F.E. (Semester – I) Examination, 2011
APPLIED SCIENCE – I
(Physics) (2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions : *1)* ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
2) Black figures to the ***right*** *indicate* ***full*** *marks.*
3) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed****.*
4) Assume suitable data if ***necessary****.*

1. a) Obtain the equation of path difference between the reflected rays when the monochromatic light is incident on the uniform thickness film. Give the conditions of minimum and maximum. **7**

b) Explain refraction of electron when it travels from low potential region to high potential region and explain electrostatic lens. **6**

c) When a thin transparent plate of thickness 6.3×10^{-4} cm is introduced in the path of one of the interfering rays of Michelson's interferometer then a central bright fringe shifts to a position previously occupied by 6^{th} bright fringe. If the wavelength of light is 5460 A°, find the refractive index of the plate. **4**

OR

2. a) Explain construction and working of Bainbridge mass spectrograph and prove that different isotopes follow a circular path of different radius. **7**

b) In Newton's ring's experiment, show that the diameters of dark rings are proportional to square root of natural numbers. **6**

c) An electron accelerated from rest through a potential difference of 900 V, enters a uniform perpendicular magnetic field of flux density 0.01 Tesla. Determine the linear velocity of electron and radius of circular path followed by electron in mag. field. Given $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C. **4**

3. a) With the help of circuit diagram explain how magneto-striction effect is used in oscillator circuit to generate ultrasonic waves. **6**

b) What is diffraction grating ? Give the equation of resultant intensity of light with the meaning of each symbol, when monochromatic light is diffracted from grating. Obtain the equation of maxima and minima. **6**

c) A single slit Fraunhoffer's diffraction pattern is formed using white light. For what wavelength of light does the second minimum will coincide with third minimum of light of wavelength 4000 A°. **4**

OR

4. a) What is diffraction of light ? What are the types of diffraction ? Distinguish between them. **6**

b) Explain echo sounding and cavitation techniques as an application of ultrasonic waves. **6**

c) A grating has 6000 lines per cm. If the monochromatic light of wavelength 4500 A° is diffracted from it, how many orders can be seen ? If another grating having 7000 lines per cm is used, what is the effect on number of order seen ? **4**

5. a) What is polarization by double refraction ? Explain it on the basis of Huygen's theory. What is positive and negative crystals ? **7**

b) What is nuclear chain reaction in fission ? Why it is not possible in natural uranium ? Discuss how it is made possible. **6**

c) The protons in a cyclotron describes a circular path of radius 0.4 m just before emerging from the dees. If the magnetic flux density is 1.5 Tesla, what is the maximum kinetic energy of protons and frequency of applied AC voltage between the dees ?

(Given : $m_p = 1.67 \times 10^{-27}$ kg)
$q = 1.6 \times 10^{-19}$C **4**

OR

6. a) Explain principle, construction and working of Betatron and derive the equation of Betatron condition. **7**

b) Explain how to analyze the given beam of light as a unpolarized, plane, elliptically ,circularly and partially polarized with the help of Nicol prism and quarter wave plate. **6**

c) A retardation plate of thickness 2.275×10^{-3} cm is cut with its faces parallel to optic axis. If the emergent beam of light is elliptically polarized find the wavelength of monochromatic light incident normally on it.

(Given $\mu_o = 1.586, \mu_e = 1.592$). **4**

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F.E. (Semester – II) Examination, 2011
BASIC ELECTRONICS ENGINEERING
(2008 Pattern)
(For Students Admitted During the Academic Year 2009-2010 and Onwards)

Time : 2 Hours Max. Marks : 50

Instructions : *1)* ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
2) Black figures to the ***right*** *indicate* ***full*** *marks.*
3) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed****.*
4) Assume ***suitable*** *data, if* ***necessary****.*

1. A) For a half wave rectifier derive the expression for the following :

   1) I_{dc} 2) V_{dc}
   3) P_{dc} 4) Ripple factor. **4**

   B) List different materials used in LEDs along with the colour of light emitted. **4**

   C) With the help of neat diagram explain the operation of p-channel JFET and sketch the output characteristics. **8**

OR

2. A) Draw the circuit diagram of zener voltage regulator and explain how it gives line and load regulation. **8**

   B) Explain operation of BJT as a switch with neat circuit diagram. **4**

   C) Compare SCR and TRIAC. **4**

3. A) Draw the 1 : 16 DEMUX logic circuit and explain its working with the help of truth table. **6**

   B) What is meant by universal gate ? By using any universal gate draw all the basic gates. **4**

   C) Draw and explain the operation of a) Voltage follower b) V-I converter. **6**

OR

P.T.O.

4. A) Draw and explain the 8-bit ring counter using D flip-flops. **6**

   B) For the inverting summing amplifier if following inputs are applied then calculate output voltage.

   $V_{in1} = 1.5$ V $V_{in2} = 3.5$ V

   Given that $R_1 = R_2 = R_F = 5.2\ K\Omega$. **4**

   C) Draw the circuit diagram of integrator and explain its working. Draw the output waveform for square wave input. **6**

5. A) List the different pressure transducers. Explain the working of any one in detail. **6**

   B) Draw and explain electromagnetic spectrum. **6**

   C) Write short note on CNC machine. **6**

OR

6. A) Draw the block diagram of communication system and explain each block in detail. **6**

   B) What is the need of modulation ? Explain frequency modulation in detail. **6**

   C) Write short note on PLC. **6**

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[3961] – 101

F.E. (Semester – I) Examination, 2011

ENGINEERING MATHEMATICS – I

(2008 Pattern)

Time: 3 Hours Max. Marks: 100

Instructions : 1) Answers to the **two** Sections should be written in ***separate*** books.

2) **Neat** diagrams must be drawn **wherever** necessary.

3) Black figures to the **right** indicate ***full*** marks.

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

5) Assume suitable data, ***if necessary.***

SECTION – I

1. A) Reduce the following matrix A to its normal form and hence find its rank. **5**

$$A = \begin{bmatrix} 2 & -1 & -1 & -3 \\ 2 & 4 & -1 & 0 \\ 4 & -3 & 2 & -1 \end{bmatrix}$$

B) Examine the consistency of the system of linear equations and solve if consistent : **6**

$$x + y + z = 6$$

$$2x - 2y + 3z = 7$$

$$x - y + 2z = 5$$

$$3x + y + z = 8$$

P.T.O.

C) Verify Cayley Hamilton theorem for the matrix **7**

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

OR

2. A) Find Eigen values and Eigen vectors for the matrix **7**

$$A = \begin{bmatrix} 4 & 0 & 1 \\ -2 & 1 & 0 \\ -2 & 0 & 1 \end{bmatrix}$$

B) Examine whether the following vectors are linearly dependent. If so, find the relation between them :

$X_1 = (-4, 1, 0), X_2 = (3, 1, 2), X_3 = (1, 1, 1)$ **5**

C) Show that the matrix **6**

$$A = \begin{bmatrix} \cos\theta & 0 & \sin\theta \\ 0 & 1 & 0 \\ -\sin\theta & 0 & \cos\theta \end{bmatrix}$$ is orthogonal matrix, hence find A^{-1}.

3. A) If z_1 and z_2 and origin represent on the Argand diagram, vertices of an equilateral triangle, show that **6**

$$\frac{1}{z_1^2} + \frac{1}{z_2^2} = \frac{1}{z_1 z_2}$$

B) If $\cos\alpha + \cos\beta + \cos\gamma = \sin\alpha + \sin\beta + \sin\gamma = 0$ show that

$\cos 2\alpha + \cos 2\beta + \cos 2\gamma = \sin 2\alpha + \sin 2\beta + \sin 2\gamma = 0$ **5**

C) Show that for n positive integer

$(\cosh x + \sinh x)^n = \cosh nx + \sinh nx$ **5**

OR

4. A) Solve : $x^4 - x^3 + x^2 - x + 1 = 0$ **5**

B) Prove that real part of the principal value of

$i^{\log(1+i)}$ is $e^{\frac{-\pi^2}{8}} \cos\left(\frac{\pi}{4}\log 2\right)$. **5**

C) If P log (a+ib) = (x + iy) log m, Prove that

$\frac{y}{x} = \frac{2\tan^{-1}\frac{b}{a}}{\log(a^2 + b^2)}$. **6**

5. A) If $y = x^2 e^{3x} \cos 4x$.

then find n^{th} order differential coefficient of y w.r. t. x **5**

B) If y = a cos (log x) + b sin (log x) **5**

then prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$

C) Test convergence of the series (**any one**) : **6**

1) $\frac{1}{1+\sqrt{2}}+\frac{2}{1+2\sqrt{3}}+\frac{3}{1+3\sqrt{4}}\ldots$

2) $\sum_{n=1}^{\infty}\frac{(n+1)x^n}{n^3}$

OR

6\. A) If $y = (x^2 - 1)^n$ **5**

then prove that $(x^2-1)y_{n+2}+2xy_{n+1}-n(n+1)y_n=0$

B) If $y = x \log (x + 1)$ **5**

then find n^{th} order differential coefficient of y w.r.t. x

C) Test convergence of the series (**any one**) : **6**

1) $\frac{x}{1.2}+\frac{x^2}{3.4}+\frac{x^3}{5.6}+\ldots$

2) $\frac{2^1}{1^3+1}+\frac{2^2}{2^3+1}+\frac{2^3}{3^3+1}+\ldots$

SECTION – II

7. a) Using Taylor's theorem, express $7+(x+2)+3(x+2)^3+(x+2)^4$ in ascending powers of x. **5**

b) Prove that **5**

$$\cot^{-1}\left[\frac{3x-x^3}{1-3x^2}\right]=\frac{\pi}{2}-3\left(x-\frac{x^3}{3}+\frac{x^5}{5}\ldots\right)$$

c) Solve (**any one**) : **6**

1) Evaluate

$$\lim_{x\to\infty}\left(\frac{ax+1}{ax-1}\right)^x$$

2) Find a and b if

$$\lim_{x\to 0}\frac{a\cos x-a+bx^2}{x^4}=\frac{1}{12}$$

OR

8. a) Expand log cos x about $\frac{\pi}{3}$ using Taylor's theorem. **5**

b) Show that

$$(1+x)^{\frac{1}{x}}=e\left[1-\frac{x}{2}+\frac{11}{24}x^2+\ldots\right].$$ **5**

c) Solve (**any one**) : **6**

1) Prove that

$$\lim_{x\to 0}\left(\frac{1^x+2^x+3^x+4^x}{4}\right)^{\frac{1}{x}}=\sqrt[4]{24}$$

2) Evaluate :

$$\lim_{x\to\infty}\left(x+\frac{1}{2}\right)\left\{\log\left(x+\frac{1}{2}\right)-\log x\right\}$$

9. Solve (**any two**) : **16**

a) If $x^2 = au + bv$, $y^2 = au - bv$,

prove that

$$\left(\frac{\partial u}{\partial x}\right)_y\left(\frac{\partial x}{\partial u}\right)_v=\left(\frac{\partial v}{\partial y}\right)_x\left(\frac{\partial y}{\partial v}\right)_u$$

b) If $u=\sin^{-1}\left(\frac{x+y}{\sqrt{x}+\sqrt{y}}\right)$, prove that

$$x^2\frac{\partial^2 u}{\partial x^2}+2xy\frac{\partial^2 u}{\partial x\partial y}+y^2\frac{\partial^2 u}{\partial y^2}=\frac{1}{4}(\tan^3 u-\tan u)$$

c) If $z = f(u, v)$, where $u = x^2 - 2xy - y^2$ and $v = y$ show that

$$(x+y)\frac{\partial z}{\partial x}+(x-y)\frac{\partial z}{\partial y}=(x-y)\frac{\partial z}{\partial v}$$

OR

10. Solve (**any two**) : **16**

a) If $z^3 - xz - y = 0$, prove that $\frac{\partial^2 z}{\partial x \partial y} = -\frac{(3z^2 + x)}{(3z^2 - x)^3}$.

b) If $u = \sin\left(\sqrt{x} + \sqrt{y}\right)$, prove that,

$$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{1}{2}\left(\sqrt{x} + \sqrt{y}\right)\cos\left(\sqrt{x} + \sqrt{y}\right).$$

c) If $x^2 y - e^z + x\sin z = 0$ and $x^2 + y^2 + z^2 = a^2$,

evaluate $\frac{dy}{dx}$ and $\frac{dx}{dz}$.

