle size distribution curve for a well graded soil and explain how C_c and C_u are obtained. Give the IS criteria for classification of soil based on the values of C_c and C_u. [5]

Or

(*a*) Draw a neat sketch to show change in the volume of soil due to change in the water content for a cohesive soil and define Atterberg limits. [6]

(*b*) Draw a neat sketch of plasticity chart as given by IS and classify the soil with liquid limit = 75% and plastic limit = 42% according to the chart. [6]

(*c*) A specimen of soil having a volume of 300 CC weighs 550 gm in wet condition. Determine voids ratio, degree of saturation, porosity and water content of the soil specimen if after oven drying at 105°C for 24 hours, its weight reduced to 472 gm. Take G = 2.67. [5]

2. (*a*) State Darcy's law, define coefficient of permeability and derive equation for coefficient of permeability used in constant head method. [6]

(*b*) With a neat sketch explain "quick sand condition" and derive expression for critical hydraulic gradient. [6]

(*c*) The void ratio of a soil is 0.76 while its coefficient of permeability is 1.2×10^{-4} cm/sec. If, keeping all other factors constant, the soil is compacted so as to reduce the void ratio to 0.60, what will be the coefficient of permeability of the soil if $k \propto \left(\frac{e^3}{1+e}\right)$. [5]

Or

(*a*) Draw an illustrative flownet for a sheet pile and state any *four* properties of flownet. State equation used to calculate seepage through a dam using flownet and give the meaning of all the terms in the equation. [6]

(*b*) With a neat sketch, describe pumping out method for determination of coefficient of permeability of soil in the field, for unconfined aquifer and derive the equation for coefficient of permeability. [6]

(*c*) In order to compute the seepage loss through the foundation of a dam, flownet was drawn. The flownet study gave number of flow channels $N_f = 8$ and number of equipotential drops $N_d = 18$. The head of water lost during seepage was 6 m. If the coefficient of permeability of foundation soil is 4×10^{-5} m/min, compute the seepage loss per meter length of dam per day. [5]

3. (*a*) State and explain any *four* factors which influence compaction of soil. [4]

(*b*) Explain how compaction control is achieved in the field using a Proctor needle. [4]

(*c*) In a standard compaction test, on a soil sample having specific gravity 2.7, the following test results were obtained :

Water Content (%)	**Bulk Density** (gm/cc)
5	1.89
8	2.13
10	2.2
12	2.21
15	2.16
20	2.08

Determine OMC, MDD, Void ratio, Porosity and Degree of saturation at OMC. [8]

Or

(*a*) State the formula for stress in a soil mass, due to a point load, at a point below ground level as given by Boussinesq and give the meaning of all the terms in it. [4]

(*b*) With a neat sketch, explain the use of Newmarks influence chart to find stress at a given point under a loaded area. [6]

(*c*) A 2 m × 2 m square footing carries a gross load of 550 kN. The footing rests at a depth of 1.5 m below ground level. The subsoil consists of a 2 m thick layer of sand having a unit weight of 18 kN/m^3. The sand layer is underlain by a 4 m thick layer of soft clay having unit weight of 17.2 kN/m^3. Compute the maximum vertical stress at the middle of the clay layer before and after the construction of the footing. Use Boussinesq's equation. [6]

SECTION II

4. (*a*) Explain Mohr-Coulomb failure theory and state Coulomb's law of shearing strength in total and effective stress condition. [6]

(*b*) What are the advantages and disadvantages of triaxial compression test in comparison with the direct shear test ? [6]

(*c*) A direct shear test was carried out on a cohesive soil sample and the following results were obtained :

Normal Stress (kN/m^2)	**Shear Stress at Failure** (kN/m^2)
150	110
250	120

What would be the deviator stress at failure if a triaxial test is carried out on the same soil with cell pressure of 150 kN/m^2 ? [6]

Or

(*a*) State the factors affecting shear strength of soil and explain the terms sensitivity and thixotropy. [6]

(*b*) Write a note on Vane Shear Test. [6]

(*c*) The shear strength parameters of a given soil are, C = 0.26 kg/cm^2 and f = 21°. Undrained triaxial tests are to be carried out on specimens of this soil. Determine deviator stress at which failure will occur if the cell pressure be 2.5 kg/cm^2. [6]

5. (*a*) Explain Rankine's earth pressure theory for cohesionless soils. [5]

(*b*) Explain Rehbann's graphical method for evaluation of earth pressure. [5]

(*c*) A retaining wall 9 m high retains a cohesionless soil, with an angle of internal friction 33°. The surface is level with the top of the wall. The unit weight of the top 3 m of the fill is 2.1 t/m^3 and that of the rest is 2.7 t/m^3. Find the magnitude and point of application of the resultant active thrust. [6]

Or

(*a*) Explain active and passive states of plastic equilibrium. [5]

(*b*) State assumption in Rankine's earth pressure theory. [4]

(*c*) A retaining wall, 7.5 m high, retains a cohesionless backfill. The top 3 m of the fill has a unit weight of 18 kN/m^3 and f = 30° and the rest has a unit weight of 24 kN/m^3 and f = 20°. Determine the pressure distribution on the wall. [7]

6. (*a*) Describe with figures, the modes of failure for finite and infinite slopes. [8]

(*b*) Rock classification by RMR method. [4]

(*c*) Explain durability of rocks. [4]

Or

(*a*) Explain tests for determination of shear strength of rocks. [8]

(*b*) Write short notes on causes and remedial measures of Landslides. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-106

S.E. (Civil) (Second Semester) EXAMINATION, 2010

FLUID MECHANICS—I

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

Attempt Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6** from Section I. 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*) Define absolute viscosity and give classification of fluids based on Newton's law of viscosity and represent it graphically. [6]

(*b*) A glass tube of 0.2 mm diameter is immersed in mercury. The surface tension of mercury in contact with air is 0.5 N/m. The angle of contact for mercury is 130°. Calculate the capillary effect. [6]

(*c*) What parameter is used to determine whether the flow is :

(*i*) Subcritical or critical

(*ii*) Laminar or turbulent

(*iii*) Subsonic or supersonic. [6]

Or

2. (*a*) Calculate the gauge pressure and the absolute pressure within :

(*i*) a droplet of water 0.3 cm in diameter

(*ii*) a jet of water 0.3 cm in diameter.

Assume the surface tension of water as 0.07 N/m and atmospheric pressure as 101.3 N/m^2. [4]

(*b*) The force F on the propeller of an aircraft is known to depend upon speed of the aircraft V, air density r, air viscosity m, propeller diameter D, speed of rotation of propeller N. Derive an expression for force F. [8]

(c) An oil of specific gravity 0.9 and viscosity 0.9 poise is to be transported at the rate of 1000 l/s through a 1.2 m diameter pipe. Tests were conducted on a 10 cm diameter pipe using water at 20°C. Viscosity of water at 20°C is 0.01 poise. Find the rate of flow in the model. [6]

3. (a) Derive an expression for total pressure and the depth of centre of pressure from free surface of liquid, at inclined plane surface submerged in the liquid. [8]

(b) What is metacentre ? Define metacentric height.

A wooden block of specific gravity 0.8 floats in water. If the size of the block is 1 m × 0.6 m × 0.5 m. Find its metacentric height. [8]

Or

4. (a) Explain the procedure of computing the resultant hydrostatic force on a curved surface. [8]

(b) A closed cylindrical tank 2 m diameter, 4 m high contains water upto 3 m when it is rest. The cylinder is rotated with its longitudinal axis vertical. Find :

(i) the angular speed when water just touches the top

(ii) the depth of water at the centre of the tank when it is rotated at 120 r.p.m. [8]

5. (*a*) Derive the continuity equation for one-dimensional flow. State the assumptions made. [8]

(*b*) The velocity components in two-dimensional irrotational flow of an incompressible fluid are :

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

$$v = xy^2 - 2y - \frac{x^3}{3}.$$

Obtain the expression for velocity potential and stream function. [8]

Or

6. (*a*) Explain any *one* method of drawing flownet. Show that the streamlines and equipotential lines intersect each other orthogonally. What are the used of the flownet ? [8]

(*b*) (*i*) Determine the missing component of velocity distribution such that they satisfy continuity equation :

$$v = 2yz^2 + 3z^2, \; w = -4xz - 2yz - \frac{2}{3}z^3, \; u = ?$$

(*ii*) Define stream function y. [8]

SECTION II

7. (*a*) State Bernoulli's equation. Derive an expression for measuring discharge of fluid through a pipe with venturimeter. [8]

(*b*) A vertical sharp edged orifice 100 mm in diameter, is discharging water at the rate of 100 l/s under a constant head of 10 m. The co-ordinate of a point on the jet is 4.5 m horizontal and 0.5 m vertical, from the vena contracta. Find :

(*i*) Coefficient of velocity

(*ii*) Coefficient of discharge

(*iii*) Coefficient of contraction. [8]

Or

8. (*a*) Derive Euler's equation of motion and then derive Bernoulli's equation along the stream tube. [8]

(*b*) A pipeline carrying oil (sp. gr. 0.8) changes its diameter from 200 mm to 400 mm, which is 5 m at a higher level. If the pressures at these two points are 100 kN/m^2 and 50 kN/m^2 respectively and the discharge is 250 l/s, determine direction of flow and loss of head. [8]

9. (*a*) For a steady laminar flow through a circular pipe, prove that the velocity distribution is parabolic and average velocity is half of the maximum velocity. [10]

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

$$\frac{u}{v} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2,$$

δ—thickness of boundary layer.

Calculate :

(*i*) Displacement thickness

(*ii*) Momentum thickness. [8]

Or

10. (*a*) Show that for laminar flow between two parallel plates at rest, the mean velocity is two-third of maximum velocity. [10]

(*b*) Explain the development of boundary layer over a flat plate held parallel to the direction of flow. Also, state various factors affecting growth of boundary layer. [8]

11. (*a*) Write short notes on :

(*i*) Prandtl's mixing length theory

(*ii*) Hydrodynamically smooth and rough pipes. [8]

(*b*) What are the different losses in pipe flow and write expression for computing them ? [8]

Or

12. (*a*) Using Prandtl's mixing length theory, show that velocity variation for turbulent flow is logarithmic. [8]

(*b*) Derive an expression for the loss of head due to sudden enlargement in pipe flow. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-107

S.E. (Civil) (Second Semester) EXAMINATION, 2010

BUILDING PLANNING

(2008 COURSE)

Time : Four Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve 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*) Use separately answer-sheet for Section I and Drawing Sheet for Section II.

(*iii*) Figures to the right indicate full marks.

(*vi*) Assume suitable data, if necessary.

SECTION I

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

(*b*) Explain the role of plan sanctioning authority for townships. [6]

(*c*) Write short notes on eco-friendly and cost effective buildings. [6]

Or

2. (*a*) Write a short note on 7/12 abstract, giving meaning of each term. [6]

(*b*) Write a short note on benefits of "Green Buildings". [6]

(*c*) Explain how architectural planning principles help architectural composition. [6]

3. (*a*) What is F.A.R. ? What are the areas exempted while calculating F.A.R. ? [6]

(*b*) Give the definitions of the following :

(*i*) Building height

(*ii*) Development. [4]

(*c*) Write short notes on :

(*i*) Natural Ventilation

(*ii*) Artificial Lighting. [6]

Or

4. (*a*) State the byelaws regarding road width and height of the building. [6]

(*b*) The internal dimensions of a factory building are 40 m × 25 m × 12 m. The number of air changes required per hour are three. The difference between indoor and outdoor temperature is 8°C. Find the area of openings required if the distance between inlet and outlet openings is 8 m. [6]

(*c*) Explain the importance of daylighting and the factors influencing the daylighting. [4]

5. (*a*) Explain in detail any *two* constructional measures for noise control. [6]

(*b*) What is fire hazard ? Explain the means of fire control. [6]

(*c*) Explain two-pipe plumbing system. [4]

Or

6. (*a*) What are different acoustical defects ? Explain any *one* in detail. [6]

(*b*) Explain the following terms :

(*i*) Fire load

(*ii*) Evacuation time

(*iii*) Travel distance. [6]

(*c*) What factors affect designing and planning of electrical services ? [4]

SECTION II

7. Draw plan and elevation of a twin bungalow. The plot size is 300 m^2 and maximum F.S.I. is 0.8. Road of 8 m width is on the East side of the plot. Structure is R.C.C. and G + 1. Ext. wall thickness is 230 mm and internal 150 mm. [20]

Or

8. Draw plan and elevation of a twin bungalow. The plot size is 300 m^2 and maximum F.S.I. is 1.0. Road of 8 m width is on the North side of the plot. Structure is load bearing and G + 1. Ext. wall thickness is 300 mm and internal 230 mm. [20]

9. Draw the sketches for the following symbols :

(*i*) Timber

(*ii*) VCR Masonry

(*iii*) Wash basin

(*iv*) Rolled shape-I section

(*v*) Revolving door. [10]

Or

10. Draw to a scale 1 : 100 or suitable, a two point perspective view of an object shown in Fig. 1. Assume eye level 1.8 m above GL. [10]

Fig. 1

All dimensions are in mm.

11. It is proposed to construct a PWD Executive Engineer's office with the following data :

(1) Entrance + Waiting — 12 m^2

(2) Administrative office — 15 m^2

(3) E.E. office (attached toilet) — 18 m^2

(4) Technical Session — 15 m^2

(5) Record room — 9 m^2

(6) PA to Executive — 9 m^2

(7) Sanitary block (Ladies & Gents) — Suitable

(8) Passage — 1.5 m wide

Draw to a scale of 1 : 50 or suitable :

(*i*) Line plan showing locations of doors, windows. [10]

(*ii*) Schedule of openings. [5]

(*iii*) Suggest suitable flooring for different areas. [5]

Or

12. Design a single storeyed Restaurant building on a highway. The following units are to be provided :

(*i*) Entrance + General Shop — 45 m^2

(*ii*) Dining Hall — 300 m^2

(*iii*) Service — 35 m^2

(*iv*) Kitchen — 45 m^2

(*v*) Store room — 20 m^2

(*vi*) Cloak room — 15 m^2

(*vii*) Sanitary block for Ladies
and Gents (separate) — Suitable

(*viii*) Passage — 1.5 m wide

Draw to a scale of 1 : 50 or suitable :

(*a*) Line plan showing locations of doors and windows. [10]

(*b*) Schedule of openings. [4]

(*c*) Furniture arrangement in the dining area. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-108

S.E. (Civil) (Second Semester) EXAMINATION, 2010

SURVEYING

(2008 COURSE)

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 orientation in plane table survey ? Explain method of backsighting for orientation. [5]

(*b*) A closed traverse was run along a square PQRS in counter-clockwise direction. The bearing of the line PQ was observed as 118° 30¢. Find the Forebearings and Backbearings of the remaining lines and record them in a tabular form. [7]

(*c*) Differentiate between Dip and Declination. The magnetic bearing of the sun at noon is 356° 30¢. Find out the declination. [6]

Or

2. (*a*) While carrying out compass traverse, the following Forebearings and Backbearings of various lines were observed. Correct the bearings affected by local attraction and enter your result in tabular form : [7]

Line	**Observed FB**	**Observed BB**
PQ	110° 00¢	292° 00¢
QR	40° 00¢	220° 00¢
RS	320° 30¢	140° 00¢
ST	270° 00¢	91° 00¢

(*b*) Explain in brief intersection method of plane table survey. When is it used ? [5]

(*c*) Write in tabular form, how you will convert the bearings from Reduced Bearing system to WCB system. [6]

3. (*a*) What is meant by interpolation of contours ? State various methods of it and explain any *one* in detail. [6]

(b) Reciprocal levels were taken with dumpy level as under : [6]

Instrument at	**Reading on**		**Remarks**
	P	**Q**	
P	1.500	2.250	Distance between
Q	0.600	1.320	P and Q = 880 m

Assuming collimation error to be –0.005 in 100 m. Calculate the true difference between P and Q and the correction for curvature, refraction and collimation.

(c) Write a short note on profile levelling. [4]

Or

4. (a) Differentiate between collimation plane method and Rise and Fall method. [4]

(b) State and define various fundamental axes of dumpy level. Also write the relationships between them. [6]

(c) Derive an expression for the combined correction for curvature and refraction effect in levelling. [6]

5. (a) How would you determine omitted measurement when length of one side and bearing of other side is omitted ? [6]

(*b*) Define the following terms : [4]

(1) Vertical Asix

(2) Trunion Axis

(3) Optical Axis

(4) Line of Collimation.

(*c*) The following are the latitudes and departure for a closed traverse ABCD. Compute the missing length and whole circle bearing of side DA of the traverse : [6]

Line	**Latitude**	**Departure**
AB	–116.10	–44.40
BC	+6.80	+58.20
CD	+80.50	+17.20
DA	?	?

Or

6. (*a*) What do you mean by prolongation of a straight line ? How is it done using 20¢¢ Theodolite ? [6]

(*b*) Define deflection angle. Explain in brief the procedure of measurement of the deflection angle using 20¢¢ vernier transit theodolite. [6]

(*c*) Define the following terms with neat sketch : [4]

(1) Closing error of traverse

(2) Independent co-ordinates

(3) Open traverse

(4) Closed traverse.

SECTION II

7. (*a*) State the functions of the following parts of a Theodolite : [6]

(1) Clip screw

(2) Optical plumet

(3) Eyepiece

(4) Shifting head

(5) Bubble tube

(6) Lower tangent screw.

(*b*) A staff was held vertically at a distance of 125 m and 50 m from the centre of a Tacheometer. The staff intercepts with the telescope horizontal were 1.248 and 0.498 respectively. Calculate the constants of a tacheometer. [6]

(*c*) Explain the necessary test and adjustment for making the vertical circle to read zero when the line of collimation is horizontal. [6]

Or

8. (*a*) Describe in detail the field procedure of determining the constants of a Tacheometer. [6]

(*b*) Write a short note on Tacheometric Contour Survey. [4]

(*c*) A tacheometer was set up at an intermediate point between two stations A and B and the following observations were made on a vertically held staff : [8]

Staff Station	**Vertical Angle**	**Staff Readings**
A	+4° 30¢	1.605, 2.400, 3.195
B	–2° 45¢	0.805, 1.345, 1.885

The instrument is fitted with an anallatic lens having a constant of 100. Compute the length AB and R.L. of point B, if that of A was 395.400 m. The instrument and staff stations are in one straight line.

9. (*a*) Draw the neat sketches of the following : [4]

(1) Simple circular curve

(2) Compound curve

(3) Reverse curve

(4) Valley curve.

(*b*) Work out the relationships between the elements of a simple circular curve. [4]

(*c*) Two straights of road intersects at a chainage of 2550.50 m. The angle of intersection being 110°. Taking chord length of 30 m, calculate the following : [8]

(1) Radius of curve

(2) Length of curve

(3) Tangent length

(4) Length of long chord

(5) Chainages at the starting point and end point.

Or

10. (*a*) Write a short note on necessity of vertical curves in highways. [4]

(*b*) Describe in detail the method of setting out a simple circular curve by offset from chord produced. [6]

(*c*) A transition curve is to be designed for the following data : [6]

(1) Radius of circular curve = 300 m

(2) Gauge = 1.5 m

(3) Maximum superelevation = 15 cm

(4) No lateral pressure on rails

(5) Rate of gain of radial acceleration = 0.3 m/sec^3.

Find the length of the curve and design speed.

11. (*a*) State the classification of EDM instruments. [5]

(*b*) Explain in brief the process of setting out a building on ground. [5]

(*c*) What is total station ? State any *five* special functions available in total station. [6]

Or

12. (*a*) Define gradient. What is the importance of gradient while laying sewer pipe ? How is it decided ? [6]

(*b*) Write a short note on basic principle of EDM Instruments. [5]

(*c*) Write a short note on different types of construction survey. [5]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-109

S.E. (Civil) (Second Semester) EXAMINATION, 2010

CONCRETE TECHNOLOGY (Theory)

(2008 COURSE)

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 electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Write in short on chemical composition of cement. [6]

(*b*) Explain the procedure for aggregate impact value test. [6]

(*c*) Write short notes on :

(*i*) Gas forming admixtures

(*ii*) Fly ash. [6]

Or

2. (*a*) What are the methods of manufacture of cement ? Explain *one* of them in detail. [6]

(*b*) Write short note on Grading of Aggregates. [6]

(*c*) What are the different types of admixtures ? [6]

3. (*a*) Define workability and explain the tests for workability. [5]

(*b*) What care should be taken to while transporting and placing of concrete ? [5]

(*c*) Write short note on shrinkage and its different types. [6]

Or

4. (*a*) Write short note on Gel/Space ratio. [5]

(*b*) Explain the relationship between compressive strength and tensile strength of concrete. [5]

(*c*) Write short note on Segregation and Bleeding. [6]

5. (*a*) What is the significance and objective of mix design ? [5]

(*b*) Define :

(*i*) Characteristic strength of concrete (*ii*) Mean strength

(*iii*) Variance

(*iv*) Standard Deviation

(*v*) Coefficient of Variation. [5]

(*c*) Explain DOE method of mix design in brief. [6]

Or

6. 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 :

(1) Coarse aggregates — II

(2) Fine aggregates — II.

(*b*) **Characteristics of material :**

Cement :

(*i*) Type of cement — OPC 43 grade

(*ii*) Specific gravity — 3.15

(*iii*) Bulk density — 1450 kg/m^3.

Aggregates :

	Fine aggregates	Coarse aggregates
(*i*) Specific gravity	2.6	2.65
(*ii*) Bulk density (kg/m^3)	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 kg/m^3.

(*iv*) Maximum free water cement ratio — 0.5.

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

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

Fig. 1

SECTION II

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

(*b*) Write short notes on :

(*i*) Type of formwork

(*ii*) Pull out test. [8]

Or

8. (*a*) Write short note on Analysis of fresh concrete. [6]

(*b*) Write short notes on :

(*i*) Principles of design of formwork

(*ii*) Ready mixed concrete. [10]

9. (*a*) Explain Under water concreting. [6]

(*b*) Write short note on Batching plants. [5]

(*c*) State the advantages of light weight concrete. [5]

Or

10. (*a*) Write short notes on :

(*i*) Polymer concrete

(*ii*) Fibre reinforced concrete. [8]

(*b*) Write short notes on :

(*i*) Pumps and

(*ii*) Vibrators. [8]

11. (*a*) What is durability of concrete ? State its significance and effect water/cement ratio on it. [8]

(*b*) Write short notes on :

(*i*) Repair by stitching

(*ii*) Shotcrete. [10]

Or

12. (*a*) Explain in detail Carbonation of concrete. [6]

(*b*) Write short notes on :

(*i*) Sulphate attack on concrete

(*ii*) Acid attack on concrete

(*iii*) Resin based repairs. [12]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-110

S.E. (Civil) (Second Semester) EXAMINATION, 2010

STRUCTURAL ANALYSIS—I

(2008 COURSE)

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.

SECTION I

1. (*a*) Differentiate Static and Kinematic Indeterminacy. [2]

(*b*) Determine the slope at 'C' and A and the deflection at mid-point 'D' of the overhang beam as shown, E = 200 MPa, I = 1.2×10^8 mm^4. Use Conjugate Beam Method. [8]

20 kN

A D B C

I 2I

6 m 2 m

P.T.O.

(*c*) Using Castigliano's first theorem, determine deflection of overhang end 'A' of the beam loaded as shown below. [8]

M

B C

A

L/3 L

2. (*a*) Find degree of static and kinematic indeterminacy. [2]

(*b*) Find slope at 'C' and maximum deflection. Take flexural rigidity = 4×10^4 kNm^2. [8]

24 kN/m 72 kN

A B

C D

3 m 1 m 2 m

(*c*) Calculate the central deflection and the slope at ends of simply supported beam carrying udl over whole span using Castigliano's first thm. [8]

3. (*a*) Analyse the continuous beam shown below. [8]

20 kN

20 kN

5 kN

A 1 m 3 m B 1 m 2 m C 1 m D

(*b*) A horizontal prismatic beam AB of span '*l*' m is fixed at its ends A & B. If the right end B of the beam settles down by 'd', find the reacting force and reacting moments of each end of beam. Use Castigliano's second thm. [8]

4. (*a*) A continuous beam ABC is simply supported at A, B, C. AB = BC = *l*. If while loading the beam the support B sinks by d_1 and support C sinks by d_2. Find the moment produced at B and the reactions at the supports due to sinking of supports. If $d_1 > d_2$. [8]

(*b*) Find the reaction at the prop for the loaded propped cantilever shown below :

200 kN

20 kN/m

A

4 m

C

2 m

B

R

Use Castigliano's second thm. [8]

5. (*a*) Find the vertical and horizontal deflections of joint 'C' of the truss shown below. The area of inclined tie is 2000 mm^2, while the area of horizontal member is 1600 mm^2. Take E = 200 kN/mm^2. [8]

A

3 m

120 kN

B

C

4 m

(*b*) Find forces in members of the frame. C/S area and material of all members is same. [8]

W

A l B

l

C

D

6. (*a*) Find horizontal deflections of joint 'C' of the pin jointed truss. The area of horizontal members is 150 mm^2 and the areas of members AC and BC are 200 mm^2 each. Take E = 200 kN/mm^2. [8]

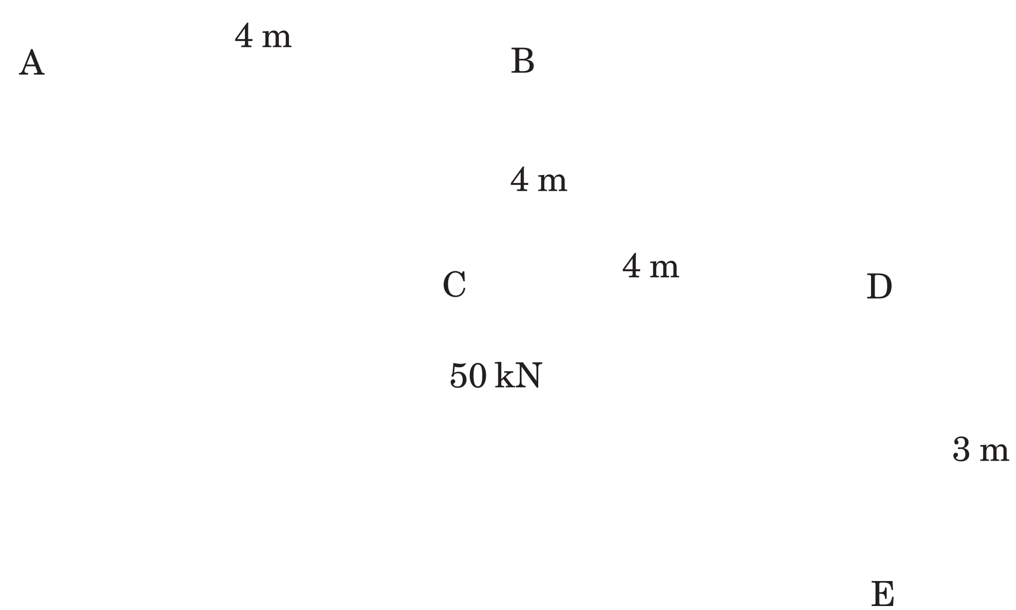
9 kN

C

4.5 m

A 6 m 6 m B

(*b*) Find the force in wire rope BC if member AB is made of Aluminium and that of member CD and CE are of mild steel. C/S areas of member CD and CE are 1600 mm^2 and 2400 mm^2 respectively. Joint 'C' is loaded by a 50 kN load. The second moment of area of member AB is 2.5×10^8 mm^4. C/S area of wire BC is 800 mm^2. [8]



SECTION II

7. (*a*) Write notes on : [6]

(*i*) Elastic-Plastic stress-strain diagram

(*ii*) Plastic Hinge.

(*b*) Write assumptions in Plastic theory. [6]

(*c*) A fixed beam of uniform section and length '*l*' and fully plastic moment M_P is subjected to a total udl '*w*' together with a concentrated load 'P' at a dist. *l*/3 from left end of beam. Find the value of W which would cause collapse for P = 0.25 W. [6]

8. (*a*) Write notes on : [9]

(*i*) The upper bound theorem

(*ii*) The lower bound theorem

(*iii*) Uniqueness theorem

(*iv*) Mechanism conditions.

(*b*) The figure below shows a rectangular portal frame whose legs are fixed at base. The frame carries a point load W at mid-span and a horizontal sway load $\frac{W}{2}$. Find the value of W at which the frame will collapse. All the members are of the same section. [9]

W

B *l*/2 *l*/2 C

W/2

l/2

A D

9. (*a*) For the balanced cantilever beam, draw ILD for reactions at supports A and B, S.F. and B.M. at G and S.F. and B.M. at H. [8]

A G B H C 24 m D E F

6 m 6 m 4 m 4 m 8 m 12 m

Hinge

(*b*) Draw the influence line diagrams for the forces in members L_1U_2, U_2L_2, U_2L_3 and L_1L_2 for the truss shown below. [8]

U_2 U_3 U_4 U_5 U_6

4 m

L_1 L_7

L_2 L_3 L_4 L_5 L_6

Panels at 4 m each = 24 m

10. (*a*) A beam ABC 7 m long fixed at 'A' and is simply supported at 'B' and is provided with an internal hinge at 'C', 4 m from A. Draw influence line diagrams for the following :

(*i*) Reaction at A

(*ii*) Reaction at B

(*iii*) Reaction at C

(*iv*) B.M. at D, the middle point of AC. [8]

A D C E B

2 m 2 m 1 m 2 m

Hinge

(*b*) Draw the influence line diagrams for the forces in members U_3U_4, L_3L_4, U_3L_3 and U_3L_4 for the truss shown in Fig. Q. No. 9 (*b*). [8]

11. (*a*) Draw the influence lines for reactions at supports A, B, C and bending moment at support B for the beam shown. There is a hinge provided at 'D'. Find their maximum values when a travelling load of 60 kN per meter may cover any part of span. [8]

A 6 m B 3 m D 3 m C

(*b*) Two wheel loads 200 kN and 80 kN spaced 0.8 m apart roll on the girder shown below. Find the maximum positive and negative bending moments that can occur at the section 'C'. [8]

D A C B E

3 m 3 m 4 m 2 m

12. (*a*) A distributed load of 80 kN/m run may occupy any part of span on the beam. Find maximum positive and negative shear force at section marked 'C'. [8]

D 3 m A 3 m C 4 m B 2 m E

(*b*) The wheel load system shown below can move on a girder of span 5 m. Find the maximum positive and negative shear force for the girder. [8]

120 kN 400 kN 150 kN 250 kN

0.8 m 1 m 0.8 m

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-111

S.E. (Mechanical)(First Semester) EXAMINATION, 2010

APPLIED THERMODYNAMICS

(2008 COURSE)

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*) 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 an expression for entropy change in the form :

$$S_2 - S_1 = c_p \ln \frac{T_2}{T_1} - R \ln \frac{P_2}{P_1}.$$ [8]

(*b*) What are statements of second law of thermodynamics ? How is second law applicable to compressors and air receiver tanks ? [8]

Or

2. (*a*) Air is compressed from 100 kPa and 17°C to 600 kPa and 57°C. What will be entropy change ? Now if this process is carried out in isentropic way by maintaining initial conditions and pressure ratio, what will be final temperature of air ? [8]

(*b*) Explain Clausius inequality. [8]

3. (*a*) Carbon steel balls of density 7833 kg/m^3 and C_p 0.465 kJ/kgK, diameter 8 mm are annealed by heating to 900°C and then by slow cooling at 100°C in the air. Air temperature is 35°C. If 1200 balls are to be processed per hour, determine total rate of heat transfer and lost work. [10]

(*b*) Derive expression for polytropic specific heat capacity. [6]

Or

4. (*a*) 0.1 m^3 of a gas is compressed from 120 kPa and 25°C to 1.2 MN/m^2 according to a law $PV^{1.2} = C$. Calculate work done, change of internal energy, heat transfer. Also state direction of heat transfer. [8]

(*b*) Obtain expression for non-flow energy. [8]

5. (*a*) Explain with sketch working of separating and throttling calorimeter. [8]

(*b*) What is throttling process ? Steam at 1.5 MPa and 0.7 dry is throttled to 0.10 MPa. Find out dryness fraction after throttle. [6]

(*c*) Explain significance of specific steam consumption and work ratio. [4]

Or

6. (*a*) Show Rankine cycle of P-V and T-S diagram when steam is superheated. Also discuss whether efficiency of cycle will change if reheat is employed. Show this process of reheat in two stages on Mollier chart. [8]

(*b*) A steam turbine plant working on Rankine cycle uses steam at 15 bar and condenses at 0.3 bar. Determine Rankine efficiency if :

(*i*) steam is dry saturated

(*ii*) superheated at 400°C.

Also find specific steam consumption in second case. Neglect feed pump work in both cases. [10]

SECTION II

7. (*a*) Distinguish between :

(*i*) Mass fraction and mole fraction

(*ii*) Lean mixture and rich mixture. [4]

(*b*) Explain NDIR method of gas analysis in brief. [4]

(*c*) The following data was obtained during experimental determination of calorific value of fuel by Bomb calorimeter :

Mass of coal = 0.78 gm

Mass of fuse wire = 0.032 gm

Calorific value of fuse wire = 7 kJ/gm

Mass of water in calorimeter = 2 kg

Water equivalent of calorimeter = 0.4 kg

Rise in temperature of calorimeter water = 3.2°C

Cooling correction = 0.01°C.

Determine HCV and LCV of coal at NTP conditions. Given the coal contains 90% of carbon and 5% of hydrogen. [8]

Or

8. (*a*) With the help of neat sketch discuss the method of determining calorific value of gaseous fuel. [8]

(*b*) The composition of dry flue gas as obtained by using Orsat apparatus was CO_2 = 9.8%, CO = 7.2%, H_2 = 3.4%, CH_4 = 0.3%, N_2 = 79.3%. Calculate :

(*i*) Air fuel ratio

(*ii*) Stoichiometric air

(*iii*) Mixture strength. [8]

9. (*a*) What are the advantages of multistaging in reciprocating air compressor ? [4]

(*b*) Differentiate between reciprocating and rotary compressors. [4]

(*c*) A single stage, single acting reciprocating air compressor delivers 0.7 kg of air per min at 6 bar. The suction temperature and pressure are 25°C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of swept volume. Assuming index of compression and expansion to be 1.3. Find :

(*i*) Volumetric efficiency of the compressor

(*ii*) Power supplied to drive the compressor if mechanical efficiency is 85%

(*iii*) Speed of the compressor (RPM). [10]

Or

10. (*a*) Discuss the factors those influence the volumetric efficiency of a reciprocating air compressor. [6]

(*b*) A two-stage reciprocating air compressor takes in air at 1 bar and 27°C. Air is delivered at 10 bar. The intermediate pressure is deal and intercooling is perfect. The law for compression is $PV^{1.35} = C$. The rate of discharge is 0.1 kg/s. Find :

(*i*) Power required to drive the compressor

(*ii*) Saving in work compared to single stage

(*iii*) Isothermal efficiency for multistage

(*iv*) Heat rejected in intercooler.

Take $R = 0.287$ kJ/kg K and $C_p = 1$ kJ/kg K. [12]

11. (*a*) Differentiate between mountings and accessories of the boiler. [4]

(*b*) Write a short note on artificial draught. [4]

(*c*) During the boiler trial the following data were obtained :

Duration of trial = 8 hrs.

Pressure of steam = 1400 kPa

Dryness fraction = 0.973

Feed water evaporated = 26700 kg

Hot well temperature = 50°C

Coal used = 4260 kg

CV of coal = 28900 kJ/kg

Air used per kg of fuel = 17 kg

Temperature of flue gases = 344°C

Boiler house temperature = 21°C

C_p of flue gases = 1.1 kJ/kg K.

Determine :

(*i*) Boiler efficiency

(*ii*) Equivalent evaporation

(*iii*) Heat lost to flue gases. [8]

Or

12. (*a*) Explain the term boiler efficiency and equivalent evaporation by writing its significance. [6]

(*b*) Explain how it is an advantageous using an economizer and superheater in steam power plant. [4]

(*c*) A 32 m high chimney is used to discharge hot gases at 297°C to the atmosphere which is at 27°C. Find the mass of air actually used per kg of fuel, if the draught produced is 12 mm of water. Also calculate draught measured in terms of hot gas column. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-112

S.E. (Mech. & Mech. Sand) (First Semester) EXAMINATION, 2010

METALLURGY

(2008 COURSE)

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. Answer the following :

(*a*) Define cold working. Draw microstructure of mild steel before and after cold working. Why cold worked materials are annealed ? [6]

P.T.O.

(*b*) Give reasons (any *three*) : [9]

(*i*) Aluminium shows higher ductility than steel.

(*ii*) Fine grained steels are stronger than coarse grained steels.

(*iii*) Substitutional and interstitial crystal defects improve the strength and hardness.

(*iv*) Dislocations play an important role during plastic deformation of metals.

(*c*) Define slip plane and slip direction. [3]

Or

2. Answer the following :

(*a*) Give the classification of crystal imperfections. Explain with neat sketches screw dislocation and volume defects. [8]

(*b*) Define the recrystallization temperature and work hardening. Why are alloys worked hardened during plastic deformation ? [5]

(*c*) Obtain effective number of atoms per unit cell for cubic unit cells and state its significance. [5]

3. Answer the following :

(*a*) Define engineering and true stress. Obtain the relationship between engineering stress, strain and true stress, strain. [6]

(*b*) Draw a neat sketch of creep testing m/c and explain the test procedure. Draw the standard creep curve. [7]

(*c*) Explain the significance of Endurance limit. [3]

Or

4. Answer the following :

(*a*) With a neat sketch explain the procedure for Rockwell hardness test. State *two* main differences between Brinnel and Rockwell hardness tests. [7]

(*b*) Give the reason (any *three*) : [9]

(*i*) Specimens are notched in impact test.

(*ii*) Ultrasonic flaw inspection is not suitable to detect the defects in thin materials.

(*iii*) Magnaflux test is used to detect surface and subsurface defects.

(*iv*) Radiography is used to detect the defects in welded joints of boilers.

(*v*) Eddy current test can be used for sorting the steels.

5. Answer the following :

(*a*) Draw Fe-Fe_3C phase equilibrium diagram and label completely. Explain the phases, critical temperatures and phase transformation reactions. [10]

(*b*) State the requirements of steels used for various tools. Explain the significance of chromium and vanadium in tool steel. [6]

Or

6. Answer the following :

(*a*) Draw the microstructures and state the properties and applications of the following : [6]

(*i*) S.G. iron

(*ii*) Grey cast iron.

(*b*) Give the significance of the following (any *two*) : [6]

(*i*) En353

(*ii*) AISI1040

(*iii*) C45

(*c*) Explain free cutting steels w.r.t. composition and machinability. [4]

SECTION II

7. Answer the following :

(*a*) Define annealing and normalising. Explain any *three* annealing treatments with the use of proper portion of Fe-Fe_3C phase equilibrium diagram. [9]

(*b*) Define hardenability. Draw standard Jominey hardenability test set-up. Draw hardenability curves for 0.4% carbon and 0.8% carbon steels. Explain the significance of hardenability curves. [7]

(*c*) Give *four* differences between flame and induction hardening. [2]

Or

8. Answer the following :

(*a*) Draw TTT curve for 0.8% carbon steel. How are TTT curves used for the annealing, normalising and hardening treatments. [8]

(*b*) Explain the principle of carburising and nitriding. [4]

(*c*) State the characteristics of martensite and tempered martensite. Why are tool steels multitempered ? [6]

9. Answer the following :

(*a*) Explain the following characteristics of metal powder : [6]

(*i*) Particle size and shape distribution

(*ii*) Flow rate

(*iii*) Apparent density.

(*b*) Explain the effect of the following variables on metal powder characteristics in atomisation method : [6]

(*i*) Atomising pressure

(*ii*) Nozzle geometry

(*iii*) Pouring temperature.

(*c*) Draw Al-Si phase transformation diagram and give eutectic phase transformation reaction. [4]

Or

10. Answer the following :

(*a*) Define sintering. Why Briquettes need sintering treatment ? Explain the sintering process used for cemented carbide tools. [6]

(*b*) Explain the blending and compacting processes. [4]

(*c*) Explain anodising used for aluminium alloys. [3]

(*d*) Distinguish between brass and bronze. [3]

11. Answer the following :

(*a*) Explain the basic characteristics required to produce good composites. [4]

(*b*) Explain the properties and applications of the following fibers : [8]

(*i*) Aramid

(*ii*) Glass

(*iii*) Graphite

(*iv*) Alumina

(*v*) Silicon.

(*c*) State and explain usual problem that occur at cryogenic temperature. [4]

Or

12. Answer the following :

(*a*) Explain the characteristics of high temperature materials. [3]

(*b*) State any *one* material used for the turbine and give the reason. [4]

(*c*) Give classification of refractories. State properties and applications of each type of refractories. [7]

(*d*) Give classification of silicate glass. [2]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-113

S.E. (Mechanical/S/W) (First Semester) EXAMINATION, 2010

FLUID MECHANICS

(2008 COURSE)

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 whenever 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

(Unit I)

1. (*a*) State and explain Newton's law of viscosity. [4]

(*b*) A 0.12 m disc rotates on a table separated by an oil film of 0.018 m thickness. Find the viscosity of oil if the torque required to rotate the disc at 60 r.p.m. is 4×10^{-4} Nm. Assume the velocity gradient in the oil film to be linear. [8]

(*c*) Differentiate between the Eulerian and Lagrangian methods of representing fluid flow. [6]

Or

2. (*a*) What is capillarity ? Derive expression for height of capillary rise. [6]

(*b*) Derive the continuity equation in Cartesian coordinates. [6]

(*c*) Define stream function and velocity potential. Show that the streamlines and equipotential lines form a net of mutually perpendicular lines. [6]

(Unit II)

3. (*a*) Derive expressions for total pressure and centre of pressure for a vertically immersed surface. [6]

(*b*) Explain briefly different types of equilibrium of floating bodies. [4]

(*c*) A solid cube of sides 1 m each is made of a material of relative density 0.5. The cube floats in a liquid of relative density 0.95 with two of its faces horizontal. Determine its stability. [6]

Or

4. (*a*) Describe the experimental method of determination of the metacentric height of a floating object. [6]

(*b*) A 3.6 m by 1.5 m wide rectangular gate is vertical and is hinged at point 0.15 m below the centre of gravity of the gate. The total depth of water is 10 m. What horizontal force must be applied at the bottom of the gate to keep the gate closed ? [10]

(Unit III)

5. (*a*) State and prove Bernoulli's equation. What are limitations of the Bernoulli's equation ? [6]

(*b*) Describe an orificemeter and find an expression for measuring discharge of fluid through a pipe with this device. [6]

(*c*) What is a Pitot tube ? How is it used ? [4]

Or

6. (*a*) Describe an Venturimeter and find an expression for measuring discharge of fluid through a pipe with this device. [8]

(*b*) What is a notch ? How are the notches classified ? Find an expression for measuring discharge of fluid across a triangular notch. [8]

SECTION II

(Unit IV)

7. (*a*) Derive Hagen-Poiseuille equation and state the assumptions made. [6]

(*b*) Oil of viscosity 0.05 Ns/m^2 is flowing between two stationary parallel plates 1 m wide and maintained 10 mm part. The velocity midway between the plates is 3 m/s. Find : [10]

(*i*) Pressure gradient along flow

(*ii*) Average velocity

(*iii*) Discharge of oil

Or

8. (*a*) What is dimensional homogeneity ? Explain how dimensional analysis helps in analysis of fluid flow problem. [8]

(*b*) Explain in brief the Buckinngham p-theorem as method of dimensional analysis. [8]

(Unit V)

9. (*a*) Derive Darcy-Weisbach formula for calculating loss of head due to friction in pipe. [8]

(*b*) What is Syphon ? Where is it used ? [4]

(*c*) Derive an expression for the power transmission through the pipes. [4]

Or

10. (*a*) What do you mean by Hydraulic Gradient line and Energy Gradient line ? [6]

(*b*) Define the terms major energy losses and minor energy losses in pipe. [6]

(*c*) What is an equivalent pipe ? [4]

(Unit VI)

11. (*a*) Why is it necessary to control the growth of boundary layer on most of the bodies ? What are the methods for such control ? [6]

(*b*) How will you determine whether a boundary layer flow is attached flow, detached flow or on the verge of separation ? [8]

(*c*) What is CFD methodology ? [4]

Or

12. (*a*) Define drag force and lift force of an object immersed in a fluid. Distinguish between the friction drag and the pressure drag. [8]

(*b*) Derive an expression for the lift produced on a rotating cylinder placed in a uniform flow field such that the axis of the cylinder is perpendicular to the direction of flow. [6]

(*c*) What is Magnus effect ? [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-114

S.E. (Mech., Production, S/W)(First Sem.) EXAMINATION, 2010

ENGINEERING MATHEMATICS—III

(2008 COURSE)

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 electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve the following differential equations (any *three*) : [12]

(1) $\left(D^3 - D^2 - 6D\right)y = 1 + x^2$

(2) $\left(D^2 - 5D + 6\right)y = x \cos 2x$

(3) $$x^2 \frac{d^2y}{dx^2} + 5x\frac{dy}{dx} + 3y = \frac{\log x}{x^2}$$

(4) $$\left(D^3 - 4D\right)y = 2\cosh^2(2x)$$

(5) $$\frac{x\,dx}{z^2 - 2yz - y^2} = \frac{dy}{y+z} = \frac{dz}{y-z}.$$

(*b*) Solve the simultaneous differential equations :

$$4\frac{dx}{dt} + x - y = 0,\ x + 2\frac{dy}{dt} - y = 0$$

given $x = 20$ and $y = 100$ at $t = 0$. [5]

Or

2. (*a*) Solve the following differential equations (any *three*) : [12]

(1) $$\left(D^2 + 6D + 9\right)y = 5^x - \log 2$$

(2) $$(D-1)^2\left(D^2+1\right)y = e^x + \sin^2\frac{x}{2}$$

(3) $$(x+1)^2\frac{d^2y}{dx^2} + (x+1)\frac{dy}{dx} = (2x+3)(2x+4)$$

(4) $$\left(D^2 - 1\right)y = \left(1 + e^{-x}\right)^2$$

(5) $$\left(D^2 - 2D + 1\right)y = x^{3/2}e^x.$$

(by using variation of parameters method) (*b*) A body weighing 20 kg is hung from a spring. A pull of 40 kg weight will stretch the spring to 10 cm. The body is pulled down to 20 cm below the state of equilibrium position and then released. Find the displacement of the body from its equilibrium position at time t secs. Also find maximum velocity and period of oscillation. [5]

3. (*a*) Find Laplace Transform of (any *two*) : [6]

(1) $e^{t}\left(1+\sqrt{t}\right)^{3}$

(2) $t\sqrt{1+\sin t}$

(3) $e^{-t}\sin t\, u(t-\pi)$.

(*b*) Solve using Laplace Transform method :

$$y'' + 4y' + 8y = 1$$

given $y(0) = 0,\ y'(0) = 1.$ [5]

(*c*) Find Fourier transform of :

$$f(x) = \sin x \qquad 0 < x < \pi$$
$$= 0 \qquad x > \pi \text{ and } x < 0.$$ [6]

Or

4. (*a*) Find inverse Laplace Transform of (any *two*) : [8]

(1) $\dfrac{s+2}{s^{2}(s+3)}$

(2) $\dfrac{1}{(s-2)^4\,(s+3)}$ by convolution thm.

(3) $\log \dfrac{s^2+1}{s(s+1)}$.

(*b*) Evaluate :

$$\int_0^{\infty} e^{-2t}\, t^2 \sin 3t\, dt. \qquad [4]$$

(*c*) Solve the integral equation : [5]

$$\begin{aligned} \int_0^{\infty} f(x) \sin \lambda x\, dx &= 1 \qquad 0 \le \lambda < 1 \\ &= 2 \qquad 1 \le \lambda < 2 \\ &= 0 \qquad \lambda > 2. \end{aligned}$$

5. (*a*) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is :

$$\begin{aligned} u(x, 0) &= x \qquad && 0 \le x \le 50 \\ &= 100 - x && 50 \le x \le 100. \end{aligned}$$

Find the temperature $u(x, t)$ at any time. [8]

(*b*) The vibrations of an elastic string is governed by the partial differential equations :

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

The length of the string is π and the ends are fixed. The initial velocity is zero and the initial deflection is $u(x, 0) = 2(\sin x + \sin 3x)$. Find the deflection of the string for $t > 0$. [8]

Or

6. (*a*) Solve :

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

subject to the conditions :

(1) $u(0, y) = 0$

(2) $u(10, y) = 0$

(3) $u(x, \infty) = 0$

(4) $u(x, 0) = 20x \qquad 0 \le x \le 5$

$\qquad\qquad = 20(10 - x) \qquad 5 \le x \le 10.$ [8]

(*b*) Use Fourier sine transform to solve the equation :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \qquad 0 < x < \infty,\ t > 0$$

subject to the conditions :

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

(2) $u(x, 0) = e^{-x} \qquad x > 0$

(3) u & $\dfrac{\partial u}{\partial x} \to 0$ as $x \to \infty$. [8]

SECTION II

7. (*a*) Ten students got the following percentage of marks in Economics and Statistics :

Marks in Economics	**Marks in Statistics**
78	84
36	51
98	91
25	60
75	68
82	62
90	86
62	58
65	53
39	47

Calculate coefficient of correlation. [6]

(*b*) The probability that a bomb dropped from a plane will strike the target is $\frac{1}{5}$. If six bombs are dropped, find the probability that exactly two will strike the target. [5]

(*c*) Calculate the first four moments of the following distribution about the mean and hence find b_1 and b_2 : [6]

x	f
0	1
1	8

2	28
3	56
4	70
5	56
6	28
7	8
8	1

Or

8. (*a*) Goals scored by two teams A and B in a football season were as follows :

No. of Goals Scored in a Match	**No. of Matches A**	**B**
0	27	17
1	09	09
2	08	06
3	05	05
4	04	03

Find out which team is more consistent. [6]

(*b*) Between the hours 2 p.m. and 4 p.m. the average number of phone calls per minute into switch board of a company is 2.35. Find the probability that during one particular minute there will be at most 2 phone calls. [6]

(*c*) In a test on 2000 electric bulbs it was found that the life of a particular make was normally distributed with an average time 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely burn for more than 1920 hours but less than 2160 hours.

(Given $z = 2$, Area $= .4772$) [5]

9. (*a*) The acceleration of a particle at any time $t \geq 0$ is given by :

$$12\cos 2t i - 8\sin 2t j + 16tk.$$

The velocity and displacement are zero at $t = 0$. Find velocity and displacement at any time t. [6]

(*b*) If $(xyz)^b \left(x^a i + y^a j + z^a k\right)$ is an irrotational vector field, prove that either $b = 0$ or $a = -1$. [6]

(*c*) Find the directional derivative of $\operatorname{div}\left(x^5 i + y^5 j + z^5 k\right)$ at (2, 2, 1) in the direction of outward normal to the surface $x^2 + y^2 + z^2 = 9$ at the point (2, 2, 1). [5]

Or

10. (*a*) Prove that (any *two*) : [6]

(1) $\phi = \dfrac{1}{r}$ satisfies Laplace equation

(2) $\nabla \times \left(\bar{a} \times \nabla \log r\right) = \dfrac{2\left(\bar{a} \cdot \bar{r}\right)\bar{r}}{r^4}$

(3) $\nabla \cdot \left(r \nabla \dfrac{1}{r^3}\right) = \dfrac{3}{r^4}.$

(*b*) Show that the vector field $f(r)\bar{r}$ is always irrotational and determine $f(r)$ such that the field is solenoidal also. [6]

(*c*) If f has at the point (1, 2) directional derivative +2 in the direction towards (2, 2) and –2 in the direction towards (1, 1). Find grad f at (1, 2). [5]

11. (*a*) Evaluate

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

where

$$\bar{F} = \left(3x^2 - 6yz\right)i + \left(2y + 3xz\right)j + \left(1 - 4xyz^2\right)k$$

along the line joining the points (0, 0, 0), (1, 2, 3). [5]

(*b*) Evaluate :

$$\int_s \bar{F} \cdot d\bar{s}$$

where

$$\bar{F} = 4xi - 2y^2 j + z^2 k$$

and s is surface bounding region $x^2 + y^2 = 4$, $z = 0$, $z = 3$. [6]

(*c*) Apply Stokes' theorem to evaluate :

$$\int_c y\,dx + z\,dy + x\,dz$$

where c is the curve of intersection of $x^2 + y^2 + z^2 = a^2$ and $x + z = a$. [5]

Or

12. (*a*) Use divergence theorem to evaluate :

$$\iint_{s} \left(2xyi + yz^2 j + xzk\right) . d\bar{s}$$

where s is surface of the region bounded by $x = 0$, $y = 0$, $z = 0$, $y = 3$, $x + 2z = 6$. [5]

(*b*) Verify Stokes' theorem in the plane $z = 0$ for $\bar{\mathrm{F}} = \left(x - y^2\right)i + 2xyj$ for the region bounded by $y = 0$, $x = 2$, $y = x$. [6]

(*c*) Find the work done by :

$$\bar{\mathrm{F}} = 2xy^2 i + \left(2x^2 y + y\right)j$$

in taking a particle from (0, 0, 0) to (2, 4, 0) along the parabola $y = x^2$, $z = 0$. [5]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-115

S.E. (Mech.) (First Semester) EXAMINATION, 2010

MANUFACTURING PROCESSES

(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 books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Assume suitable data, if necessary.

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

SECTION I

UNIT I

1. (*a*) Explain pattern making allowances in detail. [6]

(*b*) Describe centrifugal casting process with suitable sketch and also explain its various types. [6]

(*c*) Draw only a neat sketch of gating system and show the following elements on it (any *three*) : [6]

(*i*) Pouring basin

(*ii*) Sprue

(*iii*) Riser.

Or

2. (*a*) Explain in brief shell moulding process. [6]

(*b*) Explain the following characteristics of good moulding sand : [6]

(*i*) Permeability

(*ii*) Thermal stability

(*iii*) Porosity.

(*c*) Explain the following defects in casting process with their causes and remedies : [6]

(*i*) Hot tears

(*ii*) Mismatch.

UNIT II

3. (*a*) What is stretch forming ? How is it done and what are its advantages ? [5]

(*b*) Write down difference between Hot working and Cold working. [5]

(*c*) Write a short note on Roll Forging. [6]

Or

4. (*a*) Explain forward extrusion process. [4]

(*b*) Explain any *two* : [6]

(*i*) Wire drawing

(*ii*) Spinning

(*iii*) Shot peening.

(*c*) Explain drop forging process with suitable sketch. [6]

UNIT III

5. (*a*) Explain submerged Arc welding process with a suitable sketch. [6]

(*b*) Describe Arc shielding. [4]

(*c*) Explain Forehand welding and Backhand welding technique. [6]

Or

6. (*a*) Explain principle of resistance welding and its applications. [6]

(*b*) Explain any *two* : [6]

(*i*) GTAW

(*ii*) GMAW

(*iii*) FCAW.

(*c*) Differentiate : [4]

(*i*) Soldering

(*ii*) Brazing.

SECTION II

UNIT IV

7. (*a*) Describe with neat sketch : [8]

(*i*) Apron mechanism of a Lathe.

(*ii*) Geometry of single point cutting tool.

(*b*) Explain the method of taper turning using tailstock setover. [4]

(*c*) Explain the following Lathe operations with sketch (any *three*) : [6]

(*i*) Chamfering

(*ii*) Knurling

(*iii*) Grooving

(*iv*) Threading.

Or

8. (*a*) Calculate machining time for a workpiece 0 and £ 90 mm diameter and 130 mm length turned in 2 passes. If the approach length is 12 mm and over travel is 5 mm. Given cutting speed = 30 m/min and feed 0.3 mm/rev. [6]

(*b*) List the various Lathe M/c accessories and explain any *two* in detail. [6]

(*c*) Explain with neat sketch Lathe setup for thread cutting operation. [6]

UNIT V

9. (*a*) Differentiate between upmilling and downmilling. [4]

(*b*) Explain with neat sketch working mechanism knee type milling machine. [6]

(*c*) Explain milling cutter geometry. [6]

Or

10. (*a*) A hole of 30 mm dia. and 75 mm depth is to be drilled. The suggested feed 1.3 mm per rev. and the cutting speed 62 m/mim. Assuming tool approach and tool overtravel as 6 mm, calculate : [6]

(*i*) Spindle rpm

(*ii*) Feed, speed

(*iii*) Cutting time.

(*b*) Write short notes on : [6]

(*i*) Radial Drilling M/c

(*ii*) Horizontal Milling M/c.

(*c*) It is required to divide the periphery of a job into 28 equal divisions. Find the indexing arrangement. [4]

UNIT VI

11. (*a*) Differentiate between Honing and Lapping. [6]

(*b*) Explain any *two* : [4]

(*i*) Buffing

(*ii*) Superfinishing

(*iii*) Dressing.

(*c*) Explain the meaning of grinding wheel signature :

26–C–60–M–7–V–28. [6]

Or

12. (*a*) Explain centreless grinding operation. [6]

(*b*) Describe various type of surface grinders with simple sketches. [6]

(*c*) What are the properties required for a good abrasive ? [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-116

S.E. (Mechanical) (Second Sem.) EXAMINATION, 2010

THEORY OF MACHINES—I

(2008 COURSE)

Time : Four 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.

(*viii*) The problems having graphical solutions preferred to solve completely on drawing sheets.

SECTION I

UNIT I

1. (*a*) Define :

(*i*) Kinematic link

(*ii*) Kinematic pair

(*iii*) Kinematic chain

(*iv*) Mechanism. [4]

(*b*) Write a short note on Gnome engine. [4]

(*c*) What is the condition of correct steering ? Explain the construction and working of Davis Steering Gear Mechanism with the help of neat sketch. [8]

Or

2. (*a*) Define :

(*i*) Degree of freedom

(*ii*) Machine

(*iii*) Ternary joint

(*iv*) Grashoff's law. [4]

(*b*) Write a short note on 'Scotch yoke' mechanism. [4]

(*c*) Write short notes on :

(*i*) Pantograph

(*ii*) Equivalent linkage of mechanisms. [8]

UNIT II

3. The dimensions of the differential stroke engine mechanism are shown in Fig. 1 and other are OA = 75 mm, QB = 35 mm, AC = BC = 150 mm, CP = 100 mm, OA and QB are geared together so that QB turns at twice the speed of OA and in opposite direction of OA. For the given configuration, find velocity, acceleration of piston and angular velocity, angular acceleration of CP if OA turns with a speed of 700 rpm in clockwise direction. [16]

Fig. 1

Or

4. The Fig. 2 shows a crank OA 100 mm long, rotating clockwise about O at 130 rpm. AB is connecting rod 400 mm long. At a point C on AB, 150 mm from A, the rod CE, 350 mm long is attached. This rod CE slides in a slot in a turnnion at D. The end E is connected by link EF 300 mm long, to the horizontally moving slides F.

For the mechanism in the position shown, determine using theorem of three centers in line the velocity of F. [16]

Fig. 2

UNIT III

5. The Fig. 3 shows a mechanism in which crank OA is rotating clockwise at 10 rad/s. At the instant shown, the coupler AC is horizontal and freely slides in a slotted trunnion B. The slotted trunnion is carried on the second link EF which is freely slides vertically in the guides. Hence determine :

(*i*) linear velocity and acceleration of link EF,

(*ii*) angular velocity and angular acceleration of the trunnion. [18]

Fig. 3

Or

6. (*a*) In a slider crank mechanism having a crank length 20 cm and obliquity ratio of 4. The crank is rotating uniformly clockwise. The angular acceleration of connecting rod is 50 rad/s^2 when the crank is perpendicular to the line of stroke. Determine using Klein's construction :

(*i*) Linear velocity and acceleration of slider.

(*ii*) Angular velocity of the connecting rod. [6]

(*b*) The Fig. 4 shows a mechanism in which crank OA is rotating clockwise at 10 rad/s. Slider pivoted at A slides along the rod BC. Link BCD is a rigid bell crank lever pivoted at C. At the instant shown, determine :

(*i*) Acceleration of point D

(*ii*) Instantaneous angular acceleration of bell crank lever BCD. [12]

Fig. 4

SECTION II

UNIT IV

7. (*a*) In an IC engine mechanism, stroke is 120 mm and connecting rod is 3 times the crank length. The crank rotates at 1200 rpm in counterclockwise direction. Determine :

(*i*) Velocity and acceleration of piston

(*ii*) Angular velocity and angular acceleration of the connecting rod when the piston has moved one-fourth of its stroke from inner dead center. [8]

(*b*) Two horizontal shafts are connected by a Hooke's joint. The angle between the shafts is 160º. The driving shaft rotates uniformly at 150 rpm. The driven shaft with attached masses has a mass of 50 kg at a radius of gyration of 100 mm.

(*i*) If a driven shaft is subjected to a constant resisting torque of 100 N-m, find the torque required at the driving shaft, when $q = 30^\circ$. [6]

(*ii*) At what value of inclination angle will the total fluctuation of speed of the driven shaft be limited to 25 rpm ? [2]

Or

8. (*a*) The crank of a reciprocating engine is 100 mm long and it rotates at an uniform speed of 20 rad/sec counterclockwise. The connecting rod length is 400 mm. Determine :

(*i*) velocity and acceleration of piston

(*ii*) angular velocity and angular acceleration of connecting rod

by using Complex Algebra method when the crank makes normal to the line of stroke. [12]

(*b*) State the applications of Hooke's joint. [4]

UNIT V

9. (*a*) The rocker of a crank-rocker mechanism is to have a length of 400 mm and swing through a total angle of 50º with a time ratio of 1.25. Determine the suitable lengths of remaining links. [8]

(*b*) A function varies from 0 to 8. Find the Chebychev spacing for four precision positions by using graphical method. [4]

(*c*) Explain the following terms related to synthesis problem :

(*i*) Function Generation

(*ii*) Body Guidance. [4]

Or

10. (*a*) Synthesis a four bar mechanism for three successive positions given in the table below :

Positions	**1**	**2**	**3**
q	30	90	180
f	40	115	175

Consider L_1 = Grounded Link, L_2 = Input Link, L_3 = Coupler Link, L_4 = Output Link, q = input link angle, f = output link angle.

If the grounded link of length 100 mm is horizontal and input link is of 20 mm length, synthesize the mechanism using precision positions of the input link and precision positions of the output link. Ground the pivot of input link on left hand side and ground the pivot of output link on right hand side. Input and output links are rotating in opposite directions. Use the method of inversion. [7]

Draw the mechanism in its first precision position. [2]

Comment on the mechanism obtained. [1]

(*b*) Explain the following terms :

(*i*) Precision positions

(*ii*) Structural error

(*iii*) Chebychev spacing. [6]

UNIT VI

11. A high speed vertical engine has a connecting rod length five times the crank which is 60 mm. Its mass is 3 kg and has a C.G. 200 mm from the small end bearing. When suspended in a small end bearing, it makes 50 oscillations in 52 seconds. The reciprocating parts have a mass of 1.5 kg. Determine the torque exerted on the crankshaft due to inertia of the moving parts when the crank makes an angle of 135° with TDC, and speed of rotation is 1200 rpm. [18]

Or

12. (*a*) With the help of a neat diagram, derive the expression for the natural frequency of "Trifilar Suspension". [8]

(*b*) The connecting rod of an engine has a length equal to 220 mm between centers and has a mass equal to 2 kg. Its centre of gravity is at 150 mm from the small end centre and the moment of inertia of 0.02 kg-m^2 about its centre of gravity. Find :

(*i*) the two mass dynamically equivalent system when one mass is located at the small end centre,

(*ii*) the correction couple, if two masses are placed at the two ends and the angular acceleration of the connecting rod is 20,000 rad/s^2 anticlockwise. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-117

S.E. (Mechanical) (Second Semester) EXAMINATION, 2010

INTERNAL COMBUSTION ENGINES

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions form 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*) Derive an expression for air standard efficiency of a Otto cycle with usual notations. Hence show that the efficiency of the Otto cycle is lower than that of a Carnot cycle. [8]

(*b*) An oil engine takes in air at 1.01 bar, 20°C and the maximum cycle pressure is 69 bar. The compression ratio is 18 : 1. Calculate the air standard efficiency and mean effective pressure based on dual combustion cycle. Assume that heat added at constant volume is equal to heat added at constant pressure. Take C_p = 1.005 kJ/kgK, C_v = 0.718 kJ/kgK and g = 1.4 [10]

Or

2. (*a*) Explain in brief how chemical equilibrium affects the performance of the engine. [6]

(*b*) Draw theoretical and actual valve timing diagrams for four stroke diesel engine. Explain the reasons for the difference. [7]

(*c*) Explain pumping and friction losses and their effects on the power output of the engine. [5]

3. (*a*) What are the advantages and disadvantages of petrol injection system over conventional carburettor system ? [5]

(*b*) Discuss the effect of the following engine variables on flame propagation :

(*i*) Fuel-air ratio

(*ii*) Compression ratio. [5]

(*c*) Explain the factors which affect the tendency to detonate. [6]

Or

4. (*a*) Explain with neat sketches the following systems of a carburettor :

(*i*) Idling system

(*ii*) Choke. [7]

(*b*) Explain any *three* types of combustion chambers used in S.I. engines. [9]

5. (*a*) Explain phenomenon of diesel knock. Compare it with the phenomenon of detonation in S.I. engines. [8]

(*b*) Explain the following factors which affect the delay period : [8]

(*i*) Fuel

(*ii*) Injection pressure

(*iii*) Compression ratio

(*iv*) Speed.

Or

6. (*a*) Draw a schematic diagram of a Bosch type fuel pump and explain its construction and working : [8]

(*b*) Write short notes on the following :

(*i*) Supercharging

(*ii*) Turbocharging. [8]

SECTION II

7. (*a*) Explain battery ignition system with a neat sketch. [8]

(*b*) What are the different properties of lubricating oil ? [4]

(*c*) Write a short note on additives used in lubrication system. [4]

Or

8. (*a*) Define intake manifold and their function. State materials used. Discuss the requirement for design of intake manifolds. [8]

(*b*) Explain the valve mechanism for overhead valves in engine cylinder and list the materials for valves. [8]

9. (*a*) What is a dynamometer ? Name various types of dynamometers. Explain prony type of dynamometer with the help of a neat sketch. [8]

(*b*) A six cylinder gasoline engine operates on the four stroke cycle. The bore of each cylinder is 80 mm and stroke 100 mm. The clearance volume per cylinder is 70 CC. At a speed of 4000 r.p.m., the fuel consumption is 30 kg/hr. and the torque developed is 150 N.m. Calculate :

(*i*) The brake power

(*ii*) The brake mean effective pressure

(*iii*) The brake thermal efficiency.

Assume the calorific value of fuel as 43,000 kJ/kg. Also estimate relative efficiency when engine works on constant volume cycle with = 1.4 for air. [10]

Or

10. (*a*) The following observations were recorded during a trial on 4-stroke diesel engine :

Speed of the engine	=	1700 r.p.m.
Brake Torque	=	327.4 N.m
Friction power	=	15 kW
Fuel used	=	15 kg/hr
C.V. of fuel	=	42,000 kJ/kg
Air supplied	=	4.75 kg/min

Outlet temperature of cooling water = 65.8°C.