11. a) Examine for the functional dependence **6**

$u = \sin^{-1}x + \sin^{-1}y$, $v = x\sqrt{1 - y^2} + y\sqrt{1 - x^2}$ find the relation between them if exist.

b) Find $\left[(3.82)^2 + 2(2.1)^3\right]^{\frac{1}{5}}$ by using the theory of approximations. **6**

c) Find the point on the surface $Z^2 = xy + 1$ nearest to the origin by using Lagranges method. **6**

OR

12. a) If $x=v^2+w^2$, $y=w^2+u^2$, $z=u^2+v^2$, prove that $JJ'=1$. **6**

b) In the manufacture of closed reactangular boxes with specified sides a, b, c $(a \neq b \neq c)$ small changes of A%, B%, C% occurred in a, b, c respectively from box to box from the specified dimension. However, the volume and surface area of all boxes were according to the specification.

Show that : **6**

$$\frac{A}{a(b-c)}=\frac{B}{b(c-a)}=\frac{C}{c(a-b)}$$

c) Find all the stationary points of the function $x^2+3xy^2-15x^2-15y^2+72x$. **6**

Examine whether the function is maximum or minimum at those points.

F.E. Examination, 2011
ENGINEERING MATHEMATICS – I
(2008 Pattern)

Time : 3 Hours | Max. Marks : 100

Instructions : *1) In Section – **I**, attempt Q.No. **1** or Q.No. **2**, Q.No. **3** or Q.No. **4**, Q.No. **5** or Q.No. **6**.*
*In Section – **II**, attempt Q.No. **7** or Q.No. **8**, Q.No. **9** or No. **10**, Q.No. **11** or Q.No. **12**.*
*2) Answers to the **two** Sections should be written in **separate** answer books.*
*3) **Figures** to the **right** indicate **full** marks.*
*4) **Neat** diagrams must be drawn **wherever** necessary.*
*5) **Use** of non-programmable Electronic Pocket Calculator is **allowed**.*
*6) Assume **suitable** data, if **necessary**.*

SECTION – I

1. a) Find non-singular matrices P and Q such that PAQ is in the normal form. Hence find rank of A. **6**

$$A = \begin{bmatrix} 1 & 2 & 1 & 0 \\ -2 & 4 & 3 & 0 \\ 1 & 0 & 2 & -8 \end{bmatrix}$$

b) Examine the consistency of the system of the following equations. If consistent, solve system of the equations : **6**

$2x_1 - 3x_2 + 5x_3 = 1$

$3x_1 + x_2 - x_3 = 2$

$x_1 + 4x_2 - 6x_3 = 1.$

c) Verify Cayley Hamilton Theorem for the following matrix A and use it to find A^{-1}.

$$A=\begin{bmatrix}1 & 0 & 2\\ 0 & 2 & 1\\ 2 & 0 & 3\end{bmatrix}.$$ **6**

OR

2. a) Find Eigen values and corresponding Eigen vectors for the matrix. **7**

$$A=\begin{bmatrix}2 & 0 & -1\\ 0 & 2 & 0\\ -1 & 0 & 2\end{bmatrix}$$

b) Examine whether the following vectors are linearly dependent. If so, find the relation between them : **5**

$X_1 = (1, 2, 3)$, $X_2 = (3, -2, 1)$, $X_3 = (1, -6, -5)$

c) Determine whether the following transformation is orthogonal or not. **6**

$$y_1 = \frac{2}{3}x_1 + \frac{1}{3}x_2 + \frac{2}{3}x_3$$

$$y_2 = \frac{-2}{3}x_1 + \frac{2}{3}x_2 + \frac{1}{3}x_3$$

$$y_3 = \frac{1}{3}x_1 + \frac{2}{3}x_2 - \frac{2}{3}x_3$$

3. a) If z_1 and z_2 are two complex numbers such that $|z_1 + z_2| = |z_1 - z_2|$, then show that $\text{amp}\left(\frac{z_1}{z_2}\right) = \frac{\pi}{2}$ **6**

b) Find locus of z satisfying $|z - 3| - |z + 3| = 4$. **5**

c) Prove that the real part of the principal value of $i^{\log(1+i)}$ is $e^{-\pi^2/8}\cos\left(\frac{\pi}{4}\log 2\right)$. **5**

OR

4. a) On Argand diagram, the circumcentre of an equilateral triangle represents the complex number 1 + i. If one vertex represents the complex number –1 + 3i, find the complex number represented by the other two vertices of the triangle. **6**

b) If $\cos\left(\frac{\pi}{4} + ia\right)\cosh\left(b + \frac{i\pi}{4}\right) = 1$ where a and b are real numbers, show that

$2b = \log\ (2 + \sqrt{3})$ **5**

c) Find all the values of $(1+i)^{1/5}$, show that their product is (1 + i) **5**

5. a) If $y = \frac{x}{(x-1)(x-2)(x-3)}$, find y_n **5**

b) If y = cos (m log x), then show that **5**

$x^2 y_{n+2} + (2n+1) xy_{n+1} + (m^2 + n^2)y_n = 0$

c) Test the convergence of the series (**any one**) : **6**

i) $1+\frac{x}{2^2}+\frac{x^2}{3^2}+\frac{x^3}{4^2}+.....$

ii) $\sum_{n=1}^{\infty} \frac{x^n}{a+\sqrt{n}}$

OR

6. a) Find n^{th} derivative of **5**

cosh 4x cos 3x

b) If $y=\frac{\sin^{-1}x}{\sqrt{1-x^2}}$, then prove that $(1-x^2)\, y_{n+2}-(2n+3)\, xy_{n+1}-(n+1)^2 y_n=0$ **5**

c) Test the convergence of the series (**any one**) : **6**

i) $1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\frac{1}{5^2}+....$

ii) $\sum_{n=1}^{\infty} \frac{1^2.5^2.9^2.......(4n-3)^2}{4^2.8^2.12^2....(4n)^2}$

SECTION – II

7. A) Expand $\cos^{-1}(4x^3-3x)$ in ascending powers of x upto term in x^5. **5**

B) Use Taylor's theorem to expand

$x^4-3x^3+2x^2-x+1$ in powers of $(x-3)$. **5**

C) Solve (**any one**) : **6**

a) Find the values of a and b if $\lim_{x\to 0}\frac{a\sinh x+b\sin x}{x^3}=\frac{5}{3}$

b) Prove that $\lim_{x\to 0}\left(\frac{2^x+3^x+4^x}{3}\right)^{1/x}=(24)^{1/3}$

OR

8. A) Expand log $(1 + x + x^2)$ upto term in x^4. **5**

B) Use Taylor's theorem to find $\sqrt{25.15}$ correct upto three decimal places. **5**

C) Solve **(any one)** : **6**

a) $\lim\limits_{\theta \to \frac{\pi}{2}} \dfrac{\log(\theta - \pi/2)}{\tan\theta}$

b) $\lim\limits_{x \to 0} \left(\dfrac{\pi}{4x} - \dfrac{\pi}{2x(e^{\pi x} + 1)} \right)$

9. Solve **(any two)** : **16**

A) If $v = \dfrac{c}{\sqrt{t}} \, e^{-x^2/4a^2t}$ then show that $\dfrac{\partial v}{\partial t} = a^2 \dfrac{\partial^2 v}{\partial x^2}$

B) If $T = \sin\left(\dfrac{xy}{x^2 + y^2} \right) + \sqrt{x^2 + y^2} + \dfrac{x^2 y}{x + y}$ then find $x\dfrac{\partial T}{\partial x} + y\dfrac{\partial T}{\partial y}$

C) If x = au + bv, y = au – bv prove that $\left(\dfrac{\partial u}{\partial x} \right)_y \cdot \left(\dfrac{\partial x}{\partial u} \right)_v = \left(\dfrac{\partial v}{\partial y} \right)_x \cdot \left(\dfrac{\partial y}{\partial v} \right)_x$

OR

10. Solve (**any two**) : **16**

A) If $u = \tan^{-1}\left(\frac{y^2}{x}\right)$ prove that $x^2\frac{\partial^2 u}{\partial x^2} + 2xy\frac{\partial^2 u}{\partial x \partial y} + y^2\frac{\partial^2 u}{\partial y^2} = -\sin^2 u . \sin 2u$.

B) If $u = f\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$ then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = 0$.

C) If $x^2y - e^z + x \sin z = 0$ and $x^2 + y^2 + z^2 = a^2$, evaluate $\frac{dy}{dx}$ and $\frac{dx}{dz}$.

11. A) If $u = xyz$, $v = x^2 + y^2 + z^2$, $w = x + y + z$ find $\frac{\partial(x, y, z)}{\partial(u, v, w)}$. **6**

B) Find the percentage error in the area of an ellipse when an error of 2% is made in measuring its major and minor axes both. **6**

C) Find the maxima and minima of $x^3y^2 (1 - x - y)$. **6**

OR

12. A) If $u + v^2 = x$, $v + w^2 = y$, $w + u^2 = z$ find $\frac{\partial u}{\partial x}$. **6**

B) Examine for functional dependence. If dependent find relation among them

$u = x + y + z$, $v = x - y + z$, $w = x^2 + y^2 + z^2 + 2xz$. **6**

C) Divide 120 into three parts so that sum of their products taken two at a time shall be maximum by using Lagrange’s method of undetermined multipliers. **6**

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F.E. (Semester – I) Examination, 2011
APPLIED SCIENCE – I (Chemistry) (2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions : *1) Solve Q.* ***1*** *or Q.* ***2,*** *Q.* ***3*** *or Q.* ***4*** *and Q.* ***5*** *or Q.* ***6.***
2) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
3) Black figures to the ***right*** *indicate* ***full*** *marks.*
4) ***Use*** *of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is* ***allowed.***
5) Assume ***suitable*** *data, if necessary.*

1. A) What are liquid crystals ? Give their types and applications. **7**

B) State the law of rational indices. How are the lattice planes in a lattice designated by Miller method ? **6**

C) What is radius ratio ? How is it related to co-ordination numbers of a cations ? **4**

OR

2. A) State the causes of defects in metals ? Give the types of defects in metals and their effect on properties of metals. **7**

B) Explain structure of fullerene and its conductivity. Give applications of fullerenes. **6**

C) (211) planes in a cubic lattice of edge length 5 A°, produces first order reflection maxima with X-rays of wavelength 0.8 A°. Find the glancing angle. **4**

3. A) Explain Mohr's and Volhard's methods for determination of halide ion quantity in a water sample. **6**

B) Explain the role of indicators used in
i) iodometric titration ii) titration of $K_2Cr_2O_7$ versus Fe^{++}. **6**

C) A solution contains 4 gms of $KMnO_4$ per litre. Find the normality of solution which is to be used for titration in acidic medium. **4**

OR

4. A) Explain the strong acid - strong base titration curve with suitable indicator. Also give the formulae for calculation of pH before and after equivalence point. **6**

   B) 25 ml 0.1 N acetic acid in conical flask, is titrated against 0.075 N NaOH from burette. If dissociation constant of acetic acid is 1.85×10^{-5}, then find the pH of titration mixture at following stages :

   1) 20 ml NaOH added   2) 36 ml NaOH added. **6**

   C) Give a note on complexometric titrations. **4**

5. A) What is vulcanisation of rubber ? Give the structural changes and effect on properties of natural rubber on vulcanisation by sulphur ? **7**

   B) Give preparation reaction, properties and uses of **any two** of the following : **6**

   i) Polypropylene   ii) HDPE   iii) SBR.