Cooling water circulated = 16 kg/min

Temperature of exhaust gas = 400°C

Room temperature = 20.8°C

Specific heat of exhaust gas = 1.25 kJ/kgK

Specific heat of water = 4.18 kJ/kgK

Estimate the following :

(*i*) BP

(*ii*) Mechanical efficiency

(*iii*) bsfc

(*iv*) Draw heat balance sheet on kW basis. [10]

(*b*) Write short notes on :

(*i*) Importance of heat balance sheet

(*ii*) Various factors affecting volumetric efficiency. [8]

11. (*a*) Discuss various types exhaust emissions from an automobile. Which of these are harmful ? [8]

(*b*) What is cracking ? What are the various methods of cracking employed to obtain various hydrocarbon compounds ? [8]

Or

12. (*a*) Enumerate the desirable properties of a fuel for I.C. engines. [8]

(*b*) What are Euro-III and Bharat norms ? List these norms for petrol engines. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-118

S.E. (Mech. Sand/Prod./Indus.) (Second Semester) EXAMINATION, 2010

ELECTRICAL TECHNOLOGY

(2008 COURSE)

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 whenever 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*) State and explain various factors affecting for good lighting scheme. [5]

(*b*) Explain in brief constituents of HT/LV electricity bill. [5]

(*c*) Draw only the connection diagram how CT and PT are used for measurement of energy of single phase load. [4]

(*d*) Three identical impedances each of $14 \angle 45.578^\circ$ W are connected in delta across a 400 V, 3-phase, 50 Hz A.C. supply. If power supplied to the load is measured by two wattmeter method, find the two wattmeter readings. [4]

Or

2. (*a*) Write a short note on 'Existing 1-phase and 3-phase tariff'. [5]

(*b*) Two wattmeter method is used for the measurement of power in a three-phase balance circuit, supplied from 415 V, three-phase, 50 Hz supply. Calculate : [5]

(*i*) Total power

(*ii*) Power factor

(*iii*) Line current

if both wattmeter readings are 8.5 kW each.

(*c*) Define the following terms in connection with illumination : [4]

(*i*) Plane angle

(*ii*) Solid angle

(*iii*) Luminous flux

(*iv*) Illumination.

(*d*) State and explain any *four* specifications of three-phase energymeter. [4]

3. (*a*) Derive condition for maximum efficiency in a transformer. Also derive the expression for kVA supplied at maximum efficiency. [8]

(*b*) Full load power input to 4-pole, 50 Hz, three-phase induction motor is 50 kW while running at 1440 r.p.m. If stator losses are 1000 watt and frictional losses are 800 watt, determine : [8]

(*i*) synchronous speed

(*ii*) % slip

(*iii*) rotor losses

(*iv*) rotor power output

(*v*) % efficiency at full load.

Or

4. (*a*) With simple diagram explain construction, working, advantages, disadvantages and applications of three-phase induction motor : [8]

(*i*) Squirrel cage

(*ii*) Wound rotor/slip ring.

(*b*) With the help of single line diagram explain distribution transformer substation. (Answer should contain explanation of various equipments, protections, instruments etc. used in the system) [8]

5. (*a*) State the various types of single-phase motors used in day-to-day practice. Explain construction, working and applications of any *one* motor with diagram. [8]

(*b*) Derive from first principle, the e.m.f. generated per phase of synchronous generator. [5]

(*c*) A three-phase, 4-pole, 50 Hz alternator has total 96 slots and 12 conductors per slot. If flux per pole is 50 mWb, coil span factor is 0.9914 and distribution factor is 0.9576, determine e.m.f. generated per phase. [3]

Or

6. (*a*) A 100 kVA, 865 V, 50 Hz, three-phase star connected alternator has an armature resistance and synchronous reactance of 0.2 W and 4 W respectively per phase. Find the regulation when the alternator its rated output at : [8]

(*i*) 0.8 lagging power factor

(*ii*) 0.8 leading power factor.

(*b*) With neat construction diagram explain construction, working, application and features of shaded pole motor. [5]

(*c*) List the specifications of synchronous generator used in practice. [3]

SECTION II

7. (*a*) Derive the e.m.f. equation of a d.c. generator from first principle. [6]

(*b*) With the help of suitable diagram, explain any *one* type of stepper motor. Also state its applications. [6]

(*c*) A 8-pole d.c. motor takes 80 A armature current from supply. If flux per pole of the motor is 50 mWb and armature has total 720 conductors lap wound, calculate the gross torque develop by the motor armature. [6]

Or

8. (*a*) State the comparison between a.c. and d.c. servomotor. [6]

(*b*) A 250 V, d.c. shunt motor has armature resistance 0.15 W and field winding resistance of 125 W. At full load motor draw 50 A current from the supply and runs at 1500 r.p.m. Determine the speed of the motor when motor draws 15 A current from the supply. [6]

(*c*) Explain with diagram any *two* methods of speed control of d.c. series motor. [6]

9. (*a*) Draw and explain V-I characteristic of SCR. Mark all salient points on it. [8]

(*b*) Explain construction, working, output characteristic, transfer characteristic of enhancement type *n*-channel MOSFET. [8]

Or

10. (*a*) Explain merits, demerits and applications of IGBT. Also explain its V-I characteristic. [8]

(*b*) State in detail comparison between SCR and MOSFET (at least 8 points). [8]

11. (*a*) State and explain various advantages offered by electrical drives. [6]

(*b*) Explain with the help of neat diagram and V-I characteristic two quadrant chopper circuit. [6]

(*c*) Write a short note on V/F control of three-phase induction motor. [4]

Or

12. (*a*) State advantages, disadvantages and applications of group drives system used in industry. [6]

(*b*) Explain with suitable diagram, how frequency control of three-phase induction motor is obtained by solid state controlled devices. [6]

(*c*) Suggest the motor suitable for the following application with reason : [4]

(*i*) Electrical traction

(*ii*) Lathe machine.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+4**

[3862]-119

S.E. (Mechanical & Mechanical Sandwich)

(Second Semester) EXAMINATION, 2010

(For Mechanical Branch Sem.-II and

For Mechanical Sandwich Sem.-I

STRENGTH OF MACHINE ELEMENTS

(2008 COURSE)

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*) Derive the relation between Young's modulus and Bulk modulus. [4]

(*b*) A wagon weighing 35 kN is attached to the wire rope and moving down an inclined plane at speed of 3.6 kmph. The wire rope diameter is 40 mm and its length is 60 m. When the rope jams and the wagon is suddenly brought to rest. Calculate the maximum instantaneous stress and maximum instantaneous elongation produced in it. Take modulus of elasticity E = 210 GPa. [6]

(*c*) A steel rod 40 mm in diameter is enclosed by a copper tube of external diameter 50 mm and internal diameter 40 mm. A pin 25 mm in diameter is fitted transverse to the assembly at each end as shown in Fig. 1 so as to secure the rod and the tube. If the temperature of the assembly is raised by 60°C, find :

(*i*) the stresses in steel rod and copper tube and

(*ii*) shear stress in the pin.

Take E_{st} = 200 GPa, E_{cu} = 100 GPa, $\alpha_{st} = 1.2 \times 10^{-5}$/°C, $\alpha_{cu} = 1.6 \times 10^{-5}$/°C. [8]

Copper tube

ϕ50 Steel Rod ϕ40

Fig. 1

Or

2. (*a*) Water under pressure 8 MPa is suddenly admitted on to a plunger of 80 mm diameter, attached to a rod of 25 mm diameter, 2.5 m long. Find the maximum instantaneous stress and deformation of the rod. Take E = 210 GPa. [6]

(*b*) Determine the elongation of a bar of tapering section having diameter d_1 and d_2 and length L and subjected to an axial force P. [4]

(*c*) The bulk modulus for the material is 50 GPa. A 12 mm diameter rod of the material was subjected to an axial pull of 14 kN and the change in diameter was observed to be 3.6×10^{-3} mm. Calculate Poisson's ratio and Modulus of elasticity. [8]

UNIT II

3. (*a*) Simply supported beam of span L carrying U.D.L. of W per unit run over the whole span. Derive the equation for maximum deflection and slope at each end. [6]

(*b*) A beam ABCDEF 12 m long and supported at A and E as shown in Fig. 2. Draw Shear Force and Bending Moment diagrams of the beam. Also find the position of point of contraflexure, if any. [10]

40 kN

20 kN 30 kN

20 kN/m 1.5 m 15 kN/m E

A 2 m B 2 m C 1.5 m D 5 m 1.5 m F

Fig. 2

Or

4. (*a*) Determine slope and deflection at point B and maximum deflection for the beam as shown in Fig. 3. Take E = 200 GPa, Moment of Inertia I = 20×10^{-5}. [8]

2 kN

0.5 m

0.5 m

A B C D

2 m 2 m 1 m

Fig. 3

(*b*) Fig. 4 shows the Shear Force diagram for a beam which rests on two supports one of them is at left end. Draw the Loading diagram and Bending moment diagram and also find the position of second support. [8]

10 kN

5.5 kN

3 kN 3 kN

1.5 kN

9 kN

6 m 10 m 2 m

Fig. 4

UNIT III

5. (*a*) Derive the equations for normal and shear (tangential) stresses on an inclined plane BE when it is subjected to two mutually perpendicular tensile stresses s_x and s_y as shown in Fig. 5. [8]

s_y

A B

q

s_x s_x

D C

E

s_y

Fig. 5

(*b*) A bolt is subjected to an axial pull of 8 kN and a transverse shear force of 3 kN. Determine the diameter of the bolt required based on :

(*i*) Maximum principal stress theory

(*ii*) Maximum shear stress theory and

(*iii*) Maximum strain energy theory.

Take elastic limit in simple tension is equal to 270 MPa and Poisson's ratio = 0.3. Adopt Factor of Safety = 3. [8]

Or

6. (*a*) What are various theories of failures ? Explain in detail :

(*i*) Maximum Principal stress theory and

(*ii*) Maximum strain energy theory. [8]

(*b*) A rectangular block of material is subjected to stresses on perpendicular planes as shown in Fig. 6. Using Mohr's Circle method (Graphical method) find :

(*i*) The normal and shear stresses on a plane for which q = 30°

(*ii*) The magnitude of principal stresses and (*iii*) inclination of the planes on which principal stresses acts. [8]

90 N/mm^2

q = 50 N/mm^2

140 N/mm^2

140 N/mm^2

q = 50 N/mm^2

90 N/mm^2

Fig. 6

SECTION II

UNIT IV

7. (*a*) A simply supported beam of 4 m span carries a load 'P' acting vertically downward as shown in Fig. 7 (*a*). The cross-section is I section the dimensions are given in Fig. 7 (*b*). If the permissible stresses in tension and compression are 40 MPa and 30 MPa respectively. Determine the maximum safe value of 'P'. [8]

P

3 m

1 m

4 m

Fig. 7 (*a*)

60 mm

20 mm

20 mm

100 mm

20 mm

100 mm

Fig. 7 (*b*)

(*b*) A cantilever beam of negligible self-weight carries uniform distributed load 40 kN/m over entire span of 1 m and also has a concentrated load 80 kN at free end, find shear stresses along horizontal planes passing through points *a, b* and *c*. Section of beam and the points are shown in Fig. 8. [8]

200 mm

a 80 mm

b

X 80 kN 100 mm

40 kN/m

c

0.5 m 0.5 m 100 mm

X Section

30 mm

Fig. 8

Or

8. (*a*) A cantilever beam has 'T' shaped cross-section. It is acted upon by a clockwise couple 'M' at free end. Determine 'M' if allowable stresses in bending in tension and compression are 40 MPa and 105 MPa respectively. Fig. 9 shows the dimensions. [8]

100 mm

12 mm

38 mm

12 mm

Fig. 9

(*b*) A timber box beam having cross-section as shown in Fig. 10. The beam is simply supported and carries a vertical load 'P' at mid span. Length of beam is 2 m; allowable working stress in bending is 8 MPa. Each screw can transmit a shear force of 3000 N. Find the spacing of screws. [8]

30 mm

240 mm

30 mm

200 mm

50 mm

50 mm

Fig. 10

UNIT V

9. (*a*) A hollow shaft has 60 mm external diameter and 50 mm internal diameter :

(*i*) Determine the twisting moment it can resist if permissible shear stress is 100 MPa.

(*ii*) Determine the diameter of solid circular shaft made of the same material which can transmit same twisting moment.

(*iii*) Compare their weights per meter length.

Take G = 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 38 mm and internal diameter 33 mm. Strut is fixed at one end and hinged at other end. Yield stress for steel 335 MPa, E = 205 GPa, $a = \frac{1}{7500}$. [8]

Or

10. (*a*) A solid shaft of 180 mm diameter has the same cross-sectional area as that of hollow shaft of the same materials of inside diameter 130 mm.

(*i*) Find out the ratio of power transmitted by the two shafts of same angular velocity.

(*ii*) Compare angle of twist in equal lengths of these shafts when stressed equal. [8]

(*b*) Derive Euler's formula for buckling load for column with hinged ends. Also state the limitations of Euler's formula. [8]

UNIT VI

11. (*a*) Design a cotter joint to transmit a load of 90 kN in tension or compression. Assume the following stress for socket, spigot and cotter :

Allowable tensile stress = 90 MPa

Allowable crushing stress = 120 MPa

Allowable shear stress = 60 MPa. [12]

(*b*) What is preferred series ? What are the advantages of it ? Write the first five numbers of R-10 series. [6]

Or

12. (*a*) A knuckle joint is subjected to an axial load of 100 kN. Determine the diameter of knuckle pin considering the load to be uniformly distributed over the pin in the eye and uniformly varying over the portion of pin in forks :

Allowable tensile and compressive stress for pin = 600 N/mm^2

Allowable shear stress for pin = 300 N/mm^2

Allowable bearing pressure for pin = 200 N/mm^2

Thickness of eye = 1.5 × pin diameter

Total fork thickness = eye thickness.

Draw a neat sketch of the joint. [12]

(*b*) Write a short note on Design for environment. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-120

S.E. (Mechanical) (Second Semester) EXAMINATION, 2010

PRODUCTION TECHNOLOGY

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt *one* question of each unit from Section I and Section II.

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

(*iii*) Draw neat diagrams wherever necessary.

(*iv*) Assume suitable data, if required.

SECTION I

UNIT I

1. (*a*) How is the tool shank of a single point cutting tool designed ? [8]

(*b*) In an orthogonal cutting test with a tool rake angel 10º, the following observations were made :

(*i*) Chip thickness ratio : 0.3

(*ii*) Horizontal component of the cutting force = 1290 N (*iii*) Vertical component of the cutting force = 1650 N.

From Merchant's theory, calculate the various components of the cutting force and the coefficient of friction at the chip tool interface. [10]

Or

2. (*a*) What is meant by built-up edge (BUE) ? With a neat sketch explain the formation of a (BUE). [6]

(*b*) How do you define tool life ? Explain the parameters that control the tool life of a single point cutting tool. [6]

(*c*) During an orthogonal machining (turning) operation of C-40 steel, the following data were obtained :

(*i*) chip thickness = 0.45 mm

(*ii*) width of cut = 2.5 mm

(*iii*) feed = 0.25 mm/rev

(*iv*) Tangential cut force = 1130 N

(*v*) Feed thrust force = 295 N

(*vi*) Cutting speed = 2.5 m/s

(*vii*) Rake angle = +10°.

Calculate :

(*a*) Force of shear at the shear time.

(*b*) Kinematic coefficient of friction at the chip tool interface. [6]

UNIT II

3. (*a*) Explain the principle of Gear hobbing. List advantages and disadvantages of gear hobbing. [8]

(*b*) What is thread rolling ? Explain its advantages. [8]

Or

4. (*a*) Sketch the tool shape of broach and write briefly about its elements. [6]

(*b*) The bore of an alloy steel component prior to broaching is $32.25^{+0.05}_{-0.00}$ mm. The bore is to be finish broached to $32.75^{+0.01}_{-0.00}$ mm diameter. If the length of bore is 35 mm and cutting speed is 0.15 m/s, determine the broaching power for broaching and design the broach. Given : Value of Rise per tooth = 0.05 s-mm. Value of 'C' Alloy steel = 45 N/mm^2. [10]

UNIT III

5. (*a*) Write short notes on the following : [8]

(*i*) FMS (Flexible Manufacturing System)

(*ii*) CNC Machine.

(*b*) Explain principle and block diagram of machining centers. State its advantages and disadvantages. [8]

Or

6. (*a*) Explain the advantages and limitations of numerical control of machine tool. [8]

(*b*) Explain the following codes : [8]

(*i*) G06

(*ii*) G08

(*iii*) G11

(*iv*) M68

(*v*) M13

(*vi*) G92

(*vii*) M16

(*viii*) M40-M45.

SECTION II

UNIT IV

7. (*a*) What factors should be considered for selecting an appropriate press for a given job ? [6]

(*b*) Differntiate between cutting die and blanking die. [4]

(*c*) Find the total pressure, dimensions of tools to produce a washer 50 mm. Outside diameter with a 24 mm diameter hole, from material 4 mm thick, having a shear strength of 360 N/mm^2. [8]

Or

8. (*a*) The symmetrical cup workpiece shown in figure below is to be made from cold rolled steel 0.8 mm thick. Make the necessary calculations for designing the drawing die for this part. [8]

50 0.8

50

1.6 R

(*b*) Define spring back and explain how allowances may be made to compensate for its harmful effects. [5]

(*c*) Sketch the various methods of applying shear to the punch and die. [5]

UNIT V

9. (*a*) Explain why unconventional machining processes are used. [4]

(*b*) Explain the disadvantages of the relaxation circuit and show the alternative arrangement of pulse generator used in EDM. [6]

(*c*) Briefly explain the working of ECM showing important element. [6]

Or

10. (*a*) What is the function of abrasive slurry in USM ? Explain how the abrasive selection is made. [6]

(*b*) Explain the various methods used for preparing the mask for chemical machining. [6]

(*c*) Draw sketch of LBM and state its advantages. [4]

UNIT VI

11. (*a*) Describe the degrees of freedom of a workpiece located in space. [6]

(*b*) What is meant by angular location ? [4]

(*c*) What is meant by foolproofing as applied to jig and fixture ? How can it be achieved ? [6]

Or

12. (*a*) Design and draw drilling jig for drilling the holes in the component shown in figure below. [10]

100 mm

$25^{-0.025}_{-0.050}$

80 mm

Drill 6 mm dia. hole

(*b*) Explain the advantages to be obtained from the use of pneumatic and hydraulic clamping devices. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-121

S.E. (Mech-SW) (First Sem.) EXAMINATION, 2010

THERMAL ENGINEERING—I

(2008 COURSE)

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 adiabetic process. Derive an expression for the workdone during the adiabetic expansion of an ideal gas. [6]

(*b*) How do you determine whether a given process is reversible or irreversible ? [4]

(*c*) 5 kg of oxygen is heated in a reversible non-flow constant volume process from temperature of 60°C until the pressure is doubled. Determine :

(*i*) final temperature

(*ii*) work done

(*iii*) change in internal energy

(*iv*) heat transfered

(*v*) change in entropy.

Take C_V = 0.653 kJ/kg°K, C_P = 0.913 kJ/kg°K. [6]

Or

2. (*a*) A reversible heat engine, a reversible heat pump and a reversible refrigerator are operating between a high temperature reservoir at T_1 and a low temperature reservoir at T_2, prove that :

$$h_{engine} = \frac{1}{(COP)_{HP}} \quad \text{and} \quad (COP)_{HP} = 1 + (COP)_{Ref}.$$ [6]

(*b*) What is the physical concept of entropy ? Explain. [4]

(*c*) A Carnot heat engine works between two temperature of source at 900°K and sink at 300°K. It runs a Carnot refrigerator working between two temperature of 300°K and 250°K. The engine is supplied 4000 kJ/min and net workout of heat engine-refrigerator plant is 12 kW. Determine the heat transfered to the refrigerant and the net heat transfer to the sink maintained at 300°K. [6]

3. (*a*) What are the major differences between mountings and accessories ? Give *three* examples each. [6]

(*b*) What are the advantages of Preheating the air ? Explain the function of superheater. [4]

(*c*) Calculate the boiler efficiency and equivalent evaporation from and at 100°C of a boiler for which the following data were obtained during a trial :

(*i*) steam pressure : 16 bar

(*ii*) steam temperature : 280°C

(*iii*) feed water temperature : 38°C

(*iv*) water evaporated 10 kg per kg of coal fired of calorific value 33700 kJ/kg. [6]

Or

4. (*a*) Explain why safety valves are needed in boiler. Also explain the purpose of fugible plug. [4]

(*b*) Explain the heat balance sheet of a boiler. [4]

(*c*) A coal fired boiler plant consumes 400 kg of coal per hour. The boiler evaporates 3200 kg of water at 44.5°C into superheated steam at a pressure of 12 bar and 274.5°C. If the calorific value of fuel is 32760 kJ/kg of coal, determine :

(*i*) Equivalent evaporation

(*ii*) Boiler efficiency.

Assume specific heat of superheated steam as 2.1 kJ/kg°K. [8]

5. (*a*) Explain the term "quality of steam". Differentiate between wet, dry saturated and superheated steam. [6]

(*b*) Discuss the principle of throttling calorimeter used for determining the dryness fraction of steam. [4]

(*c*) Steam at 15 bar and 0.95 dry expands isentropically to 7.5 bar and then throttled until it becomes just dry. Determine per kg of steam, change in enthalpy and change in entropy. Also calculate change in internal energy. [8]

Or

6. (*a*) Draw Rankine cycle on T-S diagram using dry saturated steam and obtain an expression for the Rankine cycle efficiency. [4]

(*b*) Write a short note on "combined separating and throttling calorimeter". [6]

(*c*) In an ideal Rankine cycle, the steam condition at turbine inlet is 20 bar and 350°C. The condenser pressure is 0.08 bar. Determine :

(*i*) Rankine efficiency

(*ii*) If the steam flow rate is 2000 kg/h, what is the power output in kW. [8]

SECTION II

7. (*a*) Explain with neat sketch Boy's gas calorimeter. [6]

(*b*) What is the significance of knowing volumetric analysis of dry combustion products ? [4]

(*c*) A steam boiler uses pulverised coal in the furnace. The ultimate analysis of coal as received is C = 78%, H_2 = 3%, O_2 = 3%, ash = 10% and moisture = 5%. Excess air supplied is 30%. Calculate actual air supplied and mass of gaseous products formed per kg of coal burnt. [6]

Or

8. (*a*) Explain the following terms related to fuels :

(*i*) Volatility

(*ii*) Flash point

(*iii*) Specific gravity. [6]

(*b*) What are alternative fuels used in IC engine ? [4]

(*c*) A fuel having chemical formula C_7H_{16} is burnt with 10% excess air. Assume 90% carbon burnt to CO_2 and remaining to CO. Determine volumetric analysis of dry flue gases. [6]

9. (*a*) Derive an expression for thermal efficiency of dual cycle. [8]

(*b*) An engine working on constant volume cycle has clearance volume of 1 litre and stroke volume of 6 litre. The suction pressure and temperature are 1 bar and 20°C respectively. The pressure at the end of heat addition is 25 bar. Determine :

(*i*) Pressure and temperature of salient points of cycle.

(*ii*) Thermal efficiency of cycle.

(*iii*) Work done per cycle.

Take C_V for heat supplied is 0.807 kJ/kgK

C_V for heat rejected is 0.737 kJ/kgK. [8]

Or

10. (*a*) Compare Otto, Diesel and dual cycle for :

(*i*) Same compression ratio and same heat input

(*ii*) For constant max. pressure and same heat input. [8]

(*b*) A diesel engine operating on air standard diesel cycle has 100 mm bore and 120 mm stroke. Engine speed is 1800 rpm. At the beginning of compression the pressure and temperature of air are 1.03 bar and 35°C. If clearance volume is 1/8th of stroke volume, calculate :

(*i*) Pressure and temperature at salient points of cycle

(*ii*) Compression ratio

(*iii*) Efficiency of cycle. [8]

11. (*a*) Explain the following terms related to compressor :

(*i*) Free air delivery

(*ii*) Capacity of compressor

(*iii*) Volumetric efficiency. [6]

(*b*) What is the influence of intake temperature, intake pressure, clearance and compression and expansion indices on performance of reciprocating compressor ? [6]

(*c*) A single stage single acting air compressor works between 1 bar and 16 bar. Compression follows $PV^{1.3} = C$. Piston speed is 200 m/min. It runs at 350 r.p.m. It has an indicated power consumption of 300 kW and volumetric efficiency is 85%. Find cylinder diameter and stroke length. [6]

Or

12. (*a*) Prove that intercooler pressure (P_2) for minimum work required, for two stage reciprocating air compressor is given by $P_2 = \sqrt{P_1 P_3}$. [6]

(*b*) Discuss various methods to improve isothermal efficiency of reciprocating compressor. [4]

(*c*) In a 3 stage compressor air is compressed from 98 kPa to 500 kPa. Calculate for 1 m^3 of air per second :

(*i*) Work under ideal condition

(*ii*) Isothermal work

(*iii*) Saving in work due to multistaging

(*iv*) Isothermal efficiency in each case. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+3**

[3862]-122

S.E. (Mechanical Sandwich) (Second Sem.) EXAMINATION, 2010

THEORY OF MACHINE AND MACHINE DESIGN—I

(2008 COURSE)

Time : Four 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*) 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*) Explain the following terms :

(*i*) Lower Pair

(*ii*) Higher Pair

(*iii*) Kinematic Chain

(*iv*) Inversion. [8]

(*b*) Explain Grubler's criterion for determining degree of freedom for mechanisms. [4]

(*c*) State and prove the condition of correct steering for a four wheeled vehicle. [4]

Or

2. (*a*) Explain the following mechanisms with neat sketch :

(*i*) Pendulum pump

(*ii*) Crank and slotted lever quick return mechanism.

(*iii*) Whithworth quick return mechanism

(*iv*) Elliptical trammel. [12]

(*b*) Write a short note on Kutzbach Criterion. [4]

3. (*a*) State and prove Kennedy's theorem of three centres in line. [4]

(*b*) The driving crank AB of the quick return mechanism, as shown in Fig. 1 revolves at a uniform speed of 200 rpm. Find the velocity and acceleration of slider R, in the position when the crank makes an angle of 60° with the vertical line of centres PA. Also find the acceleration of sliding of block at B along the slotted lever PQ. [14]

Link AB = 75 mm

RQ = 500 mm

AP = 200 mm

PQ = 375 mm

Fig. 1

Or

4. (*a*) What is the significance of the "loop-closure" equation in Kinematics ? [4]

(*b*) In the mechanism shown in Fig. 2 OA = 300 mm, AB = 600 mm, AC = 1200 mm and BD = 1200 mm. OD is horizontal at the instant shown and OA rotates at 200 rpm in clockwise direction. Find :

(*i*) Velocities of C and D

(*ii*) Angular velocities of links AC and BD

(*iii*) Acceleration of C. [14]

30° A

O

30°

D

B

C

300 mm

Fig. 2

5. (*a*) In a slider crank mechanism, the crank is 200 mm long and connecting rod 800 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 60° from IDC. The angular velocity of the crank is 20 rad/s and is increasing at rate of 10 rad/s every second. [6]

(*b*) Explain :

(*i*) The compound pendulum method of finding radius of gyration of rigid body.

(*ii*) Two point dynamically equivalent system.

(*iii*) Correction couple. [10]

Or

6. (*a*) The piston diameter of an internal combustion engine is 125 mm and stroke is 220 mm. The connecting rod is 4.5 times the crank length and has a mass of 50 kg. The mass of the reciprocating parts is 30 kg. The centre of mass of the connecting rod is 170 mm from the crank pin centre and the radius of gyration about an axis through the centre of mass is 148 mm. The engine runs at 320 rpm. Find the magnitude and direction of the inertia force and the corresponding torque on the crankshaft when the angle turned by the crank is 140° from the IDC. [10]

(*b*) Explain the following :

(*i*) Piston effort of an IC engine.

(*ii*) Bifilar suspension method of finding radius of gyration of a rigid body. [6]

SECTION II

7. (*a*) A steel shaft made of 40C8 is used to drive a machine. It rotates at 1500 rpm. The pulleys A, B and bearings C, D are located as shown in Fig. 3. The belt tensions are also shown in figure. Determine the diameter of the shaft using ASME code of design. The yield strength of shaft material is 330 N/mm^2 and the ultimate tensile strength is 600 N/mm^2. Combined shock and fatigue factor applied to bending = 1.5 and combined shock and fatigue factor applied to torsion = 1.2. [8]

Fig. 3

(*b*) "A square key is stronger against crushing than rectangular key." Explain. [6]

(*c*) Give advantages and disadvantages of Welded joints over threaded joints. [4]

Or

8. (*a*) A protected type flange coupling is used to transmit 25 kW power at 500 rpm from an engine to a machine. Design the coupling for an overload capacity of 25%. Assume the following permissible stresses :

	CI Flanges	**Shaft & Keys**	**Bolts**
Permissible tensile stress, MPa	20	60	60
Permissible shear stress, MPa	12	35	28
Permissible compressive stress, MPa	60	60	60

Assume number of bolts as 6. Draw a neat sketch of the assembly showing all the components. [10]

(*b*) Explain design of Kennedy key. [2]

(*c*) A bracket as shown in Fig. 4 is welded to a column. Determine the size of the weld, if the permissible shear strength of the weld is 80 N/mm^2. [6]

Fig. 4

9. (*a*) A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The outer and inner diameters of screw collar are 50 mm and 20 mm respectively. The coefficient of thread friction and collar friction may be assumed as 0.2 and 0.15 respectively.

The screw rotates at 12 rpm. Assuming uniform wear condition at collar and allowable thread bearing pressure of 5.77 N/mm^2, find :

(*i*) the torque required to rotate the screw

(*ii*) the stress in screw and

(*iii*) the height of the nut. [8]

(*b*) A composite compression spring has two closed coiled helical springs. The outer spring is 75 mm longer than the inner spring. The outer spring has 10 coils of mean diameter 40 mm and wire diameter of 5 mm. The inner spring has 8 coils of mean diameter 30 mm and wire diameter 4 mm. When the spring is subjected to an axial load of 400 N, find :

(*i*) Compression of each spring,

(*ii*) Load shared by each spring,

(*iii*) Shear stress induced in each spring,

(*iv*) Combined stiffness.

Assume G = 84 kN/mm^2. [8]

Or

10. (*a*) A valve spring of an IC Engine is to be designed for the following details :

Spring load = 80 N when valve is closed

Spring load = 100 N when valve is open

Space constraints for the fitment of the spring are :

Inside guide bush diameter = 24 mm

Outside recess diameter = 36 mm

Valve lift = 5 mm

Spring steel has the following properties :

Permissible shear stress = 355 MPa

Modulus of rigidity = 8×10^4 N/mm^2

Spring ends = squared and ground

Design :

(*i*) wire diameter,

(*ii*) spring index,

(*iii*) total number of coils,

(*iv*) solid length of the spring,

(*v*) free length of the spring

when additional 15% of working deflection is used to avoid complete closing of coils. [10]

(*b*) The lead screw of a lathe has ACME threads of 60 mm outside diameter and 8 mm pitch. It supplies drive to a tool carriage which needs an axial force of 2000 N. A collar bearing with inner and outer radii as 30 mm and 60 mm respectively, is provided. The coefficient of friction for screw threads is 0.12 and for collar it is 0.1. Find the torque required to drive the screw and efficiency of the screw. If the lead screw rotates at 30 rpm, find the power required to drive the screw. [6]

11. (*a*) Two parallel shafts are to be connected by an open flat belt. The diameter of the pulleys are 1.5 m and 1 m and they are 3 m apart. The initial tension in the belt when stationary is 4 kN. The mass of the belt is 2.5 kg/m and the coefficient of friction between the belt and pulley is 0.3. Calculate the power transmitted, if the smaller pulley rotates at 600 rpm. Also suggest the speed of the smaller pulley for maximum power transmitted by the belt. Determine its maximum power. [8]

(*b*) The effective turning moment exerted by a two stroke engine at crank is represented by :

$$T = 8000 + 1000 \sin 2q - 2000 \cos 2q, \text{ Nm}$$

where q is the inclination of the crank to the IDC. The cycle repeats after every 180° of crank rotation. Assuming an external resistance constant, determine the mass and cross section ($b = 4t$) of the flywheel. Also find the power developed by the flywheel. Assume total percentage fluctuation of speed as 0.8% of mean speed of 300 rpm and $r = 7200$ kg/m^3. From space constraints, the flywheel radius should not exceed 750 mm. [8]

Or

12. (*a*) The T-θ diagram of a diesel engine consists of intercepted areas which are +40, –85, +79, –68, +96 and –62 mm^2 in one cycle in the given order. The torque axis scale is 1 mm = 75 Nm and crank angle scale is 1 mm = 5°. Mean speed of the engine is 500 rpm. Design the rim of the flywheel for the following data :

(*i*) Limiting rim speed at mean radius = 30 m/sec.

(*ii*) The fluctuation of speed is not to exceed 2% of mean speed.

(*iii*) Width to thickness ratio for rectangular rim cross-section is 1.5.

(*iv*) Flywheel material density is 7200 kg/m^3. Neglect the effect of hub and arms.

Also evaluate the stresses in the rim by considering the centrifugal forces. [8]

(*b*) Explain phenomenon of slip and creep in the belt drives. [4]

(*c*) Compare Flat belts and V-belts. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

+1 Chart Attached

[3862]-123

S.E. (Mech. S/W) (Second Semester) EXAMINATION, 2010

THERMAL ENGINEERING-II

(2008 COURSE)

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 advantages and disadvantages of vapor absorption refrigeration system over vapor compression system. [6]

(*b*) Discuss the relative merits of NH_3 and R12 as refrigerants. [4]

(*c*) A refrigerator working on Bell Coleman cycle operates between pressure limits of 1.05 bar and 8.5 bar. Air is drawn from cold chamber at 10°C, compressed and then it is cooled to 30°C before entering the expansion cylinder. Expansion and Compression follow the law $PV^{1.35} = C$. Determine theoretical COP of the system and heat rejected per kg of air. Take $\gamma = 1.4$ and $C_P = 1.0$ kJ/kg°K for air. [6]

Or

2. (*a*) What is subcooling and superheating ? Explain with the help of diagram ? Why is superheating considered to be good in certain cases ? [8]

P.T.O.

(*b*) A Refrigerator works between –7°C and 27°C. The vapor is dry and saturated at the end of isentropic compression. There is no undercooling and the evaporation is by throttle valve. Find (*i*) C.O.P. (*ii*) power of compressor to remove 175 kJ/min. The properties of refrigerant are as under : [8]

Temperature °C	**Sensible Heat kJ/kg**	**Latent Heat kJ/kg**	**Entropy of Liquid kJ/kg°K**	**Entropy of dry Saturated Vapor kJ/kg°K**
–7	–29.4	1298	–0.1088	4.748
27	124.8	1172.8	0.427	4.334

3. (*a*) Establish the following expression for air-vapor mixture : [4]

$$\text{Specific Humidity} = w = 0.622 \ \frac{P_V}{P - P_V}$$

where P_V = Partial Pressure of water vapor

P = Barometric Pressure.

(*b*) Show the following processes on the skeleton psychrometric chart and explain : [4]

(*i*) Dehumidification of moist air by cooling

(*ii*) Adiabatic mixing of two streams.

(*c*) Two kg of air at 40°C DBT and 50% RH is mixed with three kg of air at 20°C DBT and 12°C DPT. Calculate temperature and specific humidity of the mixture. Take ambient pressure = 1.013 bar. Use psychrometric relations only. [8]

Or

4. (*a*) Define : [4]

(*i*) Specific humidity

(*ii*) DPT

(*iii*) Degree of saturation

(*iv*) By-pass factor.

(*b*) Explain summer air-conditioning system with heat sketch. [4]

(*c*) 90 m^3 of air per minute at 20°C and 75% RH is heated unit its DBT becomes 30°C. Determine : [8]

(*i*) R.H. of heated air

(*ii*) Heat added per minute.

Use psychrometric chart.

5. (*a*) Explain the classification of condensers used in refrigeration and air-conditioning system. Explain any *one* with neat sketch. [6]

(*b*) What are the methods used for duct sizing ? Explain. [6]

(*c*) Write a short note on "Types of Ducts used in air-conditioning plants. [6]

Or

6. (*a*) Explain the common refrigeration controls. [6]

(*b*) Explain the functions of automatic controls in air-conditioning plants. [6]

(*c*) Explain the equal friction method for ducts. [6]

SECTION II

7. (*a*) Explain with neat sketch simple carburettor. [6]

(*b*) What is the importance of ignition timing and what are major factors affecting optimum spark setting ? [4]

(*c*) A single cylinder four stroke petrol engine delivers 100 kW of brake power at 3000 rpm. BMEP is 9 bar. Mechanical efficiency is 80%. BSFC is 0.240 kg/kwh. Calorific value of fuel is 43000 kJ/kg. Stroke to bore ratio is 1. Compression ratio is 7. Determine :

(*i*) Bore and stroke length

(*ii*) Brake thermal efficiency

(*iii*) Air standard efficiency

(*iv*) Indicated thermal efficiency

(*v*) Indicated mean effective pressure. [8]

Or

8. (*a*) Explain dry sump lubrication system. [6]

(*b*) What is the purpose of testing I.C. engine ? [4]

(c) A diesel engine develops 75 kW and consumes 20.4 kg of diesel oil per hour. C.V. of fuel is 45000 kJ/kg. The water supplied to engine jacket on its exit enters an exhaust gas calorimeter. The following observations are made :

Mass of water circulated to jacket = 25 kg/min.

Temperature of water entering jacket = 27°C

Temperature of water leaving jakcket = 66°C

Temperature of water leaving exhaust gas calorimeter = 91°C

Temperature of exhaust gas leaving engine = 410°C

Temperature of exhaust gas leaving exhaust gas calorimeter = 160°C

Room temperature = 27°C

If air standard efficiency is 60%, find relative efficiency. Draw up energy balance on minute basis and percentage basis. [8]

9. (*a*) Explain stages of combustion in S.I. engine. [6]

(*b*) What are the factors influencing flame speed ? [4]

(*c*) Explain T-shape combustion chamber with neat sketch. [6]

Or

10. (*a*) Explain diesel knock. [6]

(*b*) How are diesel fuels rated ? [4]

(*c*) Explain the effect of variable that affects ignition delay period. [6]

11. (*a*) Explain with neat sketch constant pressure turbochanging. [6]

(*b*) What are the limitations of superchanging in CI engine ? [4]

(*c*) Explain with neat sketch any *two* superchargers. [6]

Or

12. (*a*) Explain with neat sketch exhaust gas recirculation system. [6]

(*b*) What are the harmful effects of engine emission ? [4]

(*c*) What are the latest emission norms ? [6]

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

[3862]-124

S.E. (Mech.S/W) (Second Semester) EXAMINATION, 2010

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 the procedure to find grain fineness number. [6]

(*b*) Explain Upset and shot peening process. [5]

(*c*) Distinguish between hot working and cold working. [5]

Or

2. (*a*) List the defects in casting with remedies for the same. [5]

(*b*) Explain the jolting molding machine with a neat sketch. [6]

(*c*) Write a note on tube drawing process. [5]

P.T.O.

3. (*a*) Write a note on FCAW mentioning its advantages. [6]

(*b*) Explain the steps in soldering and also list its application. [6]

(*c*) What are the types of adhesives used ? [6]

Or

4. (*a*) Write a note on submerged arc welding. [6]

(*b*) Write a note on GTAW. [6]

(*c*) On what principle resistance welding is done and explain projection welding. [6]

5. (*a*) Explain the lapping process with neat sketch mentioning the control parameters. [6]

(*b*) List the taper turning methods on lathe and describe taper turning attachment with neat sketch. [6]

(*c*) Explain the procedure for compound indexing. [4]

Or

6. (*a*) What is the difference between truing and dressing related to grinding wheel ? [4]

(*b*) Sketch and explain floating holder used on drilling machine and why is it used ? [6]

(*c*) Sketch and explain the arbor assembly of milling machine. [6]

SECTION II

7. (*a*) List the limitations of broaching operation. [5]

(*b*) Explain merchant force circle with a neat sketch. [6]

(*c*) Write a note on gear hobbing. [5]

Or

8. (*a*) Define tool life and factors affecting tool life. [6]

(*b*) Explain thread chasing operation. [5]

(*c*) Sketch and label single point cutting tool. [5]

9. (*a*) Distinguish between NC and CNC. [4]

(*b*) Write a note on AJM. [6]

(*c*) Write a note on ATC. [6]

Or

10. (*a*) Write a note on machining centre. [6]

(*b*) Write a note on EBM. [6]

(*c*) What do you mean by a block in CNC programming ? Write the format of the block mentioning the meaning of each. [4]

11. (*a*) What are the methods to reduce cutting force ? [6]

(*b*) Sketch diamond pin and conical locator mentioning its application. [6]

(*c*) Draw the strip layout showing back scrap, front scrap, scrap bridge and scrap on the length and give relations to find out feed, no. of pieces and scrap on the length and percentage utilization. [6]

Or

12. (*a*) Define center of pressure. Why is it found ? What are the steps to find it ? [6]

(*b*) Write a note on modular fixture. [6]

(*c*) Explain turning fixture with neat sketch. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-125

S.E. (Mech. S/W) (Second Semester) EXAMINATION, 2010

COMPUTER APPLICATION

(2008 COURSE)

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*) Find a real root of equation :

$$3x = \cos x + 1$$

by Newton-Raphson's method. [8]

(*b*) Draw a flowchart to solve Gauss-Legendre 2-point formula. [4]

(*c*) Differentiate between Newton-Raphson's method and Regula-Falsi method. [4]

P.T.O.

Or

2. (*a*) A train is moving at speed of 30 m/s, suddenly brakes are applied. The speed of the train per second after '*t*' second is given by :

Time (*t*)	**Speed (*v*)**
00	30
05	24
10	19
15	16
20	13
25	11
30	10
35	08
40	07
45	05

Apply Simpson's 3/8 rule to determine the distance moved by the train in 45 seconds. [6]

(*b*) What is modified Newton-Raphson's method ? [4]

(*c*) Evaluate :

$$A = \int_0^1 \int_0^1 e^{x+y} \, dx \, . \, dy,$$

using trapezoidal rule. [6]

3. (*a*) From the following table, estimate the number of student who obtained marks between 40 & 45 : [8]

Marks	**No. of Students**
30—40	31
40—50	42
50—60	51
60—70	35
70—80	31

(*b*) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x = 1.1$: [8]

x	y
1.0	7.981
1.1	8.403
1.2	8.781
1.3	9.129
1.4	9.451
1.5	9.750
1.6	10.031

Or

4. (*a*) The velocity distribution of fluid near a flat surface is given below :

x	v
0.1	0.72
0.3	1.81
0.6	2.73
0.8	3.47

'x' is distance from surface (mm) and 'v' is the velocity $\left(\frac{\text{mm}}{\text{sec}}\right)$.

Use Lagranges interpolation polynomials to obtain the velocity at $x = 0.4$. [8]

(*b*) The relation between x and y is defined by a function :

$$y = \frac{x^2}{10}, \text{ find } \frac{dy}{dx} \text{ and } \frac{d^2y}{dx^2} \text{ at } x = 6.$$

The given values of x are 0, 1, 2, 3, 4, 5, 6. [8]

5. (*a*) Apply the Gauss-Seidel iterative method to solve the following equations :

$$\begin{aligned} 10x_1 - 5x_2 - 2x_3 &= 3 \\ -4x_1 + 10x_2 - 3x_3 &= 3 \\ -x_1 - 6x_2 + 10x_3 &= 3 \end{aligned}$$

Iterate up to a maximum of 10 times or up to an accuracy of 0.0001. [12]

(*b*) Explain Cholesky method. [6]

Or

6. (*a*) Solve the equations :

$$\begin{aligned} 10x_1 + x_2 + x_3 &= 12 \\ x_1 + 10x_2 - x_3 &= 10 \\ x_1 - 2x_2 + 10x_3 &= 9 \end{aligned}$$

by using Gauss-Jordon method. [10]

(*b*) Explain LU decomposition method. [8]

SECTION II

7. (*a*) For the following data fit a curve of the type $y = ax^b$: [8]

x	y
10	1.06
20	1.33
30	1.52
40	1.68
50	1.81
60	1.91
70	2.01
80	2.11

(*b*) Draw flowchart for fitting a curve of the type $y = ae^{bx}$. [4]

(*c*) Explain the following type of errors with example : [4]

(*i*) Absolutor error

(*ii*) Relative error

(*iii*) Percentile error

(*iv*) Round-off error.

Or

8. (*a*) Fit a second degree curve of the type $y = ax^2 + bx + c$ of the following data : [8]

x	y
–3	12
–2	4
–1	1
0	2
1	7
2	15
3	30

(*b*) Draw flowchart for fitting a straight line. [4]

(*c*) Explain error propagation. [4]

9. (*a*) Given :

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}, \quad y(1) = 1.$$

Evaluate $y(1.2)$ by modified Euler method. Take $h = 0.1$, accuracy $= 0.001$. [10]

(*b*) Write a computer program for Taylor series method to solve : [6]

$$\frac{dy}{dx} = 1 + xy$$

Or

10. (*a*) Using Runge-Kutta method of fourth order find $y(0.1)$, $y(0.2)$ and $y(0.3)$: [10]

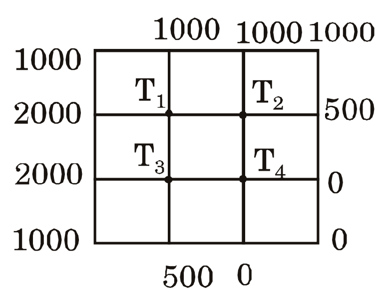
Given Þ $\frac{dy}{dx} = 1 + xy, \quad y(0) = 2.$

(*b*) Draw flowchart for modified Euler method. [6]

11. (*a*) Solve Laplace equation :

$$\frac{\P^2 T}{\P x^2} + \frac{\P^2 T}{\P y^2} = 0$$

at the interior points of square mesh is given below : [10]



(b) Draw a flowchart for solving hyperbolic equation of type : [8]

$$16\,\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial u^2}.$$

Or

12. (a) Solve :

$$16\,\frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$$

given that $u(0, t) = 0, \quad u(5, t) = 0$

$$u(x, 0) = x^2(x - 5) \text{ and } u(x, 0) = 0$$

by taking $h = 1$ and up to 4 times steps. [10]

(b) Draw flowchart to solve Laplace equation in Q. 11 (a). [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-131

S.E. (Prod./S/W) (First Semester) EXAMINATION, 2010

HEAT AND FLUID ENGINEERING

(2008 COURSE)

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*) Define the following terms : [8]

(*i*) Ideal fluid and real fluid

(*ii*) Compressibility and bulk modulus

(*iii*) Dynamic viscosity and kinematic viscosity

(*iv*) Surface tension and vapour pressure.

(*b*) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. Thickness of the oil film is 12.5 mm. The upper plate which moves at 2.5 m/sec requires a force of 98.1 N to maintain the speed. [8]

Determine :

(*i*) Dynamic viscosity of oil in poise

(*ii*) Kinematic viscosity of oil in stokes if specific gravity of the oil is 0.95.

Or

2. (*a*) Derive an expression for total pressure and center of pressure for an inclined plane immersed in liquid. [10]

(*b*) State and prove Pascal's law. Write its application. [6]

3. (*a*) A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of sp. gr. 0.8. The discharge of oil through venturimeter is 60 litres/sec. Find the reading of the oil-mercury differential manometer. Take $C_d = 0.98$. [8]

(*b*) What are the different types of forces acting on the fluid flow ? [4]

(*c*) Write Bernoulli's equation and write its assumption. [4]

Or

4. (*a*) Derive an expression for discharge through circular orifice plate. [8]

(*b*) Water flows through a triangular right angled notch and then over a rectangular notch of 1 m width. The discharge coefficients of the triangular and rectangular notch are 0.6 and 0.7 respectively. If the depth of the triangular notch is 360 mm, find the depth of water over the rectangular notch. [8]

5. (*a*) Derive Darcy-Weisbach equation for head loss due to friction. [8]

(*b*) The pressure difference Δp in a circular pipe of diameter D and length L due to viscous flow depends on the velocity V, viscosity μ and density ρ. Using Buckingham's π-theorem, obtain an expression for : [10]

$$\Delta p = \frac{\mu N}{D} \times \frac{L}{D} f[Re].$$

Or

6. (*a*) Explain with neat sketch working of any *one* hydraulic turbine. [8]

(*b*) Explain the following terms : [10]

(*i*) Reynolds number

(*ii*) Froude number

(*iii*) Euler number

(*iv*) Mach number

(*v*) Dimensional homogeneity.

SECTION II

7. (*a*) The following results were obtained in a boiler trial : [10]

Feed water/hr	—	700 kg
Feed water inlet temperature	—	27°C
Steam produced at a pressure	—	8 bar
Dryness fraction of steam	—	0.97
Coal used	—	100 kg/hr
C.V. of coal	—	25000 kJ/kg
Ash and unburnt coal collected	—	7.25 kg/hr
C.V. of unburnt fuel	—	2000 kJ/kg
Flue gases formed/kg of fuel	—	17.3 kg
Flue gas temperature	—	325°C
Temperature of air in the room	—	16°C
C_p of flue gases	—	1.025 kJ/kgK

Draw up energy balance on minute basis and find boiler efficiency.

(*b*) Explain the working principle of Babcock and Wilcox Boiler with neat sketch. [6]

Or

8. (*a*) A petrol consists of 86% carbon, 14% hydrogen by mass. If fuel is burnt with 20% excess air and combustion is complete, estimate volumetric composition of products of combustion including water vapour formed. [8]

(*b*) Define the following terms : [4]

(*i*) Mole fraction and Mass fraction

(*ii*) Stoichiometric air and Excess air

(*c*) Explain ultimate and proximate analysis. [4]

9. (*a*) Describe with a neat sketch the operation of an air refrigeration system working on Bell Coleman cycle. [8]

(*b*) Draw P-h and T-s diagrams of vapour compression refrigeration system and explain the effect of superheating and subcooling on COP of it. [8]

Or

10. (*a*) What are the different types of air-conditioning system ? Explain the Central Air-conditioning system. [8]

(*b*) Explain the following with psychrometric chart : [4]

(*i*) Heating and Humidification;

(*ii*) Cooling and Dehumidification.

(*c*) Define the following terms : [4]

(*i*) Dry bulb temperature

(*ii*) Wet bulb temperature

(*iii*) Due point temperature

(*iv*) Relative humidity.

11. (*a*) Derive the relation for volumetric efficiency of reciprocating air-compressor with clearance and hence explain the effect of pressure ratio and clearance ratio on it. [8]

(*b*) Define volumetric efficiency and isothermal efficiency of reciprocating air compressor.

A single stage double acting compressor running at 120 r.p.m. and power input = 75 kW, Piston speed = 200 m/min, suction pressure 1 bar and delivery pressure 10 bar h_{vol} = 85%. Assuming the index for expansion and compression (n) = 1.25, find the cylinder bore and clearance volume as a percent of swept volume. [10]

Or

12. (*a*) A trial carried out on a four-stroke single cylinder gas engine. The following are the observations taken during trial : [10]

Cylinder diameter = 30 cm

Engine stroke = 50 cm

Clearance volume = 6750 cm^3

Indicated mean effective pressure = 7.64 bar

Net load on the brake = 1.864 kN

Brake diameter = 1.5 m

Rope diameter = 2.5 cm

Speed = 240 r.p.m.

Gas used = 20 m^3/hr

C.V. of gas = 42000 kJ/m^3

Determine :

(*i*) The compression ratio

(*ii*) The mechanical efficiency

(*iii*) The indicated thermal efficiency

(*iv*) The air-standard efficiency

(*v*) The relative efficiency (Assume γ = 1.4 for air)

(*b*) Using the T-s diagram, prove that, for the same quantity of heat added, increase of compression ratio increases the thermal efficiency of an Otto-cycle. [8]

Total No. of Questions—12] [Total No. of Printed Pages—8+1

[3862]-132

S.E. (Production & Production Sandwich)

(First Semester) EXAMINATION, 2010

STRENGTH ANALYSIS OF MACHINE ELEMENTS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt *one* question form each Unit of 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*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

UNIT I

1. (*a*) Explain with neat sketches tensile, compressive and shear stresses and strains. [6]

(*b*) A member ABCD is subjected to point loads P_1, P_2, P_3, and P_4 as shown in Fig. 1. Calculate the force P_3 necessary for the equilibrium if P_1 = 120 kN, P_2 = 220 kN and

$P_4 = 160$ kN. Also determine the net change in the length of the member. Take $E = 2 \times 10^5$ N/mm^2. [10]

Or

2. (*a*) Comment on the bars of composite sections. Derive the relation for total load on composite bar and modular ratio. [6]

(*b*) A weight of 200 kN is supported by three short pillars, each 500 mm^2 in section. The central pillar is of steel and the outer pillars are of copper. The pillars are so adjusted that at a tempreature of 15°C each carries equal load. The temperature is then raised to 115°C. Estimate the stress in each pillar at 15°C and 115°C.

Take $E_s = 2.0 \times 10^5$ N/mm^2 and $E_c = 0.8 \times 10^5$ N/mm^2.

$\alpha_s = 1.2 \times 10^{-5}$ per °C, $\alpha_c = 1.85 \times 10^{-5}$ per °C. [10]

UNIT II

3. (*a*) A simply supported beam AB of span 8 m carrying concentrated loads of 4 kN, 10 kN and 7 kN at distances of 1.5 m, 4 m and 6 m from the left support as shown in Fig. 2. Draw the shear force diagram and bending moment diagram for the beam AB. [6]

(*b*) Find the reaction at the fixed end of the cantilever loaded as shown in Fig. 3. Also draw the shear force diagram and bending moment diagram for the beam. [12]

Or

4. (*a*) Draw the bending moment diagram for the cantilever shown in Fig. 4. [6]

(*b*) The diagram shown in Fig. 5 is the shear force diagram for a beam which rests on two supports one being the left hand end. Deduce directly from the shear force diagram.

(*i*) Loading on the beam

(*ii*) Determine the magnitude of maximum bending moment and draw the bending moment diagram. [12]

UNIT III

5. (*a*) Prove the relations :

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

Where,

M = Total moment of resistance offered by the beam section in N-mm

I = Moment of Inertia of the section about the neutral axis in mm^4

σ = Stress intensity in the fiber N/mm^2

y = Distance of the fiber from the neutral axis in mm

E = Modulus of Elasticity in N/mm^2

R = Radius of Neutral surface in mm. [6]

(*b*) A cast iron bracket as shown in Fig. 6 is subjected to bending and has cross-section of I-form with unequal flanges. The total depth of the section is 280 mm and the metal is 40 mm thick throughout. The top flange is 200 mm wide. Find the position of neutral axis and the moment of inertia of the section about the neutral axis and determine the maximum bending moment that should be imposed on this section if the tensile stress in the top flange is not to exceed 20 N/mm^2. What is then the value of the compressive stress in the bottom flange ? [10]

Or

6. (*a*) State the assumptions made in the theory of simple bending. [6]

(*b*) The T-beam section shown in Fig. 7 is subjected to sagging moment. If the extreme tensile stress is two times the extreme compressive stress, find the thickness of the flange and the web. Note that the thickness of the flange is two times the thickness of the web. [10]

SECTION II

UNIT IV

7. (*a*) Show that in a direct stress system, the maximum shear stress in a body is half the magnitude of the applied stress. [8]

(*b*) At a certain point in a strained material the principal stresses are 100 N/mm^2 and 40 N/mm^2 both tensile. Find the normal, tangential and resultant stresses across a plane through the point at 48° to the major principle plane, using Mohr's circle of stress. [8]

Or

8. (*a*) What is strain energy of a material ? Derive the expressions for the same in different forms. [8]

(*b*) A rod 12.5 mm in diameter is stretched by 3.20 mm under a steady load of 10,000 N. What stress would be produced in the bar by a weight of 700 N falling through 75 mm before commencing to stretch the rod if it is initially unstressed. The value of E may be taken as 2.1×10^5 N/mm^2. [8]

UNIT V

9. (*a*) Deduce the torsion equation stating the assumptions made. [8]

(*b*) Determine the diameter of a solid shaft which will transmit 90 kW at 160 rpm if the shear stress in the shaft is limited to 60 N/mm^2. Find also the length of the shaft, if the twist must not exceed 1° over the entire length.

Take C = 8×10^4 N/mm^2. [10]

Or

10. (*a*) Two shafts of the same meterial are subjected to the same torque. If the first shaft is of solid circular section and the second shaft is of hollow section whose internal diameter is 2/3 of the outside diameter, compare the weights of the two shafts. [10]

(*b*) A solid circular shaft is to transmit 300 kW at 100 rpm. If the shear stress is not to exceed 80 N/mm^2, find the diameter of the shaft. What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, the material and the mxaimum shear stress being the same. [8]

Unit VI

11. (*a*) A horizontal beam, simply supported at its ends carries a load of varying intensity which varies uniformly from 10 kN/m at one end to 50 kN/m at the other. Find the central deflection if the span is 9 m in length and 500 mm deep. Take maximum bending stress as 80 MPa and E = 210 GPa. [8]

(*b*) Explain Maculay's method of beam deflection analysis and discuss its advantages over the dierct integration method. [8]

Or

12. (*a*) What is Euler's curve ? Describe its features. [6]

(*b*) A 800 mm long straight bar of alloy steel and of 10 mm × 4 mm section is mounted in a strut testing machine and loaded axially. The load is increased till the bar buckles. Determine the maximum central defection before the material attains the yield point of 300 MPa. Assume the Euler's formula for pinned ends. E = 75 GPa. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-133

S.E. (Production) (First Semester) EXAMINATION, 2010

MACHINE TOOL OPERATIONS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

(*ii*) Use separate answer-sheets for each Section.

(*iii*) Assume suitable data, if required.

SECTION I

1. (*a*) Explain working of all geared head stock with suitable sketch. [8]

(*b*) Discuss various types of mandrels with suitable sketches. [6]

(*c*) Find full taper angle, if D = 100 mm, d = 85 mm and length = 120 mm. [4]

Or

2. (*a*) Discuss various taper turning methods with suitable sketches. [8]

P.T.O.

(*b*) Explain tumbler gear feed reversing mechanism with suitable sketches. [6]

(*c*) The pitch of leadscrew is 8 mm and the pitch of the thread to be cut is 1.5 mm. Find the change gears. [4]

3. (*a*) Discuss various types of drills with suitable sketches. [8]

(*b*) Explain working of floating holder with suitable sketch. [8]

Or

4. (*a*) Discuss various types of reamers with suitable sketches. [8]

(*b*) Explain construction and working of Jig boring machine with a suitable sketch. [8]

5. (*a*) List various types of milling machine and explain column and knee type milling machine with suitable sketch. [8]

(*b*) Explain construction and working of universal dividing head. [8]

Or

6. (*a*) Explain Up milling and Down milling with suitable sketches. [8]

(*b*) Discuss various types of milling cutters with suitable sketches. [8]

SECTION II

7. (*a*) Discuss various types of Broaching machines with suitable sketches. [10]

(*b*) Explain hydraulic mechanism used in shaper with suitable sketch. [8]

Or

8. (*a*) Explain auto feed mechanism used in shaper with suitable sketch. [10]

(*b*) Explain working of Crank and Slotted Link mechanism with suitable sketch. [8]

9. (*a*) Discuss factors to be considered for selection of grinding wheel. [8]

(*b*) Explain external centerless grinding with suitable sketches. [8]

Or

10. (*a*) Explain mounting of grinding wheel with suitable sketch. [8]

(*b*) Explain marking system of grinding wheel. [8]

11. (*a*) Explain Honing with suitable sketch. [8]

(*b*) Explain electroplating with suitable sketch. [8]

Or

12. Write short notes on the following : [16]

(*i*) Polishing;

(*ii*) Metal spraying

(*iii*) Hot dipping.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-134

S.E. (Production) (First Semester) EXAMINATION, 2010

(Common to Prod./SW)

MATERIAL SCIENCE

(2008 COURSE)

Time : Four Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt Q. No. **1** or **2**, Q. No. **3** or **4**, Q. No. **5** or **6** from Section I and 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.

(*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 cast iron ? What are different types of C.I. ? Explain with one application each. [6]

(*b*) What is work Hardening ? Explain its effect on Mechanical Properties of metal with proper graph. [6]

(*c*) Draw the following planes on cubic : [6]

(*i*) (1 1 1)

(*ii*) (2 2 2)

(*iii*) (1 1 0).

Or

2. (*a*) Explain classification of steels based on % carbon and give typical use of each of them with mech. properties. [6]

(*b*) Explain Edge and Screw dislocation. [6]

(*c*) Define : [2]

(*i*) Unit cell

(*ii*) Co-ordination no.

(*d*) Explain point imperfections in detail. [4]

3. (*a*) Differentiate between Izod and Charpy. [16]

(*b*) Explain Radiography.

(*c*) What is fatigue ? What factors improve fatigue strength ?

(*d*) Show self-explanatory diagram :

(*i*) Stress-strain diagram for MS

(*ii*) S-N. diagram for steel.

Or

4. (*a*) Draw self explanatory diagram for Erichsen cupping and cone test and explain. [16]

(*b*) Differentiate between Vickers and Brinell Hardness Tester.

(*c*) Write a short note on ultrasonic testing.

(*d*) Explain and give reason.

(*i*) Magnetic particle test is used to detect defects in plastic component.

(*ii*) Hardness of rubber blade is checked on Brinell hardness tester.

5. (*a*) Write Hume Rothery Rule for solid-solution formation. [16]

(*b*) Draw and explain cooling curve for pure metal.

(*c*) Draw a typical equilibrium diagram for 2 metals, which have 100% solubility in each other in liquid as well as solid state.

(*d*) Explain :

(*i*) Eutectic transformation

(*ii*) Eutectoid transformation.

Or

6. (*a*) Write a short note on use of eutectic alloys. [4]

(*b*) Define Gibbs phase rule and show its application on cooling curve for eutectic alloys. [4]

(*c*) Plot an equilibrium dia on given data and show slow cooling of alloy having 15% B from its liquidus temp. till the room temp.

Melting point of A : 961ºC

Melting point of B : 1083ºC

Eutectic temp. : 780ºC

Eutectic composition : 28.1% of B

Max. solubility of B in A i.e. in a is 8.8% at Eutectic temp. and A in B is 7.9% at Eutectic temp. [8]

SECTION II

7. (*a*) Explain strengthening by martensitic transformation. [16]

(*b*) Explain principle, operation of resistance pyrometer.

(*c*) Draw disappearing filament pyrometer.

(*d*) How composite materials are useful for strengthening ? Explain.

Or

8. Write short notes on : [16]

(*a*) Total radiation pyrometer

(*b*) Solid-solution hardening

(*c*) Precipitation hardening

(*d*) Thermocouple.

9. (*a*) What is corrosion ? How is corrosion prevented in material selection processes ? Explain. [8]

(*b*) Explain electrodeposition in detail. [6]

(*c*) How is humidity responsible in increasing corrosion rate ? [2]

Or

10. (*a*) Explain ion implantation. [4]

(*b*) How is design of component responsible to change corrosion of metal ? Explain with example. [6]

(*c*) What is Anodic coating ? [2]

(*d*) Explain PVD process. [4]

11. (*a*) Explain mechanical processes for powder manufacturing. [6]

(*b*) What are different advantages of Powder Metallurgy ? [6]

(*c*) Define the following : [6]

(*i*) Apparent Density

(*ii*) Tap Density

(*iii*) Compressibility.

Or

12. (*a*) Write short notes on : [12]

(*i*) Diamond impregnated tool

(*ii*) Electrical contact material

(*iii*) Carbide tool.

(*b*) What are physical methods of powder manufacturing. [4]

(*c*) Is it possible to manufacture a component having wt. of 10 kg by powder metallurgy ? Explain. [2]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-135

S.E. (Prod/Prod SW) (Second Sem.) EXAMINATION, 2010

THEORY OF MACHINES

(2008 COURSE)

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*) 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 terms :

(*i*) Screw pair

(*ii*) Mechanism

(*iii*) Ternary link

(*iv*) Compound chain. [4]

(*b*) Explain in brief Kutzback criterion for determining DOF of Mechanism. [6]

(*c*) List inversions of four bar chain and explain any *two* with neat sketch. [6]

Or

2. (*a*) Define Kinematic link. Can spring, belt, liquid be treated as links ? Justify your answer. [5]

(*b*) Describe Watt's straight line mechanism. What are the practical uses of straight line mechanism ? [6]

(*c*) Differentiate between Spatial and Planer Mechanism. [5]

3. (*a*) The length of various links of mechanism as shown in Fig. 1 are OA = 0.3 m, AB = 1 m, CD = 0.8 m and AC = CB.

Determine for the given configuration :

(*i*) Velocity of slider B

(*ii*) Velocity of slider D

(*iii*) Angular velocity of CD

(*iv*) Angular velocity of AB.

If OA rotates at 60 rpm clockwise, use instantaneous centre method.

Also find absolute velocity of point C. [12]

Fig. 1

(*b*) In a slider crank mechanism having a stroke length of 30 cm and an obliquity ratio of 4, the crank is rotating uniformly clockwise. The velocity of slider is 6 m/s when the crank has turned 120° from I.D.C. Determine using Klein's construction :

(*i*) Acceleration of slider

(*ii*) Angular velocity and angular acceleration of connecting rod. [6]

Or

4. (*a*) Fig. 2 shows the toggle mechanism in which the crank OA rotates at a uniform speed of 105 rpm in clockwise direction. Determine the velocity and acceleration of slider 'P'.

The lengths of various links are : OA = 8 cm, AB = 18 cm, BC = 24 cm and BP = 28 cm. [14]

Fig. 2

(*b*) Explain different types of ICRs. [4]

5. (*a*) Explain in detail various types of friction. [8]

(*b*) Explain in detail the following :

(*i*) Coulomb's theory of Interlocking

(*ii*) Stick-slip Mechanism of friction. [8]

Or

6. (*a*) Define 'Tribology'. Discuss the different areas covered under 'Tribology'. [5]

(*b*) State the applications where friction and wear are useful. [5]

(*c*) Write short notes on (any *two*) :

(*i*) Two body and three body abrasive wear

(*ii*) Corrosive wear

(*iii*) Surface fatigue wear. [6]

SECTION II

7. (*a*) Define and explain the following terms :

(*i*) Belt-drive

(*ii*) Rope-drive

(*iii*) Chain-drive

(*iv*) Slip and creep of a belt. [6]

(*b*) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the length and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25 ? [10]

Or

8. (*a*) Distinguish between initial tension and centrifugal tension in a belt. [6]

(*b*) An open belt running over two pulleys 240 mm and 600 mm diameter connects two parallel shafts 3 meters apart and transmits 4 kW from the smaller pulley that rotates at 300 rpm. 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]

9. (*a*) What is the difference between brakes and dynamometers ? [5]

(*b*) A simple-band brake is applied to a rotating drum of diameter 500 mm. The angle of lap of the band on the drum is 270°.

One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If the co-efficient of friction is 0.25 and a braking force of

90 N is applied at a distance of 600 mm from the fulcrum, find the braking torque when the drum rotates in the :

(*i*) Anti-clockwise direction and

(*ii*) Clockwise direction. [11]

Fig. 3

Or

10. (*a*) Differentiate between Absorption dynamometer and Transmission dynamometer. [6]

(*b*) Fig. 4 shows a differential band brake of drum diameter 400 mm. The two ends of the band are fixed to the points on the opposite side of fulcrum of the lever at a distance of 50 mm and 160 mm from the fulcrum as shown in figure. The brake is to sustain a torque of 300 Nm. The coefficient of friction between band and the brake is 0.2.

The angle of contact is 210° and the length of lever from the fulcrum is 600 mm. Determine :

(*i*) The force required at the end of the lever for the clockwise and anticlockwise rotation of the drum.

(*ii*) Value of OB for the brake to be self-locking for clockwise rotation. [10]

Fig. 4

11. (*a*) Explain D'Alembert's principle. [4]

(*b*) Explain the trifilar suspension system. [6]

(*c*) A connecting rod is suspended from a point 25 mm above the small end centre and 650 mm above its C.G. It takes 35 seconds for 20 oscillations. Find dynamically equivalent system of two masses when one mass is located at small end centre. Mass of the connecting rod is 40 kg. [8]

Or

12. (*a*) Explain dynamically equivalent system. [6]

(*b*) With the help of neat Schematic diagram, derive frequency equation of Bifillar Suspension System. [6]

(*c*) A rigid link, 500 mm long has mass 2 kg and radius of gyration 200 mm. Replace this link by dynamically equivalent system of two concentrated masses located at the ends of the link. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-136

S.E. (Production) (Second Semester) EXAMINATION, 2010

WELDING AND FOUNDRY

(2008 COURSE)

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 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

Unit I

1. (*a*) Explain GTAW process considering the points :

(*i*) Working principle

(*ii*) Process parameters

(*iii*) Advantages

(*iv*) Disadvantages

(*v*) Applications. [10]

(*b*) Explain with neat sketch an arc blow in the welding. Also explain causes, effects and remedies of arc blow. [8]

P.T.O.

Or

2. (*a*) Describe with neat sketch SAW process and its applications. [10]

   (*b*) Explain Voltage-Current and Voltage-Arc length characteristics in welding. [8]

Unit II

3. (*a*) Compare spot welding and projection welding processes with neat sketch. [8]

   (*b*) Distinguish with suitable sketches different types of Oxy-Acetylene gas flames stating how they are obtained and their applications. [8]

Or

4. (*a*) Discuss the different variables in resistance welding process. How are dissimilar metals welded by resistance welding ? [8]

   (*b*) Sketch various types of flames used in the welding of Mild Steel, Alloy Steel, Aluminum and High Carbon Steel. [8]

Unit III

5. (*a*) Explain Laser beam welding process with neat sketch and state its advantages and limitations over electron beam welding process. [8]

   (*b*) Write a short note on friction welding. [8]

Or

6. (*a*) Explain with neat sketch electron beam welding process and effect of vacuum on the penetration. [8]

   (*b*) Write a short note on explosive welding. [8]

SECTION II

Unit IV

7. (*a*) Explain in detail various allowances given to the patterns. [8]

(*b*) With neat sketch explain construction and operation of a Cupola. [8]

Or

8. (*a*) Which are the different ingredients of moulding sand ? State their importance during mould making. [8]

(*b*) Explain with neat sketch construction of an electric furnaces. [8]

Unit V

9. (*a*) Explain with neat sketch pressure die-casting process. List out merits, demerits and applications of it. [8]

(*b*) Explain with neat sketch investment casting process. [8]

Or

10. (*a*) Explain with neat sketch centrifugal casting process. [8]

(*b*) Explain various casting defects with their causes and remedies. [8]

Unit VI

11. (*a*) What is meant by pressurized and un-pressurized gating system ? State the standard gating ratios used for Aluminium, Steel and Brass. [8]

(*b*) Compare directional and progressive solidification of casting. [6]

(*c*) Explain Chvorinov's rule. [4]

Or

12. (*a*) Using Caine's method calculate the size of cylindrical riser (Height = Diameter) necessary to feed steel slab casting 30 × 30 × 5 cm with side riser, casting is poured horizontally into the mould.

Data for Steel Casting $a = 0.1$, $b = 0.03$ and $c = 1.0$ [8]

(*b*) Explain the following : [10]

(*i*) Criteria used for designing of pouring basin

(*ii*) Casting yield and methods to increase it.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-137

S.E. (Production/Production S/W) (II Sem.) EXAMINATION, 2010

DESIGN OF MACHINE ELEMENTS

(2008 COURSE)

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 different design methods ? Also compare these methods. [6]

(*b*) A link of "S" shape made of 30 mm diameter as shown in Fig. 1. Determine the maximum tensile stress and shear stress in the link. [12]

1000 N

75 mm

100 mm

f 30

1000 N

Fig. 1

Or

2. (*a*) What is design synthesis and design analysis ? [6]

(*b*) A bell crank lever is to be designed to raise load of 5 kN at the short end. The arm lengths are 150 mm and 500 mm. The permissible stresses for lever and pin material in shear and tension are 60 N/mm^2 and 90 N/mm^2 respectively. The bearing pressure on the pin is to be limited 12 N/mm^2. Assume the lever cross-section as $t \times 4t$. [12]

3. (*a*) Compare the weights of equal length of hollow shaft and solid shaft to transmit a given torque for the same maximum shear stress. The material for both the shafts is same and inside diameter is 2/3rd of outside diameter for hollow shaft. [6]

(*b*) A standard splined connection of $8 \times 52 \times 60$ mm is used for the gear and shaft assembly of gearbox, 20 kW power at 300 r.p.m. is transmitted by the splines. The normal pressure on splines is limited to 6.5 N/mm^2. Coefficient of friction is 0.06. Calculate the length of hub of the bear and force required. [10]

Or

4. (*a*) Write a short note on protected type flange coupling. [6]

(*b*) Along with a neat sketch state the design procedure for rigid type flange coupling. [10]

5. (*a*) Derive the expression for the torque requirement for tightening of bolt. [6]

(*b*) A bracket shown in fig. is fixed to the support by means of three bolts. The dimensions given in Fig. 2 are in mm. The bolts are made of plain carbon steel 45C8. (S_{yt} = 380 N/mm^2) factor of safety is 2.5, assume $d = d_c/0.84$. [10]

250

25

7500 N

2 Bolts (2, 3)

175

1 Bolt (1)

25

Fig. 2

Or

6. (*a*) A Fig. 3 shows the welded joints subjected to an eccentric load of 25 kN. The welding is on only one side. Permissiable shear stress is 55 MPa. Determine the weld size. [10]

25 kN

100

100

150

Fig. 3

(*b*) Write a short note on welded joints subjected to torsional load. [6]

SECTION II

7. (*a*) Explain various types of screw threads along with applications. [6]

(*b*) The following data is given for a screw jack :

(1) Nominal diameter of the shaft of screw : 40 mm

(2) Pitch of square threads : 7 mm

(3) Coefficient of thread friction : 0.15

(4) Coefficient of collar friction : 0.1

(5) Effective mean diameter of collar : 70 mm.

The operator can comfortably exert a force of 150 N at radius of 1.2 m to raise the load. Assuming single start threads, calculate the maximum load can be lifted, the efficiency of the screw and the overall efficiency. [10]

Or

8. A power screw having double start square threads of 25 mm nominal diameter and 5 mm pitch is acted upon by an axial load of 10 kN. The collar outer and inner are 50 mm and 20 mm respectively. The coefficient of friction of thread and collar friction is 0.22 and 0.15 respectively. The screw rotates at 12 r.p.m. Assuming uniform wear condition at the collar and allowable bearing pressure of 5.5 N/mm^2, find the torque required to rotate the screw and stresses in the screw and height of nut. [16]

9. (a) Write a short note on Wahl stress factor. [4]

(b) Design a helical compression spring for a maximum load of 1200 N for deflection of 25 mm using the value of spring index as 5. Assume maximum permissible shear stress for spring material as 400 N/mm^2, Modulus of rigidity can be assumed as 85 GN/m^2. [12]

Or

10. A valve spring of I.C. Engine is designed as the following details :

(1) Spring load 80 N when the valve is closed.

(2) Spring load 105 N when valve is open.

(3) Inside guide bush diameter 25 mm.

(4) Outside recesses diameter 35 mm.

(5) Valve lift 5 mm.

(6) Permissible shear stress 350 MPa.

(7) Modulus of Rigidity 80 GPa.

Assume the spring ends are square ground determine wire diameter, spring index, total number of coils, solid length and free length. [16]

11. (*a*) Explain along with suitable example role of Ergonomics in Design Engg. [6]

(*b*) Write a short note on Morgan's color Code. [6]

(*c*) Explain the aesthetics design principles. [6]

Or

12. (*a*) Write a short note on design for manufacturing (DFM). [6]

(*b*) What are the guidelines followed in design of the parts for the following processes :

(1) Casting

(2) Forging

(3) Welding

(4) Powder metallurgy. [12]

Total No. of Questions—**12**] [Total No. of Printed Pages—**3**

[3862]-138

S.E. (Production) (Second Semester) EXAMINATION, 2010

INDUSTRIAL ORGANISATION AND MANAGEMENT

(2008 COURSE)

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*) Use of calculator is allowed.

(*iv*) Figures to the right indicate full marks.

(*v*) Answer *one* question from **1** & **2**, **3** & **4**, **5** & **6**, **7** & **8**, **9** & **10**, **11** & **12**.

SECTION I

1. (*a*) Define Organization. Explain functions of organization. [8]

(*b*) What do you mean by joint stock company ? Discuss types, advantages and limitations. [8]

Or

2. (*a*) Define Co-operative Organization. State objectives, advantages and limitations of co-operative enterprises. [8]

(*b*) Explain project organization with advantages and disadvantages. [8]

3. (*a*) Discuss styles of leadership. Which *one* is preferable and why ? [8]

(*b*) Explain Vroom's expectancy theory of motivation. [8]

Or

4. (*a*) Define Group Dynamics. Discuss various types of groups. [8]

(*b*) Explain Maslow's theory of need hierarchy. Compare it with Herzberg's two factor theory. [8]

5. (*a*) Discuss any *four* sources of finance for an entrepreneur. [9]

(*b*) Explain the following in break-even analysis with chart : [9]

(*i*) Break-even point

(*ii*) Margin of safety

(*iii*) Angle of incidence

Or

6. (*a*) What does bank look for in a business plan ? When does a bank reject a business plan ? [9]

(*b*) Define entrepreneur, entrepreneurship. Explain various qualities of an entrepreneur. [9]

SECTION II

7. (*a*) Discuss the major factors that influence the buyer behaviour. [8]

(*b*) Describe various stages of product life cycle. [8]

Or

8. (*a*) Explain various steps in marketing research. [8]

(*b*) Explain various brand development strategies. [8]

9. (*a*) Define human resource management. Explain its objectives. [8]

(*b*) Explain sources of recruitment with advantages and limitations. [8]

Or

10. (*a*) List and explain various functions of human resource management. [8]

(*b*) Define Selection. Explain steps in selection procedure. [8]

11. (*a*) Define the term Worker and discuss briefly the provisions relating to the welfare of worker under Factories Act 1948. [8]

(*b*) List and explain any *two* merit-rating methods. [6]

(*c*) Explain Halsey Plan for payment of wages. [4]

Or

12. (*a*) Define wage. Discuss imposition of fine and penalty under the Payment of Wages Act 1936. [8]

(*b*) Explain various steps in job evolution process. [6]

(*c*) Explain Rowan plan for payment of wages. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-139

S.E. (Prod. S/W) (First Semester) EXAMINATION, 2010

MANUFACTURING PROCESS

(2008 COURSE)

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 tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

UNIT I

1. (*a*) What are the main constituents of moulding sand ? How are binders classified ? Name few binders of each type. [6]

(*b*) Write short notes on the following : [4]

(*i*) Use of padding

(*ii*) Use of exothermic materials.

(*c*) What is centrifuging ? Describe the process with neat sketch, stating differences with other centrifugal casting methods. [8]

Or

2. (*a*) Sketch a cross-section through a complete mould and label it properly. Describe the following terms related to it : [6]

(*i*) Pattern

(*ii*) Riser

(*iii*) Flask

(*iv*) Gate

(*v*) Vent

(*vi*) Parting line.

(*b*) What is moulding machine ? What main function does it perform ? Explain with a neat sketch 'sand slinger'. [6]

(*c*) What are chapletes ? Why are they used ? Sketch and describe various types of chapletes. [6]

UNIT II

3. (*a*) State the advantages and limitations of cold working process and hot working process. [6]

(*b*) Compare a forged part with cast part in relation to mechanical properties. [4]

(c) Identify and name few components made by spinning process. Describe cold spinning process in short with neat sketch. [6]

Or

4. (a) List few components made by extrusion process. Describe indirect extrusion process in short with neat sketch. [6]

(b) Explain with neat sketch the working of Board drop hammer. [6]

(c) What are different rolling defects produced in the rolling process ? Discuss in short. [4]

UNIT III

5. (a) State the principle and working of resistance welding process. Explain with a neat sketch the 'Resistance projection welding'. [6]

(b) Write short notes on : [6]

(i) Adhesive bonding

(ii) Gas flames used in gas welding.

(c) State only advantages and disadvantages of submerged arc welding process and state the area of application of this process. [4]

Or

6. (*a*) Differentiate between soldering and brazing. [4]

(*b*) Write advantages, limitations and area of application of the following processes : [9]

(*i*) Ultrasonic welding

(*ii*) Electron beam welding

(*iii*) Explosive welding.

(*c*) Explain the following welding defects : [3]

(*i*) Lack of fusion

(*ii*) Slag

(*iii*) Lack of penetration.

SECTION II

UNIT IV

7. (*a*) Draw three view of single-point cutting tool, showing different angles. What is tool designation ? [6]

(*b*) Write short notes on the following : [6]

(*i*) Lathe spindle

(*ii*) Lathe carriage

(*iii*) Tumbler gears.

(*c*) A hallow work-piece of 75 mm outside diameter and 160 mm length is held on mandrel between centres and turned all over. Calculate the machining time for turning by using the following data : [6]

Approach length = 20 mm

Overtravel = 15 mm

Average feed = 0.6 mm/rev

Cutting speed = 30 m/min

No. of passes = 5.

Or

8. (*a*) Describe the following lathe operations with neat sketch : [6]

(*i*) Facing

(*ii*) Knurling

(*iii*) Parting off.

(*b*) What do you understand by thread catching ? Why is it necessary ? [4]

(*c*) What is taper ? State different taper turning processes used for production of taper on job. Describe tailstock set over method for producing taper with sketch. [8]

UNIT V

9. (*a*) List out various types of drills. Draw a neat sketch of twist drill and show its elements and angles. [6]

(*b*) Index 87 divisions by compound indexing method, the hole circles available are : [6]

Plate I : 15, 16, 17, 18, 19, 20

Plate II : 21, 23, 27, 29, 31, 33

Plate III : 37, 39, 41, 43, 47, 49.

(*c*) Compare sensitive drilling machine with radial drilling machine. [4]

Or

10. (*a*) Explain the terms cutting speed, feed and depth of cut to drilling operation. [4]

(*b*) Explain with neat sketch the following milling operation : [6]

(*i*) Stradle milling

(*ii*) Angular milling

(*iii*) Face milling.

(*c*) Draw block diagram of planer type milling machine and describe it. [6]

UNIT VI

11. (*a*) Explain the following bond in grinding, stating merits and demerits : [6]

(*i*) Vitrified bond

(*ii*) Silicate bond.

(*b*) Why truing and dressing are necessary in grinding wheel ? Describe any *one* method of dressing abrasive wheel. [6]

(*c*) What are the advantages of centreless grinding over centre type grinding ? [4]

Or

12. (*a*) State necessity of finishing methods. Name the finishing methods. What do you mean by micro-finishing processes ? [6]

(*b*) What are the common shapes used in grinding work ? Sketch and describe in brief (any *four*). [6]

(*c*) What are the merits and demerits of grinding as compared to other machining operations ? [4]

Total No. of Questions—**6**] [Total No. of Printed Pages—**7**

[3862]-140

S.E. (Production S/W) (Second Semester) EXAMINATION, 2010

MANUFACTURING ENGINEERING AND

METROLOGY PRACTICES

(2008 COURSE)

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

(*iv*) Assume suitable data, if necessary.

(*v*) *All* questions are compulsory.

SECTION I

1. (*a*) Calculate the cutting speed in meters per minute if spindle speed of a 19.05 mm drill is 400 rpm. [2]

(*b*) During turning a steel rod of diameter 160 mm at speed 560 rpm, feed 0.32 mm/rev and depth of cut 4.0 mm by a ceramic insert of geometry :

$$0°, \ -10°, \ 6°, \ 6°, \ 15°, \ 75°, \ 0 \ (\text{mm}).$$

The following were observed :

P_Z = 1600 N, P_X = 800 N and chip thickness = 1 mm.

Determine with the help of Merchants circle diagram the possible values of :

(*i*) F — Friction force at chip tool interface

(*ii*) N — Force normal to rake face

(*iii*) μ_a — Apparant coefficient of friction at chip tool interface

(*iv*) P_s — Shear force

(*v*) P_n — Force normal to shear force

(*vi*) Cutting Power

(*vii*) Specific energy consumption. [14]

Or

(*a*) Define Machinability. Explain effects of the following on Machinability :

(*i*) Tool Rake Angle(s)

(*ii*) Cutting Angles

(*iii*) Clearance Angles

(*iv*) Nose Radius. [8]

(*b*) If in turning of a steel rod by given cutting tool (material and geometry) at a given machining condition (S_0 and t) under given environment of cutting fluid application, the tool life decreases from 80 min to 20 min, due to increase in cutting velocity (V_C) from 60 m/min to 120 m/min. Then at what cutting velocity the life of that tool under same condition and environment will be 40 min ?

S_0—feed, t—depth of cut. [8]

2. (*a*) Explain with the help of neat sketch, what is the difference between turret and capstan lathe ? [10]

(*b*) Explain the need of transfer line from manufacturing point of view. [6]

Or

With the help of neat sketch, explain principle of operation, kinematic system, types of tools and jobs, applications for :

(*i*) Shaping machine

(*ii*) Planing machine

(*iii*) Slotting machine. [16]

3. (*a*) Draw a neat sketch of pull type broach used for finishing holes and show the following terminologies in sketch :

(*i*) Pull End

(*ii*) Neck

(*iii*) Front Pilot

(*iv*) Cutting teeth

(*v*) Finishing teeth

(*vi*) Rear Pilot. [6]

(*b*) Draw a typical sketch demonstrating geometry of teeth of Broaching tools. What are the effects of rake angle and clearance angle on Broaching operation ? [8]

(*c*) What type of materials are used for Broach ? Which are the desired material properties ? [4]

Or

(*a*) Draw a neat sketch of dies for manufacturing external screw threads :

(*i*) Split die

(*ii*) Spring die

(*iii*) Pipe die. [6]

(*b*) Explain Gear Manufacturing process by Gear Hobbing and Gear Grinding. [12]

SECTION II

4. (*a*) Explain the following terminologies for Numerical Control :

(*i*) Manual Data Input (MDI)

(*ii*) G-code programming

(*iii*) Fixed canned cycles. [12]

(*b*) Explain advantages of CNC over NC. [4]

Or

(*a*) For machining centres explain the following :

(*i*) Automatic tool changers

(*ii*) Automatic pallet changers. [8]

(*b*) A flexible manufacturing system is a computer controlled machining arrangement that can perform a variety of continuous metal-cutting operations on range of components without manual intervention. Explain. [8]

5. (*a*) A circular Bank of 30 mm diameter is to be cut from 2 mm thick 0.1 C steel sheet. Determine the die and punch sizes. Also estimate punch force and stripping force needed. Assume the following for steel :

Tensile strength : 410 MPa, Shear strength : 310 MPa. [8]

(*b*) Explain with suitable sketch drawing operation with a mathematical expression for Blank size and Drawing force. [8]

Or

(*a*) Explain clearance between, die and punch for Blanking and Piercing operation. [8]

(*b*) Explain the following :

(*i*) Inverted Die

(*ii*) Compound Die. [8]

6. Explain the following elements of jigs and fixtures : [18]

(*i*) Locating elements

(*ii*) Supporting surfaces and Base

(*iii*) Clamping elements

(*iv*) Tool guiding frame and bushes for jig

(*v*) Indexing systems

(*vi*) Auxiliary elements.

Or

Explain the following for Drill Jig Bushing : [18]

(*i*) Factors considered for designing jig

(*ii*) Types of jig bushes :

(*a*) Without head

(*b*) With head

(*c*) Flange

(*d*) Using eccentric bush.

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[3862]-141

S.E. (Prod/SW) (Second Semester) EXAMINATION, 2010

PRODUCTION AND INDUSTRIAL MANAGEMENT–I

(2008 COURSE)

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.

(*vi*) *All* questions are compulsory.

SECTION I

1. (*a*) Explain contribution of F.W. Taylor in the field of management. [8]

(*b*) Define organisation. Explain the principles of organisation. Draw any *one* organisation chart. [8]

Or

(*a*) Discuss the contribution of H. Fayol in the field of management. [8]

(*b*) List various forms of business ownerships and explain joint stock company with its advantages and disadvantages. [8]

2. (*a*) Define 'Plant Layout'. Which are the characteristics of good plant layout ? [8]

(*b*) Define production planning and control. Discuss in brief various functions of it. [10]

Or

(*a*) Define the term 'production'. List out any *seven* characteristics of mass production. [8]

(*b*) What is process planning ? What is its importance ? [4]

(*c*) Define 'maintenance'. Mention various types of maintenance and differentiate between them. [6]

3. (*a*) Explain and construct two handed process chart to record the activities performed by an operator working on Xerox machine. [8]

(*b*) Explain micro-motion study. How is it carried out ? What are the various symbols used in it ? [8]

Or

(*a*) Explain the concept and significance of the following in developing new improved methods : [8]

(*i*) Primary questions

(*ii*) Secondary questions.

(*b*) Define Ergonomics. State its objectives. Explain the effect of working conditions on human performance. [8]

SECTION II

4. (*a*) Explain various types of allowances that are considered in calculation of standard time. [8]

(*b*) Explain 'MTM' in detail. [8]

Or

(*a*) Write short notes on :

(*i*) Stopwatch time study

(*ii*) Standard data. [8]

(*b*) What are work elements ? Explain various types of work elements with suitable example. [8]

5. (*a*) Define motivation. Explain various non-financial motivation techniques to motivate the employees. [8]

(*b*) Discuss various styles of leadership. [8]

Or

(*a*) Discuss the qualities of successful entrepreneur. [8]

(*b*) Discuss any *two* motivational theories. [8]

6. Write short notes on : [18]

(*a*) Training and development

(*b*) Job evaluation

(*c*) Sources of finance.

Or

(*a*) Explain how we can calculate selling price of product by considering various expenses incurred. [6]

(*b*) Explain :

(*i*) Recruitment procedure

(*ii*) Merit rating. [6]

(*c*) A toy manufactures a doll and sells it for Rs. 25 per item. Fixed cost is Rs. 1,20,000 and variable cost is Rs. 15/unit. Calculate :

(*i*) The number of units for no profit-no loss condition. [3]

(*ii*) The number of units to be produced to have a profit of Rs. 24,000. [3]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-151

S.E. (Electrical) (First Semester) EXAMINATION, 2010

POWER PLANT ENGINEERING

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

(*ii*) Use separate answer-book for each Section.

(*iii*) Use of steam tables, Mollier charts and electronic calculators is allowed.

(*iv*) Assume suitable data, if necessary.

SECTION I

(Unit 1)

1. (*a*) Explain with neat sketch pulverised bed combustion system. [8]

(*b*) Define :

(*i*) HCV of fuel

(*ii*) Stoichiometric A : F ratio

(*iii*) Actual A : F ratio. [6]

(*c*) Differentiate between mass fraction and mole fraction. [4]

Or

2. (*a*) In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Mass flow rate is 9.5 kg/sec. Determine :

(*i*) Pump work

(*ii*) Turbine work

(*iii*) Rankine efficiency

(*iv*) Condenser heat flow

(*v*) Dryness at the end of expansion. [10]

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

Unit 2

3. (*a*) How boilers are classified ? Compare the fire tube boiler and water tube boiler. [6]

(*b*) Explain with neat sketch working of Jet Condenser. [6]

(*c*) Explain with a neat sketch working of air preheater. [4]

Or

4. (*a*) What is boiler draught ? Explain natural and artificial draught with sketches. [6]

(*b*) Explain any *three* methods of coal transferring with neat sketches. [6]

(*c*) Explain with neat sketch Pneumatic Ash Handling System. [4]

Unit 3

5. (*a*) Draw the schematic layout of hydroelectric power plant and discuss the functions of each components and operation of plant. [8]

(b) Explain working of surge tank and give its classification with neat sketch. [8]

Or

6. (a) Explain different methods of governing mechanisms of a Francis Turbine. [6]

(b) What is Hydrograph ? Explain with a neat sketch. [4]

(c) What is spillway ? Discuss various types of spillways in brief. [6]

SECTION II

Unit 4

7. (a) Explain BWR with a neat sketch. [6]

(b) Discuss the site selection criteria for Nuclear power plants and explain Nuclear Fission. [6]

(c) Explain with neat sketch wet sump lubrication system. [6]

Or

8. (a) Explain CANDU reactor power plant. [6]

(b) State advantages and disadvantages of Diesel Power plant. State the applications of Diesel Power plants. [6]

(c) Write a short note on 'Nuclear Waste Disposal'. [6]

Unit 5

9. (a) Compare Gas turbine with I.C. Engine. [6]

(b) Discuss the operation of intercoolers and regenerators used in gas turbine with a neat sketch. [6]

(c) Explain fuels for gas turbine power plants. [4]

Or

10. (*a*) Write a short note on materials used for different parts of a gas turbine. [8]

(*b*) Explain prospects and development of non-conventional power plants in India. [4]

(*c*) Write a short note on tidal power generation. [4]

Unit 6

10. (*a*) Discuss the various fixed charages and running charges which are used for calculation of cost of electrical energy. [8]

(*b*) What are base load and peak load plants ? Explain the methods by which economic load sharing between base load and peak load plants can be determined. [8]

Or

12. (*a*) Find the cost of power generation per kWh for the following data :

Capacity of plant – 150 MW

Capital cost = Rs. 25,000 per kW installed

Interest and depreciation = 10% on capital

Fuel consumption = 1.5 kg/kWh

Fuel cost = Rs. 400 per tonne

Salaries, wages and maintenance = Rs. 150×10^6 per year

Max. demand = 120 MW

Load factor = 50%. [8]

(*b*) Explain :

(*i*) Input-output curve

(*ii*) Heat rate and incremental rate curve. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-152

S.E. (Electrical) (First Semester) EXAMINATION, 2010

MATERIAL SCIENCE

(2008 COURSE)

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*) You are advised to attempt not more than 6 questions.

(*v*) Assume suitable data, if necessary.

Physical Constants :

(1) Angstrom Unit (AU) = 10^{-10} metres.

(2) Avogadro's number (N_A) = 6.0254×10^{23}/gram molecule.

(3) Boltzmann's constant (k) = 1.380×10^{-23} Joule degree^{-1}.

(4) Dielectric constant of free space ($\hat{I}_0$) = 8.85×10^{-12} Faradmetre^{-1}.

(5) Charge on electron (e) = 1.601×10^{-19} Coulomb.

(6) Mass of electron (m) = 9.107×10^{-31} kg.

(7) Electron volt (eV) = 1.602×10^{-19} Joules.

(8) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$.

(9) Mass of proton (m_ρ) = 1.627×10^{-27} kg.

(10) Velocity of light (C) = 2.998×10^{8} metre second^{-1}.

(11) Debye unit = 3.33×10^{-30} Coulomb-metre.

P.T.O.

SECTION I

1. (*a*) Differentiate between photo-conductive and photo-emissive cells. [8]

(*b*) Describe polarization process in detail. Why and how does it occur ? [8]

Or

2. (*a*) Write different materials used for photovoltaic material. Describe its construction and working principle. [8]

(*b*) Explain ionic polarization in detail. How is it different from oriental polarization ? [8]

3. Write down properties or applications of Paper Press Board, Fibrous Materials, Ceramics, Asbestos, Varnish, Askarel Insulating Gases like Air and SF6. [16]

Or

4. (*a*) Describe insulating materials used in switchgears and line insulators. [8]

(*b*) Describe between :

(*i*) Breakdown voltage and breakdown strength. [4]

(*ii*) Primary ionization and secondary ionization. [4]

5. (*a*) Explain Spontaneous Magnetization and Curie-Weiss law. [9]

(*b*) Write a short note on Magnetic Recording Materials and Compact Discs. [9]

Or

6. (*a*) Differentiate between :

(*i*) Permeability and Magnetic susceptibility. [4]

(*ii*) Soft and hard magnetic materials. [5]

(*b*) Describe properties and applications of paramagnetic materials. [9]

SECTION II

7. Write down properties or applications of Constantan, Nickel-Chromium Alloy, Tungsten, Canthal, Silver, Copper Alloys, Tungsten and Carbon. [16]

Or

8. Describe Lamp Filaments, Solders, Thermal Bimetal and Thermocouple. [6]

9. With neat diagrams describe :

(*i*) Carbon Nano-structures and Carbon Molecules. [4]

(*ii*) Carbon Clusters [4]

(*iii*) Carbon Nano-tubes [4]

(*iv*) Nano wires. [4]

Or

10. (*a*) Write down applications of Carbon Nano-tubes and BN nano-tubes. [8]

(*b*) What do you mean by Single Electron Transistor, Molecular Machines ? [8]

11. (*a*) How will you test transformer oil ? Explain with a neat diagram of test set up. [9]

(*b*) Describe any *three* tests on cable. [9]

Or

12. (*a*) Explain measurement of Tangent of Dielectric Loss Angle (tan d) by Schering Bridge as per IS 13585-1994. [9]

(*b*) Describe measurement of Dielectric strength of solid insulating material with reference to IS 2584. [9]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-153

S.E. (Electrical) (First Sem.) EXAMINATION, 2010

ANALOG AND DIGITAL ELECTRONICS

(2008 COURSE)

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 input-output characteristics of CE configuration with neat connection diagram and characteristic curve. [10]

(*b*) Explain AC-DC load line analysis using common emitter configuration. [8]

Or

2. (*a*) Draw and explain multistage amplifier. Also state advantages and applications. [6]

(*b*) Define the following terms associated with FET :

(*i*) Transconduction

(*ii*) Amplification factor. [4]

(*c*) What is significance of transfer and drain characteristics of FET ? Draw and explain. [8]

3. (*a*) Explain with neat diagram Schmitt trigger as an application of op-amp. [8]

(*b*) Explain grounded type load voltage to current converter. [8]

Or

4. (*a*) What is the role of op-amp as an instrumentation amplifier ? Explain 3-op-amp instrumentation amplifier. [8]

(*b*) Explain open loop and close loop configuration of op-amp. [8]

5. (*a*) Draw and explain monostable multivibrator. Also state applications. [8]

(*b*) Using LM317 explain variable voltage regulator with neat diagram. [8]

Or

6. (*a*) Explain sine wave generator using op-amp. Draw output w/fs. [8]

(*b*) Explain with neat connection diagram low pass filter. [8]

SECTION II

7. (*a*) Convert the following numbers into equivalent BCD : [6]

(*i*) $(11011011)_2$

(*ii*) $(333)_8$

(*iii*) $(DB)_{16}$

(*b*) State De Morgan's theorem and using Boolean algebra prove the following : [6]

$$(\overline{A} + B)\,(A + B + D)\,\overline{D} = B\overline{D}.$$

(*c*) Explain Excess-3 code in detail. [6]

Or

8. (*a*) If

$$f = \sum m(4,5,6,7,8,12) + d(1,2,3,9,13,14)$$

using K-map reduce expression and realise using logic gates. [6]

(*b*) Explain binary number system in detail. Also give the difference between binary number system and BCD. [6]

(*c*) Design 1-bit comparator using K-map and realise it using logic gates. [6]

9. (*a*) Explain J-K flip-flop in detail with input and output waveforms. Also give the functions of preset and clear pin. [8]

(*b*) Design and explain MOD 5 asynchronous counter with related timing diagram. [8]

Or

10. (*a*) Design 3-bit synchronous up counter using J-K flip-flops and K-map. [8]

(*b*) Explain edge triggered and level triggered flip-flops. Also explain D-flip-flop in detail. [8]

11. (*a*) Explain 1 : 4 demultiplexer along with logic diagram and truth table. [8]

(*b*) Explain dual slope ADC in detail. [8]

Or

12. Write short notes on : [16]

(*i*) Static RAM

(*ii*) Dynamic RAM

(*iii*) EPROM

(*iv*) EEPROM.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-154

S.E. (Electrical) (First Sem.) EXAMINATION, 2010

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2008 COURSE)

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*) What is meant by static and dynamic characteristics of measuring instruments ?

Explain : Accuracy, resolution, drift. [8]

(*b*) Describe construction and working of PMMC instrument with suitable diagram. Derive its torque equation with usual notations. [10]

Or

2. (*a*) Give detailed classification of measuring instruments. Elaborate each type in brief. [8]

(*b*) (*i*) The inductance of moving iron ammeter with a full scale deflection of 90º at 1.5 amp is given by the expression $L = 180 + 40\,\theta - 4\theta^2 - \theta^3$ μH, where θ is deflection in radian from zero position. Calculate spring constant. [4]

(*ii*) With a neat sketch, explain construction and working of moving iron instrument. What are the advantages of this instrument ? [6]

P.T.O.

3. (*a*) Give classification of resistance. Give suitable method of measurement for each category. [6]

(*b*) What are the different detectors used in a.c. bridges ? Elaborate each type in brief. Derive the general equation for bridge balance. [6]

(*c*) A length of cable is tested for insulation resistance by loss of charge method. An electrostatic voltmeter of infinite resistance is connected between cable conductor and earth forming a joint capacitance of 750 pF. It is observed that after charging, the voltage falls from 250 volt to 92 volt in 1 minute. Calculate the insulation resistance of cable. [4]

Or

4. (*a*) Draw circuit diagram of Kelvin's double bridge. Derive expression for unknown resistance with usual notations. [6]

(*b*) With a circuit diagram derive the equation for unknown capacitance measurement using Schering bridge. [6]

(*c*) The arms of Anderson's bridge are as follows :

arm AB : Unknown impedance with R_1, L_1 in series with variable resistor r_1

arm BC : Pure resistance R_3 = 100 W

arm CD : Pure resistance R_4 = 200 W

arm DA : Pure resistance R_2 = 250 W

arm DE : Variable pure resistance r

arm EC : A loss free capacitor C = 1 μF

arm BE : A detector.

a.c. supply is connected between terminal A and C. Calculate resistance and inductance R_1, L_1, if r_1 = 43.1 W and r = 229.7 W under balance condition. [4]

5. (*a*) State and explain errors in dynamometer type wattmeter. Also state the compensation for each type of error. [6]

(*b*) Two wattmeter method is used to measure power of three phase star connected lamp bank at balanced load condition. The phase voltage is $200/\sqrt{3}$ volt and line current is 5.5 amp. What will be the reading of each wattmeter ? If now load is connected in delta across same supply, what will be the reading of each wattmeter ? [6]

(*c*) Draw block diagram of multimeter. [4]

Or

6. (*a*) With a block diagram explain working of digital frequency meter. [6]

(*b*) With circuit diagram and phasor diagram explain one wattmeter method for measurement of reactive power in $(R + L)$ load. [6]

(*c*) Write a short note on LPF type wattmeter. [4]

SECTION II

7. (*a*) Explain two element energy meter with neat diagram. [8]

(*b*) An energy meter is designed to make 3200 impulses of LED for one unit of energy. Calculate the no. of impulses made by it when connected to a load carrying 20A, 230V, 0.8 p.f. for an hour. If it actually makes 12000 impulses, find the % error. [4]

(*c*) Define the following terms associated with instrument transformer :

(*i*) Transformation ratio

(*ii*) Turns ratio

(*iii*) Nominal ratio. [6]

Or

8. (*a*) Explain construction and operation of single phase induction type energy meter with neat diagram. Derive torque equation. [12]

(*b*) A 230 V, single phase energy meter is connected to a constant load of 6 A, unity power factor for 8 hours.

(*i*) If the impulses made during this are 35328, what is meter constant in imp/kWh.

(*ii*) Calculate the power factor of load if no. of impulses made by LED are 31795 when operating at 230 V, 9A for 6 hours. [6]

9. (*a*) What are different selection factors for selecting transducers. [4]

(*b*) In an experiment, the voltage across 5 kW resistor is applied to C.R.O. The screen shows a sinusoidal signal of total vertical occupancy 4 cm and total horizontal occupancy of 2 cm. The front panel controls volts/div and time/div are on 5 V/div and 5 ms/div respectively. Calculate the maximum, rms values of voltage across resistance and current through resistance. Also find its frequency. [6]

(*c*) Explain Pirani guage for measurement of low pressure. Also state advantages and disadvantages. [6]

Or

10. (*a*) What are the advantages of electric transducer ? [4]

(*b*) Explain the following terms associated with CRO :

(*i*) Volts/division

(*ii*) X10

(*iii*) Invert. [6]

(*c*) Explain different characteristics of transducer. [6]

11. (*a*) Explain ultrasonic flowmeter with neat diagram. [8]

(*b*) Explain construction and working of LVDT with neat diagram. [8]

Or

12. (*a*) Explain hydraulic method for measurement of level. [8]

(*b*) Explain foil strain guage. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-155

S.E. (Electrical Engineering) (Second Sem.) EXAMINATION, 2010

POWER SYSTEM—I

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *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 economical advantages of interconnected operation of power generating stations ? [6]

(*b*) Write a short note on time of day tariff. [4]

(*c*) A generating station supplies different customer groups :

Industrial customer : 700 MW load

Commercial customer : 300 MW load

Domestic customer : 200 MW load.

The maximum demand on the station is 1000 MW and number of kWh generated per year is 50×10^5. Determine :

(*i*) Diversity factor

(*ii*) Average load

(*iii*) Annual load factor. [6]

Or

2. (*a*) Define the following factors associated with generating stations :

(*i*) Load factor

(*ii*) Demand factor

(*iii*) Diversity factor. [6]

(*b*) Write a short note on H.T. and L.T. customers. [4]

(*c*) The load on a power plant on a typical day is :

Time	**Load** (MW)
12—6 am	10
6—10 am	30
10 am—6 pm	60
6—10 pm	90
10 pm—12 am	10

Plot daily load curve and load duration curve. Also find the energy supplied by the plant in 24 hours. [6]

3. (*a*) What are the major electrical equipments used in a power plant ? List them all. [6]

(*b*) Define the term string efficiency.

Why is string efficiency of suspension type insulators less than 100% ? State different methods of equalization of potential across each unit of a string of suspension insulators and explain any *one* of them in brief. [10]

Or

4. (*a*) Write a note on control room equipments in a generating station. [8]

(*b*) A string of suspension insulators consists of four units. The capacitance between each link pin and earth is 1/10th of the self-capacitance of a unit. The voltage between the line conductor and earth is 100 kV. Find the voltage distribution across each unit and string efficiency. [8]

5. (*a*) Write a short note on skin effect. [6]

(*b*) Derive an expression for the inductance of a three phase overhead transmission line when conductors are unsymmetrically spaced but transposed. [6]

(*c*) In a horizontal configuration of a three phase three wire system, conductors are arranged in one plane and are 4 m apart. The conductor diameter is 2 cm. Considering the length of the line to be 80 km, find the total inductance of the line. Assume complete transposition. [6]

Or

6. (*a*) Derive the expression for internal and external flux linkage of a conductor carrying current I and thereafter derive the expression for inductance of a single phase line. [10]

(*b*) A three phase single circuit bundled conductor line with two sub-conductors per phase has horizontal spacing with 6.1 m between the centre lines of adjacent phases. The distance between the sub-conductors of each phase is 30.5 cm and each sub-conductor has a diameter of 2.54 cm. Find the inductance per phase per km. [8]

SECTION II

7. (*a*) Derive the equation for capacitance per km of a single phase overhead transmission line having distance 'D' between the conductors and '*r*' as the radius of each conductor. [6]

(*b*) Explain the 'Method of Images' in determining the effect of earth on the capacitance calculation for overhead transmission lines. [6]

(*c*) A 132 kV, 50 Hz, 100 km long three phase line has its conductors at the corners of a triangle with sides 6 m, 6 m and 10 m. The conductor radius is 1.5 cm. Find the capacitance per phase per km and charging current per phase. [6]

Or

8. (*a*) Derive the expression for the capacitance per phase of a three phase overhead transmission line with unsymmetrical spacing of conductors, taking into account the effect of earth. Assume complete transposition. Comment on the effect of earth on the capacitance of the transmission line. [10]

(*b*) A single phase 10 km line is 6 m above the ground. The diameter of each conductor is 2 cm and is separated 4 m horizontally. Find :

(*i*) Capacitance between the conductors with the effect of ground.

(*ii*) Capacitance between phase and neutral taking the presence of ground into account.

(*iii*) Capacitance between the conductors neglecting the presence of ground.

(*iv*) Charging current when the line is charged at 33 kV, 50 Hz. [8]

9. (*a*) Give classification of transmission line. [4]

(*b*) Derive the expression for parameters of equivalent Tee circuit in terms of line parameters for a long transmission line. [6]

(*c*) The following data refers to a 50 Hz, single phase transmission line, length 20 km.

Load delivered at receiving end is 4 MW at 0.8 p.f. lagging.

Resistance of each conductor = 0.025 W/km.

Inductance = 0.7 mH/km.

The voltage at the receiving end is required to be kept at 10 kV. Find the sending end voltage. [6]

Or

10. (*a*) Express the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with nominal pi method of representation. Evaluate the generalised circuit constants. [8]

(*b*) A single circuit, 50 Hz, three phase, 250 km long transmission line has r = 0.3 W/km, L = 2.1 mH/km and C = 0.014 μF/km. Find A, B, C and D constants of the line using long line consideration. [8]

11. (*a*) Derive expression for maximum and minimum dielectric stress in a single core cable. [8]

(*b*) A transmission line has a span of 120 m between level supports. The conductor has a cross-sectional area of 3 cm^2. The tension in the conductor is 2000 kg. If the specific gravity of the conductor is 9.9 gm/cm^3 and wind pressure is 1.5 kg/m length, calculate the sag. Also calculate the vertical sag. [8]

Or

12. (*a*) Derive an expression for sag in case of an overhead transmission line if the supports are at unequal level. [8]

(*b*) The capacitances of a three-core belted type cable are measured as detailed below :

(*i*) Between three cores bunched together and sheath is 10 μF.

(*ii*) Between a conductor and the other two connected to sheath together is 8 μF.

Calculate the capacitance per phase. Also find the charging current when connected to 33 kV, 50 Hz supply. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-156

S.E. (Electrical) (Second Sem.) EXAMINATION, 2010

ELECTRICAL MACHINES—I

(2008 COURSE)

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 losses present in the transformer and their locations ? How will you separate hysteresis and eddy current losses from the knowledge of iron losses of a transformer ? [8]

(*b*) A 250 kVA, 1-f transformer has 98.135% efficiency at full-load and 0.8 lagging p.f. The efficiency at half-load and 0.8 lagging p.f. is 97.751%. Calculate the iron loss and full-load copper loss. [8]

Or

2. (*a*) What is an Auto-transformer ? Obtain the expression for saving of copper used in Auto-transformer as compared to simillar two winding transformer. [8]

(*b*) The open circuit and short circuit tests on a 5 KVA, 250/125 V, 50 Hz, 1-f transformer gave the following results :

O.C. Test : 250 V, 0.7 Amp, 90 Watt (HV side)

S.C. test : 12 V, 30 Amp, 90 Watt (LV side)

Calculate :

(*i*) Full-load efficiency and

(*ii*) The voltage on LV side when supplying full-load current both at 0.8 leading p.f. [8]

3. (*a*) What are the conditions to be satisfied for parallel operation ? Explain the load sharing for equal voltage ratio. [8]

(*b*) Two 1-f transformers A and B rated at 250 KVA each are operated on both sides percentage impedances for A and B are $(1 + j\,6)$ and $(1.2 + j\,4.8)$ respectively. Compute the load shared by each when the total load is 500 kVA at 0.8 p.f. lagging. [8]

Or

4. (*a*) Explain the V-V connection for a 3-f transformer for supplying a 3-f balanced load at u.p.f. List advantages and disadvantages of such connection. [8]

(*b*) Explain Scott connection to convert 3-ph supply to 2-ph supply. [8]

5. (*a*) Explain the construction of DC machine. [10]

(*b*) A DC shunt motor runs at a speed of 1,000 rpm on no load taking a current of 6 Amp from supply, when connected to 220 V dc supply. Its full-load current is 50 Amp. Calculate its speed on full-load. Assume R_a = 0.3 W and R_{sh} = 110 W. [8]

Or

6. (*a*) Show the power flow diagram of DC motor. [5]

(*b*) Obtain the torque equation of DC motor. [5]

(*c*) What is back e.m.f. ? Explain the significance of back e.m.f. [4]

(*d*) A 4-pole series motor has Z = 944, wave wound, flux/pole = 34.6 mWb. Gross torque 209 N-m, supply voltage = 500 V and R = 3 W. Calculate line current and speed. [4]

SECTION II

7. (*a*) Explain the following terms : [8]

(*i*) Commutation

(*ii*) Time of commutation

(*iii*) Reactance voltage

(*iv*) Straight line commutation.

(*b*) Explain any *two* methods of speed control of a D.C. series motor. [8]

Or

8. (*a*) Write short notes on : [8]

(*i*) Interpole

(*ii*) Compensating winding.

(*b*) Draw and explain the Torque-Armature Current, Speed-Current and Torque-Speed characteristics of DC series motor. [8]

9. (*a*) A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate :

(*i*) The speed at which the magnetic field of the stator is rotating.

(*ii*) The speed of the rotor when the slip is 0.04.

(*iii*) The frequency of the rotor currents when the slip is 0.03.

(*iv*) The frequency of the rotor currents at standstill. [8]

(*b*) Distinguish between squirrel cage and phase wound induction motor. [8]

Or

10. (*a*) Derive the expression regarding 3-phase induction motor for the following : [8]

(*i*) $\dfrac{\text{Full load torque}}{\text{Maximum torque}}$

(*ii*) $\dfrac{\text{Starting torque}}{\text{Maximum torque}}$.

(*b*) A 746 kW, 3-phase, 50 Hz, 16 pole induction motor has a rotor impedance of (0.02 + j 0.15) W at standstill. Full torque is obtained at 360 r.p.m. Calculate :

(*i*) The ratio of maximum to full-load torque

(*ii*) The speed of maximum torque and

(*iii*) The rotor resistance to be added to get maximum starting torque. [8]

11. (*a*) Draw and explain the exact and approximate equivalent circuit diagram of Induction motor. [9]

(*b*) Why are starters necessary for starting 3-phase induction motor ? Also write a short note on auto-transformer starter. [9]

Or

12. (*a*) Explain any *two* methods of speed control of a 3-phase Induction Motor. [9]

(*b*) A 3-phase, 6-pole, 50 Hz induction motor takes 60 A at full-load speed of 940 r.p.m. and develops a torque of 150 N-m. The starting current at rated voltage is 300 A. What is the starting torque ? If a star/delta starter is used, determine the starting torque and starting current. [9]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-157

S.E. (Electrical) (Second Semester) EXAMINATION, 2010

NETWORK ANALYSIS

(2008 COURSE)

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 : [6]

(*i*) Ideal and practical voltage sources

(*ii*) Ideal and practical current sources.

(*b*) Find voltage across capacitor V_C using mesh analysis. [10]

Fig. 1

Or

2. (*a*) Explain : [6]

(*i*) Circuits and networks

(*ii*) Passive and active networks

(*iii*) Linear and non-linear networks.

(*b*) Two coupled coils L_1 = 15 mH and L_2 = 25 mH are connected in two different ways, series adding and series opposing. Obtain equivalent inductances of the connections, if the coefficient of coupling K = 0.8. [4]

(*c*) Find the current through dependent source and 12 W resistor. Also find value of dependent source. Use node analysis. [6]

Fig. 2

3. (*a*) Find the voltage across r_L using superposition theorem. [8]

Fig. 3

(*b*) Obtain current in 2 W resistor in the circuit by using Thevenin's theorem. [8]

Fig. 4

Or

4. (*a*) Show the validity of reciprocity theorem for the following networks. [8]

and

Fig. 5

(*b*) State and explain : [8]

(*i*) Substitution theorem

(*ii*) Compensation theorem.

5. (*a*) Obtain the expression for capacitor voltage in a RC series circuit connected to a d.c. voltage V for $t > 0$. Assume initial charge across capacitor as zero. Also sketch the response graph for the current through capacitor and from the graph define time constant of the circuit. [9]

(*b*) In the network, find the current through the inductor for all values of t. [9]

Fig. 6

Or

6. (*a*) State all properties of Laplace transform. [4]

(*b*) Using Laplace transformation technique, find $i_2(t)$ at $t = 0^+$, the following switching at $t = 0$ of switch K in Fig. 7. Assume the network previously de-energized. [10]

Fig. 7

(*c*) Define and explain impulse function. What is the its Laplace transform ? State the relation between impulse and step function. [4]

SECTION II

7. (*a*) Obtain the complex power of the sources. [6]

Fig. 8

(*b*) What should be the value of 'R' such that maximum power transfer can take place for the network. Obtain the amount of this power. [6]

Fig. 9.

(*c*) Explain cascade connection of two port network parameter using transmission parameters. [4]

Or

8. (*a*) Explain hybrid parameters of two port network. Also obtain hybrid parameters in the terms of impedance parameters. [8]

(*b*) Find Y parameters. [8]

Fig. 10

9. (*a*) State and explain the properties of Fourier transform. [8]

(*b*) Explain high pass filter with circuit, characteristics and cut-off frequency. [8]

Or

10. (*a*) Find the Fourier series of single rectangular pulse as shown below. [8]

Fig. 11

(*b*) Explain the following terms : [8]

(*i*) Half-wave symmetry

(*ii*) Quarter wave symmetry

(*iii*) Odd symmetry

(*iv*) Even symmetry.

11. (*a*) For the network shown in Fig. 12, find the transfer functions $G_{21}(s)$, $Z_{21}(s)$ and driving point impedance $Z_{11}(s)$. [9]

Fig. 12

(*b*) The current I(*s*) in a network is given by : [9]

$$I(s) = \frac{2s}{(s+1)(s+2)}.$$

Plot the poles and zeros in the *s* plane and hence obtain time domain response.

Or

12. (*a*) For the network shown in Fig. 13, calculate : [12]

(*i*) Transfer functions $G_{21}(s)$, $G_{12}(s)$, $Z_{21}(s)$ and $Y_{21}(s)$

(*ii*) Driving point impedance $Z_{11}(s)$

R_1

Fig. 13

(*b*) Write short note on location of poles on *s*-plane and time domain behaviour of the output. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-158

S.E. (Electrical Engineering) (Second Sem.) EXAMINATION, 2010

DIGITAL COMPUTATIONAL TECHNIQUE

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

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

(*iii*) Figures to the right indicate full marks.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain truncation and round-off error with suitable example. [6]

(*b*) Use bisection method to find the roots of the equation $e^x - 3x = 0$, correct to three places of decimals. [6]

(*c*) The height of an observation tower was estimated to be 49 m, whereas its actual height was 47 m. Calculate its absolute, relative errors. [6]

Or

2. (*a*) Use synthetic division with $x = 1$, to find $f'(1)$ and $f''(1)$ for the equation :

$$F(x) = x^3 - x^2 - 1.0001x + 0.9999 = 0. \quad [6]$$

(*b*) State and explain Descarte's rule of sign. [6]

(*c*) Explain numerical instability. How can it be avoided ? [6]

3. (*a*) Explain Regula-Falsi method to find roots of a transcendental equation ? What are the failure cases ? [8]

(*b*) Find the root of the equation $x^4 + 12x + 7 = 0$, lying between –2 and –3 correct to 4 places of decimals, using Newton-Raphson method. [8]

Or

4. (*a*) Find the quadratic factor $x^2 + px + q = 0$ of the polynomial $x^4 - 3x^3 + 20x^2 + 44x + 54 = 0$ using Lin-Bairstow method and taking the initial values of $p = 2$ and $q = 2$. Perform two iterations only. [8]

(*b*) Derive Chebyshev iterative formula to find the root of an equation. [8]

5. (*a*) Explain Gauss-Seidel method to find the solution of simultaneous equation. [8]

(*b*) Using Gauss-elimination method to solve the following system of equation : [8]

$$8x_1 - 3x_2 + 2x_3 = 20$$

$$4x_1 + 11x_2 - x_3 = 33$$

$$6x_1 + 3x_2 + 12x_3 = 36$$

Or

6. (*a*) Explain Gauss-Jacobi method for solution of simultaneous equations. [8]

(*b*) Find A^{-1}, using Gauss-Jordan method if :

$$A = \begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix}.$$ [8]

SECTION II

7. (*a*) R is the resistance to motion of a train at speed V. Find a law of the type $R = a + bV^2$ using the following data : [8]

V (km/hr)	**R** (km/hr)
10	8
20	10
30	15
40	21
50	30

(*b*) Using Largrange's formula find a polynomial using the following data :

x	$y = f(x)$
2	94.8
5	87.9
8	81.3
14	68.7

Hence find $f(6)$. [8]

Or

8. (*a*) Estimate the production of sugar in the year 1935 from the data given below : [8]

Year	**Production (lakh-tonnes)**
1931	17.1
1932	13.0
1933	14.0
1934	9.6
1936	12.4
1937	18.2

(*b*) Explain Newton's Forward interpolation method. [8]

9. (*a*) Why Adam-Bashforth and Mine's method are known as predictor corrector methods ? Explain any *one* of them in detail. [8]

(*b*) Solve by using forth order Runge-Kutta method to find $y(0.2)$ and $y(0.4)$, given that :

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

by taking $h = 0.2$. [10]

Or

10. (*a*) Explain Taylor series method for the solution of ordinary differential equation. [8]

(*b*) Using Euler's method, find approximate value of y when $x = 0.6$ of

$$\frac{dy}{dx} = 1 - 2xy,$$

given that $y(0) = 0$ (take $h = 0.2$). [10]

11. (*a*) Derive the equation for Trapezoidal rule for numerical integration using Newton-Cote's quadrature formula. [6]

(*b*) Evaluate :

$$\int_1^2 \frac{\sin x}{x} \, dx$$

using Simpson's (3/8)th rule taking 10 equal intervals. [10]

Or

12. (*a*) Evaluate

$$\int_{0.5}^{0.9} x^{1/2} e^{-x} \, . \, dx$$

by using Simpson's (1/3)rd rule taking 8 intervals. [10]

(*b*) Evaluate :

$$\int_{0.2}^{1.4} (\sin x - \log_e x + e^{-x}) \, . \, dx$$

using the Trapezoidal rule taking 12 intervals. [6]

[3862]-159

S.E. (Electrical) (Second Sem.) EXAMINATION, 2010

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*) Figures to the right indicate full marks.

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

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw and explain 4K ROM interfacing with 8085 from 0000H. [8]

(*b*) Explain the following instructions of 8085 microprocessor : [10]

(*i*) LDA Addr

(*ii*) DCX Rp

(*iii*) RAR

(*iv*) ANI 00H

(*v*) JMP Addr.

Or

2. (*a*) Explain various flags with format of status flag register. [8]

(*b*) Draw and explain the block diagram architecture of 8085 microprocessor and function of each block. [10]

3. (*a*) What is interrupt ? Explain enabling, disabling and masking of interrupts. [8]

(*b*) Write an assembly language program for delay of 10 ms using two registers. Microprocessor operating frequency is 2 MHz. Calculate the required count. [8]

Or

4. (*a*) Explain stack operation of 8085 microprocessor. [8]

(*b*) Write a program to find sum of ten numbers stored in array from B000H location onwards. Store the result at C000H location. [8]

5. (*a*) Explain RS232 standard used for serial communication. [8]

(*b*) Draw and explain block diagram of 8251. [8]

Or

6. (*a*) Explain command instruction format and status word format of 8251. [8]

(*b*) Compare synchronous and asynchronous data transfer. [8]

SECTION II

7. (*a*) Draw functional block diagram of 8254 and explain function of each block. [8]

(*b*) List the operating modes of 8255. Give its control word format in I/O mode and BSR mode. [8]

Or

8. (*a*) Draw and explain the functional block diagram of 8255 PPI. [8]

(*b*) Explain mode 0 and mode 1 operation of 8254. [8]

9. (*a*) Draw interfacing diagram of DAC with 8085 microprocessor. Write an assembly language program to generate square wave using DAC. [10]

(*b*) How power factor is measured using 8085, explain with block diagram. [8]

Or

10. (*a*) With the help of interfacing diagram, explain interface of ADC0808 with 8085. Based on interfacing diagram write an assembly language program for A to D conversion. [10]

(*b*) Explain application of 8085 for measurement of voltage and current. [8]

11. (*a*) Explain application of 7 segment display using 8085. [8]

(*b*) Explain D.C. motor control using 8085. [8]

Or

12. (*a*) Explain stepper motor control using 8085. [8]

(*b*) Explain temperature control of furnace or oven using 8085. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-161

S.E. (E & TC/Elex)(First Semester) EXAMINATION, 2010

SIGNALS AND SYSTEMS

(2008 COURSE)

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*) Determine whether the signal is an energy or power signal. Find the value of the same. (Refer Fig. 1) : [6]

$x(t)$

3

$3e^{-t/2}$

-1 0 t

Fig. 1

P.T.O.

(*b*) Determine whether the signal is periodic or aperiodic. If periodic, find its period :

(*i*) $x(t) = 2 \cos \dfrac{2\pi t}{3} + 3 \cos \dfrac{2\pi t}{7}$ [4]

(*ii*) $x[n] = \cos 2\, n.$ [2]

(*c*) Find the odd and even parts of the signal (Refer Fig. 2) : [6]

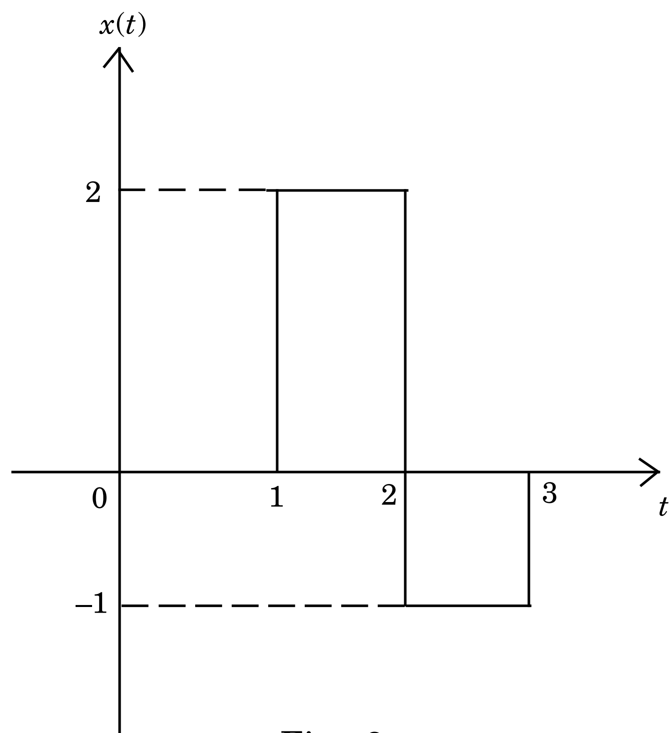


Fig. 2

Or

2. (*a*) Sketch the following waveforms : [5]

(*i*)

(*ii*) .

(*b*) Determine if the following systems is memoryless, causal, linear, time invariant and stable : [7]

$y(t) = \sin\,[x\,(t + 2)].$

(*c*) Determine if the given system is static, causal, stable if impulse reponse $h(t)$ is given by $h(t) = e^{-2t}.\ u(-t).$ [6]

3. (*a*) State the properties of convolution integral. [3]

(*b*) Find the step response of the system whose impulse response is : [6]

(*i*)

(*ii*) $u[n]$.

(*c*) Compute the convolution of and

. [7]

Or

4. Find the response $y(t)$ of the LTI system shown by the block diagram (Refer Fig. 3) : [16]

[illegible]

A

$u(t)$

$w(t)$

$x(t)$

LTI System

$y(t)$

Delay 2 sec.

Fig. 3

where

$$h(t) = e^{-2t} \quad \text{for} \quad t > 0$$
$$= 0 \quad \text{elsewhere.}$$

5. (*a*) Obtain the exponential Fourier series of the rectangular pulse shown below (Refer Fig. 4) : [8]

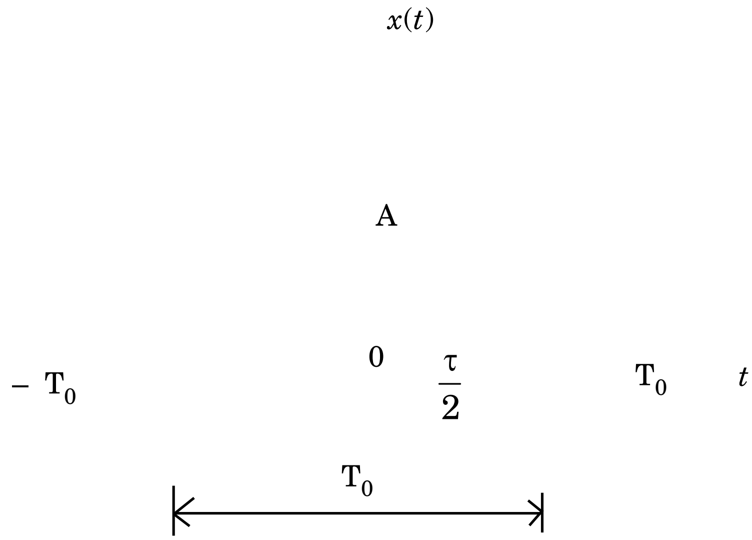


Fig. 4

(*b*) Draw the magnitude and phase spectrum of the signal in Q. 5(*a*) above. [8]

Or

6. (*a*) Obtain the Fourier transform of the signal shown below, using linearity property (Refer Fig. 5). [10]

$x(t)$

1

-2 0 2 t

-1

Fig. 5

(*b*) Obtain the Fourier transform of a unit step function and plot its magnitude and phase spectrum. [6]

SECTION II

7. (*a*) A 0.5 F capacitor is in the network which is initially charged to 10 V and switch is closed at $t = 0$. Find $i(t)$ for $t > 0$ using Laplace transform (Refer Fig. 6) : [8]

2 Ω

0.5 F

1 H

$i(t)$

Fig. 6

(*b*) Find the Laplace transform of $x(t) = e^{-3t} \cdot u(-t)$ and plot its R.O.C. [5]

(*c*) Find the initial and final value of $x(t)$ given : [5]

$$X(s) = \frac{2s + 3}{s^2 + 5s - 7}$$

Also state the Initial and Final value theorem.

Or

8. (*a*) Obtain Laplace transform of the waveform shown in Fig. 7 : [8]

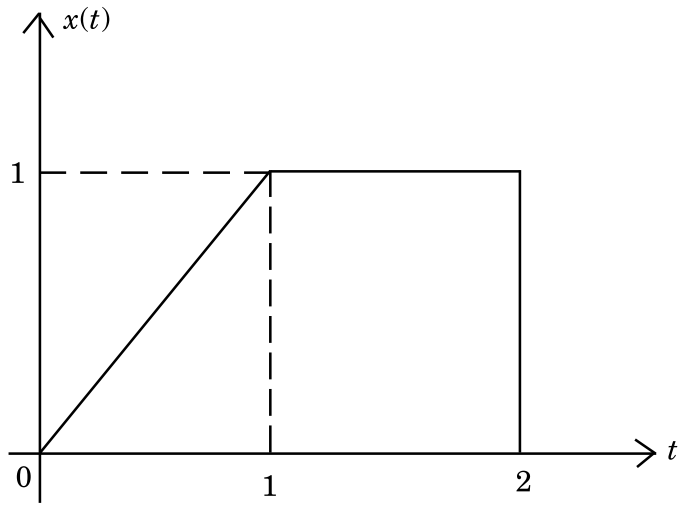


Fig. 7

(*b*) Using properties of Laplace transform, find if : [5]

$$X(s) = \frac{4s}{s^2 + 2s + 1}$$

(*i*) $x(5t)$

(*ii*) $x(t) * u(t)$.

(*c*) Find the time domain representation of the signal given : [5]

$$X(s) = \frac{s^2 + 4s + 3}{(s + 2)(s^2 + 2s + 1)}.$$

9. A time domain signal $x(t) = e^{-4t} u(t)$. [16]

Find :

(*i*) Autocorrelation function

(*ii*) Spectrum X(f)

(*iii*) Energy spectral density

(*iv*) Energy

(*v*) Plot of autocorrelation

(*vi*) Plot of ESD.

Or

10. (*a*) Obtain the cross correlation of the following sequences : [8]

$$x_1[n] = \{\underset{\uparrow}{2}, 3, 4\}, \; x_2[n] = \{\underset{\uparrow}{1}, 2, 3\}.$$

(*b*) List the properties of energy spectral density and power spectral density. [8]

11. (*a*) A box contains 3 white, 4 red and 5 black balls. A ball is drawn at random. Find the probability that it is : [6]

(*i*) Red

(*ii*) Not black

(*iii*) Black or White.

(*b*) Explain Poisson's and Gaussian distribution function. [6]

(*c*) Find the expectation of random variable X which is defined by : [4]

X = –2 with probability 1/4

= 3 with probability 1/2

= 1 with probability 1/4

Find E[X^2].

Or

12. (*a*) Each letter of the word ATTRACT is written on a separate card. The cards are then thoroughly shuffled and four of them are drawn in succession. What is the probability of getting result as TACT ? [4]

(*b*) With an example explain the concept of continuous R.V. and Discrete R.V. What is the P.D.F. and C.D.F. ? Plot PDF of uniform distributed R.V. over an interval (0 to 2π). [8]

(*c*) A continuous R.V. X has the following density function : [4]

$$0 < X < 2$$

$$= 0 \qquad \text{elsewhere}$$

Find :

(*i*) The normalising factor k

(*ii*) The probabilities that $0.2 < X < 0.5$.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-162

S.E. (E & TC) (First Semester) EXAMINATION, 2010

SOLID STATE DEVICES AND CIRCUITS

(2008 COURSE)

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*) Use of electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) For the circuit shown in Fig. 1 calculate the currents I_1 and I_2. Consider both the diodes having $R_f = 10\ \Omega$ and $V_r = 0.6$ V. [8]

10 Ω D$_1$ D$_2$

3 V I_1 15 Ω I_2 10 Ω

Fig. 1

P.T.O.

(*b*) Compare fast recovery diodes with respect to construction, working, characteristics, switching characteristics, and applications. [8]

Or

2. (*a*) Explain the following non-ideal current voltage characteristics of MOSFET : [9]

(*i*) Finite output resistance

(*ii*) Body effect

(*iii*) Subthreshold conduction.

(*b*) The *n*-channel E-MOSFET has the following parameters : [7]

$V_{CTS} = 3V$, $V_T = 1V$, $K = 0.15\ mA/V^2$,

$\lambda = 0.03\ V^{-1}$ and $V_{DS} = 8V$

Calculate :

(*i*) Drain current

(*ii*) The output resistance.

3. (*a*) The MOSFET used in the amplifier circuit shown in Fig. 2 has the following parameters. $I_{D(ON)} = 5$ mA, $V_{GS(ON)} = 6V$, $V_T = 3V$. Determine : [12]

(*i*) I_D

(*ii*) V_{GS}

(*iii*) V_{DS}

(*iv*) g_m.

24 V

2.2 K

10 mΩ

V_o

C_C

C_C

~ V_S

6.8 mΩ

750 Ω

C_S

Fig. 2

(*b*) State True *or* False : [6]

(*i*) The transconductance increases if channel length is reduced.

(*ii*) The action of MOSFET in its equivalent can best be represented as voltage controlled current source.

(*iii*) MOSFET does not suffer from thermal runaway.

(*iv*) MOS devices are subject to damage from electrostatic discharge.

(*v*) Channel-length modulation makes the output resistance in saturation finite.

(*vi*) MOSFET offers extremely high input resistance.