   C) Give a brief account of thermally stable polymers. **4**

OR

6. A) What is glass transition temperature ? Give the factors affecting it. What is the importance of glass transition temperature ? **7**

   B) Write a note on recycling of polymers. **6**

   C) Give the mechanism of addition polymerisation catalysed by cation. **4**

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[3961] – 104 B

F.E. Examination, 2011
BASIC ELECTRICAL ENGG.
(2008 Course)

Time : 3 Hours Max. Marks : 100

***Instructions**: i) Answers to the **two** Sections should be written in **separate** answer-books.*
*ii) Answer question No. **1** or **2**, Q. No. **3** or **4**, Q. No. **5** or **6**, from Section **I** and Question No. **7** or **8**, Q. No. **9** or **10**, Q. No. **11** or **12** from Section **II**.*
*iii) Figures to the **right** indicate **full** marks.*
*iv) **Use** of non-programmable pocket size scientific calculator is **permitted**.*
*v) **Neat** diagrams must be drawn **wherever** necessary.*
*vi) Assume suitable additional data, if **necessary**.*

SECTION – I

1. a) With neat sketch explain the construction and working of Lead Acid Cell. **6**

b) A coil has a resistance of $40\,\Omega$ at 25° C. When its temperature is increased to 110° C the resistance increases to $50\,\Omega$. Calculate the temperature coefficient of resistance of coil material at i) 25° C ii) 110° C and iii) 0° C. **6**

c) Write down chemical equations during charging of Lead Acid Cell. **4**

OR

2. a) With usual notations prove that $(\alpha_1 - \alpha_2) = \alpha_1\ \alpha_2 (t_2 - t_1)$. **6**

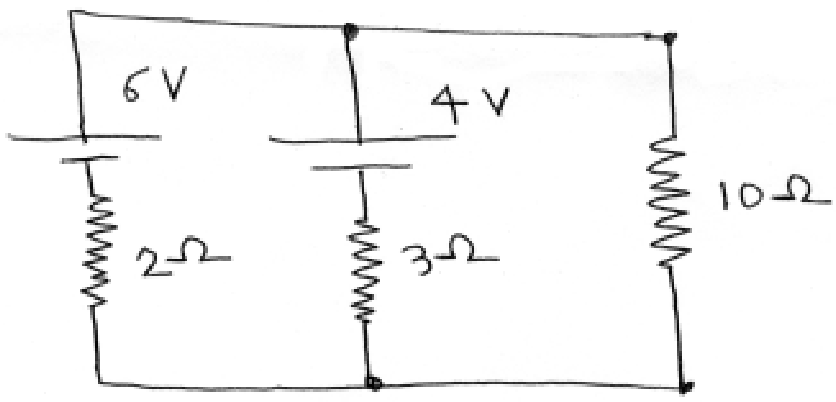
b) What is insulation resistance ? Derive the expression for insulation resistance of a Cable. **6**

c) An average water head of 200 m is available for a hydroelectric power station operating at an overall efficiency of 80%. Calculate the volume of water required to generate one unit of electricity. **4**

P.T.O.

3. a) State and explain Kirchhoff's laws. **4**

   b) Apply superposition theorem to calculate current flowing in 10 Ω resistance for the circuit shown in fig 1. **6**



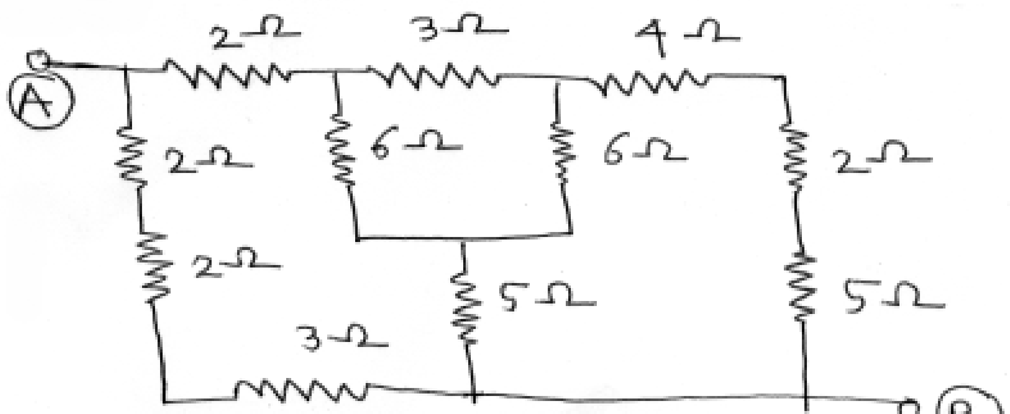
Q 3 (b) Fig (1)

   c) State and explain maximum power transfer theorem. **6**

OR

4. a) State and explain Theven's theorem. **6**

   b) Calculate the effective resistance between terminals (A) & (B) for the circuit shown in fig 2. **10**



Q 4 (b) Fig (2)

5. a) Define as related to Magnetic circuit
   i) Flux
   ii) Flux density
   iii) Magnetic field strength
   iv) Reluctance
   v) M.M.F. and
   vi) Permeability. **6**

   b) A metallic ring of uniform Cross-Section of 2 cm^2 and mean diameter of 20 cm is wound with 1000 turns of wire. When the coil carries a current of 01 Amp, the flux in the ring is 240 μ Wb. Calculate i) Relative permeability of the material and ii) magnetic field strength in the ring. **8**

   c) Define statically induced emf and dynamically induced emf. **4**

OR

6. a) Compare Electric circuit and Magnetic circuit. **8**

   b) Derive expression for the energy stored per unit volume in the magnetic field. **6**

   c) Explain the factors which affects the value of self inductance of the coil. **4**

SECTION – II

7. a) Derive expression for i) Average value and ii) R.M.S. value of the sinusoidally varying current in terms of peak value. **10**

   b) Derive an expression for energy stored in a capacitor. **6**

OR

8. a) Define as related to Electrostatics
   i) Electric Flux density
   ii) Permittivity
   iii) Dielectric strength and
   iv) Capacitance. **6**

   b) A sinusoidal alternating voltage has a peak value of 212.10 volt and frequency of 50 Hz. Its positive going half cycle starts at t = 0 find i) time required to attain 150 V for the first time and ii) time measured from first positive peak when voltage becomes 106 volt after passing thro′ it. **6**

   c) Define peak factor and form factor. **4**

9. a) Two impedances $Z_1 = 6 + j\,8$ ohm and $Z_2 = 5 + j\,12$ ohm are connected in series across a 100V, 50 Hz supply. Calculate i) P. f. of the circuit and ii) Total active, reactive and apparant power consumed. Draw relevant phasor diagram. **10**

   b) A resistance of 20 Ω, a capacitor of 100 μ F and inductance of 150 mH are connected in parallel across a 100 V, 60 Hz supply. Calculate branch currents and total current drawn from supply. **8**

OR

10. a) Prove that current in a purely capacitive circuit leads the applied voltage by 90° and current in a purely inductive circuit lags the applied voltage by 90°. **10**

    b) Define i) Admittance ii) Conductance and iii) Susceptance. Express them in rectangular and polar form and draw Admittance Triangle. **8**

11. a) Write short note on :

    i) Losses taking place in transformer and

    ii) An auto-transformer. **8**

    b) Derive the relationship between the line current and phase current, line voltage and phase voltage for a three phase balanced star connected load, connected across three phase A.C. supply. Draw the relevant phasor also. **8**

OR

12. a) A three phase balanced delta connected load takes leading current of 22 Amp from a 3 phase , 440V, 50 Hz supply. The power consumed by load is 9 kW. Calculate the values of resistance and capacitance in each phase. **8**

    b) A 3300 / 110 V, 50 Hz, 60 KVA single phase transformer has iron losses of 600 watt. Primary and secondary winding resistances are 3.3 ohm and 0.011 ohm respectively. Determine the efficiency of the transformer on full load at 0.8 lagging P.f. **8**

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B/I/11/

[3961] – 105

F.E. (Sem. – I) Examination, 2011
BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answers to the **two** Sections should be written in **separate** books.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) **Use** of Logarithmic Tables, Slide Rule, Mollier Charts, Electronic Pocket Calculator and Steam Tables is **allowed**.*
*4) Assume **suitable** data, if **necessary**.*

SECTION – I

1. A) Explain the role of civil engineer in construction of expressway. **5**
   B) Explain the importance of an interdisciplinary approach in engineering. **5**
   C) Explain two application of : **6**
      a) Project management.
      b) Environmental Engineering.
      c) Earthquake engineering.

OR

2. A) Explain two application of : **6**
      a) Remote sensing.
      b) Town planning.
      c) Fluid mechanics.
   B) Write a note on "Need and application of earthquake engineering". **5**
   C) Explain necessity and application of project management. **5**

3. A) Write a short note on : “Automation in construction industry”. **5**

B) Explain the uses of steel and its types. **6**

C) What do you understand by the following terms ? **5**

a) M15 (1:2:4) b) D.P.C c) P.S.C d) P.C e) P.C.C

OR

4. A) State and explain differential settlement. **5**

B) Explain artificial sand and its properties. **5**

C) Enlist any four materials used in construction and give two uses of each of them. **6**

5. A) Following table shows some reading in a check levelling work (started and ended on same B.M.). Calculate the missing readings shown as ‘X’. Tabulate the same and apply usual arithmetical check. **6**

ST NO	B.S	I.S	F.S	Rise	Fall	R.L.	Remarks
1	X					463.875	B.M.1
2		X		0.550		X	
3	0.965		3.655		X	X	C.P. 1
4	X		1.400		X	461.885	C.P. 2
5			1.025	X		463.875	B.M.1

B) Differentiate between :

a) Collimation plane method and rise and fall method.

b) Permanent bench mark and Arbitrary bench mark. **6**

C) Define contour, its uses and characteristics. **6**

OR

6. A) What are the advantages and limitation of GPS ? **6**

B) Differentiate between : **6**

a) Permanent bench mark and Arbitrary bench mark.

b) Contour interval and Horizontal equivalent.

C) Levelling work was carried out on a continuously sloping ground using a Dumpy Level and 4 m leveling staff. The readings were **6**

0.500, 1.00, 0.750, 1.000

1.500, 0.500 and 1.500

Rule out a page of level field book for RISE and FALL method and determine the reduced levels of all staff stations. The starting point happened to be an A.B.M. whose R.L. is 100.500 M. Apply usual arithmetic check also.

SECTION – II

7. A) State the characteristics of ecosystem. **5**

B) What is solid waste management ? Explain steps involved in it. **5**

C) Write a short note on : **6**

a) Disposal of electronics waste

b) Grassland ecosystem.

OR

8. A) Explain in detail : composting as a technique for management of solid waste. **5**

B) Write a short note on : **6**

a) EIA-overlay method

b) Hydrological cycle.

C) Explain the role of engineers towards achieving sustainable development. **5**

9. A) State the factors influencing site selection for a factory building and residential building. **6**

B) State the minimum dimension of various components of building. **5**

C) Enlist any four principles of building planning. Explain with a neat sketch 'Prospect'. **5**

OR

10. A) What is meant by 'Building bye-laws' ? Write down the specific bye-laws for : **6**
    1) Open space requirement.
    2) Height of building.
    3) F.A.R.

    B) Define building line and control line, also state the advantages of set back distance. **4**

    C) Differentiate between : **6**
    1) Building planning principles and building bye-laws.
    2) Aspect and orientation.

11. A) Explain the causes, effects and control measures of water pollution. **6**

    B) State the methods of harnessing-solar energy. **6**

    C) Explain the various techniques to control air pollution. **6**

OR

12. A) Explain in detail various possible measures to control noise pollution. **6**

    B) State the advantages and disadvantages of non-conventional source of energy. **6**

    C) Explain with a suitable sketch, the working of geothermal energy plant. **6**

B/I/II/8,450

F.E. (Sem. – I) Examination, 2011
BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
(2008 Pattern)

Time : 3 Hours | Max. Marks : 100

Instructions: *1) Answers to the* ***two*** *Sections should be written in* ***separate*** *books.*
2) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
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12. A) Explain in detail various possible measures to control noise pollution. **6**

    B) State the advantages and disadvantages of non-conventional source of energy. **6**

    C) Explain with a suitable sketch, the working of geothermal energy plant. **6**

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F.E. (Semester – I) Examination, 2011
(2008 Pattern)
ENGINEERING GRAPHICS – I

Time : 4 Hours Max. Marks : 100

Instructions : *i) Answer **one** question from **each** Unit. Answer **three** questions from Section **I** and **three** questions from Section **II**.*
*ii) Answer to the **two** Sections should be drawn on **separate** drawing sheets.*
*iii) Figures in bracket indicate **full** marks.*
*iv) Retain **all** construction lines.*
*v) Use of electronic pocket calculator is **allowed**.*
*vi) Assume suitable data, dimension, if **necessary**.*

SECTION – I

UNIT-II : ENGINEERING CURVES

1. A) The major axis of an ellipse is 130 mm and the minor axis 80 mm long. Find foci and draw the ellipse by 'arc of circle method'. Draw a tangent to the ellipse at a point 25 mm above the major axis. **7**

B) Rod OC, 70 mm long is rotating uniformly about O. During the time rod completes one and half revolution; point P starts from C moves along the rod uniformly upto O and reaches back to point P. Give the name of the curve. **8**

OR

2. A) The vertex of hyperbola is 65 mm from its focus. Draw the curve if the eccentricity is 3/2. Draw a normal and tangent at a point on the curve 70 mm from the directrix. **8**

B) Show by means of a drawing that if the diameter of the directing circle is twice that of the generating circle, the hypocycloid is a straight line. Consider the diameter of the generating circle equal to 80 mm. **7**

UNIT-III : ORTHOGRAPHIC PROJECTIONS

3. A pictorial view of a machine part is shown in the fig. 1, draw the following views, using First Angle Method of Projection :

   a) Elevation in the direction of arrow 'X'. **6**

   b) Plan. **5**

   c) Sectional End View from Left Hand Side (section along R-S). **6**

   d) Give all dimensions. **3**

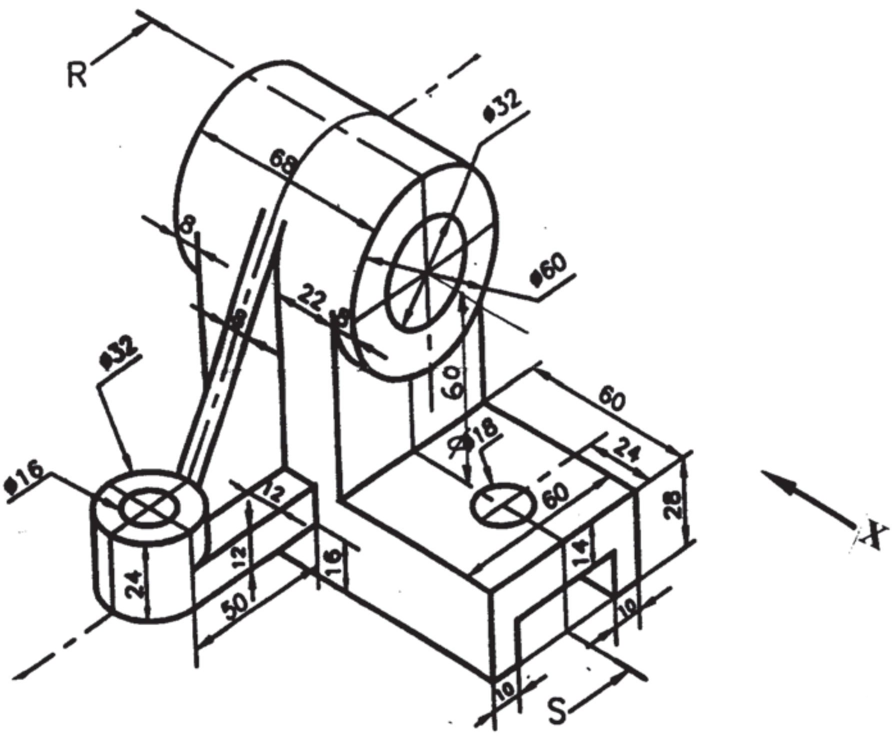

Fig. 1

OR

4. For object shown in the fig. 2, draw the following views :

a) Sectional elevation in the direction of arrow ‘X’ (section along A-B). **6**

b) Plan. **5**

c) Right Hand Side View. **6**

d) Give all dimensions. **3**

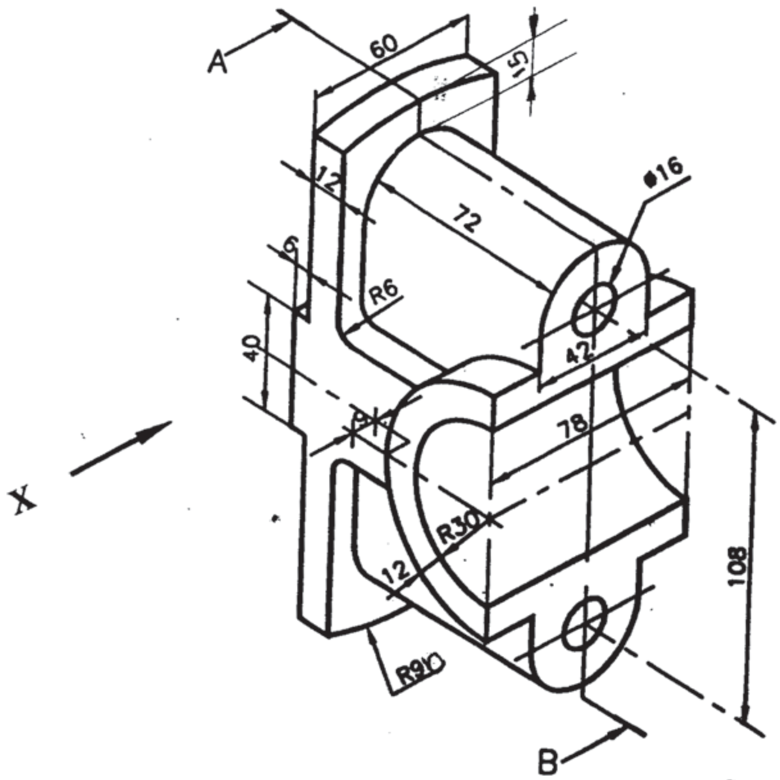

Fig. 2

UNIT-IV : AUXILIARY PROJECTIONS

5. Fig. 3 shows Incomplete Front View, Top View and Auxiliary View of an object :

a) Redraw the given views **5**

b) Complete the Front View **8**

c) Show all dimensions. **2**

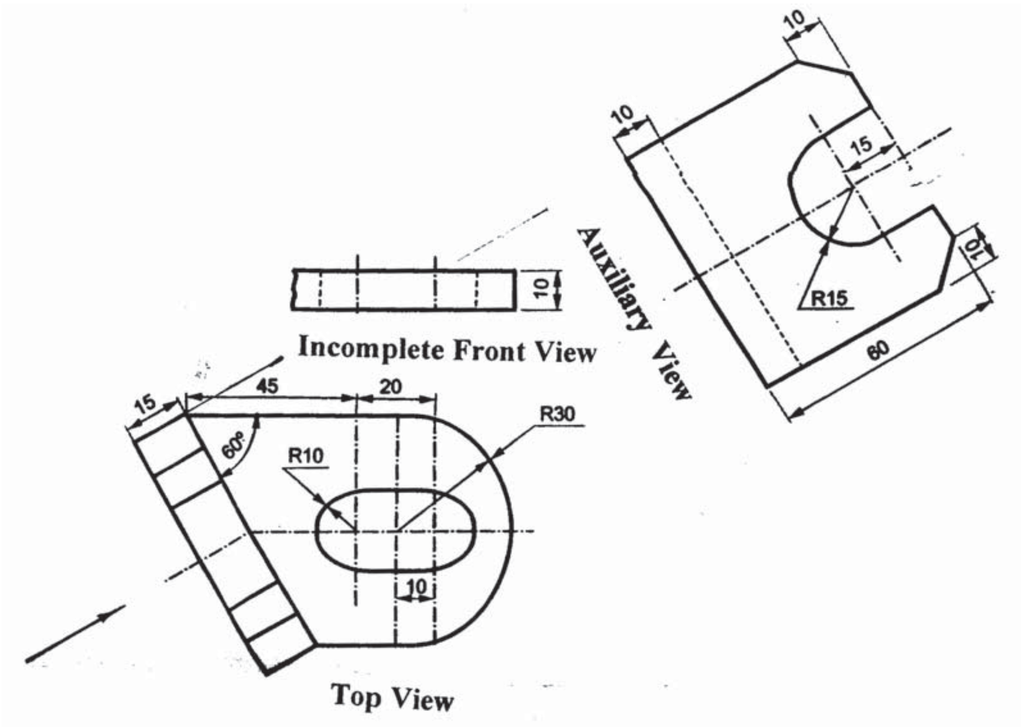

Fig. 3

OR

6. Fig. 4 shows Front view, Auxiliary Top View of an object.

a) Redraw the given views. **5**

b) Add Top View. **8**

c) Give all dimensions. **2**

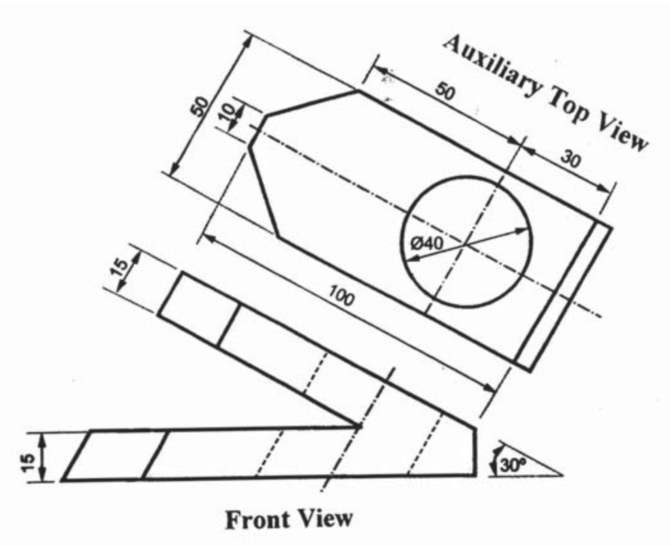

Fig. 4

SECTION – II

UNIT-V : ISOMETRIC

7. Fig. 5 shows F.V. and T.V. of an object by First Angle Method of Projection. Draw its isometric view taking origin at 'O' and give overall dimensions. **(17+3)**