Or

4. (*a*) For the common source amplifier circuit shown in Fig. 3. [10]

Determine :

(*i*) g_m

(*ii*) A_V

(*iii*) R_i, R_i'

(*iv*) A_{V_s}

(*v*) R_o and R_o'.

Given :

$K = 0.4 \text{ mA/V}^2$, $V_T = 3V$, $I_D = 1.11$ mA

$V_{GS} = 4.66$ V, $r_d = 40$ $k\Omega$.

V_{DD}

4.7 kΩ

40 MΩ

C_C

V_o

C_C

V_i

2.2 K

10 MΩ

1.2 K

C_S

Fig. 3

(*b*) Define : [8]

(*i*) Threshold voltage

(*ii*) Pinch off voltage

(*iii*) Transconductance

(*iv*) Drain resistance.

5. (*a*) For the BJT amplifier circuit shown in Fig. 4, calculate : [12]

(*i*) A_v

(*ii*) R_i and R'_i

(*iii*) A_{V_s}

(*iv*) R_o and R'_o.

Given :

$$h_{ie} = 1.1 \text{ k}\Omega, \ h_{fe} = 50, \ h_{re} = 2.5 \times 10^{-4}$$

$$h_{oe} = 25 \ \mu\text{A/V}.$$

V_{CC}

68 K 10 K Ω

500 Ω V_o

C_C

C_C 10 K Ω

5.6 K

V_S

1 K 1 K

Fig. 4

(*b*) Discuss thermal runaway. [4]

Or

6. (*a*) The transistor amplifier circuit shown in Fig. 5 uses a transistor whose h-parameters are h_{ic} = 1.1 K, h_{fc} = – 51, h_{rc} = 1, h_{oc} = 25 µA/V. [12]

Calculate :

(*i*) A_v

(*ii*) R_i and R_i'

(*iii*) AVs

(*iv*) R_o and R_o'.

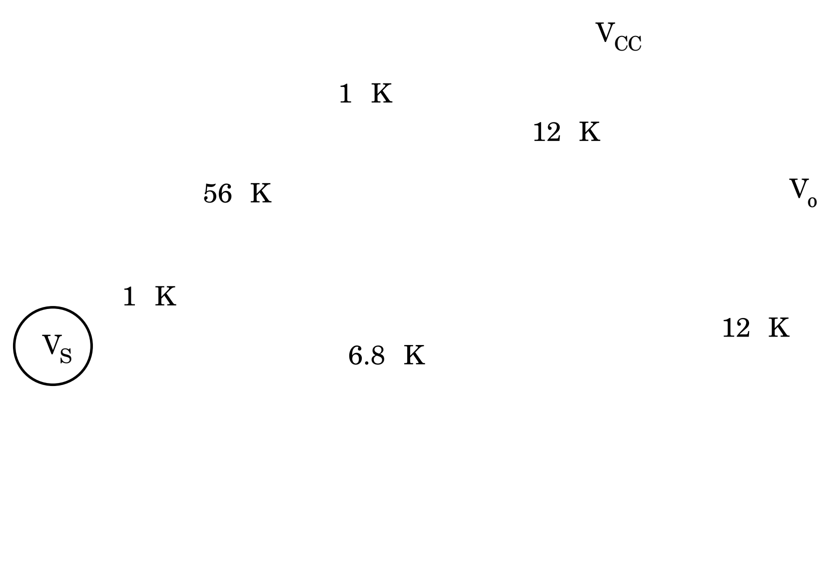


Fig. 5

(*b*) Explain need of multistage amplifier and its effect on the bandwidth. [4]

SECTION II

7. (*a*) (*i*) For the CE stage shown in Fig. 6 with $1/h_{oe} = \infty$, calculate the percentage tilt in the output if the input current I is a 100 Hz square wave.

(*ii*) What is the lowest frequency square wave which will suffer less than 1 percent tilt ? [10]

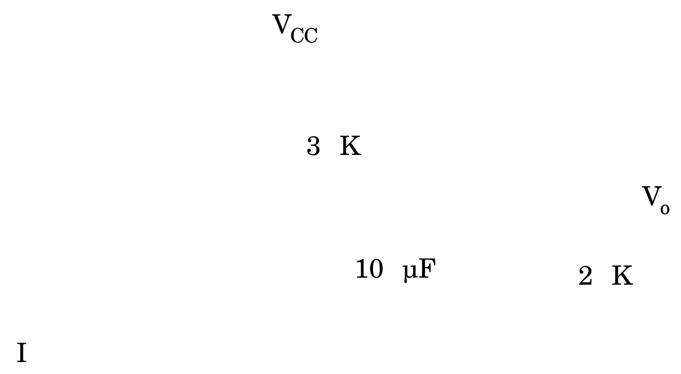


Fig. 6

(*b*) Draw and explain the small signal high frequency CE π-model of a transistor. [6]

Or

8. (*a*) The Bandwidth of an amplifier extends from 20 Hz to 20 kHz. Find the frequency range over which the voltage gain is down less than 1 dB from its midband value. [8]

(*b*) An amplifier is assumed to have a single pole high frequency transfer function. The rise time of its output response to a step function input is 35 nsec. Calculate the upper –3dB frequency for the amplifier. [4]

(*c*) Define F_{β}, f_{α} and f_{T}. [4]

9. (*a*) For the transistor amplifier stage shown in Fig. 7, $h_{fe} = 50$, $h_{ie} = 1.1$ K, $h_{re} = h_{oe} = 0$. Analyse the circuit for : [14]

(*i*) Type of feedback

(*ii*) β

(*iii*) R_M

(*iv*) R_{MF}

(*v*) A_{Vf}

(*vi*) R_{if}

(*vii*) R'_{Df}.

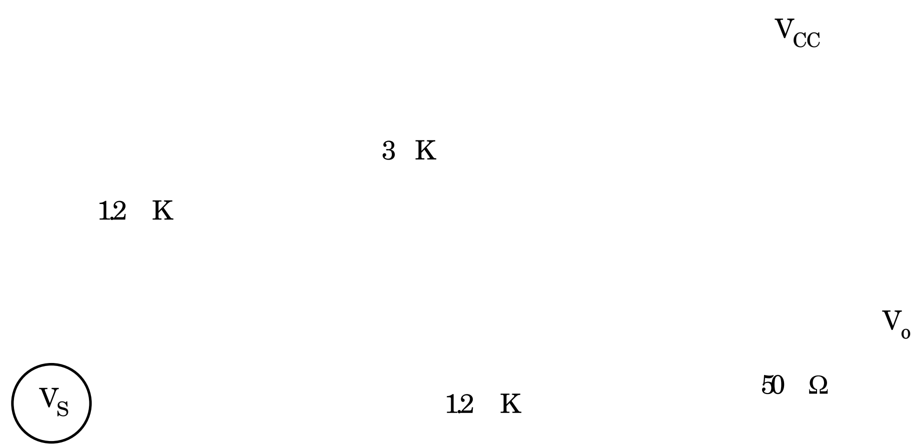


Fig. 7

(*b*) Draw neat circuit diagram of Hartley oscillator and explain its operation. [4]

Or

10. (*a*) An amplifier with an open loop voltage gain of 1,000 delivers 10 W of output power at 10 percent second harmonic distortion when the input signal is 10 mV. If 40 dB negative voltage series feedback is applied and the output power is to remain at 10 W, determine : [10]

(*i*) the required input signal

(*ii*) the percent harmonic distortion.

(*b*) An amplifier has an open loop gain of 100, and its lower and upper cut off frequency of 100 Hz and 100 kHz respectively. A feedback network with feedback factor of 0.99 is connected to the amplifier. Calculate the new lower and upper cutoff frequencies. [8]

11. (*a*) Explain advantages and disadvantages of class B push-pull power amplifier. What modifications in this circuit may eliminate most of the disadvantages of it ? What that modified power amplifier is known as ? [8]

(*b*) The power amplifier delivers 50 W output at 50% efficiency. The ambient temperature is 25°C. If the maximum allowable junction temperature is 150°C, then calculate : [8]

(*i*) Power dissipation

(*ii*) Maximum thermal resistance.

Or

12. (*a*) A class-B push-pull amplifier supplies power to a resistive load of 12 Ω. The output transformer has a turn ratio of 3 : 1 and efficiency 78.5%. [10]

Calculate :

(*i*) Maximum power output

(*ii*) Maximum power dissipation in each transistor

(*iii*) Maximum base and collector current for each transistor.

Given :

$V_{CC} = 20$ V, $h_{FE} = 25$.

(*b*) Explain how even harmonics get eliminated in class-B push-pull amplifier. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-163

S.E. (E & TC)(First Semester) EXAMINATION, 2010

NETWORK ANALYSIS

(2008 COURSE)

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*) State and explain maximum power transfer theorem as applied to AC circuits. [4]

(*b*) Determine the current through 10 Ω resistance of the network shown in Fig. 1, using the superposition theorem : [7]

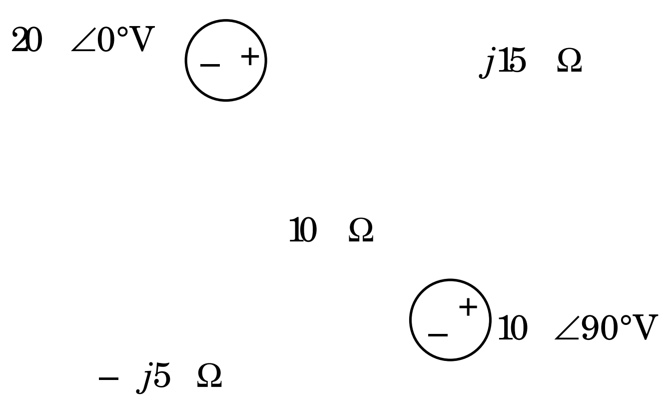


Fig. 1

(*c*) For the circuit shown in Fig. 2, find the current (I) flowing through 2 Ω resistance. [7]

2 Ω
1 Ω
1 Ω
I
1 A
2 V
2 V
2 Ω
1 Ω
1 Ω

Fig. 2

Or

2. (*a*) Calculate the current through Z_L using the Thevenin's theorem. Verify the result by direct calculations. Refer Fig. 3 : [7]

1 Ω
– *j*1 Ω
*j*1 Ω
Z_L
5 V
(1 + *j*1) Ω

Fig. 3

(*b*) Find the current through the resistance of 2 Ω in Fig. 4 using Millman's theorem. [7]

3 Ω j4 Ω 5 Ω

A

2 Ω 25 ∠90°V

10 ∠0°V

B

Fig. 4

(*c*) With appropriate examples explain the concept of source transformation and source shifting as in network analysis. [4]

3. (*a*) Compare the series and parallel RLC circuits based on the following points : [4]

(*i*) Possibility of resonance in series and parallel RLC circuit.

(*ii*) Impedance of series and parallel RLC circuit above and below, F_r and F_{ar} respectively.

(*iii*) Behaviour of the circuit at F_r and F_{ar}.

(*iv*) Applications.

(*b*) A constant voltage at a frequency 1 MHz is applied to an inductor coil in series with a variable capacitor. When the capacitor is set at 500 pF, the current has its maximum value, while the current is reduced to one half when the capacitance is 600 pF. Find :

(*i*) The resistance and the inductance of the coil.

(*ii*) The quality factor of the inductor. [6]

(*c*) A coil of 10 H and resistance of 10 Ω is in shunt with 100 pF capacitor. The combination is connected across a generator of 100 V, having internal resistance of 100 kΩ. Determine :

(*i*) Voltage across parallel circuit at resonance.

(*ii*) Bandwidth. [6]

Or

4. (*a*) Define "Null frequency". Explain Wien Bridge Network as a Notch Filter. [4]

(*b*) The generator resistance 'R_g' of an antiresonant circuit is increased to twice its original value i.e. '2 R_g'. Explain its effect on : [4]

(*i*) Bandwidth of the circuit

(*ii*) Selectivity of the circuit.

(*c*) A circuit contains resistance of 200 Ω, a capacitance of 100 pF and inductance of 100 μH in series. Find fall in the current if the generator frequency is increased by 20 kHz above resonance of the circuit. Also calculate the voltage across L and C at F_r. Find the maximum current in the circuit. Assume the generator has 50 Ω internal resistance with 10 V open circuit voltage. [8]

5. (*a*) What are asymmetrical networks ? Explain *two* characteristics of an asymmetrical network. [4]

(b) Design symmetrical lattice attenuator with 20 dB attenuation, working into 600 Ω impedance. [4]

(c) Design m derived T and π high pass filter section to work into load of 600 Ω with cut-off frequency of $\left(\frac{1000}{\pi}\right)$ Hz and peak attenuation frequency at 300 Hz. [8]

Or

6. (a) A constant K Band Pass Filter must have equal resonant and antiresonant frequencies. Justify the statement with appropriate reactance curves. [6]

(b) A π section filter network consists of a series arm inductance of 20 mH and two shunt arm capacitors of 0.16 μF each. Calculate cut-off frequency and attenuation at 1.5 kHz. What is the value of the nominal impedance in the pass band ? [5]

(c) Design a suitable matching half section to match a symmetrical T network with $Z_{OT} = 500\ \Omega$ to a generator having an internal resistance equal to 200 Ω. [5]

SECTION II

7. (a) Obtain the Laplace transform of the following input signals : [8]

(i) $t \cdot e^{-at}$

(ii) t^n

(iii) $e^{-at} \sin \omega t$

(iv) $\delta(t - a)$.

(b) Explain the physical significance of complex frequency. Define and explain Laplace transform. [4]

(*c*) State and explain : [4]

(*i*) Convolution theorem

(*ii*) Initial and final value theorem of Laplace transform.

Or

8. (*a*) In the network shown in Fig. 5, the switch S is opened at $t = 0$. Find out the node voltages $V_1(t)$ and $V_2(t)$, after opening the switch. [8]

10 Ω 1 S 10 Ω

2 $t = 0$

5 V 10 H

10 V $i(t)$

Fig. 5

(*b*) Obtain the inverse Laplace transform of : [4]

$$F(s) = \frac{7s + 2}{s^3 + 3s^2 + 2s}.$$

(*c*) Obtain the Laplace transform of basic R, L and C components with initial conditions. [4]

9. (*a*) Obtain the conditions of symmetry and reciprocity for the following : [8]

(*i*) *h*-parameters

(*ii*) T-parameters.

(*b*) For the network shown in Fig. 6, find driving point input impedance $z(s)$. Plot the pole and zeros of $z(s)$: [8]

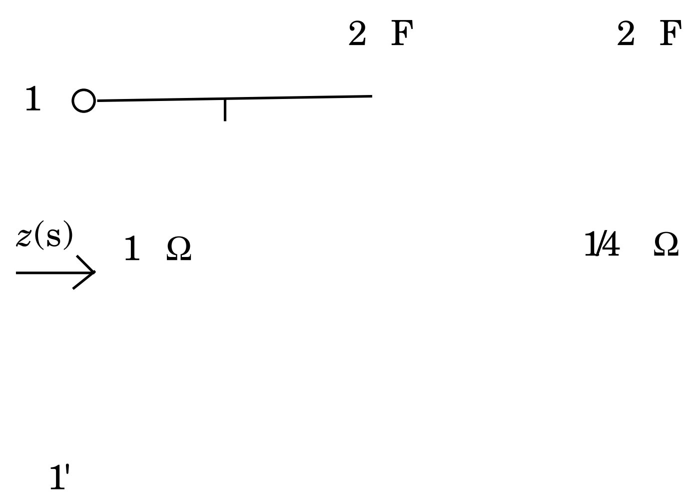


Fig. 6

Or

10. (*a*) Find y parameters for the circuit shown in Fig. 7. Using conversion formulae, calculate the Z-parameters also : [8]

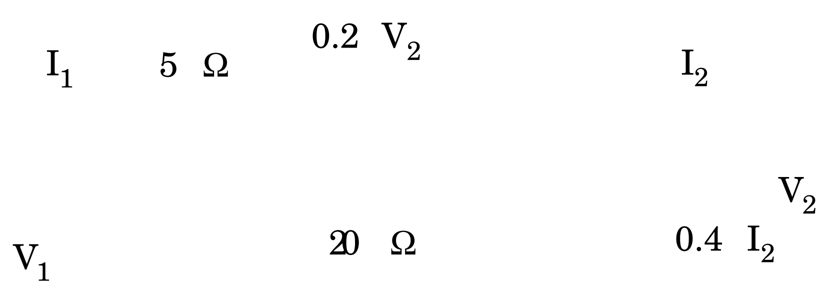


Fig. 7

(*b*) What is a network function ? Explain various types of network functions for a one port and two port networks. [4]

(*c*) Explain the significance of poles and zeros in network analysis. [4]

11. (*a*) Explain with neat diagram various types of transmission lines. State applications of each. [4]

(*b*) Define primary and secondary constants of a transmission line. Derive relationship between them. [6]

(*c*) A transmission line cable has the following primary constants per kilometer.

$R = 78\ \Omega$, $L = 1.75$ mH, $C = 0.0945\ \mu F$, $G = 62\ \mu℧$ at frequency of 1.6 kHz.

Calculate :

(1) Characteristic impedance

(2) Propagation constant

(3) Wavelength in km

(4) Velocity of signal travelling. [8]

Or

12. (*a*) What is distributed and lumped network. Explain the equivalent circuit of transmission line. [5]

(*b*) Explain the concept of standing waves on a transmission line. Are standing waves desirable ? Justify. [5]

(*c*) A 50 Ω lossless transmission line is terminated by a load impedance $Z_L = 50 - j75\ \Omega$. If the incident power is 100 mW, find the power dissipation in the load. [4]

(*d*) A cable has an attenuation of 3.5 dB/km and a phase constant of 0.28 rad/km. If 3 V is applied to the sending end, what is the voltage at a point of 10 km down the line when it is terminated into its characteristic impedance ? [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-164

S.E. (E & TC/Electronics) (I Sem.) EXAMINATION, 2010

DIGITAL LOGIC DESIGN

(2008 COURSE)

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 Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**.

(*vi*) In Section II : Attempt Q. No. **7** *or* **8**, Q. No. **9** *or* **10**, Q. No. **11** *or* **12**.

SECTION I

1. (*a*) Implement the following function using single 4 : 1 MUX and logic gates : [8]

$$F(A, B, C, D) = \Sigma m(0, 1, 5, 9, 10, 15).$$

(*b*) Minimize the expression using Quine-Mc-Clusky method : [10]

$$Y = \bar{A}B\bar{C}\bar{D} + \bar{A}B\bar{C}D + AB\bar{C}\bar{D} + AB\bar{C}D + A\bar{B}\bar{C}D + \bar{A}\bar{B}C\bar{D}.$$

Or

2. (*a*) Design a Gray to BCD code converter using two dual 4 : 1 MUX ICs and some logic gates. [6]

(*b*) Design even parity generator circuit for 4-bit input using multiplexer. [6]

(*c*) Design 2-bit comparator using suitable decoder. [6]

3. (*a*) Convert : [8]

(1) J-K FF to SR FF

(2) D FF to J-K FF.

(*b*) Design a type D counter that goes through states 0, 1, 2, 4, 0, ... the undesired states must always go to zero (000) on the next clock pulse. [8]

Or

4. (*a*) Design a pulse train generator using a shift register to generate the following waveform : [8]

(*b*) Design and implement synchronous modulo 6 Gray code counter using T FF. [8]

5. (*a*) Compare 'If' and 'Case' statement. Write down the VHDL code for 4 : 1 MUX. (Use behavioural modelling). [8]

(*b*) What is the difference between sequential and concurrent statement. [4]

(*c*) What is VHDL ? Write entity and architecture declaration for two input NAND gate. [4]

Or

6. (*a*) Consider a simple example of Half adder. How will you write a VHDL entity declaration for half adder ? Also write an architecture of Half adder in structural style of modelling and data flow style of modelling. [8]

(*b*) Write the VHDL code for DFF using synchronous and asynchronous reset input. [8]

SECTION II

7. (*a*) Design the sequential circuit using J-K FF for the state diagram shown in Fig. 1 : [8]

Fig. 1

(*b*) Explain : [8]

(1) State table

(2) State diagram

(3) Rules for state reduction

(4) State assignment.

Or

8. (*a*) Explain Moore circuit with example. Also compare Moore and Mealy circuit. [8]

(*b*) Design a sequence detector to detect a sequence 1101 (Using D FF and Mealy circuit). [8]

9. (*a*) State merits and demerits of CMOS logic family. Explain with neat diagram two input CMOS and TTL NAND gate. [12]

(*b*) Compare TTL, CMOS and ECL. [6]

Or

10. (*a*) Define the following parameter for digital IC and give their typical values for TTL and CMOS : [10]

(*i*) Propagation delay

(*ii*) Noise margin

(*iii*) Fan out

(*iv*) Figure of merit.

(*b*) Draw and explain TTL to CMOS and CMOS to TTL interfacing. [8]

11. (*a*) How to obtained 64 × 4 memory using 16 × 4 memory chip ? [8]

(*b*) A combinational circuit is defined by the function : [8]

$F_1(A, B, C) = \Sigma m(4, 5, 7)$

$F_2(A, B, C) = \Sigma m(3, 5, 7)$

Implement this ckt with PLA having 3 input, 3 product terms, and two outputs.

Or

12. (*a*) What is PLD ? What is the difference btween PAL and PLA ? Explain with the help of a neat diagram. [8]

(*b*) What is meant by SRAM and DRAM ? Explain in detail. Also compare SRAM and DRAM. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-165

S.E. (E & TC) (First Sem.) EXAMINATION, 2010

POWER DEVICES AND MACHINES

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve Q. **1** or Q. **2**, Q. **3** or Q. **4** and Q. **5** or Q. **6** from Section I and Q. **7** or Q. **8**, Q. **9** or Q. **10**, and Q. **11** or Q. **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, non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw the vertical cross-section of IGBT and explain its output characteristics. [6]

(*b*) Explain switching characteristics of MOSFET. [6]

(*c*) The bipolar transistor is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 1\ \Omega$. The dc supply voltage is $V_{CC} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If V_{CE} (sat) = 1 V and V_{BE} (sat) = 1.5 V, find :

(*i*) the value of R_B that results in saturation with an ODF of 5,

(*ii*) the β_{forced} and the power loss P_T in the transistor. [6]

Or

2. (*a*) What is anti-saturation control of power transistor ? [4]

(*b*) Draw and explain Gate Drive Circuit for IGBT. [6]

(*c*) Explain the switching characteristic of power diode. [4]

(*d*) Write a short note on Thermal runaway. [4]

3. (*a*) An SCR has a Vg-Ig characteristics given as Vg = 2 + 5 Ig. In a certain application, the gate voltage consists of rectangular pulses of 10 V and of duration 10μs is applied to gate through a 10 Ω series resistor. Calculate :

(*i*) Peak gate power

(*ii*) Triggering frequency to obtain an average gate power of 0.5 W. [6]

(*b*) Explain in detail the following current ratings of SCR in detail : [6]

(*i*) Average on state current

(*ii*) Surge current rating

(*iii*) I^2t rating.

(*c*) Explain with the help of circuit diagram, how DIAC is used as a triggering agent for a TRIAC. [4]

Or

4. (*a*) With the help of a neat structural diagram explain the turn off operation of GTO. [6]

(*b*) Describe the holding current and latching current applicable to an SCR with the help of static V-I characteristics. [6]

(*c*) Explain SCR triggering using UJT. [4]

5. (*a*) For a single-phase ac voltage regulator feeding a resistive load, draw the waveforms of source voltage, gating signals, output voltage, source and output current and voltage across SCRs. Describe its working with reference to the waveforms drawn. [10]

(*b*) What is inverting and rectifying mode of single-phase full converter with RL load ? [6]

Or

6. (*a*) Draw the circuit diagram, voltage and current waveforms for $\alpha = 60^\circ$, RL load of semi-converter. [6]

(*b*) A single-phase full wave ac voltage controller has a resistive load of R = 10Ω and the input voltage is V_s = 120V (rms), 60 Hz. The delay angles of thyristors T_1 and T_2 are equal : $\alpha_1 = \alpha_2 = \pi/2$.

Determine :

(*i*) the rms output voltage V_o,

(*ii*) the input PF,

(*iii*) the average current of thyristor I_A, and

(*iv*) the rms current of thyristor I_R. [8]

(*c*) What do you mean by commutation of SCR ? [2]

SECTION II

7. (*a*) Derive an expression for average output voltage of step down chopper. [4]

(*b*) Explain continuous and discontinuous current mode of step down copper with RL load. [6]

(*c*) The single-phase bridge inverter has a resistive load of R = 2.4 Ω and the dc input voltage is V_s = 48 V.

Determine :

(*i*) the rms output voltage at the fundamental frequency V_{01},

(*ii*) the output power P_o,

(*iii*) the average and peak current of each transistor,

(*iv*) the peak reverse blocking voltage V_{BR} of each transistor

(*v*) the THD,

(*vi*) the DF,

(*vii*) the HF and DF of LOH. [8]

Or

8. (*a*) Explain the use of step up operation for energy transfer. [4]

(*b*) Draw the circuit diagram, necessary waveforms and explain operation of single-phase full Bridge inverter with R load. [6]

(*c*) Explain the need for feedback diodes in inverter. [3]

(*d*) Explain various control strategies for d.c. choppers. [5]

9. (*a*) Explain the development of a revolving field in a three-phase IM ? [6]

(*b*) Why is the induced e.m.f. in a dc motor called the back e.m.f. or the counter e.m.f. ? [4]

(*c*) Compare squirrel cage rotor and wound rotor. [6]

Or

10. (*a*) A 220 V dc generator supplies 4 kW at a terminal voltage of 220 V, the armature resistance being 0.4 Ω. If the machine is now operated as a motor at the same terminal voltage with the same armature current, calculate the ratio of generator speed motor speed. Assume that the flux/pole is made to increase by 10% as the operation is changed over from generator to motor. [6]

(*b*) What is the voltage equation of motor and condition for maximum power ? [4]

(*c*) Explain Universal motor with reference to its construction, types and characteristics. [6]

11. (*a*) What differentiates a core type transformer from a shell type transformer ? [4]

(*b*) Write short notes on : [6]

(*i*) AC servomotor

(*ii*) Stepper motor.

(*c*) State various protection circuits for motors. Explain any *one* in detail. [6]

Or

12. (*a*) How does the speed vary in brushless dc motor which carrying torque ? [4]

(*b*) What is an autotransformer ? List its advantages and drawbacks. [4]

(*c*) Draw the circuit diagram and explain star-star connection of three-phase transformer and state merits, demerits and application of same. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-165

S.E. (E & TC) (First Sem.) EXAMINATION, 2010

POWER DEVICES AND MACHINES

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve Q. **1** or Q. **2**, Q. **3** or Q. **4** and Q. **5** or Q. **6** from Section I and Q. **7** or Q. **8**, Q. **9** or Q. **10**, and Q. **11** or Q. **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, non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw the vertical cross-section of IGBT and explain its output characteristics. [6]

(*b*) Explain switching characteristics of MOSFET. [6]

(*c*) The bipolar transistor is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 1\ \Omega$. The dc supply voltage is $V_{CC} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If V_{CE} (sat) = 1 V and V_{BE} (sat) = 1.5 V, find :

(*i*) the value of R_B that results in saturation with an ODF of 5,

(*ii*) the β_{forced} and the power loss P_T in the transistor. [6]

Or

2. (*a*) What is anti-saturation control of power transistor ? [4]

(*b*) Draw and explain Gate Drive Circuit for IGBT. [6]

(*c*) Explain the switching characteristic of power diode. [4]

(*d*) Write a short note on Thermal runaway. [4]

P.T.O.

3. (*a*) An SCR has a Vg-Ig characteristics given as Vg = 2 + 5 Ig. In a certain application, the gate voltage consists of rectangular pulses of 10 V and of duration 10μs is applied to gate through a 10 Ω series resistor. Calculate :

(*i*) Peak gate power

(*ii*) Triggering frequency to obtain an average gate power of 0.5 W. [6]

(*b*) Explain in detail the following current ratings of SCR in detail : [6]

(*i*) Average on state current

(*ii*) Surge current rating

(*iii*) I^2t rating.

(*c*) Explain with the help of circuit diagram, how DIAC is used as a triggering agent for a TRIAC. [4]

Or

4. (*a*) With the help of a neat structural diagram explain the turn off operation of GTO. [6]

(*b*) Describe the holding current and latching current applicable to an SCR with the help of static V-I characteristics. [6]

(*c*) Explain SCR triggering using UJT. [4]

5. (*a*) For a single-phase ac voltage regulator feeding a resistive load, draw the waveforms of source voltage, gating signals, output voltage, source and output current and voltage across SCRs. Describe its working with reference to the waveforms drawn. [10]

(*b*) What is inverting and rectifying mode of single-phase full converter with RL load ? [6]

Or

6. (*a*) Draw the circuit diagram, voltage and current waveforms for $\alpha = 60^\circ$, RL load of semi-converter. [6]

(*b*) A single-phase full wave ac voltage controller has a resistive load of R = 10Ω and the input voltage is V_s = 120V (rms), 60 Hz. The delay angles of thyristors T_1 and T_2 are equal : $\alpha_1 = \alpha_2 = \pi/2$.

Determine :

(*i*) the rms output voltage V_o,

(*ii*) the input PF,

(*iii*) the average current of thyristor I_A, and

(*iv*) the rms current of thyristor I_R. [8]

(*c*) What do you mean by commutation of SCR ? [2]

SECTION II

7. (*a*) Derive an expression for average output voltage of step down chopper. [4]

(*b*) Explain continuous and discontinuous current mode of step down copper with RL load. [6]

(*c*) The single-phase bridge inverter has a resistive load of R = 2.4 Ω and the dc input voltage is V_s = 48 V.

Determine :

(*i*) the rms output voltage at the fundamental frequency V_{01},

(*ii*) the output power P_o,

(*iii*) the average and peak current of each transistor,

(*iv*) the peak reverse blocking voltage V_{BR} of each transistor

(*v*) the THD,

(*vi*) the DF,

(*vii*) the HF and DF of LOH. [8]

Or

8. (*a*) Explain the use of step up operation for energy transfer. [4]

(*b*) Draw the circuit diagram, necessary waveforms and explain operation of single-phase full Bridge inverter with R load. [6]

(*c*) Explain the need for feedback diodes in inverter. [3]

(*d*) Explain various control strategies for d.c. choppers. [5]

9. (*a*) Explain the development of a revolving field in a three-phase IM ? [6]

(*b*) Why is the induced e.m.f. in a dc motor called the back e.m.f. or the counter e.m.f. ? [4]

(*c*) Compare squirrel cage rotor and wound rotor. [6]

Or

10. (*a*) A 220 V dc generator supplies 4 kW at a terminal voltage of 220 V, the armature resistance being 0.4 Ω. If the machine is now operated as a motor at the same terminal voltage with the same armature current, calculate the ratio of generator speed motor speed. Assume that the flux/pole is made to increase by 10% as the operation is changed over from generator to motor. [6]

(*b*) What is the voltage equation of motor and condition for maximum power ? [4]

(*c*) Explain Universal motor with reference to its construction, types and characteristics. [6]

11. (*a*) What differentiates a core type transformer from a shell type transformer ? [4]

(*b*) Write short notes on : [6]

(*i*) AC servomotor

(*ii*) Stepper motor.

(*c*) State various protection circuits for motors. Explain any *one* in detail. [6]

Or

12. (*a*) How does the speed vary in brushless dc motor which carrying torque ? [4]

(*b*) What is an autotransformer ? List its advantages and drawbacks. [4]

(*c*) Draw the circuit diagram and explain star-star connection of three-phase transformer and state merits, demerits and application of same. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-166

S.E. (E&TC, Electronics) (Second Semester) EXAMINATION, 2010

ENGINEERING MATHEMATICS–III

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) From Section 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 II, attempt Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* 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 logarithmic tables, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Attempt any *three* of the following : [12]

(1) Solve :

$$\frac{d^2y}{dx^2} - y = e^{-x}\sin e^{-x} + \cos e^{-x}.$$

(2) Solve :

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x.$$

P.T.O.

(3) Solve :

$$\frac{d^2y}{dx^2} - y = \frac{2}{1 + e^x}$$

(by variation of parameters)

(4) Solve :

$$x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x).$$

(5) Solve :

$$\frac{dx}{2x} = \frac{dy}{-y} = \frac{dz}{4xy^2 - 2z}.$$

(*b*) An electric circuit consists of an inductance L of 0.1 henry, a resistance R of 20 ohms and a condenser of capacitance C of 25 microfarads. If the differential equation of electrical circuit is $L\frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{Q}{C} = 0$, then find the charge Q and current I at any time t, given that, at $t = 0$, Q = 0.05 coulombs and $I = \frac{dQ}{dt} = 0$ when $t = 0$. [5]

Or

2. (*a*) Attempt any *three* of the following : [12]

(1) Solve :

$$\frac{d^3y}{dx^3} - y = (1 + e^x)^2.$$

(2) Solve :

$$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x} + \cos e^x.$$

(3) Solve :

$$\frac{d^2y}{dx^2} + y = \text{cosec } x$$

(by variation of parameters)

(4) Solve :

$$(3x + 2)^2 \frac{d^2y}{dx^2} + 3(3x + 2)\frac{dy}{dx} - 36y = 3x^2 + 4x + 1.$$

(5) Solve :

$$\frac{d^2y}{dx^2} - y = x \sin x + (1 + x^2)e^x.$$

(*b*) The currents x and y in two coupled circuits are given by :

$$L\frac{dx}{dt} + Rx + R(x - y) = E$$

$$L\frac{dy}{dt} + Ry - R(x - y) = 0$$

where L, R, E are constants, find x and y in terms of t, given that $x = 0$, $y = 0$ at $t = 0$. [5]

3. (*a*) If $f(z)$ is analytic, show that :

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2.$$ [6]

(*b*) Evaluate :

$$\oint_C \frac{4z^2 + z}{z^2 - 1} dz,$$

where C is contour $|z - 1| = \frac{1}{2}$. [5]

(*c*) Show that the map $W = \frac{2z + 3}{z - 4}$ transforms the circle $x^2 + y^2 - 4x = 0$ into the straight line $4u + 3 = 0$. [5]

Or

4. (*a*) If $f(z) = u + iv$ is analytic, find $f(z)$ in terms of z, if $u - v = (x - y)(x^2 + 4xy + y^2)$. [6]

(*b*) Evaluate using Cauchy Residue Theorem

$$\oint_C \frac{2z^2 + 2z + 1}{(z+1)^3 (z-3)} dz,$$

where C is contour $|z + 1| = 2$. [5]

(*c*) Find the bilinear transformation which maps the points $z = 1, \; i, \; 2i$ on the points $W = -2i, \; 0, \; 1$ respectively. [5]

5. (*a*) Show that Fourier transform of $f(x) = e^{-x^2/2}$ is $e^{-\lambda^2/2}$. [6]

(*b*) Find the Fourier sine transform of

$$f(x) = \begin{cases} x & 0 \le x \le 1 \\ 2 - x & 1 \le x \le 2 \\ 0 & x > 2 \end{cases}.$$ [5]

(*c*) Find z-transform of the following (any *two*) : [6]

(1) $f(k) = \left(\frac{1}{4}\right)^{|k|}$, for all k

(2) $f(k) = 2^k \cos(3k + 2)$, for $k > 0$

(3) $f(k) = (k + 1)a^k, \; k \ge 0$.

Or

6. (*a*) Find inverse z-transform of the following (any *two*) : [6]

(1) $F(z) = \dfrac{3z^2 + 2z}{z^2 - 3z + 2}, \quad 1 < |z| < 2$

(2) $F(z) = \dfrac{z^2}{z^2+1}$, by using inversion integral method

(3) $F(z) = \dfrac{1}{(z-3)(z-2)}$, $2 < |z| < 3$.

(b) Obtain $f(k)$, given that :

$12f(k+2) - 7f(k+1) + f(k) = 0$, $k > 0$, $f(0) = 0$, $f(1) = 3$. [5]

(c) What is the function $f(x)$, whose Fourier cosine transform is $\dfrac{\sin a\lambda}{\lambda}$? [6]

SECTION II

7. (a) Find the values of y for $x = 0.5$ for the following set of values of x and y using Newton's forward difference formula : [5]

x	y
0	1
1	5
2	25
3	100
4	250

(b) Evaluate :

$$\int_0^{0.8} [\log_e (x+1) + \sin (2x)]dx$$

where x is in radian, by using Simpson's $\frac{1}{3}$rd rule, divide the entire interval into 8 strips. [6]

(c) Using fourth order Runge-Kutta method, evaluate the value of y when $x = 1.1$, given that :

$$\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}, \quad y(1) = 1.$$ [5]

Or

8. (*a*) Using Lagrange's interpolation formula to evaluate y for $x = 1.07$ for the following set of values : [5]

x	y
1.0	1.0
1.2	1.728
1.3	2.197
1.5	3.375

(*b*) Evaluate :

$$\int_0^3 \frac{dx}{1+x}$$

with 7 ordinates by using Simpson's $\frac{3}{8}$ th rule and hence calculate log 2. [6]

(*c*) Use Euler's modified method to find the value of y satisfying the equation :

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

for $x = 1.2$ correct upto three decimal places by taking $h = 0.2$. [5]

9. (*a*) Show that the vector $\overline{F}$ have a constant magnitude if any only if $\overline{F} \cdot \frac{d\overline{F}}{dt} = 0$. [4]

(*b*) If $\overline{F}_1 = (y+z)\overline{i} + (z+x)\overline{j} + (x+y)\overline{k}$

and $\overline{F}_2 = (x^2 - yz)\overline{i} + (y^2 - zx)\overline{j} + (z^2 - xy)\overline{k}$

then show that $\overline{F}_1 \times \overline{F}_2$ is solenoidal. [5]

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

(*i*) $\nabla^2(r^2e^r) = (r^2 + 6r + 6)e^r$

(*ii*) $\nabla \times \left(\dfrac{\overline{a} \times \overline{r}}{r^4}\right) = \dfrac{4(\overline{a} \,.\, \overline{r})\overline{r}}{r^6} - \dfrac{2\overline{a}}{r^4}$

(*iii*) $\nabla^2(\phi\psi) = \phi\nabla^2\psi + 2\nabla\psi\nabla\phi + \psi\nabla^2\phi$

Or

10. (*a*) Prove that :

$$\overline{\mathrm{F}} = (2xy + z^3)\overline{i} + x^2\overline{j} + 3xz^2\overline{k}$$

is irrotational and find the scalar potential ϕ such that $\overline{\mathrm{F}} = \nabla\phi$. [6]

(*b*) Find the directional derivative of $\phi = e^{2x} \cos yz$ at the origin in the direction tangent to the curve $x = 3 \sin t$, $y = 3 \cos t$,

$\overline{\mathrm{F}} = (x + y)\overline{i} + (y + z)\overline{j} + (z + x)\overline{k}$ $z = 3t$ at $t = \dfrac{\pi}{4}$. [6]

(*c*) Find the angle between the normals to the surface $xy = z^2$ at (1, 4, 2) and (–3, –3, 3). [5]

11. (*a*) Find the work done in moving a particle in the force field along the curve $x = 2(t + \sin t)$, $y = 2(1 - \cos t)$ in xy-plane from $t = -\pi$ to $t = \pi$. [5]

(*b*) Use Stokes' theorem to evaluate $\iint\limits_{S} (\nabla \times \overline{\mathrm{F}}) \,.\, \hat{n}\, ds$ over the unclosed surface of the cylinder $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ bounded by the plane $z = 5$ and open at the end $z = 0$ for $\overline{\mathrm{F}} = (x - y - z)\overline{i} + (y - z - x)\overline{j} + (z - x - y)\overline{k}$. [6]

(*c*) If

$$\nabla \cdot \bar{D} = \rho,\ \nabla \cdot \bar{H} = 0,\ \nabla \times \bar{H} = \frac{1}{c}\left(\frac{\partial \bar{D}}{\partial t} + \rho \bar{v}\right),\quad \nabla \times \bar{D} = -\frac{1}{c}\frac{\partial \bar{H}}{\partial t}$$

where c is a constant, then prove that :

$$\nabla^2 \bar{D} - \frac{1}{c^2}\frac{\partial^2 \bar{D}}{\partial t^2} = \nabla \rho + \frac{1}{c^2}\frac{\partial}{\partial t}(\rho \bar{v}),\ \nabla^2 \bar{H} = \frac{1}{c^2}\frac{\partial^2 \bar{H}}{\partial t^2} - \frac{1}{c}\nabla \times (\rho \bar{v}).$$ [6]

Or

12. (*a*) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ along the curve $x^2 + 2y^2 = 1$ in xy-plane in positive quadrant where $\bar{F} = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$. [5]

(*b*) By using Stokes' theorem show that :

$$\oint_C y\,dx + z\,dy + x\,dz = -\iint_S (\cos \alpha + \cos \beta + \cos \gamma)\, dS$$

where S is the open surface bounded by the curve C and α, β, γ are the angle made by the normal to the surface S with x, y, z-axes respectively. [6]

(*c*) Evaluate :

over the total surface of region bounded by $x = 0$, $y = 0$, $z = 0$, $y = 3$ and $x + 2z = 6$. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-167

S.E. (E&TC) (Second Semester) EXAMINATION, 2010

INTEGRATED CIRCUITS AND APPLICATIONS

(2008 COURSE)

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*) Which are the different configurations of differential amplifiers ? Do the D.C. analysis of Dual-Input Balanced output differential amplifier to locate Q-point ? [8]

(*b*) Explain the working of current mirror circuit with neat circuit diagram and derive the expression for constant current. Justify why it is known as current mirror. [8]

Or

2. (*a*) What is op-amp ? Draw its block diagram and explain the function of each block in detail. [8]

(*b*) An emitter-biased dual-input balanced-output differential amplifier has the following specifications : $|V_{CC}| = |-V_{EE}| = 10$ V, $R_{C1} = R_{C2} = 2.7$ kΩ and $R_E = 5.6$ kΩ; the transistor array is CA3086 with $\beta_{a.c.} = \beta_{d.c.} = 100$ and $V_{BE} = 0.715$ V. Calculate :

(*i*) The voltage gain

(*ii*) The input resistance

(*iii*) The output resistance. [6]

(*c*) Compare Ideal op-amp and practical op-amp. [2]

3. (*a*) In the op-amp circuit given in Fig. 1, find output offset voltage. Also find value of R_{comp} to compensate this output offset voltage. [6]

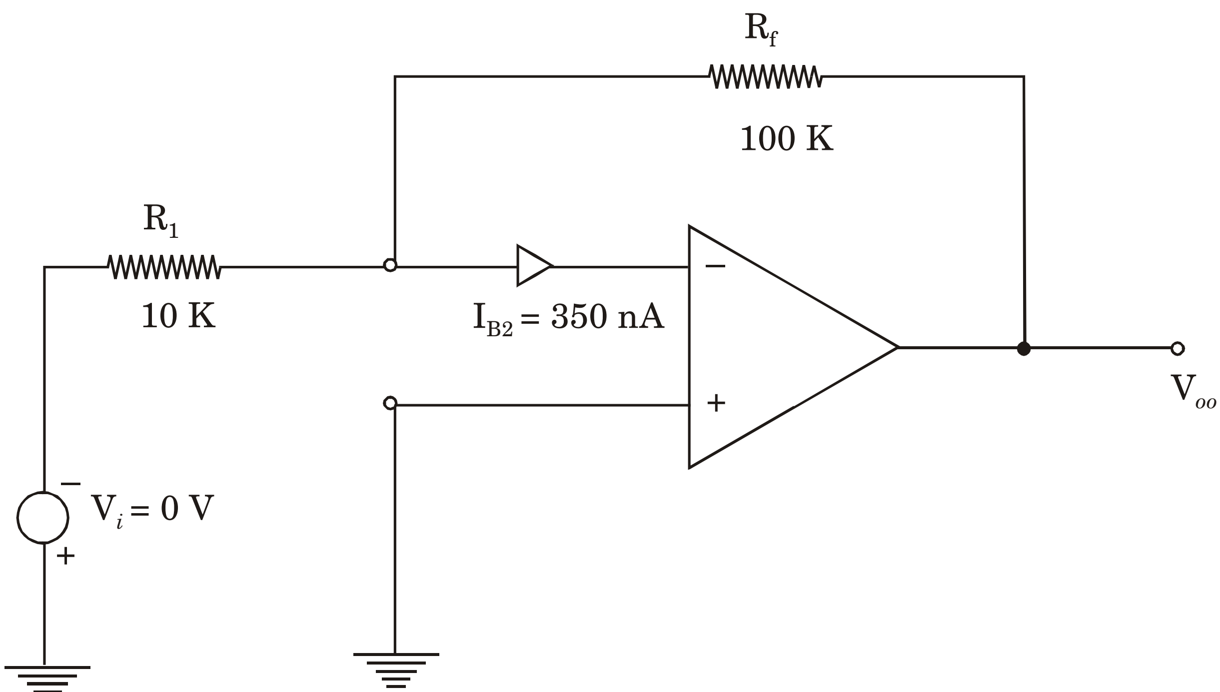


Fig. 1

(*b*) Write a short note on frequency compensation in op-amps. [6]

(*c*) What is CMRR ? Explain its significance in op-amp. [4]

Or

4. (*a*) Explain frequency dependence of loop gain using Bode plot. [8]

(*b*) Which are the different types of noises that are associated with op-amps ? Draw op-amp. noise model and give expression for output noise voltage. [8]

5. (*a*) Which are the different techniques used to achieve non-linear amplification ? Explain in detail synthesized non-linear response with neat circuit diagram. [8]

(*b*) Why basic integrator is needed to be modified ? Draw the circuit diagram of practical integrator along with frequency response and explain its operation. [6]

(*c*) Write a short note on averaging circuit. [4]

Or

6. (*a*) With neat circuit diagram explain the operation of V to I converter with grounded load and give its application. [6]

(*b*) Design a differentiator to differentiate an input signal whose frequency varies from 50 Hz to 2 kHz. [6]

(*c*) Draw the circuit diagram of two op-amp. differential amplifier and explain its operation. [6]

SECTION II

7. (*a*) What is precision rectifier ? Explain the operation of precision full wave rectifier with neat circuit diagram. [8]

(*b*) For the Inverting Schmitt Trigger given in Fig. 2, find V_{TH}, V_{TL}, ΔV_T and draw the input/output waveforms. [6]

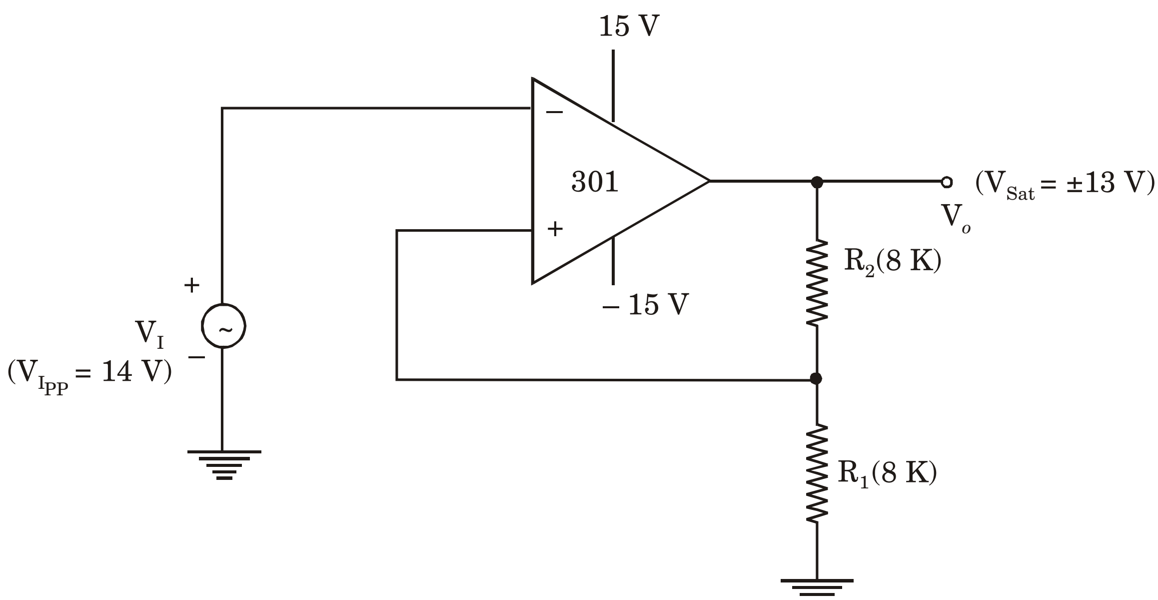


Fig. 2

(*c*) Write a short note on IC LM317. [4]

Or

8. (*a*) Draw the neat circuit diagram of Instrumentation Amplifier which amplifies output of a bridge which contains one resistive transducer. Derive the expression for output voltage. [8]

(*b*) What is sample and hold amplifier ? Explain its operation with the help of circuit diagram. [6]

(*c*) Explain operation of peak detector with the help of circuit diagram. [4]

9. (*a*) Draw the neat diagram of F to V converter and explain its operation. [8]

(*b*) Explain the operation of successive approximation type ADC with neat block diagram. [8]

Or

10. (*a*) Explain in detail specifications of ADCs. [8]

(*b*) Draw the circuit diagram of voltage mode R-2R ladder DAC and explain its working. [8]

11. (*a*) With the help of neat block diagram explain operation of PLL. Define the terms Lock range and Capture range. [8]

(*b*) Write a short note on second order active Band Pass Filter. [8]

Or

12. Write short notes on any *two* : [16]

(a) Graphic equalizer

(b) PLL as frequency synthesizer

(c) FM Demodulator using PLL.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-168

S.E. (E & TC) (Second Sem.) EXAMINATION, 2010

ELECTROMAGNETICS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II. (Q. No. **1** *or* Q. No. **2,** Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**); (Q. No. **7** *or* Q. No. **8,** Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* 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 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 charge distributions ? Derive an expression of electric field intensity due to sheet charge. [9]

(*b*) Determine the total charge : [9]

(*i*) On the line $0 < x < 5m$, if $\rho_L = 12x^2 \; m^C/m$

(*ii*) On the cylinder $\rho = 3$, $0 < z < 4m$ if $\rho_S = \rho z^2 \; n^C/m^2$.

(*iii*) Within the sphere $r = 4$ m if $\rho_V = \dfrac{10}{r \sin \theta}$ C/m^3.

Or

2. (*a*) Explain applications of Gauss law in detail. [9]

(*b*) In a certain region, the electric field is given by : [9]

$$D = 2\rho(z + 1) \cos \phi \, \hat{a}_\rho - \rho(z + 1) \sin \phi \, \hat{a}_\phi + \rho \cos \phi \, \hat{a}_z \, \mu^C/m^2$$

(*i*) Find the charge density

(*ii*) Calculate the total charge enclosed by the volume $0 < \rho < 2, \; 0 < \phi < \frac{\pi}{2}, \; 0 < z < 4.$

(*iii*) Confirm Gauss law.

3. (*a*) Define work done and potential difference. Explain relationship between E and V. [8]

(*b*) A point charge of $5n^C$ is located at the origin. If V = 2V at (0, 6, 8), find : [8]

(*i*) The potential at A(–3, 2, 6)

(*ii*) The potential at B(1, 5, 7)

(*iii*) The potential difference V_{AB}.

Or

4. (*a*) Derive an expression of energy density in electric fields. [8]

(*b*) If , calculate the current passing through : [8]

(*i*) A hemispherical shell of radius 20 cm

(*ii*) A spherical shell of radius 10 cm.

5. (*a*) State and explain Biot-Savart's law ? Determine magnetic field at any point due to a straight filamentary conductor ? [8]

(*b*) A circular loop located on $x^2 + y^2 = 9$, $z = 0$ carries a direct current of 10 A along $\hat{a}_\phi$. Determine $\bar{H}$ at (0, 0, 4) and (0, 0, –4). [8]

Or

6. (*a*) Derive an expression of Biot-Savart's law and Ampere's law based on magnetic potential. [8]

(*b*) A rectangular loop carrying 10 A current is placed on $z = 0$ plane as shown in figure below. Evaluate $\bar{H}$ at : [8]

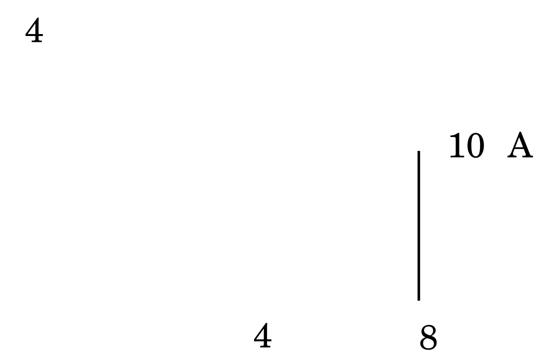


Fig. : Rectangular Loop

(*i*) (2, 2, 0)

(*ii*) (4, 2, 0)

(*iii*) (4, 8, 0)

(*iv*) (0, 0, 2).

SECTION II

7. (*a*) Derive an expression of Dielectric-Dielectric boundary conditions for electrostatic field. [9]

(*b*) Two extensive homogeneous isotropic dielectrics meet on plane $z = 0$, for $z > 0$, $\varepsilon_{r_1} = 4$ and for $z < 0$, . A uniform electric field exists for $z > 0$. Find : [9]

(*i*) E_2 for $z < 0$.

(*ii*) The angles E_1 and E_2 make with the interface.

(*iii*) The energy densities in J/m^3 in both dielectrics.

(*iv*) The energy within a cube of side 2 m centered at (3, 4, –5).

Or

8. (*a*) Derive an expression of boundary condition between two magnetic media. [9]

(*b*) The XY-plane serves as the interface between two different media. Medium 1($z < 0$) is filled with a material whose $\mu_s = 6$ and medium 2 ($z > 0$) is filled with a material whose $\mu_s = 4$. If the interface carries current $(1/\mu_0)$ and mWb/m^2. Find $\vec{H}_1$ and and $\vec{B}_1$. [9]

9. (*a*) Derive an expression of moving conducting loop in a time varying magnetic field. [8]

(*b*) In free space $\vec{E} = 20\cos(\omega t - 50x)\,\hat{a}_y$ V/m, calculate : [8]

(*i*) J_d

(*ii*) H

(*iii*) W.

Or

10. (*a*) Derive an expression of power Poynting theorem interpret each term. [8]

(*b*) The electric field and magnetic field in free space are given by : [8]

$$\vec{E} = \frac{50}{\rho}\,.\cos(10^6 t + \beta\tau)\,\hat{a}_\phi \text{ V/m}$$

$$\vec{H} = \frac{H_0}{\rho}\,.\cos(10^6 t + \beta\tau)\,\hat{a}_\rho \text{ A/m}$$

Express these in phasor form and determine the constants H_0 and β such that the fields satisfy Maxwell's equation.

11. (*a*) What are the different steps in Graphical representation of electric field lines and the equipotential lines ? [8]

(*b*) What are the steps of finite difference method ? Where is this method applicable ? [8]

Or

12. (*a*) Explain in detail the steps of the moment methods. What are the applications of this method ? Explain in detail. [8]

(*b*) What are the different steps of finite element analysis of any problem ? [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-169

S.E. (Elex/E & TC) (Second Sem.) EXAMINATION, 2010

DATA STRUCTURES

(2008 COURSE)

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 tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Write an algorithm for bubble sort. Discuss its time complexity. [6]

(*b*) Explain the advantages of function. Write a function to find factorial of number. [6]

(*c*) Write an algorithm for sequential search. [4]

Or

2. (*a*) What are uses of Single Dimensional Array ? Write a program to find sum of elements in an array. [6]

(*b*) Write a recursive function to find factorial of number. [6]

(*c*) Explain what is Abstract Data Type. [4]

3. (*a*) Explain with example parameter passing : [6]

(*i*) By value and

(*ii*) By address to function.

(*b*) What are structures ? Explain its use. Define structure having name, age and salary. [6]

(*c*) With example explain any *three* bitwise operators. [6]

Or

4. (*a*) What is an array of pointers ? Explain its use. [6]

(*b*) What are unions ? Explain its use. Define an union having an array of characters of size 4 and two integers as its elements. [6]

(*c*) How can a polynomial be stored using an array ? Explain with example. [6]

5. (*a*) Write a function for the following operations in SLL : [8]

(*i*) Display the elements

(*ii*) Search an element.

(*b*) Represent the following polynomial using GLL. Explain the node structure in GLL : [8]

$$3x^2y^2z + 8xyz + 5x^2yz^2 + 8xyz^2 + 3x^2y^2z^2$$

Or

6. (*a*) Write a function of the following operations in DLL : [8]

(*i*) Display the elements

(*ii*) Search an element.

(*b*) What is CLL ? Write a function to create circular linked list. [8]

SECTION II

7. (*a*) What is priority queue ? Explain how insert and delete operations are implemented in it. [8]

(*b*) Write an algorithm convert infix expression into postfix expression. [8]

Or

8. (*a*) Explain how a stack can be implemented using linked list. [8]

(*b*) What is circular queue ? Explain the insert and delete operators in circular queue. [8]

9. (*a*) For the following data draw binary tree. Show all steps : [6]

50 80 30 20 100 75 25 15 68

(*b*) Write a function to search an element in BST. [6]

(*c*) What is AVL tree ? Explain the RR and LL rotations with example. [6]

Or

10. (*a*) Write an algorithm to implement non-recursive in-order traversal of binary tree. [6]

(*b*) Write a function to insert an element in BST. [6]

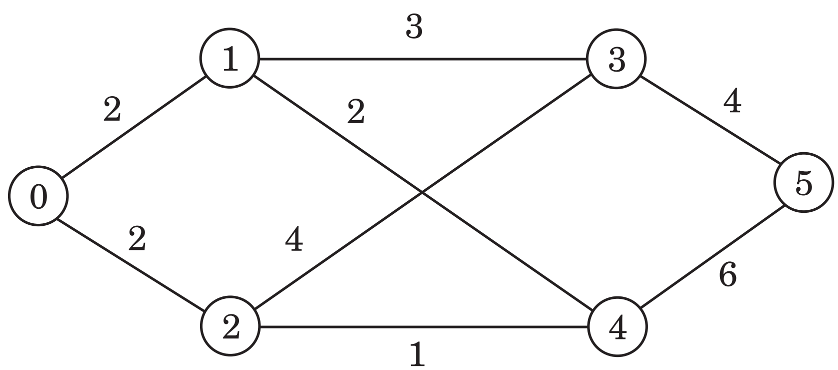
(*c*) Create an AVL tree for the following data : [6]

40 20 10 30 70 60 55

11. (*a*) How can a graph be represented ? Explain with suitable example. [6]

(*b*) What is DFS ? Write a function for DFS for a graph. [6]

(*c*) Find minimum spanning tree for the following graph using Prim's algorithm. [4]



Or

12. (*a*) Explain Dijkstra's algorithm. [6]

(*b*) What is BFS ? Write a function for BFS for a graph. [6]

(*c*) Find minimum spanning tree for the graph given in Q. 11(*c*) using Kruskal's algorithm. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-170

S.E. (E&TC/Elex) (Second Semester) EXAMINATION, 2010

COMMUNICATION THEORY

(2008 COURSE)

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*) Derive the expression for AM wave and explain power relations for DSB-FC. [6]

(*b*) Define modulation. State various types of modulation schemes along with their waveforms. [6]

(*c*) Baseband signals are not used for broadcasting, why ? [4]

Or

2. (*a*) Draw and explain block schematic of communication system and need of modulation. [8]

(*b*) AM signal is expressed as

$e = [E_C + e_m] \cos 2\pi f_C t$, where E_C = Peak amplitude of 10 V of carrier signal with frequency f_C = 1 MHz. e_m = modulating signal. If modulating signal contains 500 Hz at 7 volt amplitude

P.T.O.

and 3 kHz at 5 volt amplitude, determine total power transmitted and effective modulation index. [8]

3. (*a*) Explain with the help of neat block diagram, Armstrong method of FM generation. [8]

(*b*) A 15 watt, 1 MHz unmodulated carrier is frequency modulated with a sinusoidal signal such that the peak deviation is 6 kHz. The frequency of modulating signal is 2 kHz. Calculate the average power contained in the Bandwidth. [8]

Or

4. (*a*) Describe how Bessel's functions are useful for determining the bandwidth with proper mathematical expressions. [6]

(*b*) A carrier is frequency modulated by signal of 15 volt peak and frequency of 3 kHz. The frequency deviation constant is 1 kHz/volt. Calculate the peak frequency deviation and modulation index. [6]

(*c*) "FM is superior to AM". Justify. [4]

5. (*a*) How we recover the FM signal using Phase Locked Loop (PLL) ? [6]

(*b*) A receiver tunes signals from 550 to 1600 kHz with an IF of 455 kHz. Find the frequency tuning range for the oscillator section and for the RF section. Given a two section tuning capacitor with a maximum of 350 pF/section. Find the padder capacitor required in the oscillator section. Assume two point tracking. [6]

(*c*) What are the different types of distortions that occur in a typical diode detector circuit ? [6]

Or

6. (*a*) Compare between Envelope and Synchronous detection in AM. [6]

(*b*) The load on an AM diode detector consists of a resistance of 50 kΩ in parallel with a capacitor of 0.01 μF. Determine the maximum modulation index that the detector can handle without distortion when modulating frequency is :

(*i*) 7 kHz

(*ii*) 12 kHz. [6]

(*c*) With the help of block diagram explain superheterodyne FM receiver. [6]

SECTION II

7. (*a*) Derive the expression to calculate effective noise for series and parallel connection of resistors. [6]

(*b*) The following Fig. 1 shows the tandem connection of three links. Calculate output signal to noise ratio. [6]

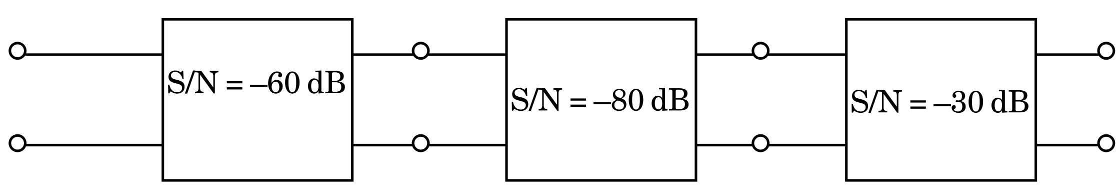


Fig. 1 : Tandem Connection

(*c*) Explain different types of Noise. [4]

Or

8. (*a*) An amplifier circuit having noise figure of 9 dB and power gain of 25 dB is followed by mixer having noise figure of 16 dB. Calculate overall noise figure and equivalent noise temperature at the input of the combination. [8]

(*b*) Explain the following :

(*i*) Avalanche Noise

(*ii*) Burst Noise

(*iii*) Flicker Noise

(*iv*) Partition Noise. [8]

9. (*a*) Explain the importance of Pre-emphasis and De-emphasis network in the performance of FM system. [8]

(*b*) Describe the performance of baseband system in presence of noise. [8]

Or

10. (*a*) Explain the performance of DSB-SC in presence of noise. [8]

(*b*) Describe in detail capture effect and FM threshold effect. [8]

11. (*a*) State and prove Sampling theorem in time domain. [6]

(*b*) With the help of block diagram explain differential PCM. [6]

(*c*) Describe with suitable example band limited and time limited signal. [6]

Or

12. (*a*) With the help of block diagram explain Adaptive Delta Modulation. [6]

(*b*) Explain in detail types of Sampling and distortions. [8]

(*c*) Describe distortions present in Delta Modulation. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-171

S.E. (Instrumentation and Control) (First Sem.) EXAMINATION, 2010

FUNDAMENTALS OF INSTRUMENTATION

(2008 COURSE)

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*) Explain the requirement and contents of calibration certificate and calibration report in calibration process. [8]

(*b*) What is input, output impedance and loading effect in measurement systems ? [8]

Or

2. (*a*) Explain the following terms : [8]

(*i*) Drift

(*ii*) Reproducibility

(*iii*) Dead zone

(*iv*) Hysteresis.

(*b*) A moving coil voltmeter has a uniform scale with 100 divisions. The full scale reading is 200 V and 1/10 of scale division can be estimated with fair degree of certainty. Determine the resolution of the instrument. [4]

(*c*) A 0.300 V voltmeter has an accuracy of +2% of full scale deflection. What would be the range of readings if true voltage is 30 V ? [4]

3. (*a*) Explain the construction and working of single phase induction type energymeter. [8]

(*b*) Design the Aryton (universal) shunt to provide an ammeter with current ranges of 1 A, 5 A and 10 A. A basic meter with internal resistance of 50 W and full scale deflection current of 1 mA is to be used. [8]

Or

4. (*a*) For the series type ohmmeter prove that : [8]

where, I_m is the current when measuring the unknown resistance R_x.

I_{fs} is the full scale deflection current.

R_h is the half scale deflection meter.

(*b*) Explain how D.C. potentiometer can be used for calibration of voltmeter. [8]

5. (*a*) A resistance bridge has the configuration shown in Fig. 1, in which R_1 = 120.4 W, R_2 = 119.0 and R_3 = 119.7 W :

(*i*) What resistance must R_4 have for balancing of the bridge ?

(*ii*) If R_4 has a value of 121.2 and if the input voltage is 12 V d.c., what is the output voltage of the bridge, assuming it to be a voltage sensitive bridge. [8]

$$\overset{W}{S} = \frac{I_m}{I_{fs}} = \frac{R_h}{R_x + R_h},$$

Fig. 1

(*b*) With the help of neat diagram derive the balancing condition in Hay's bridge and explain how it can be used for measurement of quality factor of a coil. [8]

(*c*) Differentiate voltage and current sensitive bridges. [2]

Or

6. (*a*) The Schering bridge as shown in Fig. 2 balances under the following conditions : [10]

C_2 = 400 pf, R_4 = 10

R_3 = 1 kW, C_4 = 100 pf

The bridge is driven by 1 kHz sine source. Find unknown capacitance C_1 and its internal resistance r_1. Find the dissipation factor.

Fig. 2

(*b*) Derive equation for sensitivity in Wheatstone bridge and show that the bridge sensitivity is maximum when ratio arm is equal to 1. [8]

SECTION II

7. (*a*) Explain how phase can be measured using digital phase-meter. [8]

(*b*) With the help of neat block diagram explain the working of DMM with typical specifications. [8]

Or

8. (*a*) List the advantages of Digital Instruments over analog instruments. [8]

(*b*) Write a note on Digital Tachometer. [8]

9. (*a*) Explain dual trace and dual beam oscilloscope. [8]

(*b*) How can phase and frequency be measured using X-Y mode of dual trace oscilloscope ? [8]

(*c*) Explain Z-modulation in CRO. [2]

Or

10. (*a*) What is the role of a time base generator in CRO ? [8]

(*b*) An electrically deflected CRT has a final anode voltage of 2000 V and parallel deflecting plates 1.5 cm long and 5 mm apart. If the screen is 50 cm from the centre of deflecting plates, find : [8]

(*i*) beam speed

(*ii*) the deflection sensitivity of the tube

(*iii*) the deflection factor of the tube

(Mass of electron = 9.1×10^{-31} kg, Charge of electron = 1.6×10^{-19} C)

(*c*) In XY mode if the frequency of signal applied to X channel is 200 Hz and Y channel is 100 Hz, then draw the Lissajous pattern obtained on the CRT screen. [2]

11. (*a*) The chart speed of a recording instrument is 10 mm/s. If the time base of the recorded signal is 20 mm, what is the frequency of the recorded signal ? [8]

(*b*) How are triangular and sine waves generated in a function generator ? [8]

Or

12. (*a*) Explain different marking mechanism used in recorders. [8]

(*b*) Explain the difference between strip chart recorder and X-Y recorder. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-172

S.E. (Instru.) (First Semester EXAMINATION, 2010

LINEAR INTEGRATED CIRCUIT–I

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

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

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

(*iii*) Neat diagrams must be drawn whenever 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. Define and explain the following characteristics of operational amplifier : [16]

(*a*) Slew rate

(*b*) CMRR

(*c*) Gain bandwidth product

(*d*) Drift.