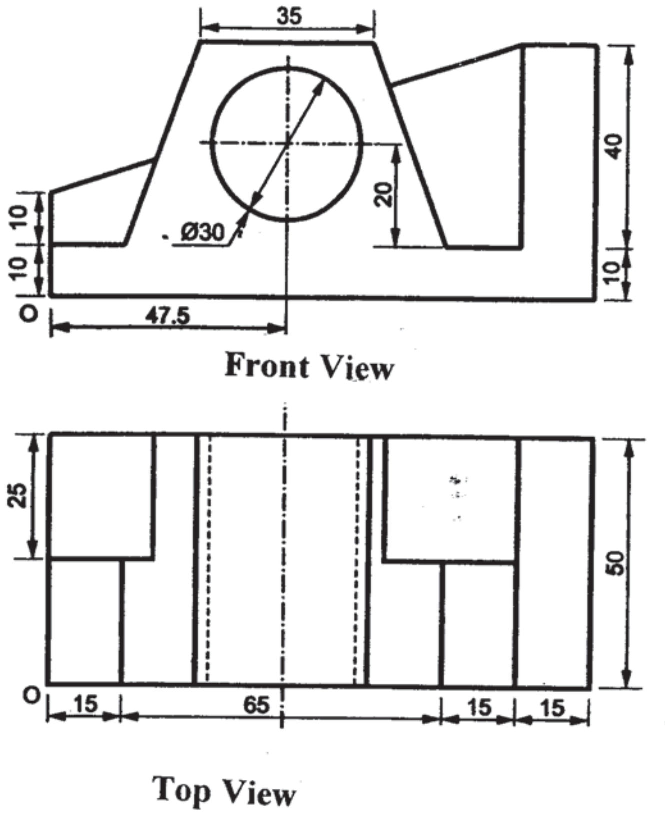

Fig. 5

OR

8. Fig. 6 shows Orthographic Views of an object by First Angle Method of Projection. Draw its isometric view taking origin at 'O' and give overall dimensions. **(17+3)**

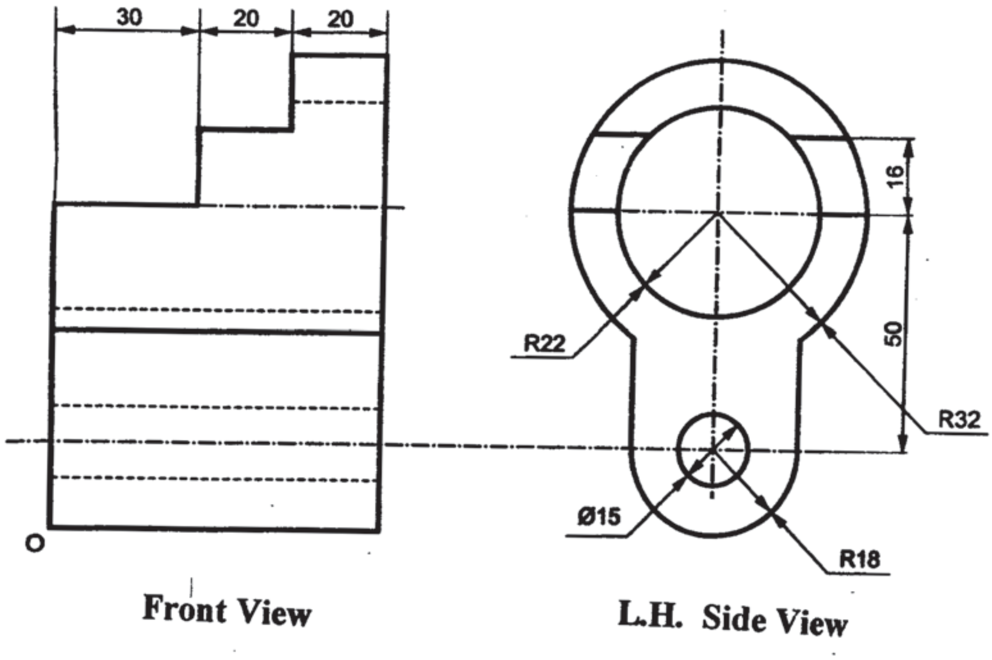

Fig. 6

UNIT-VI : MISSING VIEWS

9. Fig. 7 shows Front View and L.H. Side View of an object. Draw the following views :

   a) Sectional Front View (section along A-A). **7**

   b) L.H. Side View. **3**

   c) Top View. **8**

d) Give all dimensions. **2**

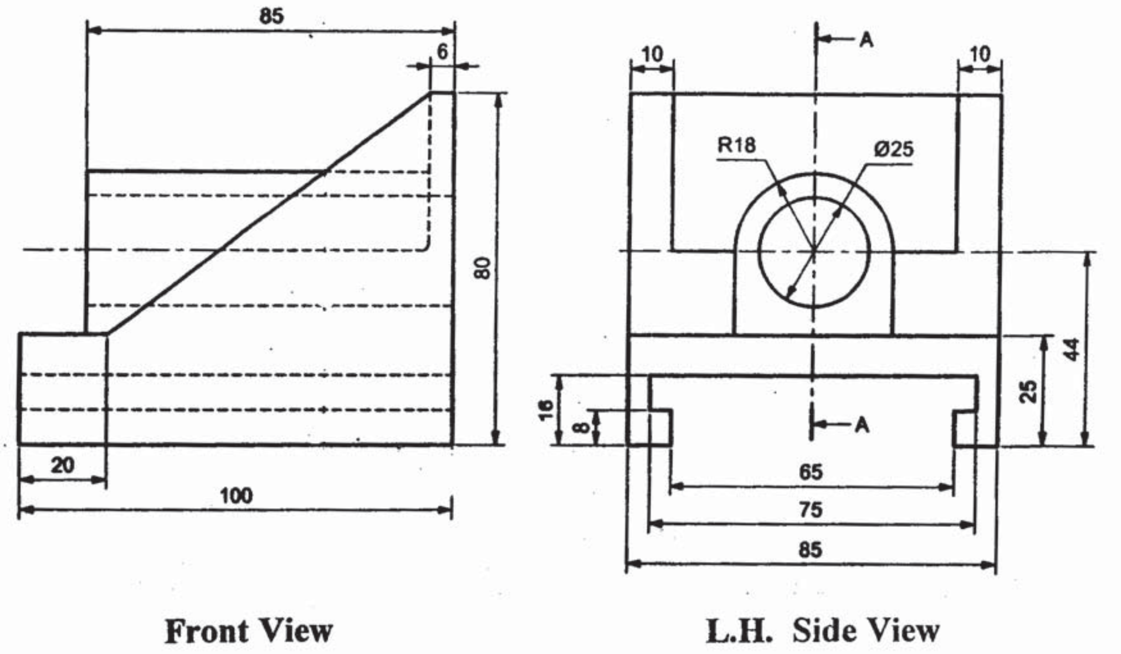

Fig. 7

OR

10. Fig. 8 shows the Front View and L.H. Side View of a machine part. Draw the following views by First Angle Method of Projection :

a) Redraw the Front View. **3**

b) Sectional L.H. Side View (Section along A-A). **7**

c) Top view. **8**

d) Give all dimensions. **2**

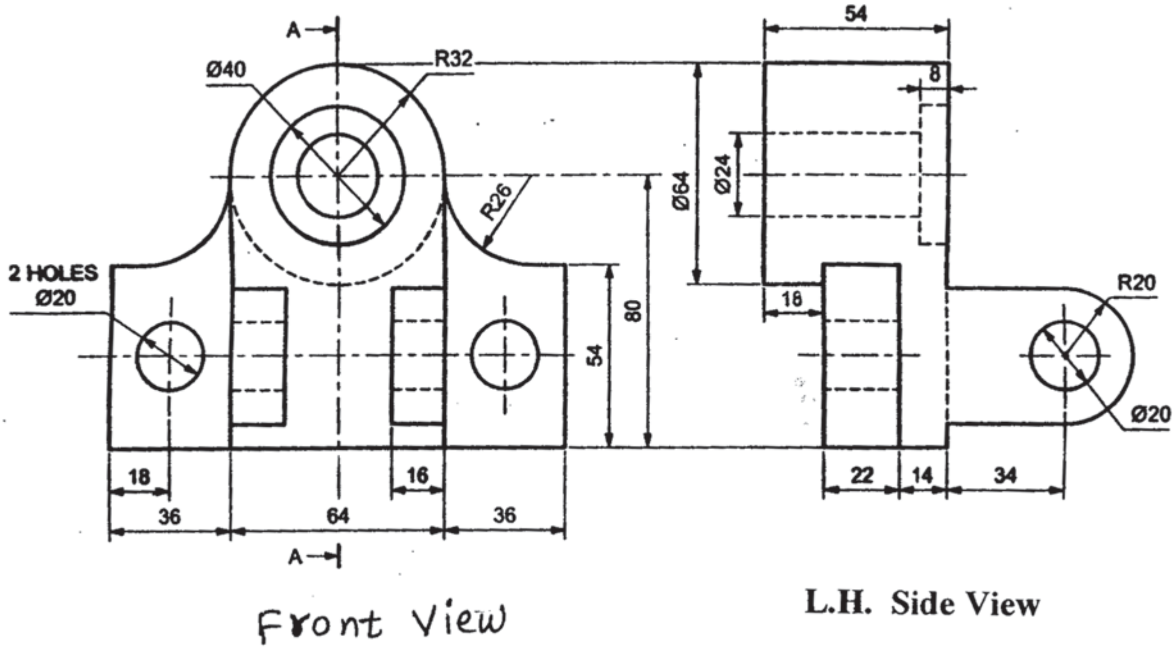

Fig. 8

UNIT-VII : FREE HAND SKETCHES

11. Draw proportionate free hand sketches of the following :

a) Whitworth threads (BSW). **3**

b) Split Muff Coupling. **3**

c) Lewis Foundation Bolt. **4**

OR

12. Draw proportionate free hand sketches of the following :

a) Eye bolt. **3**

b) Gib headed key (assembled position in shaft and hub). **3**

c) Fillet weld and Single ‘V’ butt weld. **4**

B/I/11/12,735

F.E. (Semester – II) Examination, 2011
ENGINEERING MATHEMATICS – II
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) In Section – **I**, solve Q. No.**1** or Q. No. **2**, Q. No. **3** or Q. No. **4**, Q. No. **5** or Q. No. **6.** In Section – **II**, solve Q. No. **7** or Q. No. **8**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q. NO. **12**.*
*2) Answers to the **two** Sections should be written in **separate** answer books.*
*3) Black figures to the **right** indicate **full** marks.*
*4) Assume **suitable** data, if **necessary**.*

SECTION – I

1. a) Form the differential equation whose general solution is

$y = ae^{4x} + be^{3x}$

where a and b are arbitrary constants. **6**

b) Solve **any two** : **10**

1) $\frac{dy}{dx} = \frac{x + y + 3}{2x + 2y - 3}$

2) $(e^y + 1)\cos x \, dx + e^y \sin x \, dy = 0$

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

OR

P.T.O.

2. a) Form the differential equation whose general solution is

$$\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$$

where a and b are arbitrary constants. **6**

b) Solve **any two** : **10**

1) $\left(xy-x^2\right)\frac{dy}{dx}=y^2$

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

3) $\left(x^4e^x-2mxy^2\right)dx+2mx^2y\,dy=0$.

3. Attempt **any three** : **18**

a) Find the orthogonal trajectories of the family of $r=a\left(1-\sin\theta\right)$.

b) A metal ball is heated to a temperature of 100° C and at time t = 0 it is placed in water which is maintained at 40° C. If the temperature of the ball reduces to 60° C in 4 minutes, find the time at which the temperature of the ball is 50° C.

c) A resistance of 100 ohms and an inductance of 0.5 henries are connected in series with a battery of 20 volts. Find the current in the circuit when initially i = 0 at t = 0. Also find the time that elapses before the current reaches one half of its maximum value.

d) Assuming the resistance to the motion of a ship through water is $a^2 + b^2 \nu^2$, where ν is the velocity of the ship and a, b are constants, write down the differential equation for the retardation of the ship moving with engine stopped. Prove further that the time in which the speed falls to one half of its original value is given by $\frac{W}{abg} \tan^{-1}\left[\frac{abu}{2a^2 + b^2u^2}\right]$, where u is initial velocity, W is weight of ship.

OR

4. Solve **any three** : **18**

a) A pipe 20 cms in diameter contains steam at 150° C and is protected with a covering 5 cm thick, for which k = 0.0025. If the temperature of the outer surface of the covering is 40° C, find the temperature half way through the covering.

b) An e.m.f. 200 e^{-5t} is applied to a series circuit consisting of 20 ohm resistor and 0.01 farad capacitor. Find the charge and current at any time assuming that there is no initial charge on capacitor.

c) The distance x descended by a parachuter satisfies the equation $\nu \frac{d\nu}{dx} = g\left(1 - \frac{\nu^2}{k^2}\right)$, where ν is velocity, k, g are constants. If $\nu = 0$ and x = 0 at time t = 0, show that $x = \frac{k^2}{g} \log \cosh\left(\frac{gt}{k}\right)$.

d) A tank is initially filled with 100 litres of salt solution containing 1 gm of salt per litre. Fresh brine containing 2 gm of salt per litre runs into the tank at the rate 5 litre / min. and the mixture, assumed to be kept uniform by stirring runs out at the same rate. Find the amount of salt in the tank at any time 't' and determine how long it will take for this amount to reach 150 gm ?

5. a) Find the Fourier series of $f(x) = x^2$ in the interval $(0, 2\pi)$. Hence deduce that

$$\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots..$$ **9**

b) If $I_n = \int_0^{\pi/3} \cos^n x \, dx$, show that $I_n = \frac{\sqrt{3}}{n.2^n} + \frac{n-1}{n} I_{n-2}$. **7**

Hence find $\int_0^{\pi/3} \cos^6 x \, dx$.

OR

6. a) Find the Fourier series for the following values upto first harmonic in interval (0, 6) : **8**

x	0	1	2	3	4	5
y	4	8	15	7	6	2

b) Evaluate : $\int_0^{\infty} x^7 e^{-2x^2} dx$. **4**

c) Evaluate : $\int_0^1 x^3 \left(1 - \sqrt{x}\right)^5 dx$. **4**

SECTION – II

7. a) Trace the following curves (**any two**) : **8**

1) $xy^2 = a^2 (a - x)$

2) $r(1 + \sin\theta) = 2a$

3) $x = a(\theta + \sin\theta);\ y = a(1 - \cos\theta)$

b) Prove that $\int_0^\infty \frac{1 - \cos ax}{x^2}\,dx = \frac{\pi a}{2}$. Assume that $\int_0^\infty \frac{\sin x}{x}\,dx = \frac{\pi}{2}$. **5**

c) Find the length of the arc of the curve $x = e^\theta \cos\theta,\ y = e^\theta \sin\theta$ from $\theta = 0$ to $\theta = \frac{\pi}{2}$. **4**

OR

8. a) Trace the following curves (**any two**) : **8**

1) $y^2(x^2 - 1) = x$

2) $r = a \sin 2\theta$

3) $r = a(1 + \cos\theta)$

b) Find : $\frac{d}{dx}\left[\operatorname{erf}\left(ax^n\right)\right]$. **4**

c) Find the length of the upper arc of one loop of Lemniscate $r^2 = a^2 \cos 2\theta$. **5**

9. a) Prove that the sphere $x^2 + y^2 + z^2 + 2x - 4y - 2z - 3 = 0$ touches the plane $2x - 2y - z + 16 = 0$ and find the point of contact. **5**

b) Find the semi-vertical angle and equation of the right circular cone having its vertex at the origin and passing through the circle $x^2 + z^2 = 25$, $y = 4$. **6**

c) Find the equation of right circular cylinder whose guiding curve is $x^2 + y^2 + z^2 = 25$, $x + 2y + 2z = 0$. **6**

OR

10. a) Find the equation of sphere passing through the circle

$x^2 + y^2 + z^2 = 9$, $2x + 3y + 4z = 5$ and the point (1, 2, 3). **5**

b) Find the equation of the right circular cone whose vertex is (1, –1, 2) and axis is the line $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$ and semi-vertical angle 45°. **6**

c) Find the equation of the right circular cylinder of radius 2 whose axis is the line $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{2}$. **6**

11. Solve **any two** : **16**

a) Evaluate $\iint_R \sqrt{xy(1-x-y)}\ dx\,dy$ over the region R bounded by $x = 0$, $y = 0$ and $x + y = 1$.

b) Find the area common to the circles $x^2 + y^2 = a^2$ and $x^2 + y^2 = 2ax$.

c) Find the position of the centroid of the area bounded by the curve $y^2(2a - x) = x^3$ and its asymptote.

OR

12. Solve **any two** : **16**

a) Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} \frac{\cos^{-1}x \ dx\, dy}{\sqrt{(1-x^2-y^2)(1-x^2)}}$.

b) Evaluate $\iiint \frac{dx\, dy\, dz}{\sqrt{1-x^2-y^2-z^2}}$ taken throughout the volume of the sphere $x^2 + y^2 + z^2 = 1$ in the positive octant.

c) Show that the Moment of Inertia (M.I.) of a rectangle of sides a and b about its diagonal is $\frac{M}{6}\left(\frac{a^2 b^2}{a^2 + b^2}\right)$

where M is mass of rectangle.

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F.E. Examination, 2011
ENGINEERING MATHEMATICS – II
(2008 Course) (New)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answer **any three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Assume suitable data, if **necessary**.*

SECTION – I

1. A) Form the differential equation whose general solution is $(X - A)^2 + (Y - B)^2 = 1$, (A, B are arbitrary constants). **6**

B) Solve (**any two**) : **10**

i) $(3y + 2x + 4)\,dx - (4x + 6y + 5)\,dy = 0$

ii) $\text{Cos}x \dfrac{dy}{dx} + y \sin x = \sqrt{y \sec x}$

iii) $\dfrac{dy}{dx} = \dfrac{\tan y - 2xy - y}{x^2 - x\tan^2 y + \sec^2 y}$

OR

2\. A) Form the differential equation whose general solution is
$\log y = a \sin x + b \cos x$. **6**

B) Solve (**any two**) : **10**

i) $\left(\frac{y}{x}\sec y - \tan y\right) dx + (\sec y \log x - x)\, dy = 0$

ii) $ye^y = (y^3 + 2xe^y)\frac{dy}{dx}$.

iii) $x^2\frac{dy}{dx} + xy + \sqrt{1-x^2y^2} = 0$

3\. Attempt (**any three**) : **18**

A) If the substance cools from 370 K to 330 K in 10 minutes when the temp. of surrounding air is 290 K. Find the temperature of substance after 40 minutes. **6**

B) Find orthogonal trajectories for the family of Laminscate $r^2 = a^2 \cos 2\theta$. **6**

C) Form the differential equation for the circuit containing resistance R and inductance L connected in series with constant emf E_o. Find current 'I' at any time 't' if intially $I = I_0$ at t =0. **6**

D) A particle of mass'M' is projected vertically upwards with velocity 'ν' , assuming that the air resistance is K times the velocity; show that particle will reach maximum height in time.

$$\frac{M}{K}\log\left(1+\frac{KV}{Mg}\right)$$ **6**

OR

4. Attempt **any three** : **18**

A) The charge q on the plate of a condensor of capacity 'C' charged through a resistance R by a steady voltage V satisfies the differential equation

$R\frac{dq}{dt}+\frac{q}{c}=V$. If q = 0 at t = 0 Find q in terms of 't'. **6**

B) The distance 'x' descended by a parachuter satisfies the differential equation $V\frac{dv}{dx}=g\left(1-\frac{v^2}{k^2}\right)$, where 'V' is velocity, k, g are constants. If v = 0, x = 0 at t = 0, find 'x' in terms of 't' **6**

C) A steam pipe 20 cm in diameter is protected with a covering 6 cm thick for which the co-efficient of thermal conductivity is K = 0.0003 in steady state. Find heat lost per hour through a meter length of pipe , if the inner surface of the pipe is at $200°$C and outer surface of the pipe is at $30°$C. **6**

D) The amount 'x' of a substance present in a certain chemical reaction at time 't' is given by $\frac{dx}{dt}+\frac{x}{10}=2-1.5\,e^{-t/10}$. If at t = 0, x = 0.5, find 'x' at t = 10. **6**

5. A) Find the first two harmonies of the Frrericr series for Y from the data. **9**

x°:	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
y:	2.34	3.01	3.69	4.15	3.69	2.20	0.83	0.51	0.88	1.09	1.19	1.64

B) Obtain Reduction formula connecting u_n and u_{n-2} for $u_n = \int_0^{\pi/3} \cos^h x \, dx$ and hence evaluate u_6. **7**

OR

6. A) Obtain Fourier series for $f(x) = \text{Cos}\, ax$ in the interval $(0, 2\pi)$ (where 'a' is not an integer). **8**

B) Evaluate : $\int_0^{\infty} \frac{x^a}{a^x}$ (a > 0). **4**

C) Evaluate : $\int_0^1 \left(1 - x^3\right)^{-1/3} dx$. **4**

SECTION – II

7. A) Prove that $\phi(a) = \int_{\pi/6a}^{\pi/2a} \frac{\sin ax}{x} dx$ is independent of 'a'. **5**

B) Prove that $\int_a^b e^{-x^2} dx = \frac{\sqrt{\pi}}{2}\left[\text{erf}\ (b) - \text{erf}\ (a)\right]$. **4**

C) Trace the following curves (**any two**) : **8**

i) $y^2 (a^2 - x^2) = a^3 x$

ii) $r = a (1 + 2 \cos\theta)$

iii) $x = a (t + \sin t),\ y = a (1 - \cos t)$

OR

8. A) Find the length of cardiode $r = a(1 - \cos\theta)$ which lies outside the circle $r = a\cos\theta$. **5**

B) Prove that $\int_0^t \operatorname{erf}(ax)\,dx + \int_0^t \operatorname{erf}_c(ax)\,dx = t$. **4**

C) Trace the following curves **(any two) :** **8**

i) $y^2(a + x) = (x - a)^3$.

ii) $r = a\cos 2\theta$.

iii) $\left(\frac{x}{a}\right)^{2/3} + \left(\frac{y}{b}\right)^{2/3} = 1$.