Or

2. (*a*) What is offset voltage of op-amp ? Explain experimental method for measurement. [10]

(*b*) What is power supply rejection ratio ? What is its effect on performance of op-amp ? [6]

3. (*a*) Derive equation for voltage gain of op-amp with voltage shunt feedback. [10]

(*b*) Design a circuit for non-inverting amplifier with gain of 2.5. Assume swing of op-amp is + 13 volts. What maximum input voltage can be given so that op-amp will not saturate ? [8]

Or

4. (*a*) Define amplifier, buffer, attenuater. Which configurations of op-amp are used for above said circuits ? [12]

(*b*) Prove that bandwidth of an op-amp increases with feedback configuration. [6]

5. (*a*) Explain principle and working of averaging circuit using op-amp for three input voltages : V_1, V_2, V_3. Support your answer with an application. [12]

(*b*) For a differential amplifier input resistances are of 10 kW and feedback resistances are of 100 kW. Calculate output voltage of the circuit where 8.5 volts are applied at non-inverting input and 7.0 volts are applied at inverting input. Supply voltage for the circuit is + 20 volts. [4]

Or

6. (*a*) Solve using op-amp circuit : [8]

$$V_{OUT} = 2V_1 - 3V_2 + 0.5V_3.$$

(*b*) Derive equation for gain of instrumentation amplifier and compare differential amplifier with instrumentation amplifier. [8]

SECTION II

7. (*a*) What is Barkhausen criteria ? How does it help for analysis of Wien Bridge oscillator ? Derive the equation for output frequency and gain. [12]

(*b*) For a Schmitt trigger, UTP = 3.5 volts and LTP = 2.5 volts. Calculate resistor values and $V_{(reference)}$; assume V_{sat} = + 12 volts. [4]

Or

8. (*a*) Explain principle of precision full-wave and half-wave rectifier. [12]

(*b*) Write a short note on Window Detector. [4]

9. (*a*) How astable multivibrator using IC 555 works ? Why can it not generate duty cycles less than 50% ? How is this problem overcome ?

Justify your answer with derivation for astable multivibrator. [12]

(*b*) How is IC 555 timer used for voltage to frequency converter ? [6]

Or

10. (*a*) Define the following with their units for voltage regulator : [6]

(*i*) Line regulation

(*ii*) Load regulation

(*iii*) Drop-out voltage.

(*b*) Explain working principle of voltage regulator using an op-amp and pass transistor. How does it regulate output voltage/load voltage in case of variation in the unregulated input voltage. [12]

11. Explain the working of the following filters and draw their characteristics : [16]

(*i*) Low pass

(*ii*) High pass

(*iii*) Band pass

(*iv*) Band reject filter.

Or

12. What is the difference in first order and second order Butterworth low pass filter ? Explain with circuit diagram. [16]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-173

S.E. (I & C) (First Semester) EXAMINATION, 2010

PRINCIPLES OF SENSOR AND TRANSDUCERS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any **3** questions from each Section.

(*ii*) Neat diagrams must be drawn wherever necessary.

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

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is calibration ? Explain standards available for calibration. [8]

(*b*) Define instrument. Explain function of instrument. Compare Null type and deflection type of instrument. [8]

Or

2. (*a*) Define measurement list and explain various types of errors in measurement. [8]

(*b*) Explain the following terms :

(*i*) Accuracy

(*ii*) Precision

(*iii*) Fidelity

(*iv*) Hysteresis. [8]

3. (*a*) Explain Servo controlled dynamometer in detail. [8]

(*b*) A metallic diaphragm of thickness 3 mm used for a measurement of differential pressure 2 Kg/cm^2 is required to give a deflection of its centre by 1 mm. What should be its diameter if the Young's modulus and Poisson's ratio of the element are 1,00,000 kg/cm^2 and 0.3 respectively. [8]

Or

4. (*a*) Draw and explain pressure measurement using diaphragm and bellows. [8]

(*b*) A load cell consists of a solid cylinder of steel 30 cm diameter, with four strain gauges bounded to it and connected in Wheatstone's bridge. If gauges are 120 Ω each with a gauge factor of 2, what is the sensitivity of load cell expressed in mv/N with bridge excited by 1V dc ? The modulus of elasticity of steel is 200×10^9 N/m^2 and Poisson's ratio 0.3. [8]

5. (*a*) List different units of flow measurement. [2]

(*b*) Explain in detail viscosity to torque converter and level to force converter. [6]

(*c*) A Rotameter is calibrated for metering a liquid of density 1000 kg/m^3 and has a scale ranging from 1 to 100 lit/min if it intended to use this meter for metering the flow of gas of density 1.5 kg/m^3 with a flow range between 20 to 2000 lit/min. Determine the density of new float, if the original one has a density of 2000 kg/m^3 the shape and volume of both floats assumed to be the same. [10]

Or

6. (*a*) Explain float element for level measurement. Draw and explain level to pressure converter. [8]

(*b*) Define the following terms : [4]

(*i*) Kinematics viscosity

(*ii*) Specific viscosity

(*iii*) Newtonian fluid

(*iv*) Non-Newtonian fluid.

(*c*) A gas of density 0.52 kg/m^3 flow through a pipe of 8 cm diameter. The flow is measured by a venturi tube 4 cm diameter throat and U tube manometer containing mercury. What is the flow for manometer reading of 10 cm. Take Cd = 0.95. [6]

SECTION II

7. (*a*) List resistive transducers for pressure measurement. Explain any *one* in detail. [6]

(*b*) Explain bolo-meter in detail. [4]

(*c*) Calculate the capacitance of an air gap parallel plate capacitor with plates 25 mm × 25 mm and plate separation of 1 mm. Calculate change in capacitance. As the movable plate is displaced by 0.6 mm nearer, also calculate sensitivity. [8]

Or

8. (*a*) Explain with principle thickness measurement using LVDT with a suitable diagram. [8]

(*b*) A linear resistance potentiometer is 40 mm long and is uniformly wound with wire having resistance of 8 kΩ under normal condition. The slider is at the centre of potentiometer. Find the linear displacement when the resistance of potentiometer as measured by Wheatstone's bridge for two cases is :

(*i*) 3850 Ω

(*ii*) 7560 Ω.

Comment on direction of motion. If it is possible to measure a minimum value of 10 Ω resistance, find resolution of potentiometer in mm. [10]

9. (*a*) List various types of encoders. Explain encoder for angular displacement measurement. [8]

(*b*) State piezoelectric phenomenon. Explain piezoelectric transducer for force and pressure measurement. [8]

Or

10. (*a*) Draw and explain electro-magnetic flowmeter. State its advantages and disadvantages. [8]

(*b*) Explain the following terms : [8]

(*i*) Thermoelectric phenomenon

(*ii*) Hall effect and its application.

11. (*a*) Draw and explain feedback transducer system. [8]

(*b*) Write short notes on : [8]

(*i*) Data logger

(*ii*) Alpha numeric devices.

Or

12. (*a*) With suitable application explain analog and digital read out systems. [8]

(*b*) Draw and explain any *one* self-balancing system. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-174

S.E. (Instrumentation) (First Semester) EXAMINATION, 2010

AUTOMATIC CONTROL SYSTEMS

(2008 COURSE)

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 whenever necessary.

(*iv*) Figures to the right indicate full marks.

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

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain block diagram of control systems in detail. [6]

(*b*) For the spring, damper and mass systems shown in Fig. 1, find differential equations governing the systems and also find force-voltage analogy. [12]

B_2

k_2

f

M_2 x_2

k_1

M_1 B_1

x_1

Fig. 1

Or

2. (*a*) Compare : [6]

(*i*) Feedback *Vs*. Feed forward

(*ii*) Time invariant *Vs*. Time variant

(*iii*) Causal and non-causal systems

(*b*) Apply force to current analogy and draw equivalent network for Fig. 2. [12]

k_3 x_3 B_2 k_1 x_1

M_3 k_2 x_2 B_1 M_1 F

M_2

B_3

Fig. 2

3. (*a*) Reduce the block diagram and find C/R. [8]

G_4

R B C

G_1 G_2 G_3

H_2

Fig. 3

(*b*) Define transfer function. Give merits and demerits of transfer function. [8]

Or

4. (*a*) State Mason's Gain formula. Find T.F. (Transfer Function) using the same. [8]

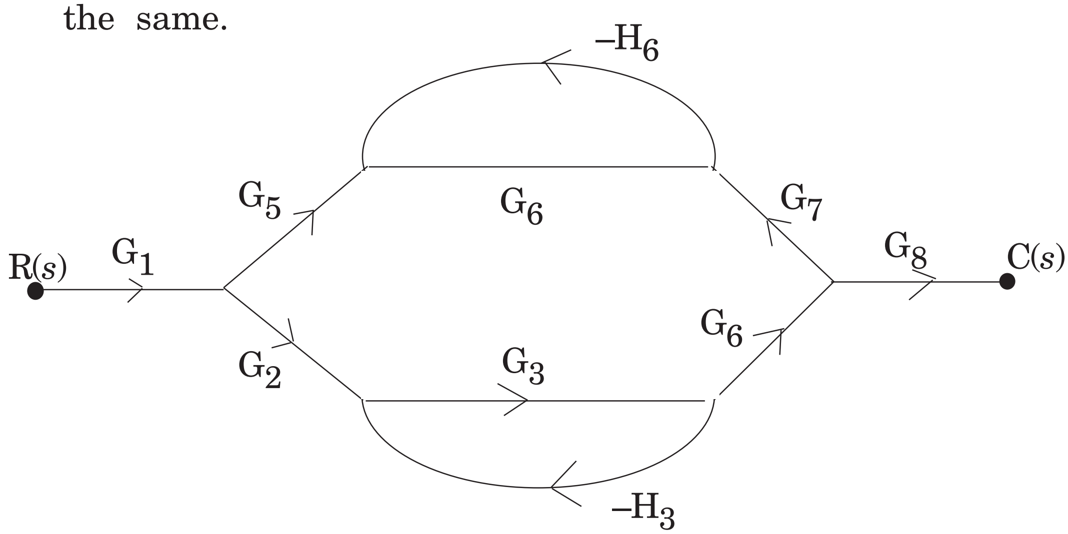


Fig. 4

(*b*) Compare block diagram technique and signal flow graph with advantages and disadvantages (minimum 4 points with explanation). [8]

5. (*a*) The block diagram of the servo system is shown in Fig. 5. Determine the characteristic equation of the system. Hence, calculate the following when the unit step I/P is given : [12]

(*i*) Undamped natural frequency (ω_n)

(*ii*) Damped frequency of oscillation (ω_d)

(*iii*) Damping ratio and damping factor

(*iv*) Maximum overshoot (M_p)

(*v*) Settling time (t_s)

(*vi*) Number of cycle. Complete before the output is settled within 2% and 5% of final value.

R(s)

20

$$\frac{1.2}{s(s+1)(0.2s+1)}$$

C(s)

$s/6$

Fig. 5

(*b*) Define pole, zero, type and order of control system. [4]

Or

6. (*a*) Define : [8]

(*i*) Rise time

(*ii*) Peak time

(*iii*) Peak overshoot

(*iv*) Settling time

(*b*) A unity gain feedback system has transfer function : [8]

$$G(s) = \frac{40(s+2)}{s(s+1)(s+4)}.$$

Determine :

(*i*) Type of the system

(*ii*) All error coefficients

(*iii*) Error for ramp input with magnitude 4.

SECTION II

7. (*a*) Define stability and find the stability of the following :

$$1 + G(s)H(s) = s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15 = 0$$

using R-H criteria (Routh Hurwitz) [8]

(*b*) Draw root loci, following are the details of the system :

$$G(s)H(s) = \frac{k}{s(s+3)(s+5)}.$$

Calculate all the parameters and comment on stability. [10]

Or

8. (*a*) Find the range of '*k*' for which systems become stable for consideration system is given below : [8]

$$G(s) = \frac{k}{(s+2)(s+4)(s^2+6s+25)}.$$

(*b*) The open loop transfer function (T.F.) of system is given below :

$$G(s)H(s) = \frac{k(s+6)}{(s+4)s}$$

H(*s*) = 1, draw root locus and comment on stability. All required details needs to calculate and draw on root locus plot. [10]

9. (*a*) Correlate frequency domain specifications with time domain specifications. [6]

(*b*) Draw bode plot of the following open loop transfer function :

$$G(s) = \frac{3.5}{s(1 + 0.2s)(1 + 0.05s)}.$$

Find gain margin and phase margin along with your comments on stability. [10]

Or

10. (*a*) Define : [6]

(*i*) Bandwidth

(*ii*) Resonant frequency

(*iii*) Resonant peak.

(*b*) Draw Bode plots for the following open loop transfer function. Indicate gain and phase margins :

$$G(s)H(s) = \frac{1}{s(s + 1)(s + 5)}.$$

Comment on stability. [10]

11. (*a*) The open loop transfer function of a unity feedback system is given by :

$$G(s)H(s) = \frac{5}{s(s + 1)(s + 2)}$$

Draw the Nyquist plot and hence, find out whether the system is stable or not. [10]

(*b*) Define : [6]

(*i*) State

(*ii*) State variable

(*iii*) State vector

(*iv*) State space

Or

12. (*a*) Explain the advantages of state space approach over classical methods. [6]

(*b*) Plot Nyquist stability plot for the system given below : [10]

$$G(s)H(s) = \frac{20}{s(1 + 0.1s)(1 + 0.5s)}.$$

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-175

S.E. (Instrumentation & Control)

(Second Semester) EXAMINATION, 2010

DIGITAL TECHNIQUES

(2008 Course)

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*) Convert the following : [8]

(*i*) $(77466)_8$ to Hexadecimal

(*ii*) $(BACF9.61C)_{16}$ to Binary

(*iii*) $(11001111011110110111)_2$ to Hexadecimal

(*iv*) $(11101110111011101111)_2$ to Octal

(*b*) Simplify the following by using tabular method : [8]

$F(W, X, Y, Z) = \Sigma m\ (0, 2, 3, 6, 7, 8, 10, 12, 13)$

Or

2. (*a*) Perform the following arithmetic functions : [8]

(*i*) $(1BDD)_{16} + (D279)_{16}$

(*ii*) $(7276)_8 + (1711)_8$

(*iii*) $(765)_8 - (423)_8 + (66)_{10}$.

Write the answer in hexadecimal form.

(*b*) What is the advantage of encoding a decimal number in BCD as compared with straight binary ? What is a disadvantage ? [4]

(*c*) Write the next four numbers in Hexadecimal counting ACEFD, ACEFE, —,—,—,—, [4]

3. (*a*) Define : [8]

(*i*) SAM

(*ii*) SRAM

(*b*) Convert the SR flip-flop to D flip-flop. [6]

Draw the truth table, excitation table, K-map and connection diagram for each conversion.

(*c*) What is programmable output polarity ? [2]

Or

4. (*a*) Answer the following questions : [8]

(*i*) Define Edge Trigger Circuits and Level Trigger Circuits.

(*ii*) Write one application in detail of Edge Trigger FFs and Level Trigger FFs.

(*b*) Convert the following : [8]

(*i*) JK flip-flop to D flip-flop

(*ii*) D flip-flop to T flip-flop.

Draw the truth table, excitation table, K-map and connection diagram for each conversion.

5. (*a*) Compare counter IC74193 and IC7493. [10]

(*b*) Design MOD-52 counter using 7492 counter IC. Explain the reset logic. [8]

Or

6. (*a*) Design MOD-12 upcounter by using 74193IC. The counter should start counting from 0010. Explain the reset logic for the same. [8]

(*b*) Design MOD-123 using 7490 counter IC. Explain the reset logic for the same. [10]

SECTION II

7. (*a*) Define Decoder and explain *one* application of Decoder in detail. [8]

(*b*) A certain multiplexer can switch one of 32 data input pins to its output. How many different input does this MUX have ? [4]

(*c*) Can more than one decoder output be activated at onn time ? Justify your answer. [4]

Or

8. (*a*) What is the difference between PAL and PLA ? [4]

(*b*) Write *two* advantages of GAL devices over PAL devices. [4]

(*c*) What are the reasons for having registers with common I/O lines ? [4]

(*d*) How does Priority Encoder differ from Ordinary Encoder ? [4]

9. (*a*) Describe the difference between current sinking and current sourcing. [6]

(*b*) In which TTL input state does the largest amount of input current flow ? Justify your answer. [6]

(*c*) Why are MOS ICs especially sensitive to static charges ? [4]

(*d*) Which IC package can be plugged into sockets ? [2]

Or

10. (*a*) Which TTL series use a special diode to reduce switching time ? How does it work ? [8]

(*b*) Which TTL series is best at high frequencies ? [2]

(*c*) What can happen if a TTL output is connected to more unit loads than its output rating specification ? [4]

(*d*) What is the function of interface circuit ? [4]

11. (*a*) Name the basic blocks that make up a digital clock circuit. [6]

(*b*) What is the best sample interval setting to use if the pulse counter has four BCD stages and the I/P frequency is between 2 and 8 MPPS ? [4]

(*c*) Write a short note on Alarm Annunciator. [6]

Or

12. (*a*) Describe in detail the Hours Section of digital clock with the hlep of circuit diagram. [10]

(*b*) The unknown frequency is 6924 pulses per second (PPS). The counter is cleared to the zero state initially. Determine the counter reading after a sampling interval of : [6]

(*i*) 0.5 second

(*ii*) 0.1 second

(*iii*) 10 milliseconds.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-176

S.E. (Instrumentation) (Second Semester) EXAMINATION, 2010

APPLIED ELECTRONICS

(2008 COURSE)

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*) How a field effect transistor will be used as a analog switch ? Explain with circuit diagram. [8]

(*b*) Outputs of three analog sensors are to be multiplexed. Let the output be 1 V, 2 V, 3 V. Draw the circuit using IC CD 4051. Which address lines will you select these inputs ? Elaborate your answer. [8]

Or

2. (*a*) List different types of analog to digital converters. Which is best among all as far as accuracy is considered ? Why ? [8]

(*b*) With neat circuit diagram explain how the fastest analog to digital converter works. [8]

P.T.O.

3. (*a*) What is the need of digital to analog converters ? How are they classified ? [8]

(*b*) How can a typical DAC be constructed using operational amplifier ? Explain. [8]

Or

4. (*a*) Is output of a DAC voltage or current ? What is monotonacity of a DAC ? What will happen if a DAC is not monotonous ? What is usual input voltage range applied to DACs ? [8]

(*b*) How to find resolution of a DAC ? How is it an important characteristics ? [8]

5. (*a*) Assume that a silicon controlled rectifier is connected in series with a resistive load "R_L". Assume that AC input voltage is applied across this circuit. Explain how it will work if firing pulse is applied at 30 degrees, 90 degrees with respect to start of input pulse. Draw required input output waveforms. [9]

(*b*) Where are devices like SCR, DIAC, TRIAC used ? Explain any *one* aplication of each in detail. [9]

Or

6. (*a*) What is snubber circuit ? Elaborate your answer with circuits. [9]

   (*b*) What are the differences between MOSFET and IGBT ? [9]

SECTION II

7. (*a*) List different types of batteries. List at least *four* applications of batteries. [8]

   (*b*) What is AH of a battery ? What is its importance ? Explain. [8]

Or

8. (*a*) Which are different battery charging techniques ? Explain any *one*. [8]

   (*b*) Write a short note on solar cells. [8]

9. (*a*) What are different types of voltage to current converters ? Explain any *one* in detail. [8]

   (*b*) How does a typical voltage controlled oscillator work ? Explain. [8]

Or

10. (*a*) Design a circuit in which zero to 100 milli volt is to be converted into zero to 5 volts. [8]

    (*b*) Write a short note on phase-locked loop. [8]

11. (*a*) What is the need of modulation ? List the types of modulation. Do you know the typical frequency at which FM channel is usually set on a radio set ? Is FM channel concerned with signal or carrier frequency ? [10]

(*b*) How are signals represented using ASK and FSK ? Explain with a typical sequence. [8]

Or

12. (*a*) List different types of signal isolators. What is MCT2E ? How is it used ? [9]

(*b*) Explain Time Division Multiplexing. [9]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-177

S.E. (Instru.) (Second Sem.) EXAMINATION, 2010

TRANSDUCERS AND SIGNAL CONDITIONING

(2008 COURSE)

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) List different blocks of signal conditioning system and explain any *two*. [6]

(B) Enlist the different methods to measure resistance. Justify "Wheatstone bridge is preferred for resistive sensor at a first stage of signal conditioning circuit". [6]

(C) Explain Radiation pyrometer with a neat diagram. [6]

Or

2. (A) Discuss with neat circuit diagram how LM35 can be used in Thermocouple signal conditioning circuits for cold junction compensation. [8]

(B) Temperature of a plating operation must be measured for control temperature within the range of 500°C to 600°C. Develop a measuring system with J type thermocouple that scales that temp. into 0 to 5 V. Assume ref. junction temperature is 0°C.

At $T_1 = 500°C$ $V_{th1} = 27.39$ mV

At $T_2 = 600°C$ $V_{th1} = 33.11$ mV. [10]

3. (A) With neat block diagram discuss the conversion of strain in to frequency signal. [8]

(B) Explain charge amplifier in detail. [8]

Or

4. (A) Explain different design and excitation considerations for strain gauge signal conditioning in detail. [8]

(B) Explain working principle of Speed pick-up along with signal conditioning blocks. [8]

5. (A) Explain absolute encoder and its disadvantages over incremental encoder. [8]

(B) Explain optical proximity sensors in detail. [8]

Or

6. (A) Explain Stroboscope with a neat diagram. [8]

(B) With neat sketch discuss the signal conditioning for optical sensors to have voltage as output. [8]

SECTION II

7. (A) Explain level measurement using Load Cell along with suitable signal conditioning blocks and necessary assumption. [8]

(B) Explain advantages of Nuclear level gauges over other level gauges. [8]

Or

8. For certain level measurement system electromechanical level gauge is used to measure level. The output of sensor is 0 to 10 kohm for the level of 0 to 10 meter. Design suitable signal conditioning circuit for having output 4 to 20 mA. [16]

9. (A) Explain working of electromagnetic flow meter along with excitation and construction consideration. [8]

(B) Explain working principle of DP cell along with necessary signal conditioning blocks. [8]

Or

10. (A) Explain working principle of Turbine flow meter. What is nature of output signal ? How can it be converted into current ? [8]

(B) Give excitation considerations for electromagnetic flow meter. [4]

(C) Explain working principle of ultrasonic flow meter with a neat diagram. [4]

11. Write short notes on : [18]

(*i*) Piezoelectric Microphone

(*ii*) Conductivity Meter.

Or

12. Write short notes on : [18]

(*i*) Glass electrode

(*ii*) Piezoelectric vibration sensor.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-178

S.E. (Instrumentation & Control)

(Second Semester) EXAMINATION, 2010

PHOTONICS AND INSTRUMENTATION

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

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

(*ii*) Neat diagrams must be drawn wherever necessary.

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

SECTION I

1. (*a*) Draw electromagnetic spectrum of light and show different ranges of visible, Infrared regions and state advantages of it. [8]

(*b*) Describe wavelength in meter and Å. Light is having frequency range of 5.4×10^{13} Hz. [4]

(*c*) Explain Snell's law. [4]

Or

2. (*a*) Explain interaction of light with matter and various properties of light by using diagram. [12]

(*b*) Refractive index of plasma tube is 1.4. Calculate the Brewster's angle to get dominant laser beam. [4]

P.T.O.

3. (*a*) Define the following terms (any *three*) : [8]

(*i*) Rerated MSCP

(*ii*) Metastable state

(*iii*) Illuminance

(*iv*) Irradiance.

(*b*) Explain units used for calculation of point light source in photometry and radiometry. [8]

Or

4. (*a*) Explain principle and working of gas discharge lamp with suitable diagram. Enlist the advantages and applications. [8]

(*b*) Explain principle of types of spectra for line, band and continues light source by giving its examples. [8]

5. (*a*) Explain principle and working of semiconductor laser with the help of neat diagram and its application. [9]

(*b*) What do you understand by a term radiation pattern of light emitting diode ? Suggest experimental set up and procedure to draw it. [9]

Or

6. (*a*) Explain basic steps required for generations of laser beam. What are different properties of laser ? State advantages and drawbacks of laser. [9]

(*b*) Explain working of light emitting diode. Draw the LED characteristics. [9]

SECTION II

7. (*a*) What are the types of thermal detector and quantum detector used in optical system ? Explain working principle of both detectors with suitable examples. [12]

(*b*) Explain Bolometer with suitable diagram. [4]

Or

8. (*a*) Differentiate between PIN and Avalanche photodiode with diagram. [8]

(*b*) Explain in detail working of photomultiplier tube. [8]

9. (*a*) What is the role of grating in optics ? Explain in detail. [8]

(*b*) Differentiate the following : [8]

(*i*) Dispersion prism and reflection prism

(*ii*) Absorption filter and interference filter.

Or

10. Write short notes on (any *four*) : [16]

(*i*) Lenses

(*ii*) Beam splitter

(*iii*) Polarizer

(*iv*) Prism

(*v*) Grating

(*vi*) Mirrors

11. Explain working principle of the following with suitable diagram : [18]

(*i*) Astronomical telescope

(*ii*) Abbe's refractometer.

Or

12. Describe the following (any *three*) : [18]

(*i*) Microscope

(*ii*) Monocromator

(*iii*) Photographic lenses

(*iv*) Optical projection system

(*v*) Cameras.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-179

S.E. (Instrumentation & Control) (Second Sem.)

EXAMINATION, 2010

DRIVES AND CONTROL

(2008 COURSE)

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 tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain with the help of a neat diagram the constructional details of DC generator. [8]

(*b*) Derive the EMF equation for DC generator. [8]

Or

2. (*a*) Explain in detail the significance of back EMF. [8]

(*b*) A 4 pole lap connected 220 V shunt motor has 600 armature conductors. It takes 21 A on full load. The flux/pole is 0.05 Wb. The armature and field resistance are 200 W and 0.1 W respectively. Contact drop per brush is 1 Volt. Calculate the speed of the motor. [8]

3. (*a*) Derive the EMF equation of the alternator. [8]

(*b*) A 3-phase four-pole alternator has a stator winding with 9 conductors per slot. The armature has total 36 slots. What will be the value of induced EMF when alternator is driven at 1800 rpm with 0.04 Wb/pole flux. Assume full pitch coil. [8]

Or

4. (*a*) Explain the principle of working and production of rotating magnetic field in case of induction motor. [8]

(*b*) Explain in detail with neat diagram the necessity of a starter for induction motors. [8]

5. (*a*) Explain in detail construction of stepper motor. Give the types of stepper motor. [8]

(*b*) With the help of neat diagrams explain the characteristics of various stepper motors. [10]

Or

6. (*a*) What do you mean by servomotors ? Give its classification. State the salient features of A.C. servomotors. [10]

   (*b*) Explain the types of DC servomotors in detail. [8]

SECTION II

7. (*a*) Explain in detail the construction of SCR and also the necessity of gate triggering in SCR. [8]

   (*b*) With the help of characteristics, explain the different modes of operation of the thyristor. [8]

Or

8. (*a*) Explain in detail the construction and operation of MOSFETs. [8]

   (*b*) Draw and explain the characteristics of TRIAC and DIAC. [8]

9. (*a*) Explain the principle of chopper operation. [8]

   (*b*) Draw the different types of chopper circuits. [8]

Or

10. (*a*) With the help of circuit diagram explain the working of single-phase half-bridge inverter. [8]

    (*b*) Explain the working principle of full wave controlled rectifier. [8]

11. (*a*) Give the methods by which speed of the induction motors can be varied. Explain any *one* in detail. [10]

(*b*) Write a short note on close loop control of induction motor. [8]

Or

12. Write short notes on : [18]

(1) Variable Frequency Drive

(2) Slip power recovery system

(3) Chopper controlled DC drives.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-182

S.E. (Printing) (First Semester) EXAMINATION, 2010

STRENGTH OF MACHINE ELEMENTS

(2008 COURSE)

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 and electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define and explain the following terms :

(*i*) Factor of safety

(*ii*) Modulus of rigidity

(*iii*) Bulk Modulus

(*iv*) Poisson's Ratio. [8]

(*b*) A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter 4 cm. The composite bar is then subjected to axial pull of 45000 N. If the length of each bar is 15 cm, determine :

(*i*) The stress in the rod and the tube

(*ii*) Load carried by each bar.

Take E for Steel = 2.1×10^5 N/mm^2 and E for copper = 1.1×10^5 N/mm^2. [8]

Or

2. (*a*) Draw stress strain diagram for ductile materials. [8]

(*b*) A steel rod and two copper rods together supports a load of 370 kN load. The cross-sectional area of steel rod is 2500 mm^2 and each of copper rod is 1600 mm^2. Find the stress in the rods. Take E for Steel = 2×10^5 N/mm^2 and E for copper = 1×10^5 N/mm^2. Length of Cu rod = 15 cm and length of steel rod = 25 cm. [8]

3. A beam AB of 8 m span is hinged at each end. It carries a uniformly distributed load of 2 kN per metre, on the left half of the beam. A point load of 25 kN act vertically downward at a distance of 6 m from left end. In addition the beam is also subjected to couples of 20 kN-m in counter-clockwise direction at left hand support and 30 kN-m in clockwise direction at right hand support. Determine the reactions at ends and draw shear force and Bending Moment diagram indicating all the values. [18]

Or

4. A beam 10 m long and simply supported at each end, has a udl of 1000 N/m extending from left end upto the centre of the beam. There is also an anticlockwise couple of 15 kN-m at a distance of 2.5 m from right end. Draw the shear force and bending moment diagrams indicating all the values. [18]

5. (*a*) With usual notations prove that :

$$\frac{M}{I} = \frac{s}{Y} = \frac{E}{R}.$$ [8]

(*b*) A cast iron beam of I-section is shown in Fig. 1. The beam is simply supported on a span of 5 m. If the tensile stress is not to exceed 20 N/mm^2, find the safe uniformly load the beam can carry. Find also the maximum compressive stress. [8]

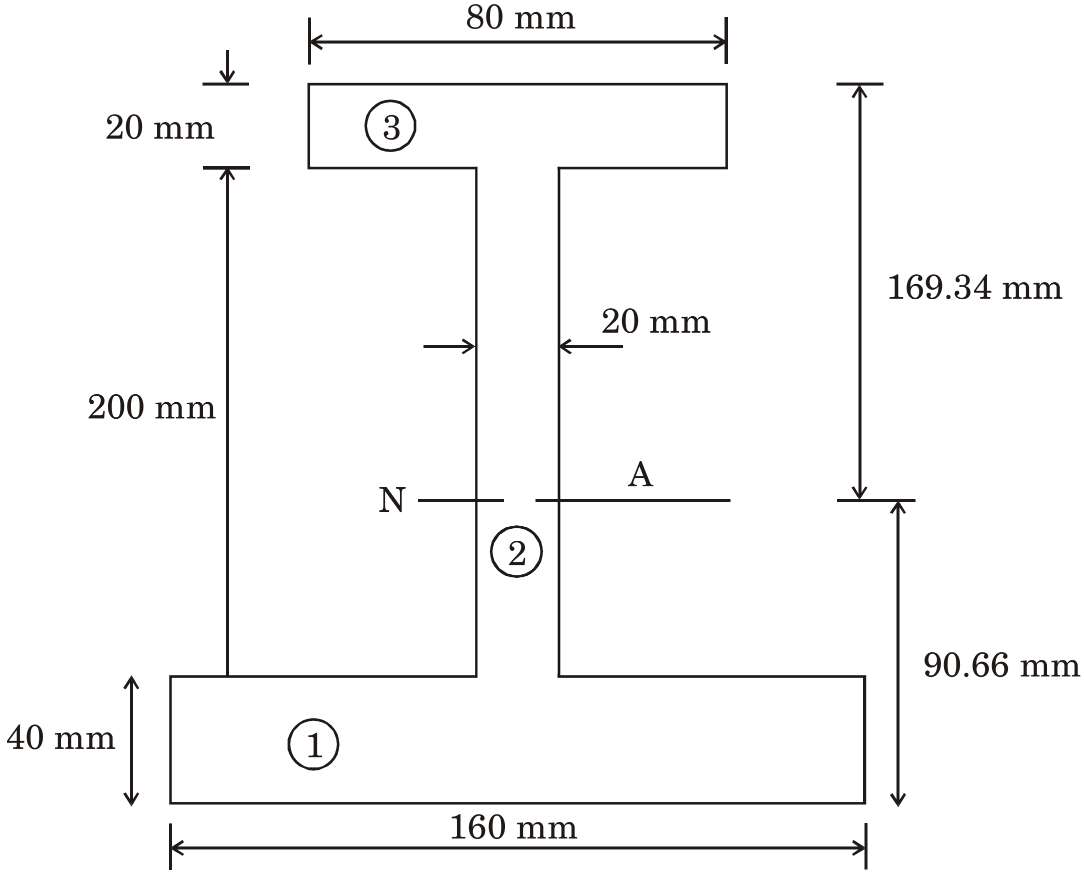


Fig. 1

Or

6. (*a*) Prove with usual notations :

$$z = \mathrm{F}\,\frac{\mathrm{A}\bar{y}}{\mathrm{I} \times b}.$$ [8]

(*b*) A beam of cross-section of an isosceles triangle is subjected to a shear force of 30 kN at a section where base width = 150 mm and height = 450 mm. Determine :

(*i*) Horizontal shear stress at the neutral axis.

(*ii*) The distance from the top of the beam where shear stress is maximum.

(*iii*) Value of maximum shear stress. [8]

SECTION II

7. (*a*) Derive with usual notations Torsion formula. [8]

(*b*) A solid circular shaft and a hollow circular shaft whose inside diameter is $\left(\frac{3}{4}\right)$ of the outside diameter, are of the same material, of equal lengths and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stress developed in the two shafts are equal. [8]

Or

8. (*a*) Derive an expression for crippling load when both the ends of the column are hinged. [8]

(*b*) A simply supported beam of length 4 metres 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 :

(*i*) one end fixed and other end hinged

(*ii*) both the ends pin jointed. [8]

9. (*a*) Explain the procedure for Mohr's circle for determining principal planes and principal stresses. [8]

(*b*) An unknown weight falls through a height of 10 mm on a collar rigidly attached to the lower end of a vertical bar 500 cm long and 600 mm^2 in section. If the maximum extension of the rod is to be 2 mm, what is the corresponding stress and magnitude of the unknown weight ? Take $E = 2 \times 10^5$ N/mm^2. [8]

Or

10. (*a*) Explain theories of failure. [8]

(*b*) A weight of 10 kN falls by 30 mm on a collar rigidly attached to a vertical bar 4 m long and 1000 mm^2 in section. Find the instantaneous expansion of bar. Take E = 210 GPa. Derive the formula you use. [8]

11. (*a*) Derive an expression for slope and deflection of a beam subjected to uniform Bending Moment. [8]

(*b*) A beam of length 8 m is simply supported at its ends. It carries a uniformly distributed load of 40 kN/m as shown in Fig. 2. Determine the deflection of the beam at its mid points and also the position of maximum deflection. Take $E = 2 \times 10^5$ N/mm^2 and $I = 4.3 \times 10^8$ mm^4. [10]

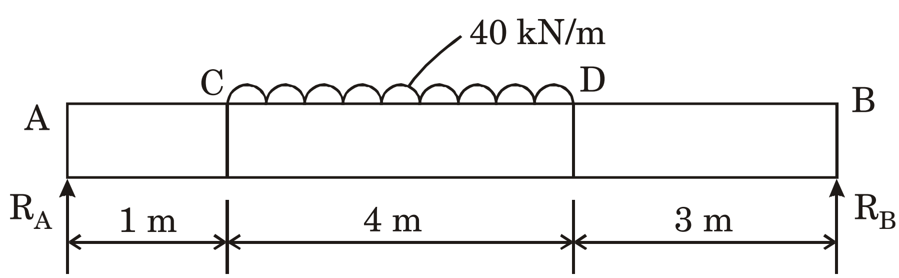


Fig. 2

Or

12. (*a*) What is Macaulay's method ? Find an expression for deflection at any section of a simply supported beam with eccentric point load using Macaulay's method. [8]

(*b*) A beam of length 6 m is simply supported at its ends and carries two point load of 48 kN and 40 kN at a dist. of 1 m and 3 m resp. from the left support. Find by Macaulay's method :

(*i*) Deflection under each load

(*ii*) Maximum deflection

(*iii*) The point at which max. deflection occurs.

Take $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-184

S.E. (Printing) (First Semester) EXAMINATION, 2010

PRINTING DIGITAL ELECTRONICS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. **1**. or Q. **2**, Q. **3** or Q. **4** and Q. **5** or Q **6** from Section I and Q. **7** or Q. **8** Q. **9** or Q. **10** and 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*) Assume suitable data, if necessary.

SECTION I

1. Perform the following conversions stepwise : [18]

(*a*) $(123.63)_{10}$ to hexadecimal

(*b*) $(32.25)_8$ to Decimal

(*c*) $(110011.11)_2$ to Decimal

(*d*) $(2497.50)_{10}$ to Octal

(*e*) $(2ADD)_{16}$ to Octal

(*f*) $(25.7A)_{16}$ to Binary.

P.T.O.

Or

2. (*a*) Design and draw a circuit for converting BCD code to Excess 3 code. Draw necessary truth table, K-map and simplified circuit for the same. [10]

(*b*) Write short notes on :

(*i*) Bar code and its applications in the field of Printing Technology.

(*ii*) ASCII code [8]

3. (*a*) Simplify using Boolean algebra and realize the simplified equation using Basic gates : [8]

(*i*) $(\bar{A} + B) \cdot (A + B)$

(*ii*) $\overline{(AB + BC) \cdot AC}$

(b) The functionality of a hand held machine is expressed as :

$f(A, B, C, D) = \Sigma m\,(0, 2, 5, 6, 7, 13) + d(8, 10, 15)$

Minimize using K-map and draw the simplified diagram. [8]

Or

4. (*a*) For the given Boolean expression : [8]

(*i*)

Implement using NAND logic.

(*ii*) $(A + \bar{B}) \cdot (\bar{A} + B + C)$

Implement using NOR logic.

(*b*) Compare TTL, CMOS and ECL logic families on the basis of the following : [8]

(*i*) Propagation delay

(*ii*) Noise margin

(*iii*) Power dissipation

For a portable handheld machine design which of the logic family would be a best choice.

5. (*a*) Design a full adder using 2 half adders. Draw block diagram to achieve addition of two eight bit numbers. [8]

(*b*) Using 2's complement method perform the following subtraction : [8]

(*i*) $(42)_{10} - (68)_{10}$

(*ii*) $(25)_{10} - (16)_{10}$

Or

6. (*a*) Covert the following decimal numbers to BCD and add them : [8]

(*i*) $(5337)_{10} + (7538)_{10}$

(*ii*) $(2355)_{10} + (2365)_{10}$

(*b*) A printing machine has a digital section that consists of combinational circuit with a 4 bit binary input and generates outputs such that : [8]

(*i*) Output A0 = 1 if sum of all digits is 1 and carry = 0

(*ii*) Output A1 = 1 if sum of all bits is 0 and carry = 1

(*iii*) Output A2 = 1 if sum of all digits is 1 and carry = 1 and

(*iv*) Given that the circuit generates an output as sum = 1 and carry = 1, when all the four inputs are 1.

Design the digital section to achieve above condition.

SECTION II

7. (*a*) Draw and explain Master-Slave JK flip-flop with the help of truth table. [8]

(*b*) Design and explain mod 6 counter. Draw a truth table and timing diagrams for the same. [10]

Or

8. (*a*) Explain 3 modes of operations of shift register IC 7495 using diagrams. [8]

(*b*) Design and explain T type flip-flop. [6]

(*c*) Explain any *one* application of counter in printing. [4]

9. (*a*) What is the need of DAC ? Explain the working of any *one* type of DAC with a neat diagram. [8]

(*b*) State the various types of displays. Explain seven segment LED display and state any *two* application areas for the same. [8]

Or

10. (*a*) What are PLD's ? State the types and advantages of PLD's. Draw and explain any *one* type of PLD. [8]

(*b*) What are memories ? State and explain various types of memories. [8]

11. (*a*) Compare and contrast between Digital camera and Digital Scanner. [8]

(*b*) Write short notes on (any *two*) : [8]

(*i*) Joystick

(*ii*) Floppy Disk

(*iii*) Keyboard

Or

12. Write short notes on (any *four*) : [16]

(*a*) Printer classification and application areas

(*b*) Operation of mouse

(*c*) Input-Output devices of a computer

(*d*) Serial and Parallel ports

(*e*) CDs

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[3862]-185

S.E. (Printing) (First Semester) EXAMINATION, 2010

TECHNOLOGY OF PRINTING MATERIALS (Theory)

(2008 COURSE)

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.

SECTION I

1. (A) Explain the specific properties of metals when selected as an image carrier in various printing processes. [8]

(B) Describe the various types of Polyethylene with their properties. [8]

Or

(A) Explain the specific properties of metals when selected as an ink transfer mechanisms in various printing processes. [8]

(B) Explain various types of Polypropylene with their properties. [8]

P.T.O.

2. (A) Explain the theory of adhesion with suitable examples. [8]

(B) Explain the procedure of preparing the screen by Direct-Indirect photographic method. [8]

Or

(A) Explain the procedure of preparing the screen by Chromoline photographic method. [8]

(B) Explain the role of various ingredients of fountain solution used in the lithography. [8]

3. (A) Explain vehicles used in printing ink with properties. [9]

(B) Explain the classification of pigments used in printing ink. [9]

Or

(A) Explain any *two* methods by which printed ink dry on substrate. [9]

(B) Explain the term Rheology of printing inks. [9]

SECTION II

4. (A) Explain the importane of determining the dispersion of pigment in the vehicle while manufacturing the ink. [8]

(B) Describe any *two* procedures of determining top and bottom side of paper. [8]

Or

(A) Explain the difference between subjective and objective methods of testing. [8]

(B) Describe any *two* procedures of determining machine and cross direction of paper. [8]

5. Explain any *two* in detail : [16]

(*i*) Explain the term "Paper per capita consumption".

(*ii*) State the importance of paper products and export potential of India for paper products.

(*iii*) State importance of fillers in paper and explain the properties to be achieved in paper.

(*iv*) Name the different finishes obtained on the surface of paper and explain MG finish paper.

Or

(A) Comment on any *two* : [8]

(*i*) Soft wood and Hard wood

(*ii*) Chemical pulp

(*iii*) Mechanical and Ground wood pulp.

(B) Explain with the help of graph, importance of beating influencing the quality of paper. [8]

6. (A) Draw a diagram of Multivat cylinder mould machine and state the importance in duplex and triplex board. [10]

(B) Write the advantage of Uniflow machine in the production of duplex board. [8]

Or

(A) Explain in detail the importance of moisture content in paper for the printing industry. [10]

(B) Comment on any *two* : [8]

(*i*) Thickness of paper

(*ii*) Acidity (pH) of paper

(*iii*) Brightness of paper

(*iv*) Coated paper

(*v*) Recycled paper.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-186

S.E. (Printing) (Second Semester) EXAMINATION, 2010

ELECTRICAL MACHINES AND UTILIZATION

(2008 COURSE)

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 with neat diagrams characteristics of d.c. motors. [8]

(*b*) A lap wound d.c. shunt generator having 80 slots with 10 conductors per slot generates at no load an e.m.f. of 400 V, when running at 1000 rpm. At what speed should it be rotated to generate a voltage of 220 V on open circuit ? [8]

Or

2. (*a*) Explain three point starter in d.c. shunt motor in detail with its necessity. [8]

(*b*) A 25 kW, 250 V d.c. shunt generator has armature and field resistance of 0.06 Ω and 100 Ω respectively. Determine the total armature power developed when working :

(*i*) As generator delivering 25 kW output and

(*ii*) As motor taking 25 kW input. [8]

P.T.O.

3. (*a*) Derive equations of power and torque for three-phase induction motor. [8]

(*b*) The rotor resistance and standstill reactance of a 3-ph induction motor are respectively 0.015 Ω and 0.09 Ω per phase

(*i*) What is p.f. of motor at start ?

(*ii*) What is p.f. at a slip of 4% ?

(*iii*) If the number of poles is 4, the supply frequency is 50 Hz and the standstill e.m.f. per rotor phase is 110 V, find out the full load torque. Take full load slip as 4%. [8]

Or

4. (*a*) Explain with neat diagram construction and working of shaded pole induction motor. [8]

(*b*) The power input to the rotor of a 400 V, 50 Hz, 6-pole 3-ph induction motor 75 kW. The rotor e.m.f. is observed to make 100 complete alternations per minute. Calculate (*i*) slip (*ii*) Rotor speed (*iii*) Rotor copper losses per phase (*iv*) Mechanical power developed and (*v*) the rotor resistance per phase if the rotor current is 60 A. [8]

5. (*a*) Explain in detail of selection of motors depending on load characteristics. [8]

(*b*) Explain a.c. servomotor in detail with applications. [10]

Or

6. (*a*) Explain advantages of electrical drive. What do you mean by individual and group drive. [8]

(*b*) Explain special features of synchronous motors. [10]

SECTION II

7. (*a*) Explain in detail various types of Electric encoders, Photo cells, Micro switches, Proximity switches. [8]

(*b*) A balanced star connected load is supplied from a symmetrical 3-phase, 440 V, 50 Hz supply system. The current in each phase is 20 A and lags behind its phase voltage by an angle 40°.

Calculate :

(*i*) Phase voltage

(*ii*) Load parameters

(*iii*) Total power and

(*iv*) Readings of two wattmeters,

connected in the load circuit to measure the total power. [8]

Or

8. (*a*) Explain with neat diagram for reactive power measurement using two wattmeter method. [8]

(*b*) Power input to a 3-phase 440 V, 37.3 kW induction motor whose efficiency and power factor are respectively 88% and 0.82 is to be measured by two wattmeter method. Find the readings of both the wattmeters and the full load line current drawn by the motor. [8]

9. (*a*) Explain any *two* methods of temperature control of induction furnaces. [8]

(*b*) A 20 kW, 1-ϕ, 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, emissivity = 0.9 and specific resistivity of wire material is 1.09×10^{-6} Ωm. [8]

Or

10. (*a*) Explain with neat diagram of resistance heating with its working principle. [8]

(*b*) A piece of an insulating material is to be heated by dielectric heating. The size of the piece is 12 cm × 12 cm × 3 cm. A frequency of 20 MHz is used and the power absorbed is 450 W. If the material has a relative permittivity of 5 and a power factor of 0.05. Calculate the voltage necessary for heating and current that flows in the material.
If the voltage were limited to 1700 V, what will be the frequency to get the same loss ? [8]

11. (*a*) Explain the safety procedures and maintenance procedures followed by printing industry. [8]

(*b*) A light source having an intensity of 400 C_p in all directions is fitted with a reflector so that it directs 80% of its light along a beam having a divergence of 15. Determine the average illumination produced on a surface normal to the beam direction at a distance of 8 meters. [10]

Or

12. (*a*) Explain Inverse Square law and Lambert's Cosine law with requirements of good lighting scheme. [8]

(*b*) A 500 W lamp having M.S.C.P. of 800 is suspended 3 m above the working plane.
Calculate :
(*i*) Illumination directly below the lamp at the working plane
(*ii*) Lamp efficiency
(*iii*) Illumination at a point 2.4 m array on the horizontal plane from vertically below the lamp. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-189

S.E (Printing and Graphic Communication)

(Second Semester) EXAMINATION, 2010

MICROPROCESSOR AND MICROCONTROLLER TECHNIQUES IN PRINTING

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) 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*) What are different registers available in 8085 microprocessor ? Explain in detail the typical use of each register. [8]

(*b*) Explain the following pins of 8085 : [8]

TRAP ALE

RST 7.5 INTR

SID RESET

S0 and S1

P.T.O.

Or

2. (*a*) Draw and explain the block diagram of 8085 in detail. [10]

   (*b*) State and explain different buses available in 8085 microprocessor. [6]

3. (*a*) Explain unconditional jump and different conditional jump instructions in 8085. [10]

   (*b*) Explain various addressing modes of 8085 with proper example. [8]

Or

4. (*a*) Explain what operation will take place when the following instructions are executed : [10]

   (*i*) LHLD

   (*ii*) MOV A, B

   (*iii*) MVI B, 92H

   (*iv*) ADI 59H

   (*v*) DCR B

   (*b*) What is stack memory ? What is the difference between stack memory and conventional memory ? Explain the use of stack memory in microprocessor. [8]

5. (*a*) Draw pin diagram of 8051 microcontroller and explain different pins in detail. [10]

   (*b*) Explain TMOD (Timer/Counter-mode control register) and TCON(Timer/Counter-control /Status register) in 8051 microcontroller. [6]

Or

6. (*a*) Explain serial port control (SCON) register in 8051 microcontroller. [10]

(*b*) Explain program status word (PSW) in 8051 microcontroller. [6]

SECTION II

7. (*a*) Explain different addressing modes in 8051 microcontroller. [10]

(*b*) Explain the following instructions in 8051 : [6]

(*i*) ADD A, @ Rn

(*ii*) MOV A, data

(*iii*) MOV A, Rn

Or

8. (*a*) Explain any 4 logical operation instructions in 8051 microcontroller. [8]

(*b*) Write short notes on : [8]

(*i*) RS 232

(*ii*) IEEE 488

9. (*a*) Explain control word in 8255 programmable peripheral interface. Explain mode 0 in 8255. [10]

(*b*) Draw and explain block diagram of 8253 programmable interval timer (PIT). [8]

Or

10. (*a*) Draw and explain pin diagram of 8251 programmable communication interface (USART). [10]

(*b*) Explain different priority modes in 8259 Programmable interrupt controller. [8]

11. (*a*) Explain concept of PLC. [8]

(*b*) Explain stepper motor interfacing with 8085 microprocessor. [8]

Or

12. (*a*) Explain application of PLC in the field of printing in detail. [8]

(*b*) Explain any *one* application of microprocessor 8085 in the field of printing. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-190

S.E. (Printing) (Second Semester) EXAMINATION, 2010

THEORY OF PRINTING MACHINES

(2008 COURSE)

Time : Four 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*) Define and explain the following :

(1) Kinematic Chain

(2) Inversion

(3) Degrees of freedom

(4) Flexible link

(5) Rigid link

(6) Machine. [6]

(*b*) Explain the inversion of Quadric cycle crank chain with neat sketches. [10]

Or

2. (*a*) Explain Ratchet and pawl arrangement with a neat sketch. [6]

(*b*) Explain the inversion of Double slider crank chain. [10]

3. Draw the velocity and acceleration for the mechanism shown in the Fig. 1. Determine the velocity and acceleration of ram 'E' for the given position, if Crank OA rotates uniformly at 150 rpm.

OA = 150 mm, AB = 550 mm, BE = 350 mm, AC = 450 mm, DC = 500 mm. [16]

E

B

C

550 mm

D

200 mm

O

A

60

500 mm

Fig. 1

Or

4. As shown in the Fig. 2, the crank OA makes 150 rpm. Find for the given configuration.

The velocity and acceleration of piston P and the angular acceleration of links ABC and CP.

OA = 150 mm, AB = 375 mm, AC = 400 mm, BC = 62.5 mm, BQ = 200 mm, CP = 450 mm, QO = 62.5 mm. [16]

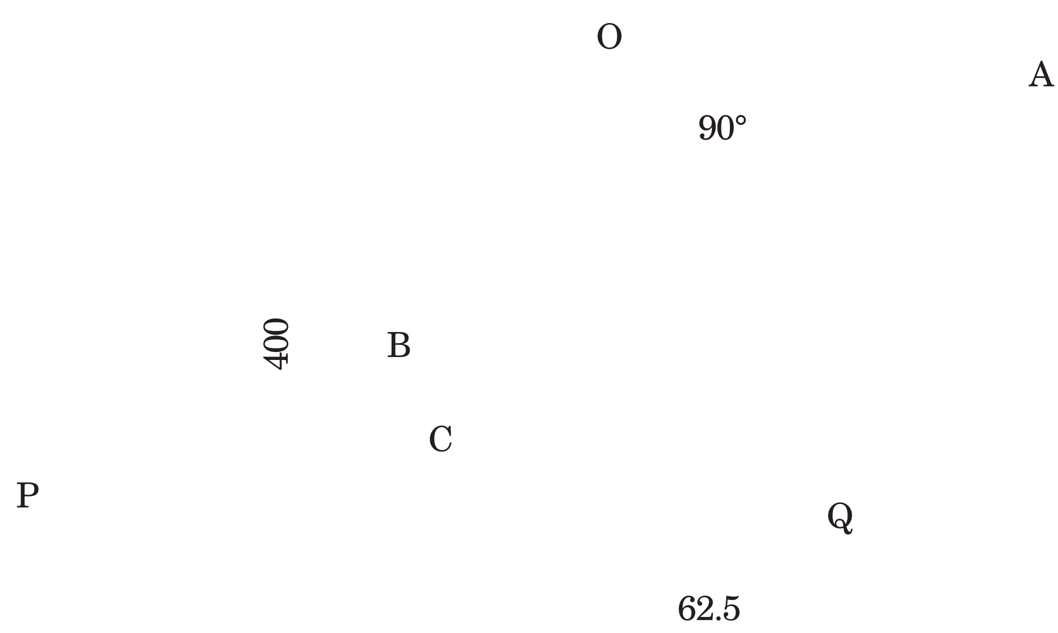


Fig. 2

5. The Fig. 3 shows a crank and slotted lever quick return mechanism, in which the distance between the fixed centres O and

C is 210 mm. The driving crank CP is 105 mm long and it rotates clockwise at 90 rpm. The length of the slotted link OD is 420 mm and the length of the link DE is 165 mm. The line of stroke of ram E is horizontal and 205 mm above the fixed centre C. At the instant when angle OCP is 110°. Find the velocity and acceleration of ram E. [18]

Ram E

D

210

P(Q)

C

110°

210

O

Fig. 3

Or

6. The Fig. 4 shows an oscillating cylinder mechanism. The crank OB rotates at speed of 300 rpm in anticlockwise direction. For the position shown, determine the angular velocity and angular acceleration of cylinder and velocity, acceleration of point A on piston. Show Coriolis component of acceleration clearly.

OB = 150 mm, OC = 600 mm, AB = 400 mm. [18]

B

A(D)

60

C

O

Fig. 4

SECTION II

7. (*a*) Explain the working of multiplate clutch with the help of neat sketch and also state its application. [8]

(*b*) Derive the expression for torque transmitting capacity of a single plate clutch with uniform wear and uniform pressure theory. [8]

Or

8. (*a*) Differentiate between hydrostatic and hydrodynamic lubrication. [8]

(*b*) Explain the working of centrifugal clutch with neat sketch. Also state its applications. [8]

9. (*a*) Explain with a neat sketch self energizing of brakes. [6]

(*b*) The rope of a winch crab supports a dead weight of 4500 kg mass and is wound round a barrel of 420 mm diameter. A brake drum of 560 mm diameter is keyed to the barrel shaft. A differential band brake act on the drum with its two ends attached to pins on opposite sides of the fulcrum of the block lever at 25 mm and 125 mm respectively. The band embraces 70% of the circumference of the drum. The coefficient of friction is 0.28. Find the least force required to be applied at the end of the brake lever 1 m from the fulcrum. [10]

Or

10. (*a*) Explain Pivoted block brake and double block brake. [6]

(*b*) A band and block brake having 14 blocks each of which subtends an angle of 15 degrees at the centre is applied to a drum of 1 m effective diameter. The drum and the flywheel mounted on the same shaft weigh 20 kN and combined radius of gyration is 500 mm. The two ends of the band are attached to pins on opposite side of the brake lever at a distance of 30 mm and 120 mm from the fulcrum. If the force of 200 N is applied at a distance of 750 mm from the fulcrum find,

(*i*) Maximum braking torque

(*ii*) Angular retardation of the drum

(*iii*) Time taken by system to come to rest from the rated speed of 360 rpm. The coefficient of friction between the block and the drum is 0.25. [10]

11. (*a*) Derive an expression for centrifugal tension for flat belt. [8]

(*b*) Write short notes on :

(*i*) Crowning of pulleys

(*ii*) Slip and creep referred to belt drive. [10]

Or

12. (*a*) Derive an expression for limiting tension ratio for V belt drive. [8]

(*b*) Write short notes on :

(*i*) Law of belting

(*ii*) Initial tension in belt. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-191

S.E. (Chem.) (First Semester) EXAMINATION, 2010

CHEMISTRY–I

(2008 COURSE)

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.

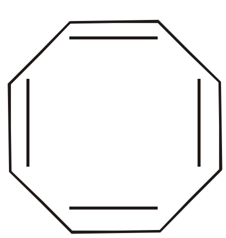
(*v*) Assume suitable data, if necessary.

SECTION I

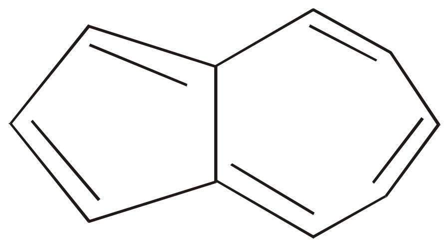
1. (*a*) What are the postulates of molecular orbital theory ? Explain the paramagnetic behaviour of O_2 molecule. [6]

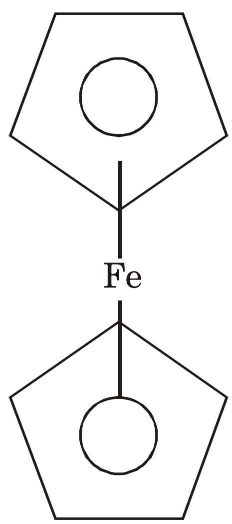
(*b*) Sketch the shapes of the M.O's formed by the overlap of atomic orbitals. [6]

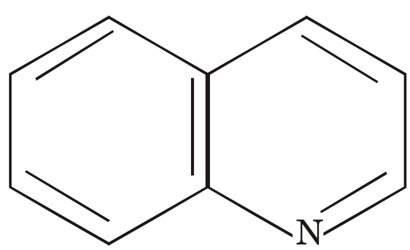
(*c*) Classify the following compounds as aromatic and non-aromatic : [4]

(*i*) 

P.T.O.

(*ii*) 

(*iii*) 

(*iv*) 

Or

2. (*a*) What are the conditions necessary for delocalization ? Explain the delocalization in benzene. [6]

(*b*) Give reasons :

(*i*) Guanidine is a strong base

(*ii*) Phenol is acidic in nature

(*iii*) Oxalic acid is stronger than formic acid. [6]

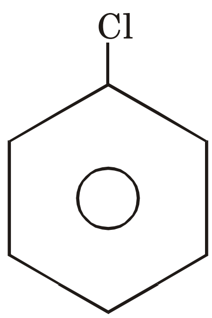
(*c*) Draw the orbital picture and show the relative order of stability of free radicals and carbanions. [4]

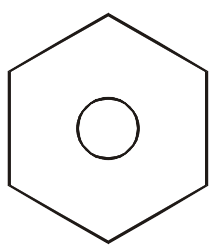
3. (*a*) Give an comparative account for S_N1 and S_N2 reactions. [6]

(*b*) Explain why $-NO_2$ group is deactivating and *m*-directing. [4]

(*c*) Predict the product : [6]

(*i*) $CH_3Br + CH_3NH_2 \rightarrow$

(*ii*)  $\xrightarrow[\text{Heat}]{\text{Fuming } H_2SO_4}$

(*iii*)  $+ \; C_{15}H_{13}OH \xrightarrow[AlCl_3]{\text{anhyd}}$

(*iv*) $CH_3COCl \xrightarrow{NaNH_2}$

(*v*) $CH_3CH = CH_2 + HI \rightarrow$

(*vi*) $(CH_3)_3CCl \xrightarrow[\text{Polar Solvent}]{\text{Base}}$

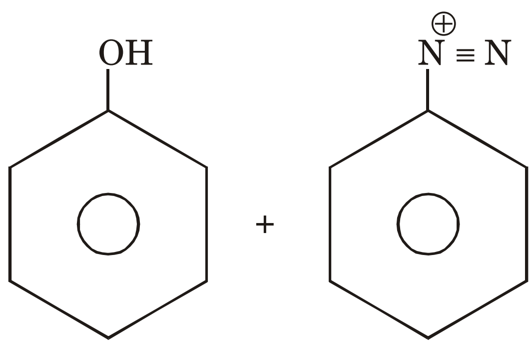
Or

4. (*a*) Discuss the mechanism of Beckmann's rearrangement. [4]

(*b*) What is sulphonation ? Give the mechanism for sulphonation of benzene. [6]

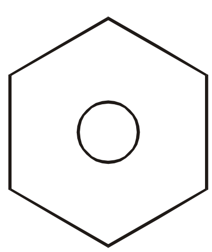
(*c*) Identify A and B in the following reactions :

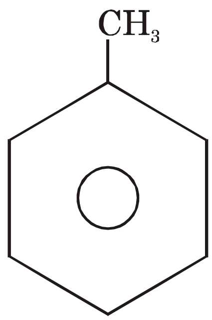
(*i*) $6CH_3{-}CH{=}CH_2 + B_2H_6 \rightarrow A \xrightarrow{6H_2O_2} B$

(*ii*)  $\rightarrow$ A

(*iii*) $CH_3OCH_2CH_3$ A + B

(*iv*) $C_6H_5CHO + Br{-}CH_2{-}COOC_2H_5 \xrightarrow[(ii)\ H^+,\ H_2O]{(i)\ Zn,\ ether} A$

(*v*)  $+ CH_3COCl \xrightarrow[AlCl_3]{anhyd} A + B$

(*vi*)  $\xrightarrow{\text{Fe, Cl}_2}$ A + B. [6]

5. (*a*) What are conductometric titrations ? Describe briefly the different types of conductometric titrations. [6]

(*b*) Discuss the interferences and limitations in flame photometry. [4]

(*c*) Give reasons :

(*i*) The equivalent conductance of an aqueous solution of a weak electrolyte increases on dilution but the specific conductance decreases.

(*ii*) The equivalent conductance of a strong electrolyte changes with its concentration. [6]

(*d*) Electrolytic specific conductance of 0.25 mol L^{-1} solution of KCl at 25°C is 2.56×10^{-2} ohm^{-1} cm^{-1}. Calculate its molar conductance. [2]

Or

6. (*a*) What are ion-selective electrodes ? Describe the working and construction of a glass electrode as a solid-state membrane electrode. [4]

(*b*) State and explain Kohlrausch's law. The ionic conductance $\lambda^0_{H^+}$ and $\lambda^0_{Cl^-}$ are 349.8 and 196.7 cm^2 ohm^{-1} $equiu^{-1}$ respectively. At 25°C κ of water = 5.7×10^{-8} ohm^{-1} cm^{-1}. Calculate the ionic product of water. Given $_0 = \Lambda$. [6]

(*c*) What is the principle of flame photometry ? Describe the premix or laminar flow burner. [4]

(*d*) Calculate the electrode potential of titration mixture when 90 ml of Ce^{+4} is added during titration of 100 ml of 0.1 N Fe^{+2} ion solution taken in flask against 0.1 N Ce^{+4} ion solution added from burette. [4]

(Given : E^0_1 = 0.785 volt, E^0_2 = 1.45 volt)

$Fe^{+2} \quad Fe^{+3} + e^-$ (E^0_1 = 0.785 volt)

$Ce^{+4} + e^- \quad Ce^{+3}$ (E^0_2 = 1.45 volt)

SECTION II

7. (*a*) Obtain rate equation for first order kinetics and give its characteristics. [6]

(*b*) Define the rate of chemical reaction. Explain the experimental techniques for the rate determination. [6]

(*c*) For the decomposition of acetone dicarboxylic acid rate constant is 2.46×10^{-5} at 273 K and 1.63×10^{-3} at 303 K. Calculate the energy of activation of the reaction. [4]

Or

8. (*a*) What is steady state approximation ? How is it useful in deriving rate law for a photochemical reaction ? [6]

(*b*) Show that in first order reaction, time required for 75% completion is double the time required for 50% reaction completion. [6]

(*c*) The reaction $2HBr \rightarrow H_2 + Br_2$ is second order with rate constant 1.2×10^{-5} liter per mole per sec. at 600 K. How long will it take to decompose 40% if HBr is kept at 50 kPa at 500 K in closed vessel. [4]

9. (*a*) Explain the principle, technique and applications of column chromatography. [6]

(*b*) What is fuel cell ? Explain construction and working of polymer electrolyte membrane fuel cell. [6]

(*c*) Define :

(*i*) Charge-discharge cycles

(*ii*) Energy density

(*iii*) Specific energy

(*iv*) Power density. [4]

Or

10. (*a*) Write a note on lithium batteries with various compositions. [6]

(*b*) What is gas chromatography ? Give its instrumentation. [6]

(*c*) State the applications of HPLC. [4]

11. (*a*) Give any *one* synthetic method and uses of the following dyes :

(*i*) Phenolphthalein

(*ii*) Crystal violet. [6]

(*b*) Discuss the aromatic character of pyrrole by giving its orbital and resonance structure. [6]

(*c*) Write the chemical reactions for the following :

(*i*) Reduction of quinoline with platinum catalyst in the presence of CH_3COOH.

(*ii*) Action of sodamide on pyridine.

(*iii*) Catalytic reduction of furan in presence of Nickel. [6]

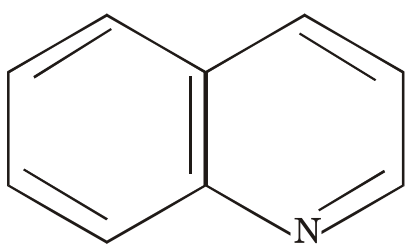
Or

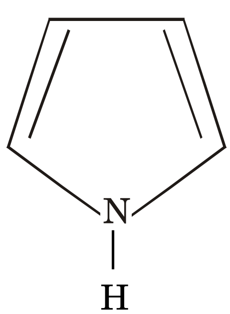
12. (*a*) How are dyes classified according to their chemical constitution ? Give specific example of each. [6]

(*b*) Write a note on Skraup synthesis of quinoline. [6]

(*c*) Complete the reaction : [6]

(*i*) $+ \ (CH_3CO)_2O \xrightarrow{BF_3/0°C}$

(*ii*)  $+ \ CH_3I \longrightarrow$

(*iii*)  $+ \ CHCl_3 \ + \ KOH \longrightarrow$

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-193

S.E. (Chemical) (First Semester) EXAMINATION, 2010

CHEMICAL ENGINEERING MATERIALS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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.

SECTION I

1. (*a*) Write the classification of Engineering Materials. [3]

(*b*) Define the following terms : [8]

(*i*) Malleability

(*ii*) Ductility

(*iii*) Hardness

(*iv*) Toughness.

(*c*) Explain Necking in brief. [5]

Or

2. (*a*) Define Poisson's ratio and its applications. [3]

(*b*) Draw stress-strain curve showing clastic and plastic limit of metal. [4]

(*c*) Define factor of safety and give its applications. [6]

(*d*) Define the term Resilience. [3]

3. What are the different types of Hardness testing methods ? Explain any *two* methods in detail. [16]

Or

4. (*a*) Write a short note on Brinell Hardness Test. [6]

(*b*) Explain Impact test in detail. [10]

5. (*a*) Draw Iron-Iron carbide equilibrium diagram. [6]

(*b*) Explain various phases observed in Iron-Iron carbide equilibrium diagram. [6]

(*c*) Explain different reaction involved in Iron-Iron carbide equilibrium diagram. [6]

Or

6. (*a*) Explain the following terms : [12]

(*i*) Insulations

(*ii*) Refractories

(*iii*) Types of steel.