9. A) Find the equation of sphere tangential to the plane $x - 2y - 2z = 7$ at $(3, -1, -1)$ and passing through the point $(1, 1, -3)$. **5**

B) Find the equation of right circular cone with vertex at A$(1, -1, 2)$, semi-vertical angle 45° and the axix as $\frac{x-1}{2} = \frac{y+1}{1} = \frac{z-2}{-2}$. **6**

C) Find the equation of right circular cylinder of radius 2 and whose axis is $\frac{x-1}{2} = \frac{y-2}{1} = \frac{z-3}{1}$. **6**

OR

10. A) Find the equation of a circle which is a section of a sphere $x^2 + y^2 + z^2 + 6y - 6z - 21 = 0$ and has its centre at the point M (2, –1, 2). **5**

B) Find the equation of right circular cone which passes through the point (2, 1, 3) with the vertex at A (1, 1, 2) and axis parallel to the line

$$\frac{x-2}{2} = \frac{y-1}{-4} = \frac{z+2}{3}.$$ **6**

C) Find the equation of right circular cylinder of radius 5 and axis is

$$\frac{x-2}{2} = \frac{y-3}{1} = \frac{z+1}{1}.$$ **6**

11. Solve the following (**any two**) :

A) Evaluate : $\int_{o}^{a} \int_{\sqrt{ax-x^2}}^{\sqrt{a^2-x^2}} \frac{xy}{x^2+y^2}\, dxdy$. **8**

B) Find the total area of Astroid,

$$x^{2/3} + y^{2/3} = a^{2/3}.$$ **8**

C) Find the C.G. of the arc of a cycloid $x = a(\theta - \sin\theta)$, $y = a(1 - \cos\theta)$ between 2 cusps from $\theta = 0$ to $\theta = 2\pi$. **8**

OR

12. Solve the following **(any two)** :

A) Express the following as a single term and then evaluate,

$$\int_0^1 \int_0^y \left(x^2 + y^2\right) dxdy + \int_1^2 \int_0^{2-y} \left(x^2 + y^2\right) dxdy .$$ **8**

B) Evaluate : $\int_0^2 \int_0^x \int_0^{2x+2y} e^{x+y+z}\, dxdydz$. **8**

C) Find M.I. about the line $\theta = \frac{\pi}{2}$ of the area enclosed by $r = a\,(1 + \cos\theta)$. **8**

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[3961] – 108

F.E. (Semester – II) Examination, 2011
APPLIED SCIENCE – II (Chemistry)
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions: *1) Answers **3** questions.*
*2) Black figures to the **right** indicate **full** marks.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

1. A) What are rocket propellants ? Give different types with example. Explain cetane number of fuel. **7**

B) Explain the principle and method for determining Calorific value of solid, liquid fuels. **6**

C) Find the % of C and H in coal sample from the following data- 0.20 gm of coal on burning in a combustion tube in presence of pure oxygen was found to increase in the weight of $CaCl_2$ tube by 0.08 gm and KOH tube by 0.12 gm. **4**

OR

2. A) Explain merits and demerits of power alcohol.
Explain octane number of fuel. **7**

B) Explain production, properties and storage and transportation of H_2 gas. **6**

C) 2.4 gm of coal sample was weighed in silica crucible. After heating for one hour at 110°C, the residue weighed as 2.25 gm. The crucible was then covered with a vented lid and strongly heated for exactly 7 minutes at 950°C. The residue weighed as 1.42 gm. The crucible was further heated without lid until a constant weight was obtained. The last residue was found to be 0.22 gm. Calculate the % results of the above analysis. **4**

3. A) What is Electrochemical Corrosion ? Explain the mechanism of it. **7**

B) Discuss the various factors affecting corrosion. **6**

C) Explain Cathodic protection method for corrosion. **4**

OR

4. A) Explain the mechanism of corrosion due to oxygen with respect to Na, Mg, Au, Cr, and Mo metals and state Pilling -Bedworth rule. **7**

B) Give different types of surface conversion coatings. **6**

C) Explain concentration cell corrosion. **4**

5. A) What are the scales and sludges ? Give their formation, disadvantages and preventive measures in boiler. **6**

B) i) Find the hardness of water sample from the given data - A zeolite bed gets exhausted on softening 2400 lit. of water and requires 10 lit. of 8% NaCl for regeneration.

ii) 100 ml of water sample requires 4.3 ml of 0.02 N HCl upto phenolphthalein end point and total 11.9 ml upto methyl orange end point. Calculate the type and amount of alkalinity present. **6**

C) In water system, name the phases in equilibrium at the following conditions :

i) – 273°C

ii) 0.0075°C and 4.58 mm pressure

iii) 374°C and 218.5 atm pressure.

iv) 0°C and 1 atm pressure. **4**

OR

6. A) State Gibbs phase rule. Explain the terms involved in it with suitable examples. What are the limitations of Gibbs phase rule. **6**

B) i) 50 ml of standard hard water containing 1 mg of pure $CaCO_3$ per ml consumed 20 ml of EDTA.

50 ml of water sample consumed 25 ml of same EDTA solution using EBT indicator. Calculate total hardness of water.

ii) Calculate the amount of cT ions in water sample, when 100 ml of sample requires 12.2 ml of 0.02 M $AgNO_3$ solution to get the end point in Mohr's method.

Express the answer in terms of $CaCO_3$. **6**

C) Explain phosphate conditioning. of water. **4**

B/I/11/37,120

3. a) Explain construction and working of He-Ne laser. **7**

b) State and explain Meissner effect. Hence show that susceptibility is negative in superconducting state. **6**

c) Explain the terms :

i) Optical pumping.

ii) Population inversion. **4**

OR

4. a) Explain BCS theory of superconductivity. **6**

b) Explain construction and working of Ruby Laser. **7**

c) Write a note on Josephson effect. **4**

5. a) Explain classification of solids into conductors, semiconductors and insulators on the basis of energy band theory. **6**

b) Explain optical and electrical properties of nanoparticles. **6**

c) Draw energy band diagrams for P-N junction diode in forward biased and reverse biased conditions. **4**

OR

6. a) Explain synthesis of metal nanoparticles by colloidal route. **6**

b) Obtain an expression for conductivity of semiconductors. **6**

c) Calculate the mobility of charge carriers in a doped silicon of which conductivity is 100 mho/m and the Hall coefficient is 3.6×10^{-4} m^3/c. **4**

F.E. (Semester – II) Examination, 2011
APPLIED SCIENCE – II (Physics)
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

***Instructions**: 1) Answer **three** questions.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Black figures to the **right** indicate **full** marks.*
*4) Use of logarithmic tables, slilde rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*5) Assume suitable data, **if necessary**.*

Constants : 1) $h = 6.63\times10^{-34}$ J.s
2) $m_e = 9.1\times10^{-31}$ kg
3) $c = 3\times10^{8}$ m/s
4) $e = 1.6\times10^{-19}$C
5) $m_p = 1.67\times10^{-27}$kg

1. a) State and explain properties of matter waves. **6**

b) Deduce Schroedinger's time independent wave equation. **7**

c) Calculate de-Broglie wavelength of 10 keV protons in A.U. **4**

OR

2. a) State and explain Heisenberg's uncertainty principle. Illustrate the same by "Electron diffraction at a single slit". **6**

b) Deduce Schroedinger's time dependent wave equation. **7**

c) Calculate the first energy eigen value of electron in eV, trapped in rigid box of length 1 A.U. **4**

[3961] – 110

F.E. (Semester – II) Examination, 2011
BASIC MECHANICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answers to the **two** Sections should be written in **separate** books.*
*2) Neat diagrams must be drawn **wherever** necessary.*
*3) Use of Logarithmic Tables, Slide Rule, Mollier Charts, Electronic Pocket Calculator and Steam Tables is **allowed**.*
*4) **Assume** suitable data, if **necessary**.*

SECTION – I

1. A) Represent constant pressure process on P–V diagram. Mark work done in the diagram. Derive equation for work done and prove that 'heat supplied' is equal to 'change in enthalpy'. **(1+1+2+2)**

B) Explain Carnot cycle using P-V diagram. **5**

C) Define :

i) Adiabatic Index

ii) Zeroth Law

iii) Thermal Equilibrium

iv) Intensive properties

v) Heat Pump. **5**

OR

2. A) State and explain Second Law of Thermodynamics. **(2+3)**

B) Explain reversibility and irreversibility with example. **(3+2)**

C) A certain gas occupies space of 0.3 m^3 at a 2 bar and temperature 77°C. It is heated at constant volume until its pressure 'P' is 7 bar. Find change in enthalpy during the process.

C_p = 1.005 kJ/kg.K

C_V = 0.712 kJ/kg.K

R = 287 J/kg.K. **6**

3. A) Draw sketch and explain package boiler. **(3+3)**

   B) Explain reciprocating compressor with neat sketch. **(2+3)**

   C) State any three application of refrigeration system. Define COP and Refrigerant. **(3+1+1)**

OR

4. A) Explain working of four stroke SI Engine. **6**

   B) Explain single acting reciprocating pump with sketch. **(2+3)**

   C) State any five criteria for boiler classification. **(5×1=5)**

5. A) Explain any one hybrid power plant with block diagram. **(3+3)**

   B) State Fourier's Law of conduction. Derive unit of conductivity. Explain insulating material with two examples. **(2+1+3)**

   C) Explain concept of series and parallel thermal resistances in composite slab. **(3+3)**

OR

6. A) Draw and explain thermal power plant. **(3+3)**

   B) State advantages and disadvantages of hydroelectric plant. **(3+3)**

   C) Heat is conducted through composite plate of two different parallel materials A and B, of conductivities 134 and 60 watt/mK., each of them with thickness 36 and 42 mm respectively. If temperature of outer face of A and B are found to be steady at 96°C and 8°C respectively, find temperature of interface of plate A and B. **6**

SECTION – II

7. A) Explain with neat sketch working of centrifugal governor. State its application. **(4+3+1)**

   B) Describe Ratchet Pawl mechanism with neat sketch. State its application. **(3+3+2)**

OR

8. A) How gears are classified ? What are the functions of gears ? State applications of different types of gears. **(3+2+3)**

B) Compare sliding contact bearing and rolling contact bearing, with figure. **(4×2=8)**

9. A) Explain aesthetic and ergonomics considerations in product design. **(4+5)**

B) State any six factors to be considered for selecting materials. Explain any two. **(3+3+3)**

OR

10. A) What do you understand by Fabrication ? Explain any three operations in sheet metal work. **(3+6)**

B) Draw only sketches of :

i) Stress-strain diagram of cast-iron

ii) Wire drawing process

iii) Spot welding. **(3+3+3)**

11. A) Draw neat sketch of CNC machine tool showing basic element. Explain its working and state applications. **(6+2)**

B) Explain any four operations performed on drilling machine with neat sketches. **(4×2=8)**

OR

12. A) Explain with neat sketch horrizontal milling machine. **(4+4)**

B) Describe principle of working for

i) Centreless grinding

ii) Surface grinding. **(4+4)**

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[3961] – 111

F.E. (Semester – II) Examination, 2011
BASIC ELECTRONICS ENGINEERING
(2008 Pattern)
(For Students Admitted During the Academic Year 2008 – 2009)

Time : 3 Hours Max. Marks : 100

Instructions: *1) Answer **any three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) **Neat** diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*6) Assume **suitable** data, if **necessary**.*

SECTION – I

1. A) Draw and explain the V-I characteristics of Ge diode in both the modes of operation. **4**

B) A bridge rectifier is applied with input from step down transformer having turns ratio 10:1. Input applied to transformer is 230V, 50 Hz. If the diode forward resistance is 3Ω, secondary resistance is 12Ω and load resistance is 1900Ω. Calculate : 1) Ripple factor 2) % efficiency. **4**

C) Explain the working of common cathode 7-segment LED display with the status of each segment for the digits from 0 to 9. **8**

OR

2. A) Draw the neat circuit diagram of zener voltage regulator and explain its working. **4**

B) Explain with circuit diagram the working of centre-tap transformer full wave rectifier with capacitor filter. Draw appropriate waveforms. **8**

C) A S_i PN junction has I_0 = 30 nA at a room temperature of 300°K. Calculate the junction forward voltage required to produce current of a) 0.1 mA b) 10 mA. **4**

3. A) Define α_{dc} and β_{dc}. Derive the expression for their inter-relationship. **6**

B) Draw and explain two transistor analogy of SCR. **4**

C) A n-channel JFET has I_{DSS} = 8 mA and V_P = – 4 V. a) If I_D = 4 mA calculate the value of V_{GS} b) Calculate $V_{DS(sat)}$ for I_D = 4 mA. **6**