(*b*) Explain the Rolling and Rivetting process in detail. [6]

SECTION II

7. (*a*) Give and explain any *four* types of corrosion. [12]

(*b*) Write a short note on Dry corrosion. [4]

Or

8. (*a*) Explain the different methods of prevention of corrosion. [10]

(*b*) What is an oxide film ? Explain its formation and growth mechanism. [6]

9. Explain the following : [16]

(*i*) Vulcanization of rubber

(*ii*) Nylon-6

(*iii*) Applications of polymers

(*iv*) Stress relaxation.

Or

10. (*a*) Define polymerization. Explain addition and condensation polymerization. [10]

(*b*) Define natural and synthetic polymers. [6]

11. (*a*) Write a short note on Vitrification process. [6]

(*b*) Define ceramic materials. Write applications of ceramic materials. [6]

(*c*) What are the different mechanical properties of ceramic.? [6]

Or

12. Write short notes on (any *three*) : [18]

(*i*) Glass and its types

(*ii*) Refractories

(*iii*) Applications of ceramic material

(*iv*) Cement

(*v*) Clays

(*vi*) Borosilicates.

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-194

S.E. (Chemical) (First Semester) EXAMINATION, 2010

CHEMICAL PROCESS CALCULATIONS

(2008 COURSE)

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*) The flow rate of water through is pipe is reported as 15 cubic feet per minute. Taking density of water as 1.0 gm/cm^3, calculate the mass flow rate in kg/sec. [4]

(*b*) The potential energy of a body at a height of 15 m is 2.0 kJ. If the body is moving at a velocity of 50 m/sec, what is its kinetic energy ? [6]

(*c*) The gas mixture has the following composition by volume : Hydrogen 35.2%, Methane 14.8%, Ethylene 12.8%, Carbon dioxide 1.5%, Carbon monoxide 33.9% and Nitrogen 1.8%. Find the molar volume of this gas mixture at 273 K and 101.3 kPa. [6]

Or

2. (*a*) A portland cement sample contained 20% SiO_2 by weight derived from two silicate compounds, $SiO_2.2CaO$ and $SiO_2.3CaO$ that are present in the cement in the mole ratio 3 : 4. Determine the percent by weight of each silicate compound in the cement. [8]

(*b*) An aqueous solution of K_2CO_3 contains 50% K_2CO_3. The density of solution is 1530 kg/m^3. Determine : [8]

(*i*) Mole % of K_2CO_3 in the solution

(*ii*) Molarity

(*iii*) Molality and

(*iv*) Normality of the solution.

3. (*a*) Acetone is recovered from acetone-air mixture containing 25% acetone by volume, by scrubbing with water. Assume that air is insoluble in water, determine the % of acetone, that is absorbed in water if the gas mixture leaving the scrubber analyzes 5% acetone. [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. 1000 kg of mixed acid of composition 40% H_2SO_4, 45% HNO_3 and 15% H_2O is to be produced by strengthening waste acid of composition 30% H_2SO_4, 36% HNO_3 and 34% H_2O by weight. Concentrated sulphuric acid of strength 95% and concentrated nitric acid containing 80% are available for this purpose. How many kilograms of waste acid and concentrated acids are to be mixed together ? [16]

5. A gas mixture consisting of 65% N_2, 35% SO_3 by volume is admitted to an absorption column at a rate of 4500 kg/hr. It is contacted with a stream of 50% H_2SO_4 flowing countercurrent to the gas stream at the rate of 5000 kg/hr. The gases leave at 101.3 kPa. Water lost with the exit gases exerts a partial pressure of 25 kPa. If the concentrated acid leaving the bottom of the column contained 75% H_2SO_4, what % of entering SO_3 is absorbed and converted to acid. [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 ractor pressure is 2 MPa g. The analysis of the gases leaving the reactor showed CO 57.1%, H_2 41.1%, CH_4 1.68% and CO 0.12% (by volume) on a dry basis. The reactions taking place in the reactor are :

$$CO_2 + 4H_2 = CH_4 + 2H_2O$$

and

$$CO_2 + H_2 = CO + H_2O.$$

Find :

(*a*) the conversion of CO_2 per pass

(*b*) yield of CH_4 in terms of CO_2 reacted and

(*c*) the composition of the feed. [18]

SECTION II

7. (*a*) Pure methane is heated from 30°C to 250°C at atmospheric pressure. Calculate heat added per kg of methane : [6]

$$C_p = 19.249 + (52.113 \times 10^{-3})T + (11.973 \times 10^{-6}T^2)$$

kJ/kmol K.

(*b*) Calculate the energy required to dissociate one kilogram of sodium bicarbonate at 298 K. [6]

$$2\ NaHCO_{3(s)} = Na_2CO_{3(s)} + CO_{2(g)} + H_2O_{(g)}.$$

Given data : Std. Heat of formation at 298 K :

	Component	ΔH_f kJ/mol
(1)	$Na_2CO_{3(s)}$	– 1130.68
(2)	$NaHCO_{3(s)}$	– 950.81
(3)	$H_2O_{(g)}$	– 241.82
(4)	$CO_{2(g)}$	– 393.51

(*c*) Define :

(*i*) Heat of Reaction and

(*ii*) Adiabatic Reaction Temperature. [4]

Or

8. A pilot plant reactor was charged with 50 kg of naphthalene and 200 kg of sulphuric acid (98% by weight). The reaction was carried out for 3 hrs and the reaction goes to completion. The product distribution was found to be 18.6% mono-sulphonate naphthalene (MSN) and 81.4% di-sulphonate naphthalene (DSN).

(*i*) Calculate the quantities of MSN and DSN naphthalene in product.

(*ii*) Complete analysis of product. [16]

9. (*a*) A saturated mixture of CO_2-water vapour comes out from the straight cooler at 130 kPa, 40°C before it is compressed. Find the absolute humidity in the mixture. The vapour pressure of water at 40°C is 7.375 kPa. [8]

(*b*) Define the following terms : [10]

(*i*) Dry Bulb temperature

(*ii*) Wet Bulb temperature

(*iii*) Relative humidity

(*iv*) Absolute humidity

(*v*) Dew point.

Or

10. (*a*) A solution of ethyl alcohol containing 8.6% alcohol is fed at the rate of 1000 kg/h to a continuous distillation column. The product (distillate) is a solution containing 95.5% alcohol. The waste solution 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/h and the percentage loss of alcohol. [10]

(*b*) A dryer is fed with wet solid to reduce the moisture content from 80% to 15%. The product leaving the dryer is sent to oven to reduce the moisture content to 2%. If 1000 kg of wet solid is fed to the dryer, find out the weight of the products leaving the dryer and oven. Also determine the amount of water removed in dryer and in oven. [8]

11. Explain briefly : [16]

(*a*) Types and calorific values of fuels

(*b*) Tests for proximate analysis

(*c*) Calorific vaues of fuels

(*d*) Adiabatic flame temperature.

Or

12. A gas mixture consisting of 80% ethane and 20% oxygen is burned in an engine with 100% excess air. 80% of the ethene goes to CO_2, 10% to CO and 10% remains unburned.

Calculate the composition of the exhaust gases on :

(*b*) Wet basis and

(*c*) Dry basis. [16]

Data :

Atomic weight K = 39, Si = 28, Ca = 40, Na = 23, S = 32.

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-195

S.E. (Chemical) (Second Semester) EXAMINATION, 2010

CHEMISTRY-II

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Neat diagrams must be drawn wherever necessary.

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

(*iii*) *All* questions are compulsory.

SECTION I

1. (*a*) What is an adsorption isotherm ? Explain the Freundlich isotherm. [6]

(*b*) What are the types of catalysis ? Explain the heterogenous catalysis with suitable examples. [6]

(*c*) Describe the adsorption and catalytic properties of Zeolites. [4]

Or

2. (*a*) Give the mechanisms of metal coordination compound catalysed reactions [6]

(*i*) Methanol carbonylation

(*ii*) Photolysis of water. [6]

(*b*) Explain the terms :

(*i*) Activation energy

(*ii*) Enzyme catalysis. [4]

3. (*a*) Explain the primary, secondary and tertiary structures of proteins. [6]

(*b*) What is a zwitter ion ? Describe the isolectric point. [6]

(*c*) Draw the open chain and ring structure of glucose. [4]

Or

4. (*a*) How does glucose react with :

(*i*) HNO_3

(*ii*) Acetic anhydride

(*iii*) Phenyl hydrazin. [6]

(*b*) Write a note on mutarotation. [6]

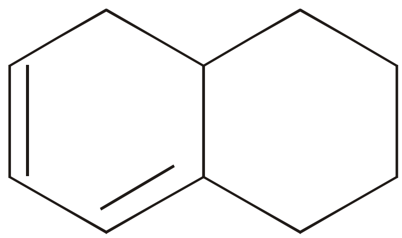
(*c*) What are polysaccharides ? Explain the properties of starch. [4]

5. (*a*) Give the principle and instrumentation involved in IR spectroscopy. [6]

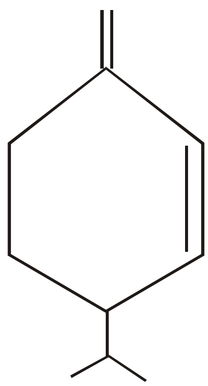
(*b*) State Lambert and Beer laws and derive the combined law equation. [6]

(*c*) Calculate U.V. absorption maxima for the following : [6]

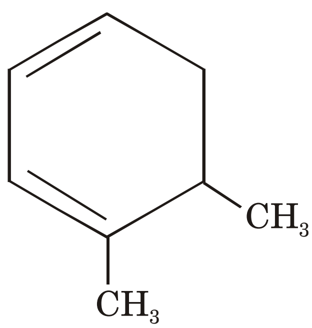
(*i*)



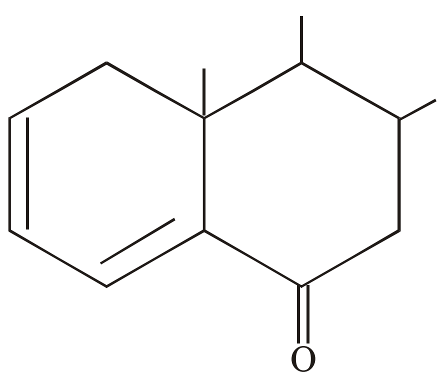
(*ii*)



(*iii*)

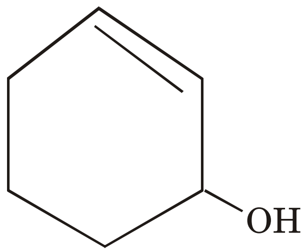
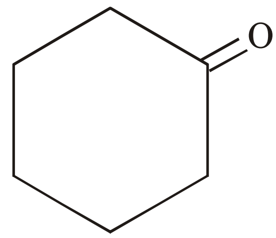


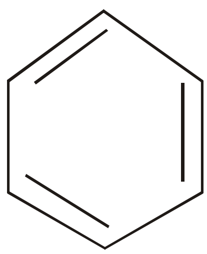
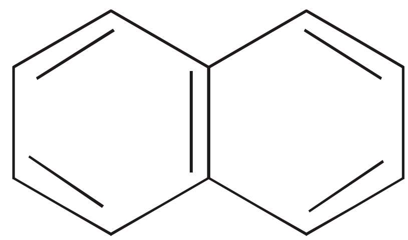
(*iv*)

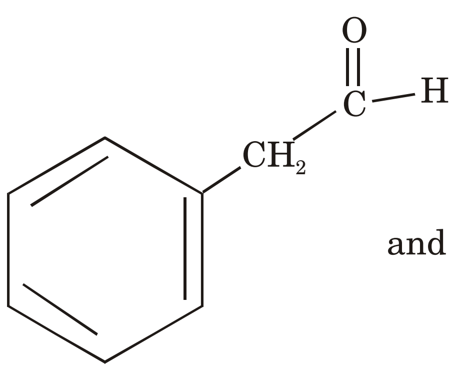
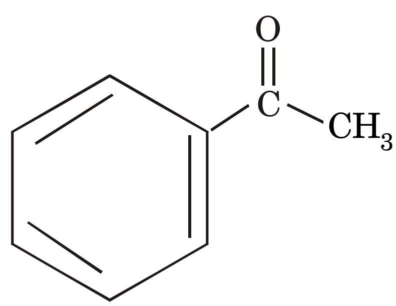


Or

6. (*a*) How will you distinguish the following pairs by UV spectroscopy : [6]

(*i*)  and 

(*ii*)  and 

(*iii*)  and 

(*b*) Deduce the structures of the following by IR spectroscopy : [6]

(*i*) C_4H_8O (1720 cm^{-1})

(*ii*) C_3H_5N (2200 cm^{-1})

(*c*) (*i*) Discuss the transitions involved in UV spectroscopy. [4]

(*ii*) Explain Aniline shows hypsochromic shift in acidic medium. [2]

SECTION II

7. (*a*) Explain 'crystal field splitting energy' with respect to octahedral complexes and calculate CFSE for $[Fe(H_2O)_6]^{2+}$ and $[Fe(CN)_6]^{4-}$. [6]

(*b*) (*i*) Using IUPAC nomenclature name the following :

(*a*) $K_3[Al(C_2O_4)_3]$

(*b*) $[Cr(H_2O)_6]Cl_3$

(*c*) $[Cu(NH_3)_4]SO_4$. [3]

(*ii*) Write a note on chelates. [3]

(*c*) Give postulates of V.B.T. [4]

Or

8. (*a*) What are the elements of first transition series ? Explain the following properties of 1st transition series :

(*i*) Colour

(*ii*) Catalytic property. [6]

(*b*) Find EAN in the following complexes :

(*i*) $[Ni(NH_3)_6]^{+}$

(*ii*) $[Fe(CN)_6]^{4-}$

(*iii*) $[Cr(NH_3)_6]^{2+}$. [6]

(*c*) Give applications of CFT. [4]

9. (*a*) Give the applications of biotechnology for :

(*i*) Bioenergy

(*ii*) Antibiotics. [6]

(*b*) Give the traditional and greener routes for synthesis of

(*i*) Ibuprofen

(*ii*) Indigodye

(*iii*) Adipic acid. [6]

(*c*) Give the scope and importance of biotechnology. [4]

Or

10. (*a*) State principles involved in green chemistry and explain any *three* of them in detail. [6]

(*b*) Write a note on membrane bioreactor. [6]

(*c*) Write a note on bioenergy. [4]

11. (*a*) Define BOD. Deduce an expression for the first stage BOD. [6]

(*b*) What is meant by hazardous waste ? Discuss physical and chemical treatment of hazardous wastes. [6]

(*c*) Write notes on the following :

(*i*) Reverse osmosis

(*ii*) Electrodialysis. [6]

Or

12. (*a*) Draw general layout of municipal waste water treatment plant and explain preliminary treatment, primary treatment, secondary treatment and tertiary treatment. [6]

(*b*) Discuss treatments for dairy industry waste water and paper mill waste water in detail. [6]

(*c*) What way the dye industry waste water is peculiar ? Suggest treatment methods for the same. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-196

S.E. (Chemical) (Second Semester) EXAMINATION, 2010

HEAT TRANSFER

(2008 COURSE)

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 in detail "Modes of Heat Transfer". [6]

(*b*) Explain "Dimensional Analysis" in detail. [6]

(*c*) Calculate temperature at an interior point of the wall at a distance 15 cm from inner surface of wall. The temperature of the inner and outer surface are 200°C and 80°C respectively. The thickness of the wall is 0.5 m. [6]

P.T.O.

Or

2. (*a*) State and explain the following : [9]

(*i*) Fourier's law

(*ii*) Newton's law of cooling

(*iii*) Stefan Boltzmann's law.

(*b*) Give the physical significance of the following : [9]

(*i*) Reynolds Number

(*ii*) Prandtl Number

(*iii*) Nusselt Number.

3. (*a*) Derive the heat flow equation for steady state heat conduction through composite plane wall. [8]

(*b*) A hollow cylinder of 20 mm inner diameter and 30 mm outer diameter is maintained at 350°K (outer surface temp.) and 420°K (inner surface temp.). Determine the heat loss per unit length and also determine the temperature at a distance of 3 mm from outer surface towards the centre. (Thermal conductivity of material is 50 W/m°K). [8]

Or

4. (*a*) Derive the heat flow equation for steady state heat conduction through composite (co-axial) cylinder ? [8]

(*b*) A hollow sphere of 24 mm inner diameter and 36 mm outer diameter is subjected to constant heat flow of 2.12 kW. In inner surface temperature is 390°K, find the temperature of outer surface and temperature at a distance of 16 mm from the centre of the sphere. Thermal conductivity of the material is 85 W/m°K. [8]

5. (*a*) Distinguish between Natural Convection and Forced Convection. [8]

(*b*) Air at 27°C and 1 atm. flow over a flat plate at a velocity of 2 m/sec. The viscosity of air at 27°C is 1.85×10^{-5} kg/m.sec. Assume unit depth. If the plate is maintained at 60°C, calculate the heat transferred per unit time in the first 0.4 m of the plate. Properties of air are :

(*i*) Kinematic viscosity = 17.36×10^{-6} m^2/sec

(*ii*) Thermal conductivity = 0.0275 W/m°K

(*iii*) Prandtl number = 0.7

(*iv*) C_p = 1.006 kJ/kg°K. [8]

Or

6. (*a*) Distinguish between heat transfer coefficient and overall heat transfer coefficient. [8]

(*b*) Air at 300°C and atmospheric pressure is heated as it flows through a tube with a diameter of 25 mm at a velocity of 12 m/sec. Calculate the heat transfer rate per unit length of tube if a constant heat flux condition is maintained at the wall which is at 32°C above the air temperature, over entire length of the tube. Calculate the rise in bulk temperature over a 3.3 m length of the tube. Properties of air are :

(*i*) Dynamic viscosity = 29.7×10^{-6} kg/m.sec

(*ii*) Thermal conductivity = 0.0461 W/m°K

(*iii*) Prandtl number = 0.674

(*iv*) C_p = 1.047 kJ/kg°K

(*v*) Density = 0.615 kg/m^3. [8]

SECTION II

7. (*a*) Explain the following : [10]

(*i*) Electromagnetic spectrum

(*ii*) Black body

(*iii*) Emissive power

(*iv*) Opaque body

(*v*) Emissivity.

(*b*) It is observed that the value of the radiation emitted by the sun is maximum at a wavelength of 0.58 microns. Estimate the temperature of surface of sun and emissive power. Consider sun to be a black body. [8]

Or

8. (*a*) A 50 mm internal diameter iron pipe at 423°K passes through a room in which the surroundings are at temperature of 300°K. If the emissivity of the pipe metal is 0.8, what is the net interchange of radiation energy per meter length of pipe ? The outside diameter of pipe is 60 mm. [9]

(*b*) Explain the following : [9]

(*i*) Specular and Diffuse Reflection

(*ii*) Radiation Shields

(*iii*) Stefan Boltzmann's law.

9. (*a*) What are heat exchangers ? Give the detailed classification. [8]

(*b*) In an oil cooler 60 gm/sec. of hot oil enters a thin metal pipe of diameter 25 mm an equal mass of cooling water flows through the annular space between the pipe and a large concentric pipe, the oil and water moving in opposite directions. The oil enters at 420°K and is to be cooled to 320°K. If water enters at 290°K, what length of pipe is required ? Take heat transfer coefficient of 1.6 kW/m^{2}K on the oil side and 3.6 kW/m^2 °K on water side. Specific heat of oil is 2 kJ/kg °K and that of water is 4.18 kJ/kg°K. [8]

Or

10. (*a*) Explain Log mean temperature difference for co-current and counter current flow heat exchanger. [8]

(*b*) 20 kg/sec. of water at 360°K entering a heat exchanger is to be cooled to 340°K by using cold water at 300°K flowing at rate of 25 kg/sec. If the overall heat transfer coefficient is 1500 W/m^2 °K. C_p for water is 4187 J/kg°K. Calculate heat transfer area required in :

(*i*) Co-current flow concentric pipe heat exchanger and

(*ii*) Counter current flow concentric pipe heat exchanger. [8]

11. (*a*) What is Evaporation ? Explain capacity, economy and types of evaporators. [8]

(*b*) 1000 kg/hr. of a dilute solution of sodium hydroxide containing 10% NaOH is to be concentrated to 40% NaOH by weight in a single effect evaporator. The feed is available at 25°C. Boiling point of the solution may be considered as 100°C. Specific heat of dilute solution is 4180 J/kg°K. Latent heat of vaporization of water is 2239 kJ/kg. Saturated steam corresponding to 1.8 bar pressure and 117°C is available for heating purpose. Latent heat of condensation of steam is 2212 kJ/kg. If the overall heat transfer coefficient for the system is 850 $W/m^2\,°K$, calculate :

(*i*) The quantity of water evaporated;

(*ii*) Steam consumed and steam economy;

(*iii*) Surface area of the evaporator. [8]

Or

12. (*a*) Explain multiple effect evaporator with different feed arrangements. [8]

(*b*) Explain vacuum evaporation and boiling point elevation. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-197

S.E. (Chemical) (II Sem.) EXAMINATION, 2010

PRINCIPLES OF DESIGN

(2008 COURSE)

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, slide rule, Mollier charts, calculator and steam table is permitted.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is a standard and what is a code ? How does one find out whether there is a standard for a product ? [6]

(*b*) A metal bar 50 mm × 50 mm in section is subjected to an axial compressive load of 500 kN. If the contraction of a 200 mm gauge length was found to be 0.5 mm and the increase in thickness is 0.04 mm, find the values of Young's modulus and Poisson's ratio for the bar material. [6]

(*c*) State and explain the Hooke's law. [4]

P.T.O.

Or

2. (*a*) What are design factors and design procedures used in machine design ? [6]

(*b*) Define stress, strain and elasticity. Derive a relation between stress and strain of an elastic body. [4]

(*c*) A load of 5 kN is to be raised with the help of a steel wire. Find the minimum diameter of the steel wire, if the stress is not to exceed 100 MPa. [6]

3. (*a*) A solid steel shaft 100 mm in diameter transmits 136 kW at 150 rpm. Calculate the torque on the shaft and the angle of twist in a length of 600 mm. Take C = 80 GPa. [6]

(*b*) A solid steel shaft 100 mm in diameter is subjected to a bending moment M and a twisting moment T. The maximum principal stress produced in the shaft is 120 MPa. If the maximum bending stress due to M is equal to the maximum shear stress due to T, find the values of M and T. [12]

Or

4. (*a*) State the hypothesis for the following theories of failure :

(1) Maximum Normal Stress Theory of Failure, and

(2) Maximum Normal Shear Theory of Failure. [8]

(*b*) A horizontal steel girder having uniform cross-section is 14 m long and is simply supported at its ends. It carries two concentrated loads as shown in the figure below. Draw Shear Force diagram and Bending Moment diagram. [10]

12 kN 8 kN

3 m 6.5 m 4.5 m

A C D B

5. (*a*) Explain various types of keys. [4]

(*b*) Find the diameter of a solid shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 4. [6]

(*c*) A steel shaft 35 mm in diameter is subjected to a torque of 500 kN-m. If the polar moment of inertia of the shaft, $J = 150 \times 10^3$ mm^4, then how much torsional shear would be produced in the shaft. Is shaft safe, if allowable shear stress = 100 MPa ? [6]

Or

6. (*a*) Explain, with sketches, Muff and Flange couplings. [6]

(*b*) Design a cast iron protective type flange coupling to connect two shafts in order to transmit 15 kW at 900 rpm. The service factor is 1.35. The following permissible stresses may be used :

Shear stress for shaft, key and bolt materials = 40 MPa

Crushing stress for bolt and key = 80 MPa

Shear stress for cast iron = 8 MPa. [10]

SECTION II

7. (*a*) Compare flat belt with V-belt. [6]

(*b*) A belt 100 mm wide and 10 mm thick is transmitting power at 1000 m/min. The driving tension is 1.5 times the tension on slack side. If the safe permissible stress on belt section is 1.6 MPa, calculate the maximum power that can be transmitted at this speed. Assume the density of leather as 1200 kg/m^3. [10]

Or

8. (*a*) Give the classification of bearings. [4]

(*b*) A ball bearing is subjected to a radial load of 2250 N and an axial load of 1250 N. The values of X and Y factors are 0.56 and 1.6 respectively. The shaft is rotating at 720 rpm and the life of bearing should be 3500 hrs. Calculate the dynamic load capacity of the bearing. [12]

9. (*a*) Explain the constructional details and give the applications of cotter joint. [6]

(*b*) Describe with sketches the various types of pipe joints commonly used. [6]

(*c*) What do you understand by the term 'Strength of a welded joint' ? Give the relation for the same. [4]

Or

10. (*a*) Find out the dimensions of a flanged joint for a cast iron pipe 250 mm diameter to carry a pressure of 0.7 N/mm^2.

For cast iron :

Allowable tensile stress σ_t = 14 N/mm^2 and

Corrosion allowance = 9 mm. [8]

(*b*) Explain the various types of welded joints. Give the advantages and disadvantages of welded joints. [4]

(*c*) What are various methods of joining pipes for water distribution systems ? [4]

11. (*a*) Estimate the optimum pipe diameter for a water flow rate of 10 kg/sec. [6]

(*b*) Give the classification of valves. [6]

(*c*) With neat sketch explain the construction and working of globe valve. [6]

Or

12. (*a*) Give the classification of pumps and their selection criterion. [6]

(*b*) Water flows through 200 mm diameter, 60 m long pipe with a velocity of 2.5 m/sec. Find head lost due to friction. [6]

(*c*) A centrifugal pump having an impeller of 300 mm diameter can deliver water at the rate of 40 m^3/hr at 10 m height. If this pump is replaced by another pump, having 400 mm impeller diameter, water would be the change in flow rate and head. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-198

S.E. (Chemical) (Second Semester) EXAMINATION, 2010

CHEMICAL ENGINEERING THERMODYNAMICS–I

(2008 COURSE)

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 particular substance undergoes a mechanically reversible process, expanding from an initial state of 20 bar to a final state of 8 bar. The path for the process is described by the equation :

$$P = \frac{0.036}{V^t} - 4,$$

where P is in bar, V^t is in m^3. If ΔU^t for the change of state is –1400 J, determine W, Q and ΔH^t. [10]

P.T.O.

(*b*) An insulated and non-conducting container filled with 10 kg of water at 20°C is fitted with a stirrer. The stirrer is made to turn by gravity acting on a weight of mass 25 kg. The weight falls slowly through a distance of 10 m in driving the stirrer. Assuming that all work done on the weight is transferred to the water and that the local acceleration of gravity is 9.8 m/s^2, determine : [8]

(*i*) The amount of work done on the water.

(*ii*) the internal energy change of the water.

(*iii*) The final temperature of water.

(*iv*) The amount of heat that must be removed from the water to return it to its initial temperature.

Or

2. (*a*) Liquid water at 100°C and 1 bar has an internal energy (on an arbitrary scale) of 419 kJ/kg and a specific volume of 1.044 cm^3/gm. [8]

(*i*) What is its enthalpy ?

(*ii*) The water is brought to the vapor state at 200°C and 800 kPa, where its enthalpy is 2838.6 kJ/kg and its specific volume is 260.79 cm^3/gm. Calculate DU and DH for the process.

(*b*) One kilogram of air is heated reversibly at constant pressure from an initial state of 300 K and 1 bar until its volume triples. Calculate W, Q, ΔU and ΔH for the process. Assume that air obeys the relation : [10]

$$\frac{PV}{T} = 83.14 \, \frac{bar.cm^3}{mol.K}, \quad C_p = 29 \text{ J/mol.K.}$$

3. (*a*) Twenty kilogram of air is compressed from 1 bar, 300 K to 5 bar in a single stage compressor. The process is polytropic with $n = 1.25$. The specific heat of air at constant pressure is : [10]

$$C_p = 27.4528 + 6.1839 \times 10^{-3} \, T - 8.9932 \times 10^{-7} \, T^2 \left(\frac{kJ}{kmol.K}\right).$$

Determine :

(*i*) Work done by compressor per cycle.

(*ii*) The amount of heat transferred to the surrounding.

(*b*) Derive an expression for work done for the reversible adiabatic process. [6]

Or

4. (*a*) Calculate the compressibility factor and molar volume for methanol vapour at 500 K and 10 bar by using : [8]

(*i*) Truncated form of virial equation

(*ii*) Redlich-Kwong equation.

Experimental values of virial coefficients are $B = -2.19 \times 10^{-4}$ m^3/mol, $C = -1.73 \times 10^{-8}$ m^6/mol^2. The critical temperature and pressure of methanol are 512.6 K and 81 bar.

(*b*) A mass of 0.5 kg of gaseous ammonia is contained in a 0.03 m^3 vessel immersed in a constant temperature bath at 338.15 K. Calculate the pressure of the gas by each of the following : [8]

(*i*) The ideal gas equation

(*ii*) A generalized correlation.

5. (*a*) Pure CO is mixed with 100% excess air and completely burned at constant pressure. The reactants are originally at 400 K. Determine the heat added or removed if the products leave at 600 K. The standard heat of reaction 298 K is 283.028 kJ per mol CO burned. The mean specific heats applicable in the temperature range of this problem are 29.10, 29.70, 29.10 and 41.45 J/mol.K respectively for CO, O_2, N_2 and CO_2. [10]

(*b*) Wrtie notes on : [6]

(*i*) Hess law of constant heat summation

(*ii*) Heat of formation and its utility.

Or

6. Methanol is synthesized according to the following reaction : [16]

$$CO(g) + 2H_2(g) \longrightarrow CH_3OH(g)$$

The standard heats of formation at 298 K are –110.125 kJ/mol for CO and –200.660 kJ/mol for methanol. The specific heats $\left(\frac{J}{mol.K}\right)$ are :

$$C_p(CH_3OH) = 19.382 + 101.564 \times 10^{-3}\ T - 28.683 \times 10^{-6}\ T^2$$

$$C_p(CO) = 28.068 + 4.631 \times 10^{-3}\ T - 2.5773 \times 10^{4}\ T^{-2}$$

$$C_p(H_2) = 27.012 + 3.509 \times 10^{-3}\ T + 6.9006 \times 10^{4}\ T^{-2}$$

(*a*) Calculate the standard heat of reaction at 1073 K.

(*b*) Express the heat of reaction as a function of temperature.

SECTION II

7. (*a*) Derive the following relation for the efficiency of Carnot engine : [8]

$$\eta = \frac{T_H - T_L}{T_H}.$$

Why is efficiency of Carnot engine maximum ?

(*b*) A nuclear power plant generates 750 MW, the reactor temperature is 588.15 K and a river with water temperature of 293.15 K is available : [8]

(*i*) What is the maximum possible thermal efficiency of the plant and what is the maximum rate at which heat must be discarded to river ?

(*ii*) If the actual thermal efficiency of the plant is 60% of the maximum, at what rate must heat be discarded to the river and what is the temperature rise of the river if it has a flow rate of 165 m^3/s.

Or

8. (*a*) Explain the concept of entropy for irreversible thermodynamic process. Show that the total entropy change is positive. [6]

(*b*) Two compartments each of 1 m^3 capacity are connected by a valve and insulated from the surroundings and from each other. One compartment contains saturated steam at 683.6 kPa and the other contains steam at the same temperature but at a pressure of 101.3 kPa. The valve is opened and the pressure is allowed to equalize. Determine the change in entropy of the system consisting of the two vessels. Comment on the irreversibility of the process. [10]

The thermodynamic properties of steam are :

Pressure (kPa)	H (kJ/kg)	S (kJ/kg)	V (m^3/kg)	U (kJ/kg
683.6(T = 437.2 K)	2761	6.7133	278.9×10^{-3}	2570.4
101.3(T = 437.6 K)	2804	7.6712	1976.2	2603.3

9. (*a*) State the defining equations for U, H, G and A. Using principles of 1st and 2nd law of thermodynamics derive the following property relations : [8]

(*i*) $dU = TdS - PdV$

(*ii*) $dH = TdS + VdP$

(*iii*) $dG = VdP - SdT$

(*iv*) $dA = -PdV - SdT$

(*b*) Explain residual properties. Derive the following fundamental residual property relation for 1 mol of a substance for closed thermodynamic system : [8]

$$\frac{dG^R}{RT} = V^R \frac{dP}{dT} - H^R \frac{dT}{RT^2}.$$

Or

10. (*a*) Using the thermodynamic property relations derive the Maxwell relations. [10]

(*b*) Derive Clausius-Clapeyron equation for vapour liquid two-phase system. [6]

11. (a) Explain absorption refrigeration cycle in detail with the help of sketch and relevant equations involved. [8]

(b) A Carnot engine is coupled to a Carnot refrigerator, so that all the work produced by the engine is used by the refrigerator in extraction of heat from a heat reservoir at 0°C at the rate of 35 kW. The source of energy for the Carnot engine is a heat reservoir at 25°C. If both devices discard heat to the surrounding at 25°C, how much heat does the engine absorb from its heat source reservoir ?

If the actual coefficient of performance of the refrigerator $COP_{actual} = 0.6\ COP_{Carnot}$ and if the thermal efficiency of the engine is $h_{actual} = 0.6 h_{Carnot}$, how much heat does the engine absorb from its heat source reservoir. [10]

Or

12. (a) Why is liquefaction of gas needed ? Explain the Linde process for gas liquefaction. [8]

(b) A vapour compression cycle using ammonia as refrigerant is employed in an ice manufacturing plant. Cooling water at 288 K enters the condensor at a rate of 0.25 kg/sec and leaves at 300 K. Ammonia at 294 K condenses at a rate of 0.50 kg/minute. Enthalpy of liquid ammonia at 294 K is 281.5 kJ/kg. The compressor efficiency is 90%.

Saturated ammonia vapour at 258 K and the enthalpy of 1426 kJ/kg enters the compressor. What is the power requirement of the compressor and refrigeration capacity in tons ? [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-199

S.E. (Chemical) (Second Semester) EXAMINATION, 2010

MECHANICAL OPERATIONS

(2008 COURSE)

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 tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) A material is crushed in a blake jaw crusher and the average size of particles is reduced from 5 cm to 1.3 cm, with the consumption of energy at the rate of 37 W hr/metric ton. What will be the consumption of energy necessary to crush the same material of average size 8 cm to an average size of 3 cm ? The mechanical efficiency remaining unchanged.

(*i*) Using Rittinger's law

(*ii*) Using Kick's law [16]

P.T.O.

(*b*) Give the advantages of Wet Grinding. [2]

Or

2. (*a*) Explain open circuit and close circuit grinding with its flow sheet. [6]

(*b*) Explain the importance of screening operation in chemical industry. [4]

(*c*) Explain different factors influence on the size of the product in Ball mill. [8]

3. (*a*) State advantages and limitations of pneumatic conveyor. [6]

(*b*) Describe with a sketch the working of belt conveyor and list advantages and disadvantages with typical applications. [8]

(*c*) Why is it necessary to clean the belt ? [2]

Or

4. (*a*) Describe with neat sketch construction of Screw Conveyor. List advantages, disadvantages and industrial applications. [8]

(*b*) Explain close loop pneumatic conveying system with its flow sheet. [8]

5. (*a*) Explain the necessity of mixing in chemical industries. [6]

(*b*) Write short notes on :

(*i*) Sigma Mixer

(*ii*) Mixing Index [8]

(*c*) Explain the importance of baffles in agitated vessels. [2]

Or

6. (*a*) Describe the types of mixers of pastes and plastic mass. [8]

(*b*) With the help of neat sketch distinguish between axial flow and radial flow impellers. [8]

SECTION II

7. (*a*) What are the various factors which affect the rate of filtration ? Derive an expression to calculate the rate of filtration. [10]

(*b*) Describe with a neat sketch the working of Rotary drum filter. [6]

Or

8. (*a*) State factors to be considered while selecting filtration equipment and enlist characteristics of filter media. [8]

(*b*) Compare pressure filter and vacuum filter. [4]

(*c*) Explain the operating cycle of centrifuge filter. [4]

9. (*a*) Describe with neat sketches the aggregate and particulate fluidization. Give typical examples of both. [8]

(*b*) Describe with neat sketch the sedimentation operation. Also sketch typical commercial equipment. [8]

Or

10. (*a*) Define Fluidization. Sate the application of fluidization technique. [8]

(*b*) Distinguish between Free settling and Hindered settling. [4]

(*c*) Explain spouted Bed. [4]

11. (*a*) Explain capacity and effectiveness of screen. [4]

(*b*) Explain Jigging separation technique with neat diagram. [6]

(*c*) Describe with neat sketches operation of Batch centrifuge and Continuous centrifuge. [8]

Or

12. (*a*) Explain froth floatation with neat diagram. [6]

(*b*) Write short notes on (any *three*) :

(*i*) Scrubbers

(*ii*) Gravity settling tank

(*iii*) Fabric Filters

(*iv*) ESP. [12]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-200

S.E. (Chem./Petrole./Polymer/Biotech./Printing)

(First Semester) EXAMINATION, 2010

ENGINEERING MATHEMATICS—III

(2008 COURSE)

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, electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

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

(1) $$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 2y = e^{-x}\sec^3 x$$

(2) $\left(D^2 - 4D + 4\right) y = e^{2x} + x^3 + \cos 2x$

(3) $x\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} + x = 0$

(4) $\dfrac{d^2y}{dx^2} + y = \sec x \tan x$ (method of variation of parameters)

(5) $\left(D^2 - 1\right) y = x \sin x + \left(1 + x^2\right) e^x$.

(*b*) Solve :

$$2\frac{dx}{dt} - x + 3y = \sin t$$

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

and obtain x and y if $x = 1/4$ and $y = -1/20$ at $t = 0$. [5]

Or

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

(1) $(1 + x)^2 \dfrac{d^2y}{dx^2} + (1 + x)\dfrac{dy}{dx} + y = 2\sin\left[\log(1 + x)\right]$

(2) $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = e^{e^x}$ (method of variation of parameters)

(3) $\dfrac{d^2y}{dx^2} + 5\dfrac{dy}{dx} + 6y = e^{-2x}\sin 2x + 4x^2e^x$

(4) $\left(D^2 - 3D + 2\right) y = \cos\left(\dfrac{1}{e^x}\right)$

(5) $\dfrac{d^2y}{dx^2} - y = \cosh x \cos x$.

(*b*) Solve :

$$\frac{dx}{z(x+y)} = \frac{dy}{z(x-y)} = \frac{dz}{x^2+y^2}. \qquad [5]$$

3. (*a*) The D.E. satisfied by a beam uniformly loaded with one end fixed and second subjected to a tensile force P is given by :

$$\mathrm{EI}\,\frac{d^2y}{dx^2} - \mathrm{P}y = -\frac{\mathrm{W}}{2}x^2.$$

Show that the elastic curve for the beam under conditions $y = 0$, $\frac{dy}{dx} = 0$ when $x = 0$ is given by :

$$y = \frac{\mathrm{W}}{2\mathrm{P}}\left[x^2 - \frac{2}{n^2} - \frac{e^{nx}}{n^2} - \frac{e^{-nx}}{n^2}\right]$$

where $\mathrm{EI} = \frac{\mathrm{P}}{n^2}$. [8]

(*b*) Solve :

$$\frac{\partial v}{\partial t} = k\,\frac{\partial^2 v}{\partial x^2} \quad \text{if}$$

(*i*) $v \neq \infty$ as $t \to \infty$

(*ii*) $\left(\frac{\partial v}{\partial x}\right)_{x=0} = 0 \quad \forall\ t$

(*iii*) $v(l, t) = 0 \quad \forall\ t$

(*iv*) $v(x, 0) = v_0$ for $0 < x < l$. [8]

Or

4. (*a*) In a certain chemical reaction, the temperature u and v satisfy the equations :

$$\frac{du}{dx} + v = \sin x$$

$$\frac{dv}{dx} + u = \cos x$$

given that when $x = 0$, then $u = 1$ and $v = 0$. Find the values of u and v. [8]

(*b*) An infinitely long plane uniform plate is bounded by two parallel edges in the y-direction and an end at right angles to them. The breadth of plate is π. This end is maintained at temperature u_0 at all points and other edge at zero temperature. Find the steady state temperature function $u(x, y)$. [8]

5. (*a*) Use Fourier transform to solve :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \qquad 0 < x < \infty, \; t > 0$$

where $u(x, t)$ satisfies the conditions :

(*i*) $\left(\frac{\partial u}{\partial x}\right)_{x=0} = 0 \quad t > 0$

(*ii*) $u(x, 0) = \begin{cases} x & 0 < x < 1 \\ 0 & x > 1 \end{cases}$

(*iii*) $|u(x, t)| < M.$ [7]

(*b*) Solve the integral equation :

$$\int_0^\infty f(x) \sin \lambda x \, dx = \begin{cases} 1 & 0 \le \lambda < 1 \\ 2 & 1 \le \lambda < 2. \\ 0 & \lambda \ge 2 \end{cases}$$ [5]

(*c*) Find the Fourier sine and cosine transforms of the following function :

$$f(x) = \begin{cases} x & 0 \le x \le 1 \\ 2 - x & 1 \le x \le 2. \\ 0 & x > 2 \end{cases}$$ [5]

Or

6. (*a*) Find the Fourier sine transform of $\dfrac{e^{-ax}}{x}$ and hence evaluate :

$$\int_0^\infty \tan^{-1}\frac{x}{a} \sin x \, dx.$$ [6]

(*b*) Using the Fourier integral representation show that :

$$\int_0^\infty \frac{\sin \pi\lambda \ \sin \lambda x}{1 - \lambda^2} \, d\lambda = \begin{cases} \dfrac{\pi}{2} \sin x & 0 \le x \le \pi \\ 0 & x > \pi \end{cases}.$$ [6]

(*c*) Using inverse Fourier sine transform, find $f(x)$ if :

$$F_s(\lambda) = \frac{\lambda}{1 + \lambda^2}.$$ [5]

SECTION II

7. (*a*) Find Laplace transform (any *three*) : [12]

(*i*) $e^{4t} \int_0^t \frac{1 - \cos 2t}{t} \, dt$

(*ii*) $\frac{\cos \sqrt{t}}{\sqrt{t}}$

(*iii*) $f(t) = \cos \frac{1}{3}(2\pi - 3t), \quad t > \frac{2\pi}{3}$

$= 0, \quad 0 < t < \frac{2\pi}{3}$

(*iv*) $f(t) = \sin \omega t, \quad 0 < t < \frac{\pi}{\omega}$

$= 0, \quad \frac{\pi}{\omega} < t < \frac{2\pi}{\omega},$

Given $f(t) = f\left(t + \frac{2\pi}{\omega}\right).$

(*b*) Find Laplace transform of $erf\left(\sqrt{t}\right)$ and hence evaluate :

$$\int_0^{\infty} e^{-t} \, erf\left(\sqrt{t}\right) dt.$$ [4]

Or

8. (*a*) Find inverse Laplace transform (any *three*) : [12]

(*i*) $\frac{5s + 3}{(s + 1)\left(s^2 + 2s + 5\right)}$

(*ii*) $\log\sqrt{\dfrac{s^2+4}{s^2+9}}$

(*iii*) $\dfrac{e^{-ps}}{\sqrt{2s+3}}$

(*iv*) $\dfrac{1}{s}\sin\left(\dfrac{1}{s}\right)$.

(*b*) Use convolution theorem to find :

$$L^{-1}\left\{\frac{s}{\left(s^2+a^2\right)^2}\right\}.$$ [4]

9. (*a*) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at the point (2, –1, 1) along the line equally inclined with co-ordinate axes. [6]

(*b*) Show that the vector field :

$$\overline{F} = \left(x^2 - yz\right)\overline{i} + \left(y^2 - zx\right)\overline{j} + \left(z^2 - xy\right)\overline{k}$$

is irrotational. Find the scalar point function ϕ such that $\overline{F} = -\nabla\phi$. [6]

(*c*) Evaluate $\int_C \overline{F} \cdot d\overline{r}$ for :

$$\overline{F} = (2y+3)\,\overline{i} + xz\,\overline{j} + (yz - x)\,\overline{k}$$

along the curve $x^2 = 4y$, $3x^3 = 8z$ from $x = 0$ to $x = 2$. [6]

Or

10. (*a*) Use Stokes' theorem to evaluate :

$$\iint_s \nabla \times \overline{F} \,.\, \hat{h}\, ds$$

over the surface of cylinder $x^2 + y^2 = 4$ bounded by $z = 9$, and open at $z = 0$, where :

$$\overline{F} = (2x - y + z)\,\overline{i} + \left(x + y - z^2\right)\overline{j} + (3x - 2y + 4z)\,\overline{k}\,. \quad [6]$$

(*b*) Evaluate :

$$\iint_s \left(x^3\,\overline{i} + y^3\,\overline{j} + z^3\,\overline{k}\right) . \, d\overline{s}$$

over the surface of sphere $x^2 + y^2 + z^2 = 16$ by using Gauss's divergence theorem. [6]

(*c*) Establish the vector identities : [6]

(*i*) $\nabla f(r) = \dfrac{f'(r)}{r}\,\overline{r},\ \left(\overline{r} = x\overline{i} + y\overline{j} + z\overline{k}\right)$

(*ii*) $\nabla \times \left(\dfrac{\overline{a} \times \overline{r}}{r}\right) = \dfrac{\overline{a}}{r} + \dfrac{(\overline{a}\,.\,\overline{r})\,\overline{r}}{r^3}$

(*iii*) $\nabla \,.\, \left(\dfrac{\overline{a} \times \overline{r}}{r^n}\right) = 0.$

11. (*a*) Solve the differential equation by using Laplace transform method :

$$\frac{d^2y}{dt^2} + 4y = f(t),$$

where

$$f(t) = \begin{cases} 1, & 0 < t < 1 \\ 0, & t > 1 \end{cases}$$

with $y(0) = 0, \quad y'(0) = 1.$ [6]

(*b*) If the velocity potential of a fluid motion is given by $\phi = \log(xyz)$, find the equations of streamlines. [5]

(*c*) The transfer function of a second order system (with $\xi < 1$) is given by :

$$G(s) = \frac{Y(s)}{X(s)} = \frac{6}{s^2 + 1.8s + 1}.$$

Find over shoot, decay ratio and period of oscillation. [5]

Or

12. (*a*) A liquid is in equilibrium under the action of field force $\overline{F}$ per unit mass is :

$$\overline{F} = \lambda\left\{(y+z)\,\overline{i} + (z+x)\,\overline{j} + (x+y)\,\overline{k}\right\}.$$

Find the pressure at any point of the field. [5]

(*b*) Solve by using Laplace transform method :

$$\frac{dy}{dt} + 2y(t) + \int_0^t y(t)\, dt = \sin t,$$

with $y(0) = 1$. [6]

(*c*) Two non-interacting tanks are connected in series. The time constants are $T_2 = 1$ and $T_1 = 0.5$ and $R_2 = 1$. Find the response using transfer function. [5]

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

[3862]-201

S.E. (Polymer/Petroleum/Petrochem)

(First Semester) EXAMINATION, 2010

ENGINEERING CHEMISTRY–I

(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*) Explain the aromaticity of : [6]

(*i*) Pyrrol

(*ii*) Azulene

(*iii*) Annulene

(*b*) Explain the formation of carbonium ion by : [6]

(*i*) Heterolytic fission

(*ii*) Protonation

(*c*) Explain why guanidine is a strong base. [4]

Or

2. (*a*) Explain the phenomenon of resonance with suitable example. [6]

(*b*) Define and give *two* examples of : [6]

(*i*) Electrophile

(*ii*) Nucleophile

(*iii*) Free-radical

(*c*) Explain why propynoic acid is stronger than propenoic acid. [4]

3. (*a*) Explain Friedel-Crafts alkylation and Friedel-Crafts acylation of benzene. [6]

(*b*) Explain Markovnikov's rule with suitable example. Also explain the anti-Markovnikov's addition. [6]

(*c*) Explain Hofmann's rule with suitable example. [4]

Or

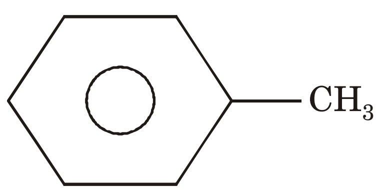
4. (*a*) Explain Favorskii rearrangement with suitable exmaple. [6]

(*b*) Predict the product (any **3**) [6]

(*i*) $2CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-O^{\ominus} \xrightarrow{\text{Electrolysis}}$

(*ii*) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-H \xrightarrow{\text{Warm dil. NaOH}}$

(*iii*) $CH_3-\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle OH}{|}}{C}}-CH_2OH \xrightarrow{H_2HO_4}$

(*iv*)  $\xrightarrow{HNO_3\ H_2HO_4}$

(*c*) Explain dimerization of isobutylene. [4]

5. (*a*) Explain the following terms with suitable examples ? [6]

(*i*) Dihedral angle

(*ii*) Racemic mixture

(*iii*) Meso isomer

(*b*) Predict product : [6]

(*i*) Quinoline $\xrightarrow{NaNH_2}$

(*ii*) Pyridine $\xrightarrow{\text{Na + Absolute alcohol}}$

(*iii*) Acetylene + HCN $\xrightarrow{\text{Red hot tube}}$

(*iv*) Furan + HNO_3 $\xrightarrow{\text{Acetic anhydride}}$

(*c*) Explain the use of 1, 4 diketone in synthesis of five membered heterocycles. [6]

Or

6. (*a*) Explain : [6]

(*i*) Pyrrole is more reactive than furan

(*ii*) Electrophilic substitution takes place at position 5 and 8 in quinoline.

(*b*) Explain the term diastereoisomers with reference to the compound 2, 3 dichloro pentane. [6]

(*c*) Explain—Two chair forms of methyl cyclohexane are not equivalent but that of cyclohexane are equivalent. [6]

SECTION II
(PHYSICAL CHEMISTRY)

7. (*a*) Derive van der Walls equation of state. [6]

(*b*) Starting with Kinetic Gas equation deduce :

(*i*) Graham's Law

(*ii*) Charles' Law

(*iii*) Avogadro's Law [6]

(*c*) The boiling point of ethyl alcohol is 351.8 kelvin and its latent heat of vaporization is 39371.44 Joules/mole.

Calculate its vapor pressure at 400 kelvin. Given R = 8.314 J/kelvin mole [4]

Or

8. (*a*) Write a short note on vapour pressure of a liquid. How is it measured ? How is it related to the boiling point of a liquid ? [6]

(*b*) What is meant by critical constants of a fluid ? How will you measure critical constants experimentally ? [6]

(*c*) (*i*) The RMS velocity of oxygen is 460 meters/second. Calculate the RMS velocity of CO_2 under the same conditions.

(*ii*) Calculate the molar heat vaporization of Toluene using Trouton's rule. Given : Boiling point of Toluene is 110°C and Trouton's constant for Toluene is 100 Joules/mole × Kelvin. [4]

9. (*a*) Explain in brief : [6]

(*i*) Low temperature Fuel cells

(*ii*) Medium temperature fuel cells

(*iii*) High temperature fuel cells

(*b*) Write a short note on Lithium ion rechargeable cell. [6]

(*c*) What is the need for storage of electrical energy ? [4]

Or

10. (*a*) Write a short note on Sodium Sulphur rechargeable battery [6]

(*b*) Explain the following terms Energy density, power density, number of charge discharge cycles, battery capacity (Ampere hours) with reference to Galvanic cells. [6]

(*c*) What do you understand by polarization of a battery (galvanic cell) ? How can it be minimized ? [4]

11. (*a*) What are colloids ? Discuss in brief *four* techniques for preparation of colloids. [7]

(*b*) Discuss in brief any *three* characteristic properties of colloidal solutions such as : Tyndall effect, dialysis, electrophoresis, electro-osmosis and Brownian motion. [7]

(*c*) Compare lyophilic and lyophobic colloids. [4]

Or

12. (*a*) Give thermodynamic derivation for molal elevation constant K_b. [7]

(*b*) (*i*) State and explain Raoult's law. Under what conditions is it applicable ?

(*ii*) Show that the relative lowering of vapour pressure of a solution of non-volatile solute is equal to the mole fraction of the solute. [7]

(*c*) A 0.2 molar solution of aluminium chloride gave osmotic pressure of 7.8 atmospheres.

Calculate the degree of dissociation for $AlCl_3$.

Given : R = 0.0821 litre × atmosphere/mole. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-202

S.E. (Poly./Petro.) (First Semester) EXAMINATION, 2010

ENGINEERING MATERIALS SCIENCE AND TECHNOLOGY

(2008 COURSE)

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 scientific electronic calculator is allowed.

(*v*) Figures to the right indicate full marks.

SECTION I

1. (*a*) What are the factors affecting the rate of diffusion in solid materials ? A 0.1 cm thick iron plate is heated to 800°C, one side of the plate is in contact with carburizing atmosphere. The diffusion coefficient at 800°C temperature is 8.17×10^{-7} cm^2/s and concentration gradient is -8.04×10^{20} atoms/cm^2. Calculate net diffusion flux. [6]

(*b*) What is edge dislocation ? Explain in brief Burger's vector and Tangent vector in the edge dislocation. [6]

(*c*) How entanglements of large polymer chains limit self-diffusion in polymeric materials ? [4]

Or

2. (*i*) What are the non-destructive tests ? Explain any *one* N.D.T. with sketch. [6]

(*ii*) What are crystalline materials ? Draw and explain the properties of FCC, HCP and BCT structures. [6]

(*iii*) How is the critical resolved shear stress responsible to produce a "Slip" in a single crystal ? [4]

3. (*a*) Explain the following with sketch (any *two*) : [8]

(*i*) Grain size measurement with ASTM number.

(*ii*) Role of grain boundaries in plastic deformation.

(*iii*) Optical microscope for observations of metallic materials.

(*b*) Draw and explain microstructures of the following (any *two*) : [8]

(*i*) A composite of alumina fibers in a matrix of Al-Li alloy (cross-section).

(*ii*) Cartridge brass specimen.

(*iii*) Normalized dead mild steel.

Or

4. (*a*) Differentiate between the trans-grannular and inter-grannular microstructures. [6]

(*b*) Suggest the suitable heat-treatment for increasing the hardness of a medium carbon steel component. Draw and explain micro-structure of hardened steel specimen. [6]

(*c*) Explain why a rubber band behaves like a window glass below 0°C temperature. [4]

5. (*a*) What is "toughness" of a material ? A cylindrical brass specimen is having an original diameter of 12 mm. Its tensile strength is 440 MPa and yield strength is 240 MPa. When a stress of 140 MPa is applied it has shown 0.15% elongation. Determine its stiffness and the maximum load that can be sustained by the specimen. [6]

(*b*) What is the difference in Vicker's and Brinell Hardness test ? In a non-standard Brinell test a specimen is tested for hardness with load 31.25 kgs; diameter of the ball indentor is 2.5 mm and that of the impression is 0.55 mm. What will be its hardness value ? [6]

(*c*) On which factors the electrical conductivity of a material depends ? The resistance of a metal rod with conductivity 3.4×10^8 (W-cm)$^{-1}$ and length 10 meters is measured to be 0.09 W. Calculate the cross-sectional area of the rod. What voltage is required to produce a current of 3.5 Amp. in this rod ? [6]

Or

6. (*i*) What are the factors on which the magnitude of dielectric polarization depends ? A dielectric material is placed in an external electric field; the number of charge centers displaced per unit volume are 1.54×10^{28} charges/m^3. The electronic charge is 1.61×10^{-19} C/charge and the displacement between the poles observed 1.62×10^{-17} m. Calculate magnitude of polarization. [6]

(*ii*) What is magnetic susceptibility ? Calculate the magnetic field strength required to create an induction equal to that of the earth in a sodium sample. The magnetic susceptibility of Na is 16×10^{-6}; Magnetic induction of the earth is 6×10^{-5} tesla. Permeability of a vacuum 4p $\times 10^{-7}$ tesla-m/Amp. [6]

(*iii*) What is a linear coefficient of thermal expansion of a material ? Draw a graphical presentation of linear coefficient of thermal expansion as a function of temperature for different materials. [6]

SECTION II

7. (*a*) Derive an equation for modulus of elasticity when unidirectional fiber composite subjected to a load in transverse direction with respect to the fiber alignment. [5]

(*b*) A continuous and aligned glass fiber reinforced composite is having cross-sectional area 250 mm^2 and stress applied in the longitudinal direction is 50 MPa. It is having 40% volume of glass fiber and 60% volume of polyster resin matrix. Determine the magnitude of the load carried by fiber and matrix phases. Also comment on the strain values of both phases. (Assume E_f = 69 GPa and E_m = 3.4 GPa.) [6]

(*c*) Explain the requirements of properties of a "matrix" material in a composite. [5]

Or

8. (*i*) Why some "Critical fiber length" is necessary when fragmented fibers are used in a composite ? Calculate critical fiber length of a glass fiber used in discontinuous fiber reinforced composite. The shear yield strength of matrix is 12 MPa. The U.T.S. of the fiber is 2.4×10^3 MPa and fiber diameter is 30 microns. [7]

(*ii*) Suggest the suitable composite for the following applications and justify your selection (any *three*) : [9]

(*a*) Bulletproof vest

(*b*) Rocket nozzle

(*c*) Hard-steel cutting tool

(*d*) Automobile tyre.

9. Explain the following (any *four*) : [16]

(*i*) Silicate materials, which are under water for a long time show static fatigue.

(*ii*) Stainless steel surgical instruments show frequent failure, if they are dried in high temperature oven after every wash.

(*iii*) Measurements of current density show that for many metals the corrosion rate decreases with time.

(*iv*) Stabilizers are added in polyethylene out-door use components.

(*v*) Plain carbon steel plates are oftenly fastened together with nickel rivets.

Or

10. Write short notes on the following (any *four*) : [16]

(*a*) Cathodic protection

(*b*) Pit and crevice corrosion

(*c*) Alteration of bond structures by atmospheric gases

(*d*) Pilling Bedworth ratio

(*e*) Radiation damage.

11. Explain the following materials processing with neat diagrams (any *three*) : [18]

(*i*) Slip casting for ceramics

(*ii*) Compression moulding for polymer products

(*iii*) Types of chills in metal castings

(*iv*) Close die forging for automotive component.

Or

12. Compare the following processes (any *three*) : [18]

(*a*) Extrusion and wire drawing

(*b*) Silicon doping and ion implantation

(*c*) Filament winding and pultrusion

(*d*) Melt spinning and solution spinning.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-203

S.E (Petrochemical, Petroleum and Polymer)

(First Semester) EXAMINATION, 2010

CHEMICAL PROCESS CALCULATIONS

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer any **3** questions from each Section.

(*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 is allowed.

(*v*) Assume suitable data, if necessary.

(*vi*) Use of steam tables wherever necessary.

SECTION I

1. (*a*) 10 kg of liquid A of specific gravity 1.2 is mixed with 3 kg of liquid B of specific gravity 0.8. Assuming that there is no volume change on mixing, what is the specific gravity of the mixture ? [4]

(*b*) An analysis of the vent gases from the chlorinator in a plant for making chlorinated rubber showed 60% by volume HCL, 30% by volume Cl_2 and the rest CCL_4. Determine the following :

(*i*) the precent composition by weight

(*ii*) the average molecular weight of the gas

(*iii*) the density at standard conditions in kg/m^3 [8]

(*c*) What is equation of states ? Express any *two* equations of states defining each term involved. [4]

Or

2. (*a*) 15 kg each of nitrogen and hydrogen are mixed together at 300 kPa and 298 K. Determine the partial pressure of nitrogen, the pure component volume of nitrogen, the specific volume of the mixture. [6]

(*b*) Calculate the volume occupied by one mole of oxygen at 300 K and 100 bar using :

(*i*) the ideal gas law

(*ii*) the van der Waals equation.

Take a = 0.1378 Nm^4/mol^2 and b = 3.18* 10^{-5} m^3/mol. [6]

(*c*) Define ^{0}API gravity. Give the classification of crude oil based on ^{0}API. [4]

3. (*a*) Explain with neat block diagram the principle, overall mass balance and component balance of the following unit operations : 12

(*i*) Distillation

(*ii*) Absorption

(*iii*) Extraction

(*b*) A process stream contains 4% (wt) salt and the rest water. This is prepared by passing a part of pure water stream through a saturator containing the salt. The solution leaving the saturator containing 20% salt is mixed the pure water bypassed to get the process stream. What fraction of the pure water available is to be bypassed through the saturator ? [6]

Or

4. (*a*) Explain with neat Block diagram the Bypass, Recycle and Purging operation. Define combined feed ratio, Mixed feed ratio and Purge ratio. [9]

(*b*) An aqueous solution of methanol containing 30% (wt) methanol is to be separated into a distillate product containing 95% methanol and the bottom product containing 3% methanol. For treating 100 kg of feed with a reflux ratio of 2.5 on a weight basis. Calculate : [9]

(*i*) amount of distillate and bottoms product

(*ii*) the amount of vapor condensed in the condenser per kg of distillate

(*iii*) the amount of vapor condensed in the condenser per kg of feed.

5. (*a*) A gas mixture consisting of 80% ethane and 20% oxygen is burned in an engine with 250% excess air. 80% of the ethane goes to CO_2, 15% to CO and 5% remains unburned. Calculate the composition of the exhaust gases on : [8]

(*i*) a wet basis

(*ii*) a dry basis.

(*b*) A synthesis gas analyzing 6% CO_2, 0.5% O_2, 40% CO, 50% H_2 and the rest N_2 is burned with 70% excess air. What is the composition of flue gas ? [8]

Or

6. A 1 : 3 nitrogen hydrogen mixture is fed to a converter resulting in 20% conversion to ammonia. After the complete separation of ammonia unconverted gases are recycled to the converter. The initial reaction mixture contains 0.2% argon by volume. If the limit of argon in the reactor is 5% by volume of N_2-H_2 mixture in the reactor.

Estimate the following : [16]

(*i*) the fraction of recycle that is purged

(*ii*) the moles of ammonia produced per 100 moles of feed

(*iii*) the overall conversion of ammonia.

SECTION II

7. (*a*) Define the following and give their utility : [8]

(*i*) Antoine equation

(*ii*) Clapeyron equation

(*iii*) Raoult's Law

(*iv*) Dew point temperature

(*b*) At 300 K, the vapor pressures of two pure liquids A and B are respectively 80 kPa and 50 kPa. the concentration of A in the vapor in equilibrium with a solution of A and B is found to be 35% (mol).

Determine the composition of the liquid and the total pressure of the vapor. [4]

(*c*) Give the Bubble point temperature calculation flow chart. [4]

Or

8. The Vapor pressure of benzene (A) and chlorobenzene (B) are given below :

T(K)	**P_A^S(kPA)**	**P_B^S (kPA)**
352.8	101.3	18.2
363.2	135.1	27.7
373.2	178.7	39.06
383.2	232.5	53.7
393.2	298.0	72.3
405.3	395.3	101.3

Assume that benzene and chlorobenzene form an ideal solution. Prepare the T-x-y diagram for the system at 101.3 kPa. Using the T-x-y diagram, determine the bubble point and dew point of an equimolar mixture of benzene and chlorobenzene at 101.3 kPa. [16]

9. (*a*) One kilogram of ice at 0ºC is heated so that it is completely converted to steam at 150ºC and 101.3 kPa. What is the enthalpy change accompanying the process. The heat of fusion of water at given 0ºC and 101.3 kPa is 335 kJ/kg. The heat capacity equation of liquid water is :

$C_p = 18.296 + 47.212*10^{-2}\ T - 133.88*10^{-5}\ T^2 + 1314.2*10^{-9}\ T^3$ and heat capacity of water vapor at 101.3 kPa is given by :

$C_p = 30.475 + 9.652 * 10^{-3}\ T + 1.189 * 10^{-6}\ T^2$

where Cp is in kJ/kmol K and T is in K.

Use steam table wherever necessary. [10]

(*b*) A gas mixture contains species A (MW = 30) 15%, species B(MW = 45) 45% and species C (MW = 80) 40% by weight. Calculate the quantity of heat necessary to heat one kilomole of the mixture from 300 K to 2700 K. The constants for molar heat capacity $Cp = a + bT + cT^2$ (kJ/kmol K) and T is in K, are given as : [8]

Species	**a**	**b**	**$c*10^3$**
A	25	0.05	–0.01
B	30	0.009	–0.05
C	21	0.08	–0.001

Or

10. (*a*) A steam jacketed vessel is charged with 200 kg of a feed material (heat capacity 3.5 kJ/kg K) at 295 K to heat it to 373 K. The heating is done by complete condensation of saturated steam at 40 bar (λ = 1714 kJ/kg) in the jacket. The rate of heat loss from the vessel is estimated to be at a rate of 1.5 kJ/s. Determine the mass of steam needed if the charge was heated for one hour. [10]

(*b*) With respect to the Humidification operation, define the following : [8]

(*i*) absolute humidity

(*ii*) Molal humidity

(*iii*) Percent humidity

(*iv*) Humid volume

(*v*) Wet bulb temperature

(*vi*) Adiabatic saturation temperature

(*vii*) Humid heat

(*viii*) Dry bulb temperature.

11. (*a*) In a sulfuric acid plant, sulfur dioxide is obtained by the roasting of iron pyrites containing 75% FeS_2 and 25% gangue. Iron sulphide reacts with oxygen according to the reaction :

$$4\ FeS_2 + 11\ O_2 \rightarrow 2\ Fe_2O_3 + 8SO_2$$

The cinder formed on the combustion analyzes 3% FeS_2. Determine the standard heat of reaction per kilogram of ore, given the following standard heat of formation values at 298 K : [12]

FeS_2 (s) = –178.02 kJ/mol; Fe_2O_3 (s) = –822.71 kJ/mol and SO_2 (g) = –296.9 kJ/mol

(*b*) State Hess's Law and Kirchhoff's equation. [4]

Or

12. Hydrogen gas is burned in an adiabatic reactor with 1.5 times the theoretical quantity of air, both air and hydrogen being at 298 K initially. What will be the temperature of the reaction products ? The standard heat of formation of gaseous water is –241.826 kJ/mol. The heat capacities $Cp = a + bT + cT^2$ in kJ/kmol K of the gases are given below : [16]

Component	***a***	**,*b***10^3	**,*c***10^6
O_2	25.611	13.260	–4.2077
N_2	27.034	5.815	–0.2889
Water vapor	30.475	9.652	1.189

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-204

S.E. (Poly/Petro/P.Chem) (First Semester) EXAMINATION, 2010

MOMENTUM TRANSFER

(2008 COURSE)

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*) Explain viscosity index and its importance in lubrication mechanics. What are multigrade oils ? Why are they used ? [4+2]

(*b*) Convert a pressure of 2000 Pa into :

(*i*) head of mercury absolute

(*ii*) head of water gauge

(*iii*) GPa gauge

(*iv*) MPa absolute.

Consider standard atmospheric pressure. [8]

(*c*) Explain bulk modulus of elasticity and its importance in compressibility. [4]

Or

2. (*a*) Explain concepts of absolute pressure and gauge pressure graphically. Show standard pressure, +ve and suction pressures correctly on it. [6]

(*b*) The velocity distribution on a rectangular plate of dimensions 5m × 3m on one side is given by :

$$u = 3y^2 - 6y + 10.$$

Determine the drag force on one side of the plate if the viscosity of fluid is 200 cs. The R.D. of fluid is 0.6. [6]

(*c*) A mercury manometer showed a deflection of 6 cms when connected to two points in a pipeline carrying water. Determine the pressure difference in kPa. If the manometer is now replaced by oil of sp. gr. 0.8, find the manometric deflection for the same pressure difference. Which manometer is suitable ? Why ? [6]

3. (*a*) List any 6 types of fluid flows and explain any *two* in detail with examples. [3+5]

(*b*) For a velocity field determined by :

$$V = (3x^2 - 6)\ i + (2y^2 - 3)\ j + (3z^2 - t)\ k$$

Determine :

(*i*) Velocity at (1, 1, 1) at $t = 2$ seconds. [2]

(*ii*) Acceleration at (1, 2, 1) at $t = 1$ second. [3]

(*iii*) Rotation at (2, 1, 1) at $t = 3$ seconds. [3]

Or

4. (*a*) State Law of Conservation of Mass. When does it fail ? Derive its mathematical expression for steady flow along a streamline. [1+1+6]

(*b*) For $\psi = 8xy$ determine ϕ and hence the velocity at the point (2, 3) vectorially and in magnitude. [8]

5. (*a*) Explain with examples 4 different corrections to the Bernoulli equation and why they are necessary. Which forces are considered in the Bernoulli equation ? [6+2]

(*b*) Draw a neat labelled sketch of the Venturimeter explaining function of each part. Derive the formula for obtaining Q through it. [5+3]

Or

6. (*a*) Compare and contrast between the Venturimeter and Orificemeter. State the formula for obtaining Q in each. [6+2]

(*b*) Draw diagram of Pitot tube and explain its principle and working. [2+1+1]

(*c*) Explain how flowmeters are calibrated with an example. [4]

SECTION II

7. (*a*) For a steady flow of oil of R.D. 0.8 and viscosity 2500 CP flowing through a pipe of 250 mm diameter with an axial velocity of 20 cm/sec, determine :

(*i*) Flow rate in 'lps'

(*ii*) Energy gradient over 10 m length

(*iii*) Power required to maintain the flow

(*iv*) Drag force over 10 m length

(*v*) Velocity at 35 mm from boundary

(*vi*) Friction factor. [12]

(*b*) Draw Moody diagram and explain how '*f*' varies with laminar and turbulent flows. What is its use ? [5+1]

Or

8. (*a*) Starting from first principles derive for laminar flow through pipes :

(*i*) Expression for maximum shear stress. [3]

(*ii*) Expression for maximum velocity. [3]

(*iii*) Hagen-Poiseuille equation. [6]

(*b*) Draw H.S.B. and H.R.B. and explain their importance in the turbulent flow. [6]

9. (*a*) Define boundary layer and explain different boundary layer thicknesses with their importance. [8]

(*b*) Explain boundary layer separation with neat sketches and show how it contributes to drag. Explain types of drag. [6+2]

Or

10. (*a*) Explain the role of boundary layer in heat transfer with sketches. [4]

(*b*) Explain two-phase flow with neat sketches. [4]

(*c*) Compare between pumps and blowers on any *four* points. [4]

(*d*) Explain the importance of boundary layer studies in the turbulent flow. [4]

11. (*a*) The pressure drop in a pipe flow ΔP depends upon the pipe length L, the flow velocity V, the pipe diameter D, the fluid viscosity μ, the fluid density ρ, surface roughness I and the friction factor *f*. Determine relevant π terms after performing dimensional analysis. [8]

(*b*) Explain the role of NPSH in cavitation studies. [4]

(*c*) Explain priming and its importance in centrifugal pumps. [4]

Or

12. (*a*) Explain how repeating variables are selected with an example. [4]

(*b*) Explain the role of D.A. in experimental work with an example. [4]

(*c*) Check whether the following equations are dimensionally homogeneous : [4]

(*i*)

(*ii*) $h_f = \dfrac{f\,LQ^2}{12.1D^5}$

(*d*) Draw operating characteristics for centrifugal pump and explain their use to the end user, with an example. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-205

S.E. (Polymer/Petroleum/Petrochemical) (First Semester)

EXAMINATION, 2010

STRENGTH OF MATERIALS

(2008 COURSE)

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*) 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*) A homogeneous cable of length L and uniform cross-section is suspended from one end :

(*i*) Denoting by r, the density of the cable material and by E its modulus of elasticity, determine the elongation of the cable dut to its own weight.

(*ii*) Assuming now the cable to be horizontal, determine the force that should be applied to each end of the cable to obtain the same elongation as in part (*i*). [10]

(*b*) A steel specimen 16 mm in diameter stretches by 0.06 mm over a gauge length of 60 mm under an axial load of 40 kN. Calculate the strain energy stored in the specimen. If the load at the elastic limit for the specimen is 60 kN, calculate the elongation at elastic limit and the proof resilience. [8]

Or

2. (*a*) A rigid bar AD is supported by two steel wires of 1.5 mm diameter (E = 200 GPa) and a pin at A as in Fig. 1 knowing that the wires were initially taught, determine :

(*i*) additional tension in each wire when a 1 kN load P is applied at D.

(*ii*) the corresponding deflection of point D. [10]

F

450 mm

P = 1 kN

E

250 mm

A

B

C

D

300 mm

300 mm

300 mm

Fig. 1

(*b*) A collar at the end of a vertical steel rod 25 mm in diameter, checks the fall of a weight of 2.5 kN which falls through a height of 4 mm before it strikes the collar. Find the shortest length of the rod which will bear the impact if the stress is not to exceed 125 N/mm^2. E = 210 GPa. [8]

3. (*a*) Derive the expression for principal stresses and position of principal plane with usual notations. [8]

(*b*) Compare the weights of equal lengths of hollow and solid shaft to resist the same torsional moment for same maximum shear stress. Assume internal diameter 0.75 times the external diameter for hollow shaft. [8]

Or

4. (*a*) Find out principal stresses, principal planes and maximum shear stress for the Fig. 2. Use Mohr's circle method. [8]

15 MPa

9 MPa

35 MPa

35 MPa

9 MPa

15 MPa

Fig. 2

(*b*) A solid circular shaft transmits 75 kW at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2 meters length of shaft and shear stress is limited to 50 MPa. Take C = 100 GPa. [8]

5. (*a*) Write the basic difference between thin and thick shells. Also write the assumption for Lame's theory for thick shell. [6]

(*b*) A cylindrical shell 3 m long which is closed at the ends has an internal diameter of 1 m and a wall thickness of 15 mm. Calculate the circumferential and longitudinal stresses induced and also change in dimensions of the shell if it is subjected to an internal pressure of 1.5 MPa. Take E = 200 GPa and m = 0.3. [10]

Or

6. (*a*) Derive the formulae for circumferential, longitudinal and maximum shear stress. Also write co-relation between them. [8]

(*b*) A thick walled closed-end cylinder is made of an Aluminium alloy with E = 72 GPa and m = 0.33, has inside diameter of 200 mm and outside diameter of 800 mm. The cylinder is subjected to internal fluid pressure of 150 MPa. Determine the principal stresses and maximum shear stress at a point on the inside surface of the cylinder. [8]

SECTION II

7. (*a*) Derive the flexural formula. [8]

(*b*) Draw S.F.D. and B.M.D. for the beam AB supported and loaded as shown in Fig. 3. [9]

10 kN

20 kN-m

5 kN/m

A B C D E

2 m 2 m 2 m 3 m

Fig. 3

Or

8. (*a*) The beam is loaded as shown in Fig. 4. The cross-section of the beam is as shown in Fig. 4. Draw bending stress diagram. [9]

50 kN

A B

2 m 2 m

250 mm

50 mm

150 mm

40 mm

Fig. 4

(*b*) Draw S.F.D. and B.M.D. for the beam shown in Fig. 5. [8]

15 kN/m 10 kN/m

A B C D

3 m 3 m 2 m

Fig. 5

9. (*a*) Derive the expression for shear stress. [8]

(*b*) Show that for mild steel columns, Euler's formula is applicable only when the slenderness ratio is greater than 80, if both the ends are hinged. Take crippling stress and modulus of elasticity as 330 MPa and 214 MPa. [8]

Or

10. (*a*) The cross-section of C.I. beam is a 'T' section with the following dimensions Flange of 'T' : 150 mm × 50 mm, we of 'T' : 50 mm × 150 mm. The beam is of 6 m span and simply supported at ends. UDL of 35 kN/m is acting throughout the span. Draw shear stress distribution diagram. [8]

(*b*) A cast iron hollow column having 80 mm external diameter and 60 mm internal diameter is 2 m long with both ends fixed. Using Rankine's formula, find the crippling load. Assume f_y = 600 MPa and Rankine's constant = (1/1600). [8]

11. (*a*) At a certain section of a shaft of 80 mm external diameter, there is a bending moment of 35 kN-m and twisting moment of 50 kN-m. Determine the principal stresses. [8]

(*b*) A simply supported beam of uniform section and span L is loaded with two equal loads W at point (L/4) from each end. Show that the central deflection is (11 WL^3/384EI). [9]

Or

12. (*a*) What is core of a section ? Derive and show the core of the rectangular section. [8]

(*b*) Determine the maximum stress in the bolts for the bracket shown in Fig. 6. [9]

100 kN

80 mm 120 mm

30

50

50

30

All dimensions are in mm.

Fig. 6

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-206

S.E (Polymer/Petroleum and Petrochemical) (Second Semester)

EXAMINATION, 2010

ENGINEERING CHEMISTRY–II

(2008 Course)

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 following reactions of glucose : [6]

(*i*) Osazone formation

(*ii*) Reduction

(*iii*) Ester formation

(*b*) Define enzyme. Explain *four* factors affecting enzyme activity. [6]

(*c*) Draw the structure of the following carbohydrates : [4]

(*i*) Amylose

(*ii*) Cellobiose

P.T.O.

Or

2. (*a*) Write a note on classification of amino acids. [6]

(*b*) Explain secondary structure of protein. [6]

(*c*) Explain the following terms : [4]

(*i*) Monosaccharides

(*ii*) Oligosaccharides

3. (*a*) Give synthesis of carboxylic acids : [6]

(*i*) By oxidation of olefins

(*ii*) By oxidation of aldehydes

(*iii*) By using Grignard reagent.

(*b*) How will you prepare aldehydes by oxidation of primary alcohols and by reduction of acid chlorides ? [6]

(*c*) Explain the use of Friedel-Craft reaction in the synthesis of ketones. [4]

Or

4. (*a*) Explain synthesis of amides starting from : [6]

(*i*) Acid chloride

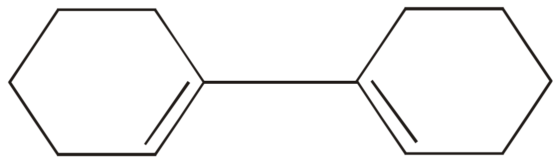
(*ii*) Acid anhydride

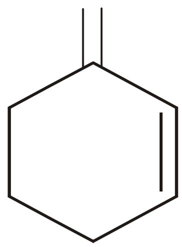
(*iii*) Nitriles

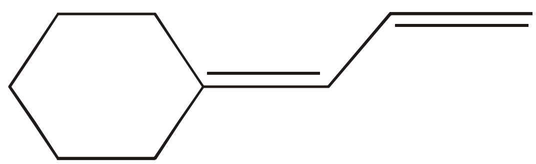
(*b*) Explain Clemmensen reduction and Wolff-Kishner reduction. [6]

(*c*) Explain Gabriel synthesis for the preparation of primary amines. [4]

5. (*a*) Find the λ_{max} for the following dienes : [6]

(*i*) 

(*ii*) 

(*iii*) 

(*b*) Explain : [6]

(*i*) How does the ring size affect the IR frequency of carbonyl compound ?

(*ii*) TMS is used as standard reference for the measurement of chemical shift.

(*c*) Define : [6]

(*i*) Chromophore

(*ii*) Bathochromic shift

(*iii*) Hypsochromic shift

(*iv*) Chemical shift

Or

6. (*a*) (*i*) State and explain Beer-Lambert's law.

(*ii*) Molecular formula of an organic compound is C_3H_6O. It shows ν_{max} = 2720 and 1730 cm^{-1}. Suggest the probable structure. [6]

(*b*) Explain with reason, how many signals are expected in NMR spectra of the following compounds : [6]

(*i*) Dimethyl ether

(*ii*) Ethanol

(*iii*) 1,4 dimethyl benzene

(*c*) How is the structure of an organic compound determined by using its UV-Visible, IR and ^{1}HNMR spectroscopy ? [6]

SECTION II

Atomic Numbers : Ti = 22, V = 23, Cr = 24, Mn = 25, Fe = 26, Co = 27, Ni = 28, Cu = 29.

7. (*a*) What is an orbital ? What are quantum numbers ? Give their significance. [6]

(*b*) With the help of molecular orbital diagram explain magnetic properties of O_2 molecule and calculate its bond order. [6]

(*c*) Explain bonding in C_2H_2 molecule on the basis of VBT theory. [4]

Or

8. (*a*) What is resonance ? Draw resonance structures for NO_3^{1-} and CO_3^{2-} ions. [6]

(*b*) With the help of molecular orbital diagram explain magnetic properties of dinitrogen molecule and calculate its bond order. [6]

(*c*) Discuss in brief the valance shell electron pair repulsion theory. [4]

9. (*a*) Calculate the crystal field stabilization energy for $[Fe(H_2O)_6]^{2+}$ and $[Fe(CN)_6]^{4-}$ and predict which *one* of them is more stable. [6]

(*b*) $[Ni(CO)_4]$ is tetrahedral and diamagnetic but $[Cu(NH_3)_4]^{2+}$ is square planar and paramagnetic, explain using VBT. [6]

(*c*) Calculate effective atomic number for $[Co(NH_3)_6]^{3+}$ and $Fe(CO)_5$. [4]

Or

10. (*a*) Explain variable oxidation states shown by first transition series. [6]

(*b*) Explain colour and catalytic properties shown by transition metal complexes. [6]

(*c*) Define and explain ligands and co-ordination number. [4]

11. (*a*) What is chromatography ? Enlist and explain various principles involved in chromatographic separations. [7]

(*b*) Write a short note on Thermo-gravimetric analysis. [7]

(*c*) Write a short informative note on Atomic absorption spectroscopy. [4]

Or

12. (*a*) Write a short note on Gas chromatography. [7]

(*b*) Explain the variation of Atomic radii with atomic number in a period and in a group. [4]

(*c*) Explain column chromatography and give its merits. [7]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-207

S.E. (Petroleum/Petrochemical/Polymer Engineering) (Second Semester) EXAMINATION, 2010

HEAT TRANSFER

(2008 COURSE)

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*) Explain the following : [16]

(*i*) Fourier's law of heat conduction

(*ii*) Newton's law of cooling

(*iii*) Stefan-Boltzmann law of Radiation

(*iv*) Thermal resistance.

(*b*) An Aluminium plate 50 mm thick whose one face is maintained at 250°C and other face at 50°C. Thermal conductivity $K_{(Al)}$ = 225 W/m°C. Calculate the rate of the heat transfer per unit area through the given plate. [2]

Or

2. (*a*) Derive the necessary expression for the heat conduction through a composite wall made up of three layers of different materials. Explain the term Thermal Contact Resistance. [14]

(*b*) Write a note on critical thickness of insulation. [4]

3. (*a*) Discuss in detail the Kirchhoff's law and Wien's displacement law. [10]

(*b*) Write a note on Black Body, White Body, Opaque Body. [6]

Or

4. (*a*) Derive and discuss in detail the necessary expression for the heat exchange between non-black parallel bodies. [10]

(*b*) Write a note on Radiation shields. [6]

5. (*a*) A hot plate 1 m × 1.5 m is maintained at 300°C, air at 20 °C blows over the plate. If the convective heat transfer coefficient is 20 W/m^2°C, calculate the rate of heat transfer. [4]

(*b*) Write a note on heat transfer by Natural Convection. Differentiate between Natural Convection *Vs*. Force Convection. [12]

Or

6. (*a*) Discuss any *five* dimensionless numbers used in heat transfer studies. [10]

(*b*) Elaborate on Dittus-Boelter equation. [6]

SECTION II

7. (*a*) Discuss the different types of heat exchangers with neat diagrams. [12]

(*b*) Define the terms : Heat Exchanger Effectiveness and Number of Transfer Units. [6]

Or

8. (*a*) Write a note on Overall heat transfer coefficient. [8]

(*b*) Write a note on NTU method to calculate the effectiveness for the parallel flow heat exchanger. [10]

9. (*a*) Write a note on film and drop-wise condensation. [10]

(*b*) Define the term boiling and condensation and applications of boiling process. [6]

Or

10. (*a*) Discuss the different boiling regimes with neat diagram. [10]

(*b*) Discuss the effects of the presence of non-condensable gases on condensation. [6]

11. (*a*) With neat diagram discuss the single effect Evaporators. [6]

(*b*) Discuss in detail Multiple Effect Evaporators. [10]

Or

12. (*a*) Discuss in detail with neat diagrams the following : [10]

(*i*) Short tube evaporator

(*ii*) Long tube vertical evaporator.

(*b*) Discuss the terms : Material and enthalpy balances for single effect evaporator. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

[3862]-208

S.E. (Poly/Petro/Petrochem) (Second Sem.) EXAMINATION, 2010

PARTICULATE TECHNOLOGY

(2008 COURSE)

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 following : [8]

(1) Single particle

(2) Sphericity

(3) Feret's diameter

(4) Mass mean diameter.

(*b*) Define Agglomeration. List different mechanism of agglomeration. Explain any *two* mechanisms with example. [8]

Or

2. (*a*) What is degree of mixing in case of solid mixing ? [2]

(*b*) List the different type of conveyor used in transportation of solid. Explain Belt conveyor with neat sketch. [8]

(*c*) Calculate the surface volume diameter for the following particulate material : [6]

Size range (mm)	**Mass of Particle in range** (gm)
–704 +352	25
–352 +176	37.5
–176 +88	62.5
–88 +44	75
PAN	50

3. (*a*) Derive the relationship between critical speed of ball mill with radius of ball mill and radius of ball. [6]

(*b*) A certain set of crushing roll has roll of 100 cm diameter by 38 cm width face. They are set so that crushing surfaces are 1.25 cm apart at narrowest point. The manufacturer recommends that they may be run at 50 to 100 rpm. They crush a rock having specific gravity 2.35 and angle of nip 30°. What are maximum permissible size of feed and maximum actual capacity in Ton per hour, if the actual capacity is 12% of theoretical ? [8]

(*c*) What would be diameter of set of rolls to take feed of size equivalent to 38 mm sphere to crush to 12.7 mm, if coefficient of friction is 0.35 ? [4]

Or

4. (*a*) Explain with neat sketch construction and working of Gyratory crusher. [8]

(*b*) A material is crushed in black jaw crusher and the average size of particle is reduced from 5 cm to 1.3 cm with consumption of 37 $\frac{\text{(watts) (hours)}}{\text{metic ton}}$. What will be the consumption of energy necessary to crush the same material of average size 8 cm to 3 cm ? You may assume that mechanical efficiency remains unchanged using :

(1) Rittinger law

(2) Kick's law. [8]

(*c*) Differentiate between Crusher and Grinder. [2]

5. (*a*) Define sedimentation. State and explain the factor affecting sedimentation. [8]

(*b*) Explain with neat sketch construction and working of continuous thickener. [8]

Or

6. (*a*) Discuss in brief Kynch theory of sedimentation. [8]

(*b*) A slurry of solid concentration 200 kg/cm^3 is fed to sludge thickener with a circular basin at rate of 360 m^3/hr. The result of batch settling test are as follows :

Solid Concentration (kg/cm^3)	**Settling Velocity** (mm/s)
400	35
500	22
600	15
700	10
800	7
900	5
1000	4
1100	3

Determine the minimum area and diameter of thickener. Also calculate the underflow volumetric flow rate, if a value of 1250 kg/m^3 for underflow conc. was selected. [8]

SECTION II

7. (*a*) Explain the following terms : [6]

(1) Fluidisation

(2) Minimum fluidisation velocity

(3) Froude Number.

(*b*) Draw neat sketch of spouted bed and explain principle and working of spouted bed. [8]

(*c*) What is centrifugal fluidisation ? [2]

Or

8. (*a*) A tube of 0.05 m^2 cross-sectional area is packed with spherical particle upto height of 0.25 m. The porosity of bed is 0.35. It is desired to fluidized particle with water (r = 1000 kg/m^3, viscosity = 10^{-3} Pa.s). Determine minimum fluidisation velocity by Ergun equation. Dia. of particle = 0.01 m, Density of particle = 2600 kg/m^3. [8]

(*b*) A 0.5 m high bed made up of 1 mm diameter of glass sphere (r = 2500 kg/m^3) is to be fluidised by water (r = 1000 kg/m^3). If at the point of incipient fluidization bed voidage 40%, calculate pressure drop cross bed. [4]

(*c*) Air flow through a packed bed of powdery material of 1 cm depth at superfacial gas velocity of 1 cm/sec. A manometer connected to unit register a pressure drop of 1 cm of water. The bed has porosity 0.4. Estimate particle size of the power (r_{air} = 1.23 kg/m^3, viscosity of air = 1.8×10^{-5} kg/ms). [4]

9. (*a*) A plate and frame press filtering slurry gave a total 25 m^3 of filtrate in 30 minutes and 35 m^3 in 60 min when filtration was stopped. Estimate the washing time in minutes if 10 m^3 of wash water is used. The resist of cloth can be neglected, constant pressure is used throughout. [8]

(*b*) A rotary drum filter, operating at 0.03 Hz filter 0.0075 m^3/sec. operating under the same vacuum and neglecting the resistance of filter cloth at what speed must filter be operated to give filtration rate of 0.0160 m^3/sec. [4]

(*c*) A leaf filter, filtering a slurry, gave a total of 8 m^3 filter rate in 30 min. Filtration was continued till 11.3 m^3 of filtrate was collected. Estimate washing time in minutes if 11.3 m^3 of water is used. Resistance of cloth is neglected and constant pressure is used throughout. [6]

Or

10. (*a*) Discuss with neat sketch working of vacuum leaf filter. [8]

(*b*) Derive relationship between thickness of cake and volume of filtrate. [6]

(*c*) Explain in brief preliminary treatment of slurry before filtration. [4]

11. (*a*) What are mechanical classifiers ? List mechanical classifiers and explain construction and working of Bowl classifier. [8]

(*b*) Explain the principle, construction and working of Gravity settling tank. [6]

(*c*) Draw neat and label sketch of electrostatic separator. [2]

Or

12. (*a*) Discuss the construction and working and principle of cyclone separator. [8]

(*b*) Write a short note on Liquid Washing. [6]

(*c*) Draw neat and label sketch of Inertia or Momentum Separators. [2]

Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

[3862]-209

S.E. (Polymer/Petroleum/Petrochemical Engineering (II Sem.)

EXAMINATION, 2010

ELEMENTS OF SOCIAL SCIENCES

(2008 COURSE)

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 Law of Demand with its assumptions and exceptions. [8]

(*b*) State and explain various kinds of markets. [8]

Or

(*a*) Economic problem arises due to scarcity. Comment. [8]

(*b*) Discuss the scope and nature of Engineering Economics. [8]

2. (*a*) Explain the features of mixed economy. [8]

(*b*) What is money ? Explain the functions of money. [8]

P.T.O.

Or

(*a*) State the different factors of production and explain in brief. [8]

(*b*) Discuss the role of Government of India for the development of modern economy. [8]

3. Write short notes on : [18]

(*i*) Specialization

(*ii*) Foreign Trade Policy of India

(*iii*) Rationing of Prices.

Or

Explain the following :

(*a*) LPG model of economic development in India. [9]

(*b*) Objectives of 5 year plans for economic development. [9]

SECTION II

4. (*a*) What is a family ? What are its different types ? Explain the features of modern family. [8]

(*b*) Trace the history of civilizations in brief. [8]

Or

(*a*) Discuss the impact of Globalization on Indian society. [8]

(*b*) India is a land of Unity in Cultural Diversity. Comment. [8]

5. (*a*) Discuss the problem of religious fundamentalism in brief. [8]

(*b*) Explain the distinctive features of Indian Philosophy. [8]

Or

(*a*) Sustainable consumption is important for sustainable development. Discuss. [8]

(*b*) IT revolution has changed the Indian society. Comment. [8]

6. Write short notes on : [18]

(*i*) Caste System in India

(*ii*) Crimes and Punishments

(*iii*) Census of India.

Or

(*i*) Social Reforms and Reformers

(*ii*) Ecology and Environment

(*iii*) Teachings of Swami Vivekananda.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+4**

[3862]-211

S.E. (I.T. & Comp.) (First Semester) EXAMINATION, 2010

DISCRETE STRUCTURES

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

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

(*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*) Prove by induction for $n \geq 0$ [6]

$$1 + a + a^2 + ... + a^n = \frac{1 - a^{n+1}}{1 - a}.$$

(*b*) In a survey of 60 people it was found that : [6]

25 read Business India

26 read India Today

26 read Times of India

11 read both Business India and India Today

9 read both Business India and Times of India

8 read both India Today and Times of India

8 read none of these.

(*i*) How many read all three ?

(*ii*) How many read exactly one ?

(*c*) Prove that $[(p \rightarrow q) \wedge (r \rightarrow s) \wedge (p \vee r)] \rightarrow (q \vee s)$ is a tautology. [4]

Or

2. (*a*) Let P and Q be 2 multisets.

$P = \{a, a, a, c, d, d\}$ and $Q = \{a, a, b, c, c\}$. Find : [4]

(*i*) $P \cup Q$

(*ii*) $P \cap Q$

(*iii*) $P - Q$

(*iv*) $P + Q$

(*b*) $P(x)$: x is even. [6]

$Q(x)$: x is a prime number.

$R(x, y)$: $x + y$ is even.

(1) Using above write an English sentence for each of the symbolic statement given below :

(*i*) $\forall x \ (\sim Q(x))$

(*ii*) $\exists y \ (\sim P(y))$

(*iii*) $\sim (\exists x \ (P(x) \ \ Q(x)))$

(2) Using the information given above write the following English sentences in symbolic form :

(*i*) The sum of any two integers is an odd integer

(*ii*) Every integer is even or prime

(*iii*) Every integer is an odd integer.

(*c*) Find the CNF and DNF for the following : [4]

(*i*) $(p \rightarrow q) \wedge (q \rightarrow p)$

(*ii*) $((p \wedge (p \rightarrow q)) \rightarrow q)$

(*d*) Define power set.

List all elements of the set p(A) XA where A = $\{a, b, c\}$. [2]

3. (*a*) Show that (I,) is a commutative ring with identity. Where + and □ are defined as : [6]

A $b = a + b - 1$ and a $b = a + b - ab$.

(*b*) Let Z_n denote the set of Integers as $\{1, ..., n-1\}$. Construct the multiplication table for with $n = 6$. Is (Z_n,) [6]

Where □ is a binary operation on Z_n such that a □ b = remainder of ab divided by n. Is Z_n an abelian group ?

(*c*) Let G be a group of real nos under addition and be the group of +ve real nos under multiplication. Let $f : G \rightarrow$ be defined as $f(x) = e^x$. Show that f is an isomorphism. [4]

Or

4. (*a*) Define : [4]

(*i*) Subgroup

(*ii*) Cyclic Group

(*iii*) Integral domain

(*iv*) Field

(*b*) Prove the following results for the group G : [6]

(*i*) The identity element is unique.

(*ii*) Each a in G has a unique inverse a^{-1}.

(*iii*) $ab = ac$ implies $b = c$.

(*c*) Consider the (3, 6) encoding function e : [6]

$e(001) = 000000$

$e(001) = 000110$

$e(010) = 010010$

$e(011) = 010100$

$e(100) = 100101$

$e(101) = 100011$

$e(110) = 110111$

$e(111) = 110001$

Show that e is a group code.

5. (*a*) Let A = B be the set of real nos. [6]

$f : A \to B$ given by $f(x) = 2x^3-1$

$g : B \to A$ given by $g(y) =$

Show that f is a bijection between A and B and g is bijection between B and A.

(*b*) For each of these relations on set A = {1, 2, 3, 4} decide whether it is reflexive, symmetric, transitive or antisymmetric. (one relation may satisfy more than one properties). [6]

$R_1 = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$

$R_2 = \{(1, 1), (1, 2), (2, 2), (2, 1), (3, 3), (4, 4)\}$

$R_3 = \{(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)\}$

(*c*) Determine whether the poset represented by each of the Hasse diagram are lattices. Justify your answer. [6]

$\sqrt[3]{\frac{1}{2} y + \frac{1}{2}}$

h

Or

6. (*a*) Find the solution to the recurrence relation

$$a_n = 6 a_{n-1} - 11 a_{n-2} + 6a_{n-3}$$

with initial condition $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$. [6]

(*b*) A = {1, 2, 3, 4, 5} and R and S be equivalent relations on A whose matrices are given below. Compute the matrix of smallest relation containing R & S. [6]

$$M_R = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix} \qquad M_s = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(*c*) Define with examples : [6]

(*i*) Poset

(*ii*) Lattice

(*iii*) Complemented Lattice.

SECTION II

7. (*a*) Which of the following graphs have a Euler circuit or path or Hamiltonian cycle ? Write the path *or* circuit : [6]

d

(*b*) Determine whether graphs G and H are isomorphic or not. Justify your answer. [6]

(*c*) Find the shortest path from a to z in the following graph. [6]

Or

8. (*a*) State and prove Euler's formula for a connected planar graph of order n, size e and with f faces. [6]

(*b*) Define the following with suitable example : [6]

(*i*) Cut set

(*ii*) Factors of graph

(*iii*) Weighted graph.

(*c*) Identify whether the graphs given are planar or not. Draw planar representation if possible : [6]

A

9. (*a*) A binary tree has 10 nodes. The inorder and preorder traversals of the trees are as shown below. Construct the binary tree. [6]

Inorder : ABCEDFJGIH

Preorder : JCBADEFIGH

(*b*) Convert the following tree into binary tree. [4]

(*c*) Using Prim's algorithm construct minimal spanning tree starting at vertex a. [6]

g

Or

10. (*a*) Find the maximum flow in the transport network given below : [6]

(*b*) Construct the expression tree for the following expression. $(3 - (2(- 11 - (9 - 4)))) \div (2 + (3 + (4 + 7)))$. [4]
Also evaluate the expression.

(*c*) Using Kruskal's algorithm construct minimal spanning tree. [6]

11. (*a*) A single card is drawn from an ordinary deck of 52 cards. Find the probability p that : [3]

(*i*) the card is a face card

(*ii*) the card is face card and heart

(*iii*) the card is face card or heart.

(*b*) How many seven letter words can be formed using the letters of the word BENZENE ? [3]

(*c*) Two dice are tossed once. Find the probability of getting an even number on first or a total of 8. [4]

(*d*) If repetitions are not permitted, how many four digit numbers can be formed from digits 1, 2, 3, 7, 8, and 5. [6]

Or

12. (*a*) How many ways can the letters in the word MISSISSIPPI be arranged ? What if P's are to be separated ? [4]

(*b*) Show that : [6]

$$C\ (2n,\ 2) = 2C(n,\ 2) + n^2.$$

(*c*) A pair of fair dice is thrown. Find the probability p that the sum is 10 or greater if : [3]

(*i*) 5 appears on first die

(*ii*) 5 appears on at least one die.

(*d*) A coin is tossed 3 times. Find the probability that there will appear : [3]

(*i*) Three heads

(*ii*) Exactly 2 heads

(*iii*) No heads.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+4**

[3862]-211

S.E. (I.T. & Comp.) (First Semester) EXAMINATION, 2010

DISCRETE STRUCTURES

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

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

(*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*) Prove by induction for $n \geq 0$ [6]

$$1 + a + a^2 + ... + a^n = \frac{1 - a^{n+1}}{1 - a}.$$

(*b*) In a survey of 60 people it was found that : [6]

25 read Business India

26 read India Today

26 read Times of India

11 read both Business India and India Today

P.T.O.

9 read both Business India and Times of India

8 read both India Today and Times of India

8 read none of these.

(*i*) How many read all three ?

(*ii*) How many read exactly one ?

(*c*) Prove that $[(p \to q) \wedge (r \to s) \wedge (p \vee r)] \to (q \vee s)$ is a tautology. [4]

Or

2. (*a*) Let P and Q be 2 multisets.

P = $\{a, a, a, c, d, d\}$ and Q = $\{a, a, b, c, c\}$. Find : [4]

(*i*) $P \cup Q$

(*ii*) $P \cap Q$

(*iii*) $P - Q$

(*iv*) $P + Q$

(*b*) $P(x)$: x is even. [6]

$Q(x)$: x is a prime number.

$R(x, y)$: $x + y$ is even.

(1) Using above write an English sentence for each of the symbolic statement given below :

(*i*) $\forall x\ (\sim Q(x))$

(*ii*) $\exists y\ (\sim P(y))$

(*iii*) $\sim (\exists x\ (P(x)\ \ Q(x)))$

(2) Using the information given above write the following English sentences in symbolic form :

(*i*) The sum of any two integers is an odd integer

(*ii*) Every integer is even or prime

(*iii*) Every integer is an odd integer.

(*c*) Find the CNF and DNF for the following : [4]

(*i*) $(p \rightarrow q) \wedge (q \rightarrow p)$

(*ii*) $((p \wedge (p \rightarrow q)) \rightarrow q)$

(*d*) Define power set.

List all elements of the set p(A) XA where A = $\{a, b, c\}$. [2]

3. (*a*) Show that (I,) is a commutative ring with identity. Where + and are defined as : [6]

A $b = a + b - 1$ and a $b = a + b - ab$.

(*b*) Let Z_n denote the set of Integers as $\{1, ..., n-1\}$. Construct the multiplication table for with $n = 6$. Is (Z_n,) [6]

Where is a binary operation on Z_n such that a b = remainder of ab divided by n. Is Z_n an abelian group ?

(*c*) Let G be a group of real nos under addition and be the group of +ve real nos under multiplication. Let $f : G \rightarrow$ be defined as $f(x) = e^x$. Show that f is an isomorphism. [4]

Or

4. (*a*) Define : [4]

(*i*) Subgroup

(*ii*) Cyclic Group

(*iii*) Integral domain

(*iv*) Field

(*b*) Prove the following results for the group G : [6]

(*i*) The identity element is unique.

(*ii*) Each a in G has a unique inverse a^{-1}.

(*iii*) $ab = ac$ implies $b = c$.

(*c*) Consider the (3, 6) encoding function e : [6]

$e(001) = 000000$

$e(001) = 000110$

$e(010) = 010010$

$e(011) = 010100$

$e(100) = 100101$

$e(101) = 100011$

$e(110) = 110111$

$e(111) = 110001$

Show that e is a group code.

5. (*a*) Let A = B be the set of real nos. [6]

$f : A \rightarrow B$ given by $f(x) = 2x^3 - 1$

$g : B \rightarrow A$ given by $g(y) =$

Show that f is a bijection between A and B and g is bijection between B and A.

(b) For each of these relations on set A = {1, 2, 3, 4} decide whether it is reflexive, symmetric, transitive or antisymmetric. (one relation may satisfy more than one properties). [6]

$R_1 = \{(1, 1), (2, 2), (3, 3), (4, 4)\}$

$R_2 = \{(1, 1), (1, 2), (2, 2), (2, 1), (3, 3), (4, 4)\}$

$R_3 = \{(1, 3), (1, 4), (2, 3), (2, 4), (3, 1), (3, 4)\}$

(c) Determine whether the poset represented by each of the Hasse diagram are lattices. Justify your answer. [6]

$\sqrt[3]{\frac{1}{2}y + \frac{1}{2}}$

h

Or

6. (a) Find the solution to the recurrence relation

$$a_n = 6\, a_{n-1} - 11\, a_{n-2} + 6a_{n-3}$$

with initial condition $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$. [6]

(*b*) A = {1, 2, 3, 4, 5} and R and S be equivalent relations on A whose matrices are given below. Compute the matrix of smallest relation containing R & S. [6]

$$M_R = \begin{bmatrix} 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 \end{bmatrix} \qquad M_s = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix}$$

(*c*) Define with examples : [6]

(*i*) Poset

(*ii*) Lattice

(*iii*) Complemented Lattice.

SECTION II

7. (*a*) Which of the following graphs have a Euler circuit or path or Hamiltonian cycle ? Write the path *or* circuit : [6]

d

(*b*) Determine whether graphs G and H are isomorphic or not. Justify your answer. [6]

(*c*) Find the shortest path from a to z in the following graph. [6]

Or

8. (*a*) State and prove Euler's formula for a connected planar graph of order n, size e and with f faces. [6]

(*b*) Define the following with suitable example : [6]

(*i*) Cut set

(*ii*) Factors of graph

(*iii*) Weighted graph.

(*c*) Identify whether the graphs given are planar or not. Draw planar representation if possible : [6]

A

9. (*a*) A binary tree has 10 nodes. The inorder and preorder traversals of the trees are as shown below. Construct the binary tree. [6]

Inorder : ABCEDFJGIH

Preorder : JCBADEFIGH

(*b*) Convert the following tree into binary tree. [4]

(*c*) Using Prim's algorithm construct minimal spanning tree starting at vertex a. [6]

Or

10. (*a*) Find the maximum flow in the transport network given below : [6]

(*b*) Construct the expression tree for the following expression. (3 – (2(– 11 – (9 – 4)))) ÷ (2 + (3 + (4 + 7))). [4] Also evaluate the expression.

(*c*) Using Kruskal's algorithm construct minimal spanning tree. [6]

11. (*a*) A single card is drawn from an ordinary deck of 52 cards. Find the probability p that : [3]

(*i*) the card is a face card

(*ii*) the card is face card and heart

(*iii*) the card is face card or heart.

(*b*) How many seven letter words can be formed using the letters of the word BENZENE ? [3]

(*c*) Two dice are tossed once. Find the probability of getting an even number on first or a total of 8. [4]

(*d*) If repetitions are not permitted, how many four digit numbers can be formed from digits 1, 2, 3, 7, 8, and 5. [6]

Or

12. (*a*) How many ways can the letters in the word MISSISSIPPI be arranged ? What if P's are to be separated ? [4]

(*b*) Show that :

$C\ (2n,\ 2) = 2C(n,\ 2) + n^2.$ [6]

(*c*) A pair of fair dice is thrown. Find the probability p that the sum is 10 or greater if : [3]

(*i*) 5 appears on first die

(*ii*) 5 appears on at least one die.

(*d*) A coin is tossed 3 times. Find the probability that there will appear : [3]

(*i*) Three heads

(*ii*) Exactly 2 heads

(*iii*) No heads.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-212

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2010

PROGRAMMING AND PROBLEM SOLVING

(2008 COURSE)

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 tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Consider any *one* problem and solve that problem using six steps of problem solving. Explain each step in detail. [8]

(*b*) State and explain any *four* difficulties with problem solving. [4]

(*c*) Compare an algorithmic solutions and heuristic solution. Support your answer with suitable example. [4]

Or

2. (*a*) The railway ticket reservation system (single counter) is to be computerized. Prepare solution to this problem using the following tools :

(*i*) IPO chart

(*ii*) Problem analysis chart

(*iii*) Interactivity chart. [8]

(*b*) Write a pseudo code algorithm to solve the problem given in Q. 2 (*a*). [4]

(*c*) What is the order of processing of the following equations ?

R = P < Q AND S * T OR U > V + W – C/3

R = A + (((B – C)/D) + E ^ F + (G – H) * I) ^ (J – K) [4]

3. (*a*) Write an algorithm to calculate and print result of your exam. (Semester – I). Identify the modules (functions) and the parameters to find the solution to this problem. Create a data dictionary for the parameters you have identified. [8]

(*b*) Draw and explain coupling diagram for problem given in Q. 3 (*a*). [4]

(*c*) Take three integers and find the minimum integer among three. Create a decision table to solve this problem. [4]

Or

4. (*a*) Design an algorithm to calculate the salary of an employee using the following problem solving strategies :

(*i*) Sequential logic

(*ii*) Decision logic

(*iii*) Iterative logic

(*iv*) Selection.

To calculate the salary consider designation, no. of days worked, wages per day, basic salary, allowances, and deductions. Calculate salary according to the designation of an employee. [8]

(*b*) What are the different parameters passing methods ? Explain each method with suitable example. [4]

(*c*) Explain the concept of local variables and global variables with suitable example. [4]

5. (*a*) How one can develop efficient computer solutions to problem ? [4]

(*b*) Design and explain an algorithm to find the sum of the digits of an integer number. [6]

(*c*) Design an algorithm for exchanging values of two variables. Explain *one* application in detail in which we use this algorithm. [8]

Or

6. (*a*) State and explain the rules for designing modules while finding solution to a problem. [4]

(*b*) Design and explain an algorithm for finding the multiplication of set of numbers. [6]

(*c*) Design an algorithm to calculate a result of 'N' students of a class and find number of students passed in grades distinction, first class, higher second class, second class, pass class. Also find count value of failed students.

(For result consider the subjects of S.E. Computer Semester–I) [8]

SECTION II

7. (*a*) Design an algorithm to find the maximum absolute difference between adjacent pairs of element in an array of 'N' elements. [6]

(*b*) Write an algorithm to find the frequency of each vowel in a line of text. [6]

(*c*) Devise and write a pseudo algorithm to remove duplicate elements from two-dimensional array. [6]

Or

8. (*a*) Design an algorithm to find the maximum number occurs and how many times it occurs in an array of 'N' elements. Only one pass should be made. [6]

(*b*) Write a pseudo algorithm to find the sum of rows, sum of columns, and sum of major diagonal of a square matrix (N × N). [6]

(*c*) Design an algorithm to search an integer number from an array of 'N' elements. Use binary search. [6]

9. (*a*) Write a pseudo algorithm for text length adjustment. Explain it. [4]

(*b*) Write and explain an algorithm for left and right justification for text. [6]

(*c*) Write and explain an algorithm that will search a string in a text. [6]

Or

10. (*a*) Take two ordered sets of numbers 'A' and 'B'. Design an algorithm to determine whether or not the set 'A' is contained within the set 'B'. [4]

(*b*) Design and explain an algorithm that will search a line of text for particular substring. [6]

(*c*) Write and explain an algorithm to count the number of times a particular word occurs in a text. [6]

11. (*a*) Explain the following features of an object oriented programming with suitable examples : [8]

(*i*) Polymorphism

(*ii*) Encapsulation.

(*b*) Write a C++ program to implement the concept of inheritance with suitable examples. [8]

Or

12. (*a*) Explain with example :

(*i*) Visibility modifiers of C++

(*ii*) Constructor

(*iii*) Destructor. [8]

(*b*) Compare procedural language and object oriented language for solving problems. What are their advantages and disadvantages ? [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-213

S.E. (Comp. Engg.) (First Semester) EXAMINATION, 2010

(Common to Computer and I.T.)

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** or **2,** Q. No. **3** or **4,** Q. No. **5 or 6** from Section I and 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.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Design and explain in detail 4-bit input grey code to 7-segment BCD code conversion technique. For this design use K-map reduction and MSI circuit for each segment of display. [16]

(*b*) Enlist various code conversion methods. [2]

Or

2. (*a*) Express the following numbers in binary format. Write step by step solution. [12]

(*i*) $(7762)_{octal}$

(*ii*) $(432A)_{hex}$

(*iii*) $(2946)_{decimal}$

(*iv*) $(1101.11)_{decimal}$.

(*b*) What will max. 4-digit equivalent Hex number for 4-digit max. Decimal number ? Also perform the following substraction : [6]

$$(7048)_{Decimal} - (07A8)_{Hex}.$$

3. (*a*) Solve the following using K–map reduction technique. Also draw MSI circuit for output. [12]

(*i*) $Z = f(A, B, C, D) = \pi\ (1, 2, 3, 9, 10, 12, 15)$

(*ii*) $Z = f(A, B, C, D) = \pi\ (0, 2, 3, 4, 6, 8, 11, 13)$.

(*b*) Explain for IC 74LSXX various characteristics in brief. [4]

Or

4. (*a*) Draw and explain the design of 3-I/P TTL NAND gate circuit. Also explain various I/P, O/P states and corresponding transistor (ON/OFF) states. [12]

(*b*) Explain working of 2-input CMOS-NOR gate. [4]

5. (*a*) Explain the working of cascaded mode magnitude comparator IC 7485. [8]

(*b*) Draw and explain 4-bit BCD adder using IC 7483. Also explain with reference to your design addition of $(9 + 5)_{BCD}$ and $(7 + 2)_{BCD}$. [8]

Or

6. (*a*) Explain decoder (1 : 8) as full adder and full substractor. Show your design. [8]

(*b*) Design 28 : 1 mux using 8 : 1 mux (with enable inputs). Explain truth table of your design in short. [Hint : you can use separate mux for enable of respective IC's] [8]

SECTION II

7. (*a*) Draw a 4-bit synchronous counter. Also explain timing diagram for the same. [10]

(*b*) What is the advantage of M-S flip-flop ? Explain working of MS J-K flip-flop in detail. [8]

Or

8. (*a*) What is advantage of MOD counter ? Explain working of MOD-17 and MOD-24 counter with detail diagram using IC-7490. [8]

(*b*) Explain ring counter with design having initial state '01011', from initial state explain all possible states in that ring. [10]

9. (*a*) What is VHDL ? Explain entity-architecture declaration for 2-bit NOR and AND gate. [8]

(*b*) What is ASM chart ? Design ASM chart for 4-bit grey code sequence with up-down conditions. [8]

Or

10. A sequential ring counter with present state '01011'. The circuit also have an input 'Z'. If Z = 0, circuit shows next-output (right shift) else for Z = 1, it shows initial state. Draw an ASM chart and state stable for this circuit to generate the output using mux controller method. [16]

11. (*a*) Explain difference between FPGA and CPLD logic. [8]

(*b*) Explain machine cycle of an addition operation of a microprocessor. Use two 8-bit numbers to explain the same. [8]

Or

12. (*a*) Explain in brief the function of Address bus, Data bus and control bus for a basic microprocessor. [8]

(*b*) Explain in brief design model of PLA for any code conversion example. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-213

S.E. (Comp. Engg.) (First Semester) EXAMINATION, 2010

(Common to Computer and I.T.)

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** or **2,** Q. No. **3** or **4,** Q. No. **5 or 6** from Section I and 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.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Design and explain in detail 4-bit input grey code to 7-segment BCD code conversion technique. For this design use K-map reduction and MSI circuit for each segment of display. [16]

(*b*) Enlist various code conversion methods. [2]

Or

2. (*a*) Express the following numbers in binary format. Write step by step solution. [12]

(*i*) $(7762)_{\text{octal}}$

(*ii*) $(432A)_{hex}$

(*iii*) $(2946)_{decimal}$

(*iv*) $(1101.11)_{decimal.}$

(*b*) What will max. 4-digit equivalent Hex number for 4-digit max. Decimal number ? Also perform the following substraction : [6]

$$(7048)_{Decimal} - (07A8)_{Hex.}$$

3. (*a*) Solve the following using K–map reduction technique. Also draw MSI circuit for output. [12]

(*i*) $Z = f(A, B, C, D) = \pi\ (1, 2, 3, 9, 10, 12, 15)$

(*ii*) $Z = f(A, B, C, D) = \pi\ (0, 2, 3, 4, 6, 8, 11, 13)$.

(*b*) Explain for IC 74LSXX various characteristics in brief. [4]

Or

4. (*a*) Draw and explain the design of 3-I/P TTL NAND gate circuit. Also explain various I/P, O/P states and corresponding transistor (ON/OFF) states. [12]

(*b*) Explain working of 2-input CMOS-NOR gate. [4]

5. (*a*) Explain the working of cascaded mode magnitude comparator IC 7485. [8]

(*b*) Draw and explain 4-bit BCD adder using IC 7483. Also explain with reference to your design addition of $(9 + 5)_{BCD}$ and $(7 + 2)_{BCD}$. [8]

Or

6. (*a*) Explain decoder (1 : 8) as full adder and full substractor. Show your design. [8]

   (*b*) Design 28 : 1 mux using 8 : 1 mux (with enable inputs). Explain truth table of your design in short. [Hint : you can use separate mux for enable of respective IC's] [8]

SECTION II

7. (*a*) Draw a 4-bit synchronous counter. Also explain timing diagram for the same. [10]

   (*b*) What is the advantage of M-S flip-flop ? Explain working of MS J-K flip-flop in detail. [8]

Or

8. (*a*) What is advantage of MOD counter ? Explain working of MOD-17 and MOD-24 counter with detail diagram using IC-7490. [8]

   (*b*) Explain ring counter with design having initial state '01011', from initial state explain all possible states in that ring. [10]

9. (*a*) What is VHDL ? Explain entity-architecture declaration for 2-bit NOR and AND gate. [8]

   (*b*) What is ASM chart ? Design ASM chart for 4-bit grey code sequence with up-down conditions. [8]

Or

10. A sequential ring counter with present state '01011'. The circuit also have an input 'Z'. If Z = 0, circuit shows next-output (right shift) else for Z = 1, it shows initial state. Draw an ASM chart and state stable for this circuit to generate the output using mux controller method. [16]

11. (*a*) Explain difference between FPGA and CPLD logic. [8]

(*b*) Explain machine cycle of an addition operation of a microprocessor. Use two 8-bit numbers to explain the same. [8]

Or

12. (*a*) Explain in brief the function of Address bus, Data bus and control bus for a basic microprocessor. [8]

(*b*) Explain in brief design model of PLA for any code conversion example. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-214

S.E. (Computer Engineering) (First Semester) EXAMINATION, 2010

DATA STRUCTURES AND ALGORITHMS

(2008 COURSE)

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 is call by value and call by reference ? Explain with *one* example for each. [8]

(*b*) Write a 'C' program to shift elements of an integer array one location ahead. Element present at last location of array should be shifted on first location of the array. Write separate functions for accepting array, shifting array, displaying array etc. [8]

Or

2. (*a*) Explain execution of the following code step by step and show the final output : [8]

```
# include < stdio.h >
void display (int);
int main( )
  {   int x = 4;
      display (x);
      return 0;
  }
void display (int n)
  {    if (n > 0)
        display (n – 1);
      printf ("%d", n);
 }
```

(*b*) Write a 'C' program to implement a structure for automobile part with data members part number, part name, quantity etc. Write separate functions for initializing structure, updating structure, displaying structure etc. [8]

3. (*a*) Explain in detail the concept of data object, data structures, linear data structure and non-linear data structure. [8]

(*b*) What is Asymptotic notation ? Write an algorithm for matrix multiplication for $n \times n$ matrix and find out its time complexity by frequency count. [8]

Or

4. (*a*) What is Abstract Data Type (ADT) ? Write an abstract data type for linked list. [8]

(*b*) Write an algorithm for Bubble sort. Find time complexity of the algorithm and express it using asymptotic notation. [8]

5. (*a*) (*i*) Show how a two-dimensional array is stored in memory. Assume that array start at the address 4000. [4]

(*ii*) Explain how a polynomial is represented using array with *one* example. [5]

(*b*) Write an algorithm for fast transpose of sparse matrix and find out its time complexity. [9]

Or

6. (*a*) Write a 'C' program to implement polynomial using array and perform its multiplication. (Write separate functions for accepting polynomial, multiplication, display). [10]

(*b*) (*i*) What is sparse matrix ? Explain with *one* example. [4]

(*ii*) What is address of element arr[4] [3] in the array 'arr' of size 6 × 6 and type integer, when 'arr' is represented using row major and column major representations ? Assume array 'arr' starts at the address 7000. [4]

SECTION II

7. (*a*) Sort the following numbers step by step by using Radix sort : [8]

20, 15, 21, 06, 08, 05, 29, 02, 14, 40.

(*b*) Write an algorithm for binary search and find out its time complexity. [8]

Or

8. (*a*) Explain with *one* example index sequential search. [8]

(*b*) Write a 'C' program to implement quicksort. [8]

9. (*a*) (*i*) What is static memory allocation and dynamic memory allocation ? [4]

(*ii*) Compare doubly linked list and circular linked list. [4]

(*b*) Write an algorithm to delete and insert a node in doubly linked list at any position. [8]

Or

10. (*a*) (*i*) What is skep list ? Epxlain with *one* example. [4]

(*ii*) Draw GLL for the following expression : [4]

$(a, b, (c, d, (e, f), g, (h, i), ((j, k)), l), m)$

(*b*) What a 'C' program to implement circular linked list and display the contents in reverse order. (Write separate functions for create and display) [8]

11. (*a*) (*i*) Define stack and write abstract data type for stack. [5]

(*ii*) What is multistack ? Explain with *one* example. [4]

(*b*) Write a 'C' program to implement circular queue using array and perform insert and delete operation. [9]

Or

12. (*a*) (*i*) Differentiate between linear and circular queue. [2]

(*ii*) Explain stack overflow and underflow conditions. [4]

(*iii*) What is priority queue ? Give an application for priority queue. [3]

(*b*) Write a 'C' program to reverse the given string using stack. Find out time complexity of program. [9]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-215

S.E. (Computer Engineering and IT)) (I Sem.)

EXAMINATION, 2010

HUMANITIES AND SOCIAL SCIENCE

(2008 COURSE)

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*) What is meant by Sociology ? Explain the importance of sociology. [6]

(*b*) Differentiate between primary and secondary kin. [4]

(*c*) Describe in brief the financial powers of Panchayati Raj Institutions. [6]

(*d*) Define caste. [2]

Or

2. (*a*) What is the difference between gender equality and gender equity ? [4]

P.T.O.

(*b*) Explain the components of secularism in India. [6]

(*c*) What are the problems in a modern Indian family ? [6]

(*d*) Define marriage. [2]

3. (*a*) Explain any *two* methods of acquiring sociological knowledge. [6]

(*b*) Explain the concept of cultural lag. [4]

(*c*) Describe in brief the National Nutrition Policy. [6]

Or

4. (*a*) What are the problems faced in the study of human beings ? [6]

(*b*) Differentiate between social change and social progress. [4]

(*c*) Describe in brief the National Social assistance program (NSAP). [6]

5. (*a*) What is the impact of precision farming in agricultural revolution ? [5]

(*b*) How does IPR laws affect the biotechnology sector development ? [6]

(*c*) Explain the *three* basic elements of Green Revolution. [3]

(*d*) Give any *two* shortcomings of Green Revolution. [2]

Or

6. (*a*) How do you classify the industries on the basis of ownership ? [5]

(*b*) Explain the consequences of Non-registration of company. [3]

(*c*) Explain in detail Public Sector. [8]

SECTION II

7. (*a*) What are the steps taken by leading IT industries for the pollution control ? [4]

(*b*) Explain in detail effects of Global warming. [4]

(*c*) What are the factors which contribute to the loss of Biodiversity ? [5]

(*d*) Explain the following ecosystems : [3]

(*i*) Arctic tundra

(*ii*) Urban ecosystem.

Or

8. (*a*) With a suitable diagram, explain ecological pyramid. [5]

(*b*) Explain energy flow models of an ecosystem. [5]

(*c*) Explain the measures to be taken for protection of biodiversity. [4]

(*d*) Define the following population characteristics : [2]

(*i*) Infant Mortality Rate (IMR)

(*ii*) Zero-population growth.

9. (*a*) What are the functions of planning commission ? [8]

(*b*) Compare the concepts of Microeconomics and Macroeconomics. [6]

(*c*) Define Inflation. [2]

Or

10. (*a*) Explain National Population Policy, 2000 (NPP 2000). [8]

(*b*) Discuss INDIA VISION, 2020. [8]

11. (*a*) What are the objectives of Budgeting ? [6]

(*b*) Differentiate between Shares and Debentures. [6]

(*c*) Define the following terms : [6]

(*i*) Marginal Cost

(*ii*) Fixed Cost

(*iii*) Variable Cost.

Or

12. Write short notes on (any *three*) : [18]

(*i*) Functions of RBI

(*ii*) Profit and Loss Account

(*iii*) Break-even analysis

(*iv*) Indian Banking

(*v*) World Trade Organization.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-216

S.E. (Comp.) (Second Semester) EXAMINATION, 2010

MICROPROCESSORS AND INTERFACING TECHNIQUES

(2008 COURSE)

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*) Draw and explain functional block diagram of the 8086 microprocessor. [8]

(*b*) Explain with a neat diagram of memory segmentation in the 8086 microprocessor. [8]

Or

2. (*a*) Draw and explain write cycle timing diagram in maximum mode of 8086 microprocessor. [8]

(*b*) Explain the flags register with instruction affecting the flags. [6]

(*c*) Explain the use of the following signals of 8086 micro-processor : [2]

(*i*) $MN/\overline{MX}$

(*ii*) $DT/\overline{R}$

3. (*a*) If

(BX) = 0158H Displacement = 1B57H

(DI) = 10ASH (DS) = 2100H

and DS is used as segment register, then calculate EA and PA for the following addressing modes : [8]

(*i*) Register addressing mode

(*ii*) Register indirect, assuming DI

(*iii*) Based indexed, assuming register BX and DI

(*iv*) Relative based indexed addressing, asuming BX and DI.

(*b*) Write an 8086 assembly language program for BCD to seven segment code conversion. Use XLAT instruction and common cathode display. Write appropriate comments. [8]

Or

4. (*a*) Explain the following instructions for 8086 : [8]

(*i*) CMPS

(*ii*) MOVSB/MOVSW

(*iii*) SCAS

(*iv*) STOS/LODS

(b) Explain the difference between near and far procedure of 8086 microprocessor. [4]

(c) Explain the stack structure of 8086 in detail. [4]

5. (a) What are the different components of MS-DOS ? With the help of neat diagram, explain how MS-DOS gets loaded. [10]

(b) What is interrupt vector table of 8086 ? Explain its structure. [8]

Or

6. (a) Explain the command words/control words of 8259 in detail. [10]

(b) Write an initialization sequence for 8259 PIC for the following specifications : [8]

(i) Interrupt type 32

(ii) Edge triggered, single and ICW_4 needed

(iii) Mask interrupts IR1 and IR3

SECTION II

7. (a) Draw a block diagram of 8255 PPI and explain in brief. [8]

(b) Explain BSR and I/O mode word formats of the 8255 PPI. Write a BSR control word subroutine to set bits PC7 and PC3 and reset them after 10 msec. Assume that a delay subroutine is available. Address for control word register = 83H. [8]

Or

8. (a) Compare asynchronous serial communication with synchronous communication. Draw the command instruction format of 8251 and explain it. [8]

(*b*) Define the following terms for D/A conversion : [8]

(*i*) Resolution

(*ii*) Accuracy

(*iii*) Monotonicity

(*iv*) Conversion time.

9. (*a*) Draw and explain the following 8279 commands : [8]

(*i*) Keyboard/display mode set command

(*ii*) Read FIFO/sensor RAM command.

(*b*) Draw and explain the functional block diagram of 8253/54. [8]

Or

10. (*a*) Give the control word format for 8253/54. Write a program to initialize counter 2 in mode 0 with a count of C030H. Assume address for control word register = 0BH, counter 0 = 08H, counter 1 = 09H and counter 2 = 0AH. [8]

(*b*) Explain the necessity of 8237 DMA controller. List the features of 8237 DMA controller. [8]

11. (*a*) Draw the maximum mode module of 8086 clearly showing address latches, transreceivers and clock generator. [10]

(*b*) Explain the data format for 8087 NDP in brief. [8]

Or

12. (*a*) Draw and explain the architecture of 8087 NDP. [10]

(*b*) Interface 8255 PPI with 8086 microprocessor in maximum mode. Draw interfacing diagram and mention address map for 8255. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

[3862]-217

S.E. (Comp.) (Second Semester) EXAMINATION, 2010

DATA STRUCTURES

(2008 COURSE)

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.

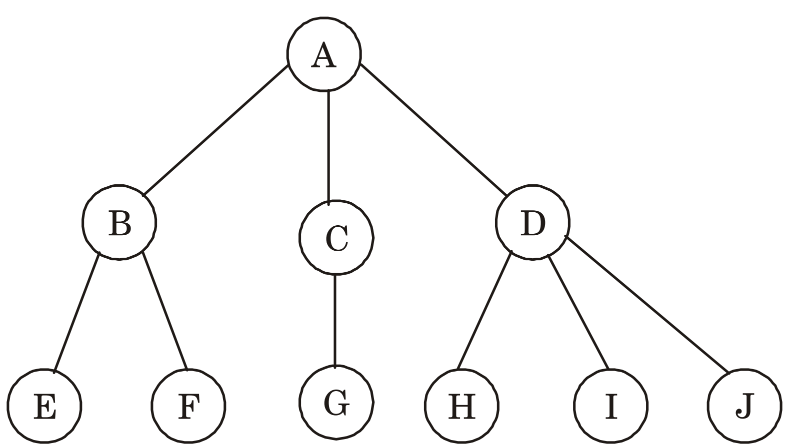
(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is binary tree ? How is it different than a basic tree ? Explain with figures. [5]

(*b*) Convert the following tree to Binary tree step by step : [5]



P.T.O.

(*c*) Write a C/C++ function to print given binary tree in BFS (without using recursion). [8]

Or

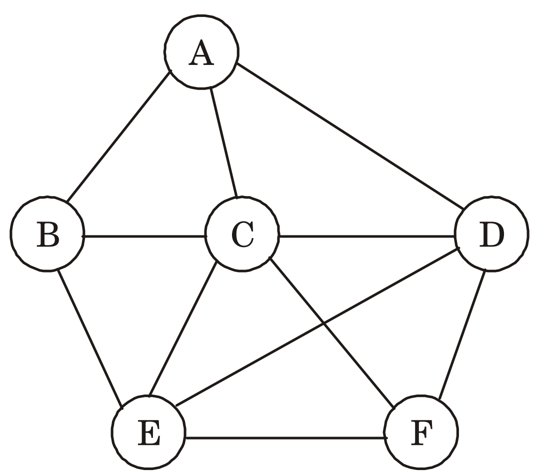
2. (*a*) (*i*) What is binary search tree ? Draw binary search tree for the following data : [4]

10, 08, 15, 12, 13, 07, 09, 17, 20, 18, 04, 05.

(*ii*) What is threaded binary tree ? What are the advantages of threaded binary tree over normal binary tree ? Draw an in-order threaded binary tree upto three levels. [6]

(*b*) Write a pseudo 'C' function to print given in-order threaded binary tree. Display the tree in inorder without using extra data structures. [8]

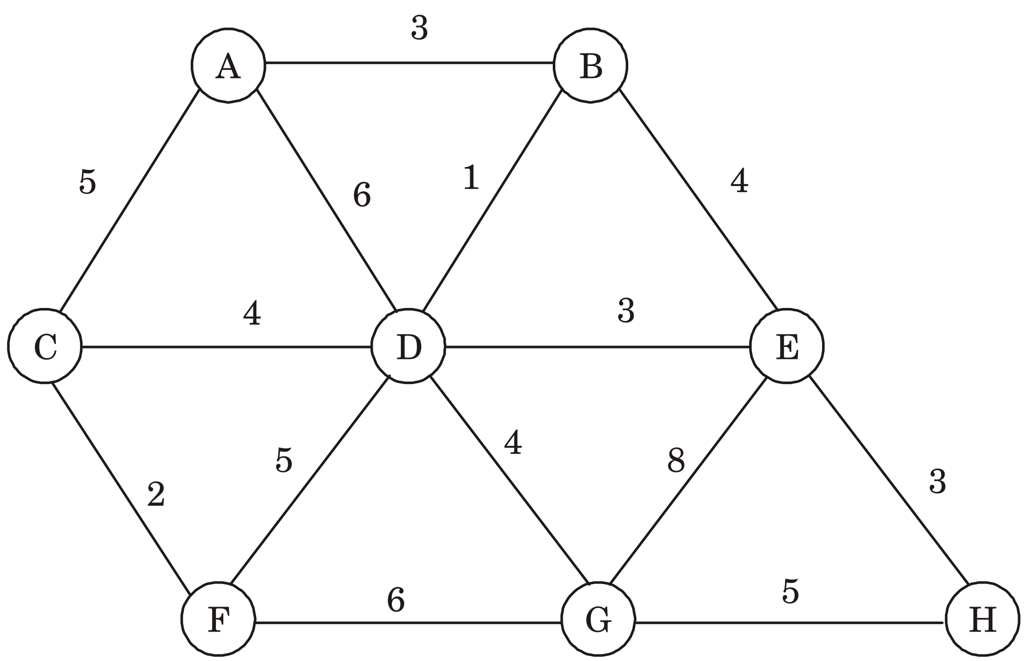
3. (*a*) What is graph ? Draw how the following graph can be represented using linked organization : [8]



(*b*) Write an algorithm to print a given graph in DFS. What is time complexity of your algorithm ? [8]

Or

4. (*a*) What is minimum spanning tree ? Find out minimum spanning tree for the given graph step-by-step : [8]



(*b*) Write a C/C++ program to find out minimum spanning tree of a given graph using Prim's algorithm. What is time complexity of your algorithm ? [8]

5. (*a*) (*i*) What is height balanced tree ? Explain with *one* example. [4]

(*ii*) Explain static and dynamic tree tables. [4]

(*b*) Write a Pseudo 'C' algorithm for LL, RR, LR and RL rotations for AVL tree. [8]

Or

6. (*a*) What is collision ? What are different collision resolution techniques ? Explain any *two* methods in detail. [8]

(*b*) Create AVL tree for the following given data : [8]

65, 85, 95, 30, 06, 71, 23, 99, 44, 21.

SECTION II

7. (*a*) Define Max Heap. Write Pseudo 'C' code for the following operations on Max Heap : [10]

(*i*) Insertion of element in Max Heap

(*ii*) Deletion of an element from Max Heap.

Mention time complexity of each operation.

(*b*) What is the difference between B – tree and B + tree ? Construct B + tree of order 3 for the following : [8]

F, S, Q, K, C, L, H, T, V, W, M, R.

Or

8. (*a*) Create Min Heap (Binary) for

10, 12, 1, 14, 6, 5, 8, 15, 3, 9, 7, 4, 11, 13.

After creating Min Heap delete element 8 from Heap and repair it. Then insert element 20 and show final result. [10]

(*b*) What is B–tree ? Write a Pseudo 'C' algorithm for deleting a node from B–tree. [8]

9. (*a*) (*i*) What is file ? Explain types of files. [4]

(*ii*) Explain different modes of opening files. [4]

(*b*) Write a C/C++ program to create a file. Insert records in the file by opening file in append mode. Display all records and search for a specific record entered by user. [8]

Or

10. (*a*) Explain in detail different file organizations. [6]

(*b*) Write a C/C++ program to implement direct access file for employee database and perform insert a record, search a record and display database. [10]

11. (*a*) (*i*) Differentiate between structures and classes. [4]

(*ii*) What is STL ? What are the components of STL ? [4]

(*b*) Write a 'C++' program using STL to perform sorting of given array of integers using bubble sort technique. [8]

Or

12. (*a*) Explain the following terms : [8]

(*i*) Containers

(*ii*) Iterations

(*iii*) Algorithms

(*iv*) Generic programming.

(*b*) Write a C++ program using STL to reverse the given array. Use container template stack. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-218

S.E. (Comp.) (Second Semester) EXAMINATION, 2010

COMPUTER GRAPHICS

(2008 COURSE)

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 Question Nos. **1** *or* **2, 3** *or* **4, 5** *or* **6** and in Section II Question Nos. **7** *or* **8, 9** *or* **10, 11** *or* **12**.

(*iii*) Neat diagrams must be drawn whenever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain DDA line algorithm and further explain how it can be extended to generate a thick line of thickness '*w*'. [8]

(*b*) What is meant by resolution of an image and an image's aspect ratio ? [4]

(*c*) Find the refresh rate of a 512 × 512 frame buffer, if the access time for each pixel is 200 nanoseconds(ns). [4]

Or

2. (*a*) Using Bresenham's line agorithm, find out which pixel would be turned on for the line with end points (4, 4) to (12, 9). [8]

(*b*) List and explain any *two* antialiasing methods. [4]

(*c*) What are the major adverse side effects of Scan Conversions ? [4]

3. (*a*) Explain Scanline algorithm for polygon filling and explain how it can be exteneded for hidden line removal. [10]

(*b*) Describe viewing transformation. [6]

Or

4. (*a*) Explain Cohen-Sutherland outcode algorithm with example. [10]

(*b*) Explain *two* methods for testing whether the point is inside the polygon or not. [6]

5. (*a*) Consider the square A(1, 0), B(0, 0), C(0, 1) and D(1, 1). Show the steps to rotate the given square by 45 degrees clockwise about point A(1, 0). [10]

(*b*) Explain the concepts of parallel and perspective projections. [8]

Or

6. (*a*) What is the need of homogenous coordinates ? Give the homogenous coordinates for translation, rotation and scaling. [10]

(*b*) Prove that 2D-rotations about the origin commutes, i.e. R1R2 = R2R1. [8]

SECTION II

7. (*a*) Give the structure of segment table and explain the segment creation and deletion operation with suitable example. [10]

(*b*) Brief the basic guideline of animation. [6]

Or

8. (*a*) What is Animation ? Discuss the different methods of controlling animations. [8]

(*b*) Discuss the concept of segmentation used in cricket animation with suitable example. Assume your animation is having at least 3 to 4 segments in it. [8]

9. (*a*) Explain Warnock agorithm. Why this algorithm is also called as area subdivision algorithm ? [8]

(*b*) List and explain any *one* two color models. [8]

Or

10. (*a*) Explain binary space partitioning tree used to detect hidden surfaces. [8]

(*b*) Describe diffuse illumination and point source illumination. [8]

11. (*a*) Compare Bezier and B-spline curves. [6]

(*b*) Why is cubic form chosen for representing curve ? [6]

(*c*) Discuss the topological and fractal dimensions. [6]

Or

12. Write short notes on any *three* of the following : [18]

(*a*) Interpolating algorithm

(*b*) True curve generation

(*c*) Hilbertz curve

(*d*) Fractal surfaces.

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

[3862]-219

S.E (Computer Engineering) (Second Sem.) EXAMINATION, 2010

COMPUTER ORGANIZATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** Answer any *three* questions from Section-I and *three* questions from Section-II.

SECTION I

1. (*a*) With neat diagram explain in detail functional units of computer system. [8]

(*b*) Perform division of the following number using restoring and non-restoring algorithm : [10]

dividend = 1011

divisor = 0011.

Or

2. (*a*) Multiply the following pair of signed two's complement numbers using Booth's Algorithm : [8]

Multiplicand = 110011

Multiplier = 101100.

(*b*) Represent the following numbers into single precision and double precision format : [10]

(*i*) 309.1875

(*ii*) 178.1875.

3. (*a*) Explain with suitable example how the size of the control words can be reduced to obtain small store. [8]

(*b*) Write control sequence for the execution of the following instruction : [8]

CALL SUB1

Or

4. (*a*) Give the comparison between : [8]

(*i*) Hardwired and Micro-programmed control.

(*ii*) Horizontal and Vertical Microinstructions.

(*b*) Explain briefly :

(*i*) Delay-element method [4]

(*ii*) Explain applications of Micro-Programming. [4]

5. (*a*) Explain register organization of 8086. [8]

(*b*) List and explain various ways in which an instruction pipeline can deal with conditional branch instructions. [8]

Or

6. (*a*) Discuss in detail instruction formats of INTEL/MOTOROLA processor. [8]

(*b*) Explain instruction cycle. How will you represent instruction cycle with interrupts ? Explain. [8]

SECTION II

7. (*a*) What is virtual memory concept ? Explain the role of TLB in virtual memory organization. [8]

(*b*) Explain in brief the following secondary storages : [10]

(*i*) DAT

(*ii*) RAID

(*iii*) CDROM

(*iv*) DVD.

Or

8. (*a*) Explain chache coherence strategies. [8]

(*b*) Explain how a memory address is mapped into a cache memory address using set associative mapped cache. The main memory is 64 K words, the cache memory has 2048 words with block size of 128 words. (use 2-way set associative memory technique). [10]

9. (*a*) Explain synchronous and asynchronous bus in an input operation with timing diagram. [8]

(*b*) Explain programmed I/O and interrupt driven I/O. [8]

Or

10. (*a*) Explain in detail DMA data transfer modes. [4]

(*b*) Explain in detail how scheduling and memory management is done by operating system with its types. [8]

(*c*) Explain : SCSI. [4]

11. (*a*) Explain in detail superscalar architecture. [8]

(*b*) Explain in detail bus arbitration techniques. [8]

Or

12. (*a*) Draw and explain architecture of a typical RISC processor. [8]

(*b*) With respect to SPARC processor, explain : [8]

(*i*) SPARC register set

(*ii*) instruction set

(*iii*) instruction format.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

[3862]-220

S.E. (COMP)(Second Semester) EXAMINATION, 2010

(Common to Elect., Instru. & I.T.)

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) In Section I, attempt Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**. In Section II, attempt Q. No. **7** *or* **8**, Q. No. **9** *or* **10**, Q. No. **11** *or* **12**.

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

(*iii*) Figures to the right indicate full marks.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

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

(*i*) $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + y = xe^x \sin x$

(*ii*) $\left(D^2 - 1\right) y = x \sin x + \left(1 + x^2\right) e^x$

(*iii*) $y'' - 6y' + 9y = \dfrac{e^{3x}}{x^2}$ (By Variation of Parameters)

(*iv*) $\left(x^2D^2 - xD + 1\right) y = x \log x$

(*v*) $\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} = \dfrac{1}{1 + e^x}.$

(*b*) An uncharged condenser of capacity C charged by applying an e.m.f. of value $E \sin \dfrac{t}{\sqrt{LC}}$ through the leads of inductance L and of negligible resistance. The charge Q on the plate of condenser satisfies the differential equation :

$$\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E}{L} \sin \frac{t}{\sqrt{LC}}.$$

Prove that the charge at any time t is given by

$$Q = \frac{EC}{2}\left[\sin \frac{t}{\sqrt{LC}} - \frac{t}{\sqrt{LC}} \cos \frac{t}{\sqrt{LC}}\right].$$ [5]

Or

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

(*i*) $\dfrac{d^3y}{dx^3} + 4\dfrac{dy}{dx} = \sin 2x$

(*ii*) $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = e^{e^x}$

(*iii*) $\frac{d^2y}{dx^2} + y = \tan x$ (By Variation of Parameters)

(*iv*) $\frac{dx}{x\left(2y^4 - z^4\right)} = \frac{dy}{y\left(z^4 - 2x^4\right)} = \frac{dz}{z\left(x^4 - y^4\right)}$

(*v*) $\left(D^4 - 2D^3 - 3D^2 + 4D + 4\right) y = x^2e^x.$

(*b*) Solve : [5]

$$\frac{dx}{dt} + 5x - 2y = t$$

$$\frac{dy}{dt} + 2x - y = 0.$$

3. (*a*) If

$$u = \frac{1}{2}\log\left(x^2 + y^2\right),$$

find v such that $f(z) = u + iv$ is analytic. Determine $f(z)$ in terms of z. [5]

(*b*) Evaluate :

$$\oint_C \frac{z^2 + 1}{z - 2}\, dz$$

where

(*i*) C is the circle $|z - 2| = 1$

(*ii*) C is the circle $|z| = 1.$ [5]

(c) Find the bilinear transformation which maps the points $z = 1, \ i, \ 2i$ on the points $w = -2i, \ 0, \ 1$ respectively. [6]

Or

4. (a) If $f(z)$ is analytic, show that :

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^4 = 16|f(z)|^2 + |f'(z)|^2 .$$ [5]

(b) Evaluate using residue theorem,

$$\oint_C \frac{2z^2 + 2z + 1}{(z+1)^3 (z-3)}\, dz,$$

where C is the contour $|z + 1| = 2$. [6]

(c) Show that under the transformation,

$$w = \frac{i - z}{i + z},$$

x-axis in z-plane is mapped onto the circle $|w| = 1$. [5]

5. (a) Find the Fourier transform of :

$$f(x) = 1 - x^2 , \quad |x| \le 1$$
$$= 0 , \quad |x| > 1$$

Hence evaluate :

$$\int_0^\infty \left(\frac{x \cos x - \sin x}{x^3}\right) \cos\frac{x}{2}\, dx.$$ [6]

(*b*) Prove that the Sine Fourier transform of :

$$f(x) = \frac{1}{x} \text{ is } \sqrt{\frac{\pi}{2}}. \quad [5]$$

(*c*) Find z-transform of the following (any *two*) : [6]

(*i*) $f(k) = 3^k \quad , \quad k < 0$

$\quad\quad = 2^k \quad , \quad k \geq 0$

(*ii*) $f(k) = \dfrac{\sin ak}{k} \quad , \quad k > 0$

(*iii*) $f(k) = ke^{-ak} \quad , \quad k \geq 0.$

Or

6. (*a*) Find inverse z-transform (any *two*) : [6]

(*i*) $F(z) = \dfrac{z}{\left(z - \dfrac{1}{4}\right)\left(z - \dfrac{1}{5}\right)} \quad , \quad |z| > \dfrac{1}{4}$

(*ii*) $F(z) = \dfrac{10z}{(z-1)(z-2)}$, By Inversion Integral Method

(*iii*) $F(z) = \dfrac{1}{(z-2)(z-3)} \quad , \quad |z| < 2$

(*b*) Solve the difference equation,

$$f(k+1) + \frac{1}{2} f(k) = \left(\frac{1}{2}\right)^k, \quad k \geq 0, \quad f(0) = 0. \quad [5]$$

(*c*) Solve the integral equation : [6]

$$\int_0^{\infty} f(x)\sin \lambda x \, dx = \begin{cases} 1, & 0 \le \lambda < 1 \\ 2, & 1 \le \lambda < 2 \\ 0, & \lambda \ge 2 \end{cases}$$

SECTION II

7. (*a*) The first four moments about the working mean 3.5 of a distribution are 0.0375, 0.4546, 0.0609 and 0.5074. Calculate the moments about the mean. Also calculate the coefficients of skewness and kurtosis. [8]

(*b*) Calculate the coefficient of correlation between the marks obtained by 8 students in Mathematics and Statistics from the following table. Also find the lines of regression : [9]

Student	**Maths** (*x*)	**Statistics** (*y*)
A	25	8
B	30	10
C	32	15
D	35	17
E	37	20
F	40	22
G	42	24
H	45	25

Or

8. (*a*) 20% of bolts produced by a machine are defective. Determine the probability that out of 4 bolts chosen at random :

(*i*) 1 is defective

(*ii*) at most 2 bolts are defective. [6]

(*b*) A telephone switch board handles 600 calls on an average during rush hour. The board can make a maximum of 20 calls per minute. Use Poisson's distribution to estimate the probability, the board will be over taxed during any given minute. [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, using the following data.

(Normal variate corresponding to 0.43 is 1.48 and corresponding to 0.39 is 1.23.) [6]

9. (*a*) Find the constant 'a' such that the tangent plane to the surface $x^3 - 2xy + yz = (a + 4)$ at the point $(2, 1, a)$ will pass through origin. [6]

(*b*) If $\bar{a}, \bar{b}$ are constant vectors and $\bar{r}$ and r have their usual meaning, then show that : [6]

(*i*)

(*ii*) $\nabla \times \left(\bar{a} \times \nabla \frac{1}{r}\right) + \nabla \left(\bar{a} \cdot \nabla \frac{1}{r}\right) = 0.$

(*c*) Show that :

$$\frac{d}{dt}\left[\bar{r} \cdot \left(\frac{d\bar{r}}{dt} \times \frac{d^2\bar{r}}{dt^2}\right)\right] = \bar{r} \cdot \left(\frac{d\bar{r}}{dt} \times \frac{d^3\bar{r}}{dt^3}\right).$$ [4]

Or

10. (*a*) If $\bar{a}$ is a constant vector and

then show that $\bar{F}$ is irrotational and hence find scalar potential ϕ such that $\bar{F} = \nabla\phi$. [6]

(*b*) Find the angle between the surfaces $xy^2 + z^3 + 3 = 0$ and $x \log z - y^2 + 4 = 0$ at $(-1, 2, 1)$. [4]

(c) If $\bar{r}_1$ and are vectors joining the fixed points $P_1(x_1, y_1, z_1)$ and $P_2(x_2, y_2, z_2)$ to the variable point $P(x, y, z)$, then show that :

(i) $\nabla(\bar{r}_1 \cdot \bar{r}_2) = \bar{r}_1 + \bar{r}_2$

(ii) $\nabla \times (\bar{r}_1 \times \bar{r}_2) = 2(\bar{r}_1 - \bar{r}_2)$. [6]

11. (a) Evaluate :

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

where $\bar{F} = 3y\,\hat{i} + 2x\,\hat{j}$ and 'C' is the boundary of a rectangle $0 \le x \le \pi;\ 0 \le y \le \sin x$. [5]

(b) Evaluate :

$$\iint_S \bar{F} \cdot d\bar{S},$$

where $\bar{F} = yz\,\hat{i} + xz\,\hat{j} + xy\,\hat{k}$, and 'S' is the surface of the sphere $x^2 + y^2 + z^2 = 1$, in the positive octant. [5]

(c) Verify Stokes' Theorem, for $\bar{F} = xy\,\hat{i} + xy^2\,\hat{j}$ and C is the square in XY-plane with vertices (1, 0), (–1, 0), (1, 1) and (–1, 1). [7]

Or

12. (*a*) Evaluate :

$$\int_{C} (\sin z \, dx - \cos x \, dy + \sin y \, dz),$$

where 'C' is boundary of the rectangle $0 \le x \le \pi$; $0 \le y \le 1, \; z = 3.$ [5]

(*b*) Evaluate :

$$\iint_{S} \frac{dS}{\sqrt{a^2x^2 + b^2y^2 + c^2z^2}},$$

over the closed surface of the ellipsoid

$$ax^2 + by^2 + cz^2 = 1.$$ [7]

(*c*) If $\overline{F} = \nabla r^2$, and 'S' is any closed surface containing volume 'V', then show that :

$$\iint_{S} \overline{F} \, . \, d\overline{S} = 6V.$$ [5]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-221

S.E. (IT) (First Semester) EXAMINATION, 2010

COMPUTER ORGANIZATION

(2008 COURSE)

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 Booth's Algorithm to multiply the following pair of two's signed complements numbers : [10]

A = 110011 (Multiplicand)

B = 101100 (Multiplier).

(*b*) Explain floating point multiplication with the help of flow chart as well as algorithm. [8]

Or

2. (*a*) Perform the following division using restoring division algorithm : [8]

Dividend = 1001

Divisor = 0101.

P.T.O.

(*b*) Explain IEEE floating point formats. [5]

(*c*) Explain the flow chart for floating point addition. [5]

3. (*a*) Draw and explain architecture of 8086. [8]

(*b*) Draw and explain read cycle of 8086 with a neat diagram. [8]

Or

4. (*a*) State the factors in the design of instruction format. Draw instruction format for intel processors and explain various fields in it. [8]

(*b*) State and explain any **4** addressing modes with examples for INTEL processors. [8]

5. (*a*) Write the control sequence for the following instruction : [8]

MOV (R3), R1.

(*b*) Draw and explain micro-programmed control unit. [8]

Or

6. (*a*) Write a micro-program of micro-instructions for the following instruction : [8]

ADD (R3), R1.

(*b*) Compare the following : [8]

(*i*) Hardwired and micro-programmed control unit

(*ii*) Horizontal and Vertical micro-Instruction format.

SECTION II

7. (*a*) Explain Set-Associative mapping technique with example. [8]

(*b*) A block Set-Associative mapped cache consists of 64 blocks divided into 4 block sets. The main memory contains 4096 blocks, each consisting of 128 words of 16-bits length : [10]

(*i*) How many bits are there in main memory ?

(*ii*) How many bits are there in TAG, BLOCK and WORD fields ?

Or

8. Write short notes on (any *four*) : [18]

(*i*) EEPROM

(*ii*) RAID

(*iii*) SDRAM

(*iv*) DVD

(*v*) Magnetic Disk

(*vi*) Optical Disk.

9. Explain techniques for performing IO and compare them. [16]

Or

10. (*a*) Explain PCI bus with a neat diagram. [6]

(*b*) Explain functions and features of 8255 and 8251. [10]

11. (*a*) Compare closely coupled and loosely coupled Multiprocessor configurations. Explain loosely coupled multiprocessor configuration. [10]

(*b*) Explain instruction level pipelining with a diagram. [6]

Or

12. Write short notes on the following (any *four*) : [16]

(*i*) NUMA

(*ii*) UMA

(*iii*) RISC

(*iv*) CISC

(*v*) Cluster

(*vi*) Superscalar Architecture.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-222

S.E. (I.T.) (First Semester) EXAMINATION, 2010

FUNDAMENTALS OF DATA STRUCTURE

(2008 COURSE))

Time : Three 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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) (*i*) Compare while and do_while loop in C. [3×2]

(*ii*) Explain enumerated data type with example.

(*b*) Select *correct* choice for the output of the following code segments : [2×3]

(*i*)
```
# define M(x) x * x
main( )
  { printf ("%d", M(2 + 3));   }
```

(1) 12

(2) 11

(3) 25

(4) error

P.T.O.

(*ii*) main( )

```
{   int x;
      x = 4 + 2% -8;
      printf ("%d", x);
}
```

(1) –6

(2) 6

(3) 4

(4) None of (1), (2), (3)

(*iii*) An expression contains relational operators, assignment operators, and arithmetic operators. In the absence of parantheses; they will be evaluated in which of the following order ?

(1) assignment, relational, arithmetic

(2) arithmetic, relational, assignment

(3) relational, arithmetic, assignment

(4) assignment, arithmetic, relational

(*c*) Write a C program to find HCF and LCM of two nos. [6]

Or

2. (*a*) Compare macro and function. [4]

(*b*) Write different bitwise operators in C and explain their use. [6]

(*c*) Write output of the following statements : [8]

(*i*) printf ("%d", 3|0);

(*ii*) printf ("% 0 % x", 10, 20);

(*iii*) printf ("%d", 3 > 2 ? 1 : q);

(*iv*) int x = 10; printf ("%d %d", ++x, x − −);

(*v*) if (–1)

printf ("Error");

else

printf ("No error");

(*vi*) printf ("%d", 1 < 2 && 3 || q);

(*vii*) printf ("%c", 4["Param"]);

(*viii*) int A[3] [2] = {1, 2, 3, 4, 5, 6};

printf ("%d", *(*(a + 2) + q));

3. (*a*) Describe the following declarations : [6]

(*i*) int *p[5];

(*ii*) int **q;

(*iii*) float (*p) (int no);

(*iv*) int (*q) [3];

(*v*) int * fun1 (int *x);

(*vi*) char s[10] [30] [80];

(*b*) Differentiate between call by value and call by reference parameter passing methods. [4]

(*c*) Write a C function to compare two strings. [4]

(*d*) Compare malloc and calloc functions in C language. [2]

Or

4. (*a*) Write output of the following C code : [3]

(*i*)

```
void fun (int val)              main( )
    {                           {
      if (val == 0)                fun(5);
         return;                }
      else
         {
               fun(val –1);
                    printf(“%d”, val);
         }
    }
```

(*ii*) void main (void) [3]

```
{
  int A[4] [3] = { {2, 4, 3},
                   {6, 8, 5},
                   {3, 5, 1}
                 };
  printf("%d %d %d", *n, n[2] [2], n[3] [2]);
}
```

(*iii*) void print (void) main( ) [2]

```
void print (void)            main( )
{ static int x = 1;          {   print( );
  printf ("%d", x);              print( );
  x ++;                          print( );
}                            }
```

(*b*) Write a C program to accept, display and find topper from a list of n students, using functions. [8]

5. (*a*) Classify data structures and give one example of each type. [8]

(*b*) Analyze time complexity of the following code segments : [8]

(*i*) for (i = 1; i <= n; i++)

```
for (i = 1; i <= n; i++)
  for (j = 1; j <= m; j++)
    for(k = 1; k <= p; k++)
      x = x + 1;
```

(*ii*) i = 1

```
while (i <= n)
{     x++;
       i++;
}
```

(*iii*) int process (int no)

```
{
   if (no <= 0)
        return (0);
   else
      return (no + process (no – 1));
}
```

Or

6. (*a*) What do you mean by frequency count of a statement ? Explain its importance in analysis of algorithm with suitable examples. [6]

(*b*) What is space complexity of an algorithm ? Explain its importance with example. [4]

(*c*) Write time complexity of the following algorithm using q and W notations : [2]

```
void disp (Node * temp)
  {
       while (temp)
     {
         temp = temp ® link;
     }
}
```

(*d*) Explain the following terms with example : [4]

(*i*) Data object

(*ii*) Data type

SECTION II

7. (*a*) Show output of each pass using bubble sort to arrange the following nos in ascending order. Write pseudo C code for bubble sort : [10]

10, 9, 8, 7, 6, 5, 4, 3, 2, 1

(*b*) Explain binary search with suitable example. [6]

Or

8. (*a*) Write output of each pass of merge sort for the following list : [6]

26, 5, 77, 1, 61, 11, 59, 15, 48, 19

(*b*) Write pseudo C code of quick sort and write average and worst case time complexity. [10]

9. (*a*) Represent sparse matrix using suitable data structure. Write pseudo C algorithm to find transpose of a sparse matrix using simple/slow transpose algorithm. Analyze its time complexity. [10]

(*b*) Explain sequential memory organization with example. [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*) Compare array and linked list. [4]

11. (*a*) Represent the following lists using generalized linked list : [4]

(*i*) ((a, b), c)

(*ii*) (a, b, c, (d, e))

(*b*) Write a C function to reverse a singly linked list by changing link pointers. [6]

(*c*) Write a C program to create doubly linked list and print the list forward and reverse using functions. [8]

Or

12. (*a*) Write a C function to add two sorted circular linked list of polynomials to form a third sorted list. Write time complexity. [12]

(*b*) Write recursive functions for : [4]

(*i*) Display SLL forward

(*ii*) Display SLL reverse

(*c*) Compare SLL and DLL. [2]

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

[3862]-223

S.E. (I.T.) (Second Sem.) EXAMINATION, 2010

COMPUTER GRAPHICS

(2008 COURSE)

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.

SECTION I

1. (*a*) Consider the line from (0, 0) to (–6, –6). Use the simple DDA algorithm for rasterizing this line. [6]

(*b*) Explain the difference between raster scan and vector scan displays. [4]

(*c*) Draw and explain the following input devices : [8]

(*i*) Trackball

(*ii*) Joystick

(*iii*) Light pen system

(*iv*) Touch panel

P.T.O.

Or

2. (*a*) Explain and derive the expression for the decision parameter in mid-point line drawing algorithm. [8]

(*b*) Explain display file structure. Why is display file interpreter used ? Which are the commands used in display file interpreter ? [6]

(*c*) Explain Stroke and Star-burst method for character generation. [4]

3. (*a*) Scale the polygon with co-ordinates A(2, 5), B(7, 10) and C(10, 2) by 3 units in x-direction and 4 units in y-direction. [6]

(*b*) A point (5, 4) is rotated anticlockwise by an angle of 45. Find rotation matrix and the resultant point. [6]

(*c*) Explain the method for testing a pixel inside or outside a polygon. (even-odd method). [4]

Or

4. (*a*) Find the transformation matrix that transform the given square ABCD to half its size with centre still remaining at the same position. The co-ordinates of the square are : A(1, 1), B(3, 1), C(3, 3), D(1, 3) and centre at (2, 2). Also find the resultant co-ordinates of square. [8]

(*b*) What is homogeneous co-ordinate system ? Explain the need of homogeneous co-ordinates. [4]

(*c*) Translate the polygon with co-ordinates A(2, 3), B(5, 9) and C(8, 9) by 6 units in x-direction and 3 units in y-direction. [4]

5. (*a*) Explain the ways of projecting 3D objects onto 2D screen in detail. [8]

(*b*) What is Spline ? Give definitions of spline curve and spline surface. Explain with neat diagrams, which are the different parametric continuity conditions ? [8]

Or

6. (*a*) What is meant by quadric surfaces ? Explain any *two* quadric surfaces with figure, its equation and parametric form : [8]

(*b*) Write short notes on (Attempt any *two*) : [8]

(*i*) Polygon tables

(*ii*) Polygon surfaces

(*iii*) Curved lines and surfaces.

SECTION II

7. (*a*) What are the different ways in which motions of the objects can be specified ? Explain each in brief. [8]

(*b*) What is Animation ? What are the basic rules required for Animation ? [6]

(*c*) Explain CIE Chromaticity diagram. [4]

Or

8. (*a*) Explain various controlling methods of Animation. [5]

(*b*) Explain difference between RGB and CMY(K) color model. [4]

(*c*) Write short notes on :

(*i*) Key Frame Systems

(*ii*) Animation Languages

(*iii*) Morphing [9]

9. (*a*) What is jittering ? State the advantages of distributed ray tracing. [4]

(*b*) Explain the following illumination models : [12]

(*i*) Phong illumination

(*ii*) Diffuse reflection

(*iii*) Specular reflection

Or

10. (*a*) Write short notes on : [9]

(*i*) Z Buffer

(*ii*) RGB Color Model

(*iii*) Ray Tracing.

(*b*) What is shading ? What are the different steps required to shade an object using Gaurads Shading Algorithm ? [7]

11. (*a*) Explain in brief Monte-Carlo method for rendering. [5]

(*b*) Explain Bezier Curve Generation using Midpoint Subdivision. [6]

(*c*) Explain the algorithm to draw fractal lines. [5]

Or

12. (*a*) Explain features of 3D Studio/Maya Graphics tool. [7]

(*b*) Write short notes on : [9]

(*i*) Texture Mapping

(*ii*) Anti-aliasing

(*iii*) Post-filtering and GPU.

Total No. of Questions—**12**] [Total No. of Printed Pages—**3**

[3862]-224

S.E. (Infor. Tech.) (Second Semester) EXAMINATION, 2010

PROCESSOR ARCHITECTURE AND INTERFACING

(2008 COURSE)

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. Draw the timing diagram of non-pipelined read cycle followed by pipelined, write cycle and explain. [16]

Or

2. (*a*) Explain Control register set of 80386 with their formats. [10]

(*b*) Give difference between 8086 and 80386. [6]

3. (*a*) How to generate .asm, .obj, .lst and .exe ? Give its significance. [10]

(*b*) Draw Interfacing diagram of 8086 with 8255 and explain. [6]

P.T.O.

Or

4. (*a*) Draw block diagram of 8255 and explain. [10]

(*b*) Explain the directives EXTRN and PUBLIC. [6]

5. (*a*) How to convert Logical address to Physical address in Real mode of 80386 ? Explain with example. [8]

(*b*) Draw the flow chart for switching from Real mode to Protected mode and returning back to RM. (All hardware and software activities should be considered). [10]

Or

6. Explain Logical to Physical address conversion when 80386 operating in Protected Mode. Draw necessary diagrams and formats. [18]

SECTION II

7. (*a*) Compare RM, VM and PM modes of 80386. [10]

(*b*) Write a short note on TSS of 80386. [6]

Or

8. (*a*) What is Privileged Instructions ? Explain two examples of Privileged Instructions. [8]

(*b*) Explain IDT of 80386 in detail with diagram and format. [8]

9. (*a*) Draw Internal memory organization of 8051. Explain. [8]

(*b*) Explain Interrupt structure of 8051 with their priority structure. [10]

Or

10. (*a*) Draw Interfacing diagram of 8051 with 8K × 8 RAM and 16 K × 8 EPROM. [10]

(*b*) Draw 8051 functional architecture diagram. [8]

11. Explain various operating modes of Timer of 8051 microcontroller. [16]

Or

12. Explain various operating modes of serial communication of 8051 microcontroller. [16]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-225

S.E. (I.T.) (Second Semester) EXAMINATION, 2010

DATA STRUCTURES AND FILES

(2008 COURSE)

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. (1) Explain various file opening modes with respect to text and binary files. [6]

(2) Explain the features of a sequential file. Write a 'C' program to copy contents of one file to another using command line arguments. [6]

(3) What are the characteristics of a good hash function ? How can collision be resolved in a hash table. [6]

Or

2. (1) Compare text and binary files. [6]

(2) Explain features of a random access file. Write a 'C' program to find sum of the nos. passed as command line arguments. [6]

(3) Assume a hash table of size 10 and hash function : [6]

$$H(X) = X \bmod 10.$$

Perform linear probing with and without replacement for the given set of values :

0, 1, 4, 71, 64, 89, 11, 33, 58, 45.

3. (1) Write a note on applications of stacks. [4]

(2) Implement stack as an ADT using sequential organisation. [6]

(3) Clearly indicate the contents of stack for evaluating the given postfix expression : [6]

623 + – 382 / + * 2 $ 3 +

Or

4. (1) Write a note on implicit and explicit stacks. [4]

(2) Clearly indicate the contents of stack during conversion of given infix expression to prefix : [8]

$$A \wedge B * C - D + E/F/(G + H).$$

(3) Implement push and pop operations for stack using linked organisation. [4]

5. (1) Write a 'C' program to implement priority queue. [8]

(2) Consider a circular queue of characters and is of size 6. "–" denotes an empty queue location. Show the queue contents as the following opns. take place : [8]

(*i*) F is added to the queue.

(*ii*) Two letters are deleted.

(*iii*) K, L and M are added to the queue.

(*iv*) Two letters are deleted.

(*v*) R is added to the queue.

(*vi*) Two letters are deleted.

(*vii*) S is added to the queue.

(*viii*) Two letters are deleted.

Initial queue configuration is :

FRONT = 2, REAR = 4, Queue : —, A, C, D, —, —

Or

6. (1) Implement circular queue as an ADT. [8]

(2) Consider the following circular double ended queue of chars and is of size 6. LEFT = 2, RIGHT = 4, DEQUE : —, A, C, D, —, — [8]

Describe the deque contents as the following opns. take place :

(*i*) F is added to the right of the dequeue.

(*ii*) Two letters are deleted on the right.

(*iii*) K, L and M are added to the left of the dequeue.

(*iv*) One letter on the left is deleted.

(*v*) R is added to the left of the dequeue.

(*vi*) S is added to the right of the dequeue.

(*vii*) T is added to the right of the dequeue.

SECTION II

7. (1) Write 'C' functions for all three binary tree traversals non-recursively. [6]

(2) Convert the given forest into a binary tree. [6]

(3) With examples, define the following terms w.r.t. trees : [6]

(*i*) Stewed binary trees

(*ii*) Complete binary tree

(*iii*) Ancestor, descendant, leaf node.

Or

8. (1) List down the formulae to represent binary trees using array. Represent the given tree using array. [6]

(2) Construct a binary tree from the given traversals : [6]

Pre-order : * + a – b c / – d e – + f g h

In-order : a + b – c * d – e / f + g – h

(3) For the binary tree represented as an array, perform in-order threading on the tree : [6]

A B C D E G H — — F — — — J K —

— — — — — — — — — — — L — —

9. (1) Write an algorithm to perform BFS traversal for a graph. Perform the same for the given graph. [8]

Fig. (*a*)

(2) For the graph in Fig. (*a*) draw adjacency list and adjacency matrix. [4]

(3) For the graph given in Fig. (*b*) show stepwise representation of MST using Prim's algorithm. [4]

Fig. (*b*)

Or

10. (1) Write an algorithm to perform DFS traversal for a graph. Perform the same for the graph in Fig. (*a*). [8]

(2) With example define the following terms w.r.t. graphs : [4]

(*i*) Degree of node

(*ii*) Isolated node

(*iii*) Path

(*iv*) Cycle.

(3) For the graph given in Fig. (*b*) show stepwise representation of MST using Kruskal's algorithm. [4]

11. (1) Suppose A to H are 8 data items with weights as follows : [8]

22, 5, 11, 19, 2, 11, 25, 5.

Build a Huffman tree and find code of each symbol.

(2) Construct an AVL search tree by inserting the following elements in the order of their occurrence. Show the BF and type of rotation at each stage : [8]

64, 1, 44, 26, 13, 110, 98, 85.

Or

12. (1) Distinguish between Huffman's tree, OBST and AVL in terms of their definitions and applications. [8]

(2) Sort the following nos. using heap sort : [8]

17, 25, 8, 0, 1, 250, 1008, 65, 48, 101.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

[3862]-226

S.E. (I.T.) (Second Semester) EXAMINATION, 2010

DATA COMMUNICATION

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any **3** 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. Attempt any *two* questions from the following : [8 marks each]

(*a*) Explain the various transmission impairment in data communication.

(*b*) State the Nyquist theorem and explain Shannon capacity and solve the given example.

Example : Calculate the channel capacity for a noisy channel having Bandwidth = 5 kHz and SNR = 0 using appropriate formula.

(*c*) What is PCM ? Describe it in detail with the help of diagram.

P.T.O.

Or

2. Attempt any *two* questions from the following : [8 marks each]

(*a*) Explain the block coding with 8B/10B scheme as an example.

(*b*) Compare the serial and parallel transmission modes for data communication.

(*c*) Describe in brief the TCP/IP protocol stack along with the layered representation.

3. (*a*) Draw and explain the Amplitude modulation generation. Draw frequency domain representation of AM. State the formula for Bandwidth calculation of AM and list out advantages of AM. [10]

(*b*) Explain in detail TDM and Statistical TDM. Mention advantages and disadvantages. [8]

Or

4. (*a*) What is constellation pattern ? Describe it in detail with representation technique details. Draw constellation patterns for the ASK, PSK, QPSK and 4-QAM. [10]

(*b*) State the principle of spread spectrum and explain FHSS in detail. [8]

5. Attempt any *two* questions from the following : [8 marks each]

(*a*) Compare any two types of the guided transmission media.

(*b*) What is switching ? Explain in detail Packet switch technique along with advantages and disadvantages of it.

(*c*) What is HDLC ? Explain with the help of its frame format. Describe all fields in detail.

Or

6. Attempt any *two* questions from the following : [8 marks each]

(*a*) Explain fiber optic cable along with its constructional detail, advantages and disadvantages.

(*b*) Describe in detail circuit switching techniques.

(*c*) Explain the terms ADSL, ADSL Lite, HDSL, SDSL.

SECTION II

7. Attempt any *two* questions from the following : [8 marks each]

(*a*) Discuss in detail CRC technique with *one* example. List out advantages of CRC over other methods.

(*b*) Explain in detail Go-Back-N Automatic Repeat request protocol.

(*c*) What is checksum ? Describe in detail internet checksum method with suitable example.

Or

8. Attempt any *two* questions from the following : [8 marks each]

(*a*) Explain in detail the selective repeat automatic repeat request protocol.

(*b*) Define error correction, error detection and Hamming Distance. Calculate Hamming distance for followed examples :

(*i*) d(000,010)

(*ii*) d(011, 110)

(*iii*) d(101, 011)

(*iv*) d(000,101)

(*c*) Draw and explain PPP protocol stack.

9. (*a*) Explain in detail CSMA/CD. State the advantages over CSMA. [8]

(*b*) Describe different controlled access protocol mentioned below in short : [10]

(*i*) Reservation

(*ii*) Polling

(*iii*) Token passing.

Or

10. (*a*) Draw and explain the MAC frame format of 802.3. Explain each field in detail. [10]

(*b*) Compare and contrast FDMA and CDMA in detail. [8]

11. Attempt any *two* questions from the following : [8 marks each]

(*a*) Draw the simple network using SONET equipment and explain STS Multiplexer/Demultiplexer, ADM, Section, Path, Regenerator in detail.

(*b*) Draw and explain BUS Backbone Network.

(*c*) Write a short note on Bridges.

Or

12. Attempt any *two* questions from the following : [8 marks each]

(*a*) Enlist different connecting device in the network and explain any *two* in detail.

(*b*) Draw and explain SONET layers in detail.

(*c*) Draw and explain Star Backbone Network in detail.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-231

S.E. (Bio-Tech.) (First Semester) EXAMINATION, 2010

APPLIED CHEMISTRY

(2008 COURSE)

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.

(*vii*) *All* questions are compulsory.

SECTION I

1. (*a*) Which of the following compounds are aromatic ? Why ? [6]

(*i*) Pyridine

(*ii*) Cyclooctatetraene

(*iii*) Benzene.

(*b*) Give reason : [6]

(*i*) N, N dimethyl aniline is a weak base than its 2, 6 methyl derivative.

(*ii*) X-clorobutyric acid is a stronger acid than H-chlorobutyric acid.

(*iii*) Aniline is a weak base.

(*c*) What is hyperconjugation ? Explain relative stability of primary, secondary and tertiary carbonium ion. [4]

Or

2. (*a*) Draw resonance structure of the following compounds : [6]

(*i*) Phenoxide ion

(*ii*) P-nitrophenol

(*iii*) Nitrobenzene.

(*b*) What is carbonium ion ? Discuss the relative stability of primary, secondary and tertiary carbonium ion. [6]

(*c*) What is inductive effect ? Explain +I and –I effect with suitable examples. [4]

3. (*a*) Explain mechanism, stereochemistry, effect of substrate, solvent for S_N^2 reaction. [6]

(*b*) Give the reagents used in synthesis of the following compounds starting from benzene : [6]

(*i*) Acetophenone

(*ii*) Nitrobenzene

(*iii*) Bromobenzene.

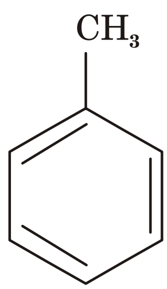
(*c*) Give the mechanism of conversion of 2-methyl, 1-propene by an acid into isopropyl alcohol. [4]

Or

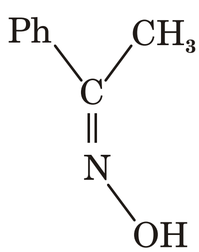
4. (*a*) Predict the product : [6]

(*i*) $CH_3{-}\overset{\overset{\large O}{\|}}{C}{-}H + CH_3\,MgI \longrightarrow ?$

(*ii*) $CH_3{-}\overset{\overset{\large O}{\|}}{C}{-}OC_2H_5 \xrightarrow{NaOC_2H_5} ?$

(*iii*)  $\xrightarrow{Br_2 \text{ in } FeBr_3} ?$

(*iv*) $CH_3{-}CH_2{-}CH{=}CH{-}CH_3 + HCl \rightarrow ?$

(*v*)  $\xrightarrow{H^+} ?$

(*vi*) $H_3C{-}\underset{\underset{\large CH_3}{|}}{\overset{\overset{\large CH_3}{|}}{C}}{-}OH + H_2SO_4 \longrightarrow ?$

(*b*) Give the mechanism of E_1 and E_2 elimination. [6]

(*c*) Write a note on Aldol condensation. [4]

5. (*a*) Discuss the conformation of propane. [6]

(*b*) Explain chair and boat conformation of cyclohexane. [6]

(*c*) Give *one* method of preparation : [6]

(*i*) Pyrrole

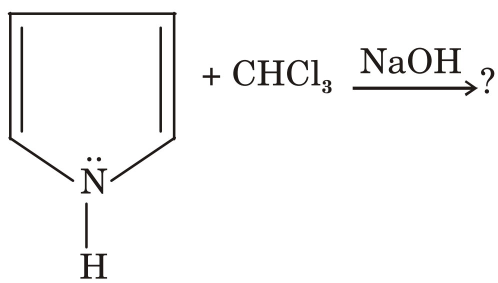
(*ii*) Thiophene.

Or

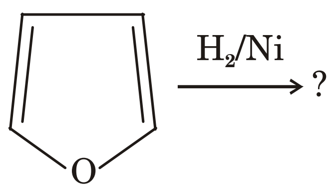
6. (*a*) Explain the optical activity of the compound containing two similar asymmetric carbon atoms. [6]

(*b*) Predict the product : [6]

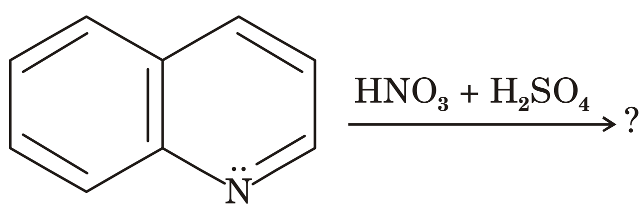
(*i*)



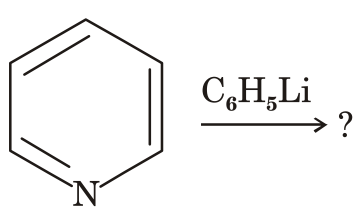
(*ii*)

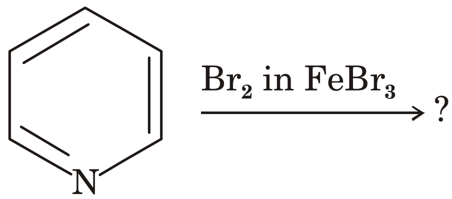


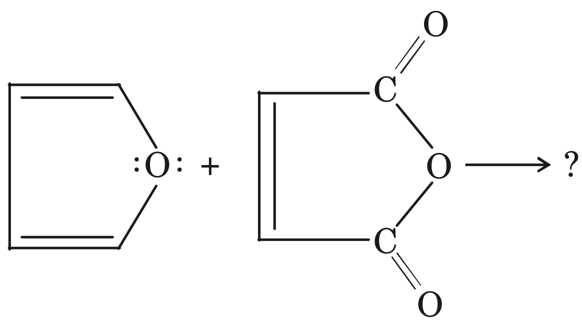
(*iii*)



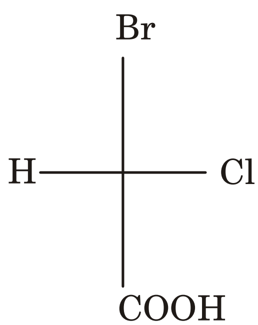
(*iv*)

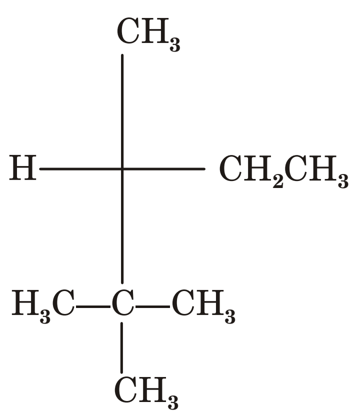


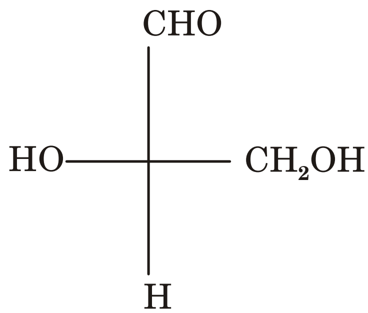
(*v*) 

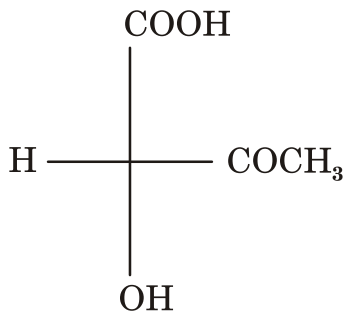
(*vi*) 

(*c*) Assign R and S configuration : [6]

(*i*) 

(*ii*) 

(*iii*) 

(*iv*) 

SECTION II

7. (*i*) Define surface tension. Describe the capillary rise method for determination of surface tension. [6]

(*ii*) In the determination of surface tension of a liquid by drop number method, it gives 55 drops, with water gave 25 drops for the same volume. Given ρ_e = 0.996 and ρ_w = 0.800 g/cm^3. Find γ of liq. if γ_w = 72 dynes/cm. [4]

(*iii*) Describe the working of isoteniscopic apparatus. [6]

Or

8. (*i*) Derive the Poisuelle equation. [6]

(*ii*) Benzene takes 46 secs to flow through an Ostwald viscometer while water takes 68 secs at the same temperature. Their respective densities are 0.8 g/cm^3 and 0.998 g/cm^3. η of water at the prevailing temperature is 1.008 centipoise. Calculate η of benzene. [4]

(*iii*) Derive the Bragg's equation. Describe any *one* method for experimental determination of glancing angle θ by use of X-ray spectrometer. [6]

9. (*i*) Define the terms collision diameter and collision frequency. Derive the expression for the no. of collisions/unit time/unit volume. [6]

(*ii*) The viscosity of methane at 20°C and 1 atm P is 1.09 μP. Calculate : [4]

(*a*) Collision diameter and

(*b*) Mean free path of the gas.

(*iii*) What are the different kinds of velocities ? How are they related to each other ? [6]

Or

10. (*i*) Describe the experimental method for determination of critical constant. [4]

(*ii*) van der Waals constant for HCl gas are a = 3.67 atm/L^2 and b = 40.8 ml/mol. Find T_C and P_C of the gas. [4]

(*iii*) What is the physical significance of '*a*' and '*b*' in the van der Waals equation ? [2]

(*iv*) Derive kinetic gas equation. [6]

11. (*i*) What is Raoult's law ? Describe the deviations from Raoult's law. [6]

(*ii*) The vapour pressure of C_2H_5OH and CH_3OH are 44.5 mm of Hg and 88.7 mm of Hg respectively. An ideal solution is formed at the same temperature by mixing 60 g of C_2H_5OH and 40 g of CH_3OH, calculate total V.P. of the solution and the mole fraction of methanol in the vapour. [6]

(*iii*) Describe the Berkeley and Hartley's method for measurement of osmotic pressure. [6]

Or

12. (*i*) What are colligative properties ? Give thermodynamic derivation for elevation in B.P. [8]

(*ii*) B.P. of acetone is 56.36°C. A solution of 0.564 g of a compound in 8.6 g of acetone boiled at 56.75°C. The molal elevation constant for acetone is 16.7. Calculate molecular weight of the solute. [4]

(*iii*) What is the effect of molecular association and molecular dissociation on molar mass of the solute ? [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

[3862]-232

S.E. (Biotechnology) (First Semester) EXAMINATION, 2010

FLUID FLOW AND UNIT OPERATIONS

(2008 COURSE)

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 whenever 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*) Explain the effect of temperature on viscosity of fluids. [5]

(*b*) The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 m/s requires a force of 98.1 N to maintain the speed. Determine : [6]

(*i*) The dynamic viscosity of oil in poise.

(*ii*) The kinematic viscosity of oil in stokes if the specific gravity of the oil is 0.95.

(*c*) Find the size (diameter) of a pipe which has to discharge oil at a rate of 2 m^3/s and of specific gravity 0.8 with a velocity of 3 m/s. [5]

Or

2. (*a*) With respect to pressure measurement define : [4]

(*i*) Gauge pressure

(*ii*) Absolute pressure

(*iii*) Vacuum pressure.

(*b*) An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_D = 0.98$. [6]

(*c*) The right limb of a simple U tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. [6]

3. (*a*) Why does energy loss take place due to sudden expansion and contraction in the flow path ? Give the expressions for head loss in the above cases. [6]

(*b*) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal pipe of diameer 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe if 100 kg of oil is collected in a tank in 30 seconds. [6]

(*c*) Water is flowing through a pipe of diameter 200 mm with a velocity of 3 m/s. Find the head lost due to friction for a length of 5 m if the coefficient of friction is given by :

$$f = 0.002 + 0.09/\mathrm{Re}^{0.3},$$

where Re is the Reynolds no. The kinematic viscosity of water is 0.01 stokes. [6]

Or

4. (*a*) Define roughness. Classify the different types of surfaces based on roughness. [6]

(*b*) Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 lit/sec. [6]

(*c*) Laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/s. Find the mean velocity. Also calculate the velocity at a distance of 4 cm from the wall of the pipe. [6]

5. (*a*) What are the standard design considerations for an agitated vessel system ? [4]

(*b*) A disc turbine with six flat blades is installed centrally in a vertical baffled tank 2 m in diameter. The turbine is 0.5 m in diameter and is positioned 0.5 m above the bottom of the tank. The liquid being agitated has a viscosity and density of 12 cp and 1500 kg/m^3 respectively. The speed of the turbine is 100 r.p.m. What power will be required ? [6]

(N_p = 5.8 for disc turbine)

(*c*) With the help of a neat sketch, explain the construction and working of pug mill. [6]

Or

6. (*a*) What is the power curve ? How is it used for determination of power consumption in an agitated vessel ? [6]

(*b*) Write a note on reciprocating pump. [5]

(*c*) Explain any *one* equipment used for kneading in detail. [5]

SECTION II

7. (*a*) For an object falling in a fluid of density r, the terminal settling velocity is given as :

$$n = \sqrt{\frac{2m(r_p - r)g}{C_D A_p r_p r}}.$$

Derive the Stokes' law for spherical particle of diameter D_p, starting from the above expression. [6]

(*b*) What is the Kynch's theory of sedimentation ? List the various assumptions made for this theory. [6]

(*c*) Explain the principle, construction and working of a hydrocyclone. [6]

Or

8. (*a*) A steel ball of diameter 40 mm and of density 8500 kg/m^3 is dropped in a large mass of water. The coefficient of drag of the ball in water is given as 0.45. Find the terminal settling velocity of the ball in water. [6]

(*b*) Describe any *one* equipment used for centrifugal sedimentation in detail. [6]

(*c*) What is drag force and drag coefficient ? What are the values of Reynolds no. and drag coefficient in laminar and turbulent regimes for an object falling in a fluid ? [6]

9. (*a*) What is fluidization and minimum fluidization velocity ? Explain how the pressure drop across the bed varies during fluidization. [6]

(*b*) What is meant by constant rate and constant pressure filtration ? Give expressions for calculating pressure drop in both the cases. [6]

(*c*) What is a filter cake ? What are the *two* different types of filter cakes ? [4]

Or

10. Write notes on the following : [16]

(*a*) Washing of filter cake

(*b*) Particulate fluidization

(*c*) Filter medium and filter aid

(*d*) Hydraulic transport using fluidization

11. (*a*) What is screen effectiveness ? Derive a formula for calculating the same. [6]

(*b*) Calculate the operating speed of the ball mill from the following data : [5]

Diameter of the ball mill : 500 mm

Diameter of the ball : 50 mm

Operating speed of ball mill is 35% of the critical speed.

(*c*) What is the work index in Bond's law ? State the Bond's law in terms of the work index. [5]

Or

12. (*a*) Define the following terms : [5]

(*i*) Sphericity

(*ii*) Arithmetic mean diameter

(*iii*) Sauter diameter

(*iv*) Closed circuit grinding

(*v*) Ideal screen.

(*b*) Explain in brief the different factors affecting screen capacity and effectiveness. [5]

(*c*) A certain crusher accepts a feed of rock having volume surface mean diameter of 0.75 inches and discharges a product of diameter 0.2 inches. The power required to crush 15 tons/hr is 12 hp. What should be the power consumption if the capcity is reduced to 10 tons/hr and the volume surface mean diameter of the product to 0.15 inches ? Use Rittinger's law. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+3**

[3862]-236

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2010

MATERIAL BALANCES AND STOICHIOMETRY

(2008 COURSE)

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 electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Sodium chloride weighing 600 kg is mixed with 200 kg potassium chloride. Find the composition of the mixture in : [4]

(*i*) Mass %

(*ii*) Mole %

(*b*) Cracked gas from a petroleum refinery has the following composition by volume : [8]

Methane : 45%

Ethane : 10%

Ethylene : 25%

Propane : 7%

Propylene : 8%

n-Butane : 5%

Find :

(*i*) The average molar mass of the gas mixture

(*ii*) The composition by mass

(*iii*) Specific gravity of the gas mixture.

(*c*) 2000 ml solution of strength 0.5 N H_2SO_4 is to be prepared in laboratory by adding 98% H_2SO_4 (sp. gr. 1.84) to water. Calculate the ml of 98% H_2SO_4 to be added to get solution of required strength. [4]

Or

2. (*a*) An aqueous solution contains 19% NH_3, 65.6% NH_4NO_3 and 6% urea by mass. Calculate the available nitrogen content of the solution. [5]

(*b*) An aqueous solution K_2CO_3 is prepared by dissolving 43 kg K_2CO_3 in 100 kg water at 293 K. Find molarity, normality and molality of the solution. Take density of solution as 1.3 kg/lit. [5]

(*c*) By electrolysing mixed brine, a gaseous mixture is obtained at the cathode having the following composition by weight : [6]

Cl_2 : 67%, Br_2 : 28% and O_2 : 5%

Calculate :

(*i*) Composition of gas

(*ii*) Average molecular weight

(*iii*) Density of the gas mixture at 298 K and 101.325 kPa.

3. (*a*) Two process streams are mixed to form a single stream. A soluble salt is added to one of the original streams at steady state. Samples taken from this stream show it to be 4.76% salt by weight. Another original stream does not contain any salt. Samples from the mixed stream show 0.62% salt by weight. What is the ratio of flows in the two streams ? [6]

(*b*) Dry neem leaves are subjected to extraction with supercritical carbon dioxide at 200 bar and 333 K. Dry leaves are analysed to contain 0.46% a-tocopherol and .01% b-carotene. Extract is found to contain 15.5% a-tocopherol and 0.41% b-carotene. All percentages are by mass. If b-carotene content of the leached residue is nil, calculate : [6]

(*i*) The mass of extract phase per kg of dry leaves

(*ii*) % recovery of a-tocopherol.

(*c*) After a crystallization operation, the solution of calcium chloride in water contains 60 grams $CaCl_2$ per 100 gram of water. Calculate the amount of this solution necessary to dissolve 200 kg of $CaCl_2.6H_2O$ crystals at a temperature of 298 K. The solubility of $CaCl_2$ at 298 K is 819.2 gm of $CaCl_2$ per 1000 gm of water. [6]

Or

4. (*a*) 1000 kg of a 30% (by mass) solution of acetone in water is contacted with pure methyl isobutyl ketone (MIBK) to extract acetone in a mixer settler. From the settler, two phases separated are withdrawn separately. What quantity of MIBK must be fed to the process to reduce the acetone concentration in water rich phase to 5% and also calculate the % of acetone in original feed solution which remains unextracted. [9]

Composition of phases :

Raffinate phase : 5% acetone; 92.5% water and 2% MIBK

Extract phase : 10% acetone; 3% water and 87% MIBK (*b*) In a textile industry, it is desired to make 24% solution by weight of caustic soda for a mercerisation process. Due to very high heat of dissolution of caustic soda in water, the above solution is prepared by a two step process. First, in a dissolution tank, caustic soda is dissolved in the correct quantity of water to produce 50% by weight solution. After complete dissolution and cooling, the solution is taken to dilution tank where some more water is added to produce 24% solution. Assuming no evaporation loss in dissolution tank, calculate the weight ratio of water fed to dissolution tank to the bypassed water to dilution tank. [9]

5. (*a*) A combustion reactor is fed with 50 kmol/hr of butane and 2000 kmol/hr of air. Calculate the % excess air used and composition of the gases leaving combustion reactor assuming complete combustion of butane. [8]

(*b*) Monochloroacetic acid [$CH_2ClCOOH$] is manufactured in a semi-batch reactor by action of glacial acetic acid [CH_3COOH] with chlorine gas using suitable catalyst at 100°C. The reaction is : [8]

$$CH_3COOH + Cl_2 \longrightarrow CH_2ClCOOH + HCl$$

The chlorine used is 15% (mole) excess of that theoretically required. The reaction is 95% complete. During chlorination the liberated hydrochloric acid gas is scrubbed with water in order to obtain 20% (by wt.) hydrochloric acid solution. Calculate :

(*i*) The raw materials required for 3000 kg of monochloroacetic acid per batch.

(*ii*) The amount of 20% (by wt.) hydrochloric acid solution produced per batch.

Or

6. Ethylene oxide is produced by oxidation of ethylene as per the following reaction :

$$2C_2H_4 + O_2 \longrightarrow C_2H_4O.$$

Fresh feed containing ethylene and air is mixed with recycle feed and mixed feed enters the reactor. The proportion of $C_2H_4 : O_2 : N_2$ in mixed feed is 1 : 0.56 : 5.65 (on mole basis). 50% per pass conversion is achieved in the reactor. The product gases leaving the reactor are fed to the absorber where only all C_2H_4O formed is removed. The gases from the absorber containing C_2H_4, O_2 and N_2 are recycled back. To avoid built up N_2 in the system, small portion of recycle stream is continuously purged. Based on 100 mol/sec ethylene in mixed feed, calculate the fresh feed to the process, purge stream, recycle ratio, combined feed ratio and overall conversion of ethylene. [16]

SECTION II

7. (*a*) A stream flowing at a rate of 15000 mol/hr containing 25 mole% N_2 and 75 mole% H_2 is to be heated from 298 K to 473 K. Calculate heat that must be transferrd using C_p^o data given below : [9]

$$C_p^o = a + bT + cT^2 + dT^3$$

Gas :	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
N_2 :	29.59	–5.41	13.18	–4.968
H_2 :	28.61	1.01	–0.147	0.769

(*b*) When liquid benzene is completely burned to carbon dioxide and liquid water, the standard heat of combustion is –3267.6 kJ/mol. The standard heat of combustion of hydrogen to liquid water is –285.83 kJ/mol and that of carbon to carbon dioxide gas is –393.51 kJ/mol. Calculate the standard heat of formation of liquid benzene. [9]

Or

8. (*a*) Toluene is heated from 290 K to 350 K at a rate of 0.25 kg/s. Calculate the heat required to be added to toluene using heat capacity data given below : [6]

$$C_p^o = a + bT + cT^2 + dT^3$$

	a	$b \times 10^3$	$c \times 10^6$	$d \times 10^9$
Toluene :	1.81	812.22	–1512.67	1630

(*b*) 100 kg/h of methanol liquid at a temperature of 303 K is to be obtained by removing heat from saturated methanol vapour. Find the amount of heat to be removed in the above case : [6]

Boiling point of methanol = 337.8 K

Latent heat of condensation of methanol = 1101.7 kJ/kg

Specific heat of methanol = 2.7235 kJ/kgK

(*c*) Calculate the heat of reaction at 298.15 K of the following reaction : [6]

$$3CaSO_4(s) + SiO_2(s) \longrightarrow 3CaO.SiO_2(s) + 3SO_2(g) + 3/2O_2(g)$$

Data :

Component	**ΔH_f^o at 298.15 K, kJ/mol**
$CaSO_4(s)$	–1432.7
$SiO_2(s)$	–903.5
$3CaO.SiO_2(s)$	–2879
$SO_2(g)$	–296.81
$O_2(g)$	0.0

9. (*a*) A 1000 kg mixture of NaCl and NH_4Cl is to be separated by fractional crystallization. It contains 40% NaCl by mass. It is dissolved in pure water at 323 K : [8]

(*i*) If stoichiometric quantity of water is used for dissolution, calculate the quantity of the component remaining undissolved and also the quantity of the saturated solution.

(*ii*) If the saturated solution at 323 K mentioned in (*i*) is cooled to 283 K, calculate the additional quantity of the original mixture which can be dissolved and also the total quantity of the component remaining out of the solution.

(*b*) On a particular day in Mumbai, a newspaper reported the weather conditions of the previous day as 308 K DB, 80% RH and barometric pressure of 100 kPa. Calculate : [8]

(*i*) The absolute humidity

(*ii*) The dew point

(*iii*) The percentage saturation

(*iv*) The humid heat

Or

10. A gas stream containing 25 mole% CO_2 and 75% CH_4 is treated in a gas conditioning plant. The stream is fed to an absorption tower at the rate of 100 kmol/h and is contacted in the tower with liquid solvent containing 0.5 mole% dissolved CO_2 and the balance methanol. The gas leaving the absorber contains 1 mole% CO_2 and essentially all the methane fed to the unit. The CO_2 rich solvent leaving the absorber goes to the stripping column; in which a stream of nitrogen gas contacts the solvent, removing 90% of the dissolved CO_2. The regenerated solvent is then recycled to the absorption tower :

(*a*) Calculate the fractional CO_2 removal (moles absorbed per moles fed), and the molal flow rate and the composition of the liquid feed to the stripping column.

(*b*) Calculate the molal feed rate to the absorber required to produce an absorber product gas flow rate of 1000 kg/h. [16]

11. (*a*) A sample of fuel oil has C/H ratio 9.33 (by weight) and contains 1.3% sulphur also on weight basis. The net calorific value of the fuel oil is 39685 kJ/kg at 298 K. Calculate its gross calorific value using latent heat of water at 298 K = 2442.5 kJ/kg. [8]

(*b*) The ultimate analysis of a residual fuel oil sample is given as below : [8]

Carbon : 88.4%; Hydrogen : 9.4% and Sulphur : 2.2% (by weight)

It is used as a fuel in a power generating boiler with 25% excess air.

Calculate :

(*i*) Theoretical dry air requirement

(*ii*) The actual dry air supplied

(*iii*) The Orsat composition of flue gases.

Or

12. (*a*) Calculate the gross and net calorific values of the natural gas at 298 K having the following molar composition : [8]

CH_4 : 89.4%; C_2H_6 : 5%; C_3H_8 : 1.9%; n-C_4H_{10} : 1%; CO_2 : 0.7% and N_2 : 2%

Data :

Component	**GCV, kJ/mol**	**NCV, kJ/mol**
CH_4	890.65	802.62
C_2H_6	1560.69	1428.64
C_3H_8	2219.17	2043.11
C_4H_{10}	2877.4	2657.32

Specific volume at 298 K and 101.3 kPa = 24.465 m^3/kmol

(*b*) The ultimate analysis of coal sample is given below : [8]

Carbon : 61.5%; Hydrogen : 3.5%; Sulphur : 0.4%; Ash : 14.2%; Nitrogen : 1.8% and rest oxygen. Calculate :

(*i*) Theoretical oxygen requirement per unit weight of coal.

(*ii*) The Orsat analysis of flue gases when coal is burned with 90% excess air.

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

[3862]-238

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2010

THERMODYNAMICS

(2008 COURSE)

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 whenever necessary.

(*iv*) Assume suitable data, if necessary.

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

(*vi*) Figures to the right indicate full marks.

SECTION I

1. (*a*) State and explain the first law of thermodynamics and its limitations. [12]

(*b*) Suppose a piston-cylinder assembly contains one mole of CO_2 at 0.101325 MPa and 300 K. The cylinder is placed on a hot plate allowing the gas to expand at constant pressure till the temperature rises to 400 K. Calculate the change in entropy of CO_2.

For CO_2; $C_P^o = 45.369 + 8.688 \times 10^{-3}\ T - 9.619 \times 10^5\ T^{-2}$. [6]

Or

2. (*a*) State and explain the various statements of second law of thermodynamics. [6]

(*b*) Calculate ΔU and ΔH in kJ for 1 kmol water, as it is vaporized at the constant temperature of 373 K and constant pressure of 101.3 kPa. The specific volumes of liquid and vapor at these conditions are 1.04×10^{-3} and 1.675 m^3/kmol respectively; 1030 kJ of heat is added to water for this change. [6]

(*c*) An inventor claims to have designed a heat engine which absorbs 1000 kJ/s energy as heat from a source at 500°C and delivers 650 kW power. He further states that the ambient atmosphere at 25°C is used as a sink for the engine. As a patent officer would you consider his claim to be theoretically feasible and issue a patent ? Support your judgement using thermodynamic concepts. [6]

3. (*a*) What is the Hess's law of constant heat summation ? Explain. [6]

(*b*) Define :

(*i*) Standard heat of combustion

(*ii*) Standard heat of formation. [4]

(*c*) Pure CO is mixed with 100% excess air and completely burned at constant pressure. The reactants are originally at 400 K. Determine the heat added or removed if the products leave at 600 K. The standard heat of reaction at 298 K is 283.028 kJ per mol CO burned. The mean specific heats applicable in the temperature range of this problem are 29.10, 29.70, 29.10, and 41.45 J/mol K respectively for CO, O_2, N_2 and CO_2 respectively. [6]

Or

4. (*a*) What is the effect of temperature on heat of reaction ? Derive the equation for the same. [12]

(*b*) Heat of combustion of solid carbon and gaseous CO are respectively, –3913.78 kJ/mol and –283.18 kJ/mol. Determine the heat of formation of CO. [4]

5. (*a*) Will it be possible to prepare 0.1 m^3 of alcohol-water solution by mixing 0.03 m^3 alcohol with 0.07 m^3 pure water ? If not possible, what volume should have been mixed in order to prepare a mixture of the same strength and of the required volume ? Density of ethanol and water are 789 and 997 kg/m^3, respectively. The partial molar volumes of ethanol and water at the desired compositions are : Ethanol = 53.6×10^{-6} m^3/mol; Water = 18×10^{-6} m^3/mol. [6]

(*b*) Explain the effect of temperature and pressure on chemical potential. [10]

Or

6. (*a*) Explain the effect of temperature and pressure on activity coefficients. [10]

(*b*) Show that in a binary solution, if the molar volume of one of the components increases with concentration, the molar volume of the other must decrease. [6]

SECTION II

7. (*a*) Prove that Raoult's law is valid for one constituent of a binary solution over the whole concentration range, it must also apply to the other constituent. [12]

(*b*) An equimolar solution of benzene and toluene is totally evaporated at a constant temperature of 363 K. At this temperature, the vapor pressure of benzene and toluene are 135.4 and 54 kPa, respectively. What are the pressures at the beginning and at the end of the vaporization process ? [6]

Or

8. (*a*) Explain the boiling point diagram. [10]

(*b*) Write short notes on :

(*i*) Duhem's theorem

(*ii*) Criterion of stability. [8]

9. (*a*) State and explain the criteria of chemical reaction equilibrium. [8]

(*b*) Show that the equilibrium constant is determined by the standard free energy change and the temperature. [8]

Or

10. (*a*) Derive the relationship between the mole fraction of the components taking part in the reaction and the extent of reaction. [8]

(*b*) Derive a series of hypothetical steps for carrying out the gas phase reaction :

$$aA + bB ® cC + dD$$

when the reactants and the products are at their standard state. Find out the free energy changes. [8]

11. (*a*) How does ATP provide energy to cells ? [10]

(*b*) Write a note on 'Applications of Gibbs' free energy to biological systems'. [6]

Or

12. (*a*) What are the types of biochemical reactions ? Explain each one of them in detail. [8]

(*b*) Explain the relationship between thermodynamics and biological system. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**3**

[3862]-239

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2010

GENETICS AND MOLECULAR BIOLOGY

(2008 COURSE)

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 whenever necessary.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. What are the steps involved in packaging of DNA ? Discuss in detail and draw a neat labelled diagram. Explain the terms Chromosome, Euchromatin and Heterochromatin. [18]

Or

2. Write notes on : [9 each]

(*a*) Hershey and Chase's experiment

(*b*) Linkage, linkage map, co-dominance.

3. Describe in detail structure of DNA as per the Watson-Crick model. What is Z DNA ? [16]

Or

4. Explain the following : [8 each]

(*a*) DNA supercoiling

(*b*) Nucleic acids in Mitochondria.

5. Enumerate semiconservative DNA replication. Describe the experiment leading to its discovery. [16]

Or

6. What is a mutation ? Describe various types of mutations and explain how they affect expression of DNA. [16]

SECTION II

7. How many types of RNA are present ? Discuss structure and function of each of them. [16]

Or

8. Describe in brief : [4 each]

(*a*) Translation initiation

(*b*) Introns and Exons

(*c*) Reverse Transcriptase

(*d*) Ribozyme.

9. What is Transcription ? Discuss in detail Transcription. [18]

Or

10. Explain the following : [9 each]

(*a*) Lac Operon

(*b*) Promoters and Enhancers.

11. How was genetic code decipherd ? What is Wobble hypothesis ? Describe salient features of genetic code. [16]

Or

12. Discuss genetic disorders with respect to Thalassemia and Diabetes. [16]