OR

4. A) Derive the equation of DC load line for a CE amplifier circuit given in the fig. 4.1. Explain the effect of position of Q-point on the working of this amplifier. **6**

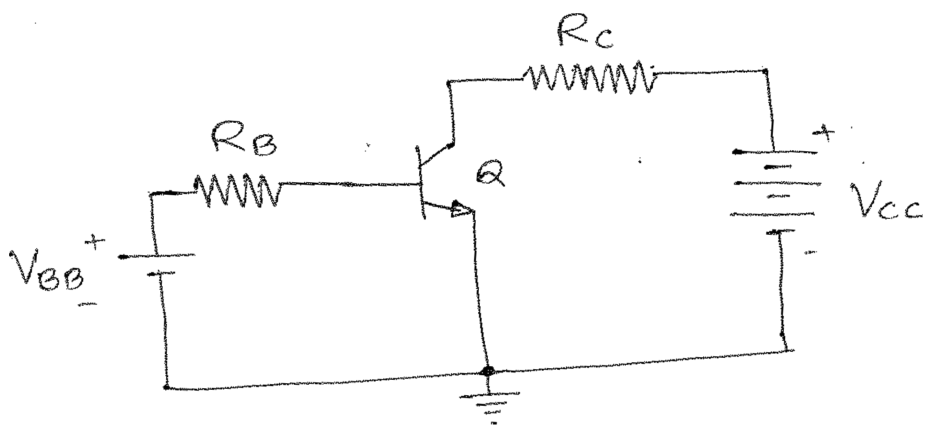

Fig. 4.1

B) Explain the construction, working and characteristics of DIAC. **6**

C) Derive the equation $\mu = g_m \times r_d$. **4**

5. A) Draw the circuit diagram and explain the working of an inverting summing amplifier. **7**

B) Draw the neat circuit diagram and derive the output equation of differentiator circuit. **7**

C) Give the typical values of following parameters for IC 741 : 1) R_i Ω 2) Input Bias current 3) Slew rate 4) CMRR. **4**

OR

6. A) Draw and explain the sine wave generator using RC phase shift oscillator. Give the expression for frequency of oscillations. **8**

B) Compare the positive and negative feedback. **6**

C) An op-amp is used in non-inverting mode with $R_1 = 1\ k\Omega$, $R_F = 10\ k\Omega$ and $V_{CC} = \pm 12V$. Calculate the output voltage for following inputs :
a) 100 mV b) 5 V. **4**

SECTION – II

7. A) Implement OR gate by using Universal NAND gate. **4**

B) What do you mean by flip-flop ? Explain the operation of clocked D flip-flop with the help of logic circuit. **6**

C) Draw and explain the full adder circuit using two half adders. **6**

OR

8. A) What is multiplexer ? Explain its working with the help of block diagram. **4**

B) What is shift register ? Explain the working of any three shift registers with the help of logic diagram. **8**

C) Draw and explain the working of CMOS NAND gate with its truth table. **4**

9. A) What is transducer ? Differentiate between active and passive transducer. **4**

B) Write short note on :

1) PID controller.

2) Alarm annunciator. **8**

C) With the help of block diagram explain working of programmable logic controller. **4**

OR

10. A) Draw and explain weight measurement using LVDT. **6**

B) Draw the block diagram of instrumentation system and state the function of each block. **6**

C) Write a short note on two wire transmitter. **4**

11. A) Explain the working of cellular telephone system. **6**

B) Name different types of wired links used in communication system. Give advantages of optical fiber link over other links. **6**

C) What is modulation ? Explain amplitude modulation technique in detail. **6**

OR

12. A) What is superheterodyne principle ? Explain the working of superheterodyne receiver with the help of block diagram. **6**

B) Compare AM and FM. **6**

C) Write short note on RG standards for co-axial cable. **6**

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[3961] – 113 A

F.E. (Common) Examination, 2011
ENGINEERING MECHANICS (101010) (2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions*:** *1) Attempt 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****, Q.* ***11*** *or | Q.* ***12*** *from Section –* ***II****.*
2) Answer to the ***two*** *Sections should be written in* ***separate*** *answer books.*
3) Neat diagrams must be drawn ***wherever*** *necessary.*
4) Figure to the ***right*** *indicates* ***full*** *marks.*
5) Assume suitable data, ***if*** *necessary and* ***clearly*** *state.*
6) ***Use*** *of cell phone is* ***prohibited*** *in the Examination hall.*
7) ***Use*** *of electronic pocket calculator is* ***allowed****.*

SECTION – I

1. a) Two forces are shown in Fig. 1 (a). Knowing that the magnitude of P is 600 N, determine
   a) The required angle θ if the resultant R of the two forces is to be vertical.
   b) The corresponding value of R. **8**

   b) Determine the position of centroid of the shaded area as shown in Fig. 1 (b) with respect to origin O. **8**

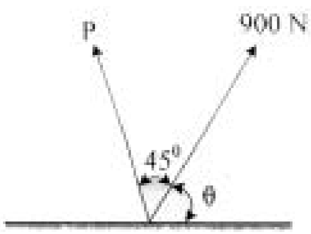

Fig. 1 a

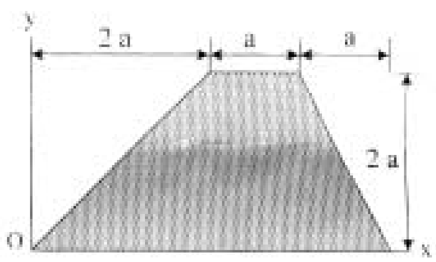

Fig. 1 b

OR

P.T.O.

2. a) Knowing that the tension in cable BC is 145 N, determine the resultant of the three forces exerted at point B of beam AB. Refer Fig. 2 (a). **8**

b) Two 24 mm diameter pegs are mounted on a steel plate at A and C, and two rods are attached to the plate at B and D. A cord is passed around the pegs and pulled as shown in Fig. 2 (b). The rods exert a force of 2.5 N on the plate. Determine

a) The resulting couple acting on the plate when T = 9 N

b) If only cord is used, in what direction should it be pulled to create same couple with the minimum tension in the cord, and

c) Magnitude of minimum tension. **8**

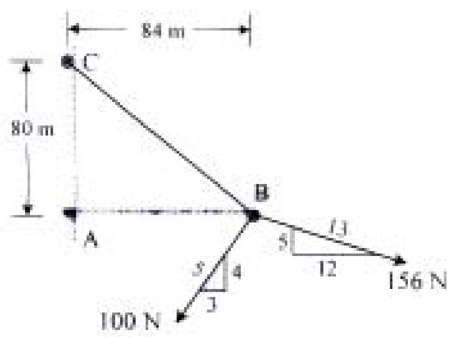

Fig. 2 a

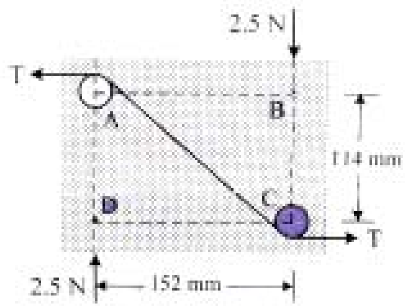

Fig. 2 b

3. a) For the given loading of the beam AB, determine the range of values of the mass of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and the reaction at E must be directed downward. Refer Fig. 3 (a). **8**

b) A tripod support a load of 30 kg as shown in Fig. 3 (b). Determine the forces in the legs of the tripod, if the length of each leg is 5 m and the distance between any two legs at the base in horizontal plane is 3 m. **8**

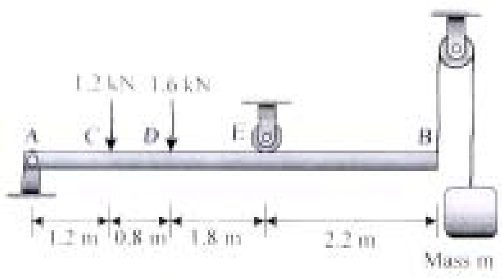

Fig. 3 a

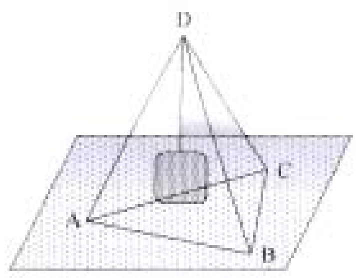

Fig. 3 b

OR

4. a) Determine the magnitude of the resultant and its location with respect to origin O as shown in Fig. 4 (a). **8**

b) The L-shaped member ACB is supported by a pin support at C and by an inextensible cord attached at A and B and passing over a frictionless pulley at D.

Determine the tension in the cord and the reaction at C. Refer Fig. 4 (b). **8**

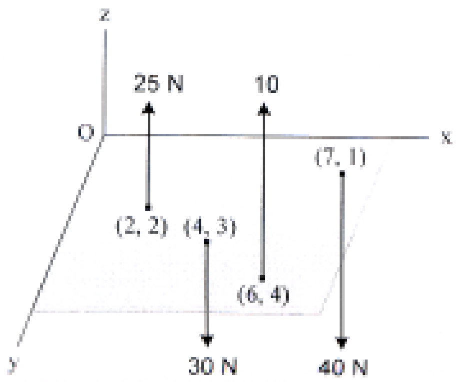

Fig. 4 a

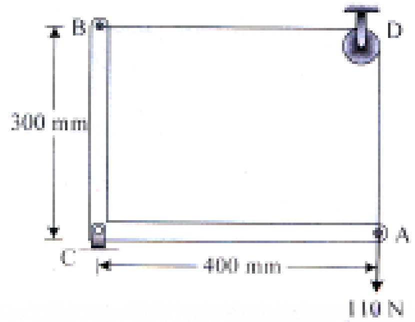

Fig. 4 b

5. a) Indentify zero force members and find magnitude and nature of forces in remaining members of the truss as shown in Fig. 5 (a). **9**

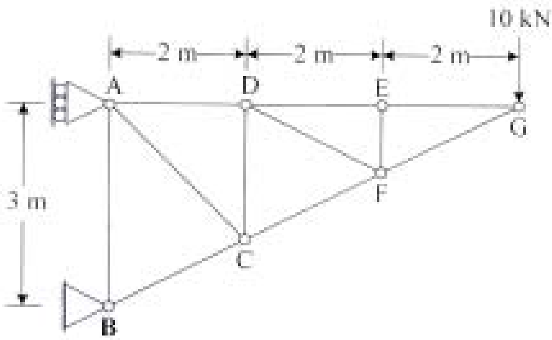

Fig. 5 a

b) A cable passes around three 0.05 m radius pulleys and supports two blocks as shown in Fig. 5 (b). Pulleys C and E are locked to prevent rotation and the coefficient of friction between the cable and pulleys are $\mu_s = 0.2$. Determine the range of values of the weight of block A for which equilibrium is maintained, if the pulley D is free to rotate. **9**

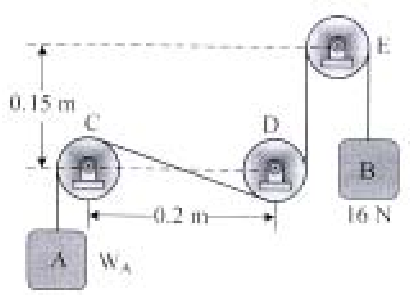

Fig. 5 b

OR

6. a) Cable ABC supports two boxes as shown in Fig. 6 (a). Knowing that b = 2.7 m, determine the required magnitude of the horizontal force P and the corresponding distance a. **9**

b) Determine whether the block shown in Fig. 6 (b), is in equilibrium, and find the magnitude and direction of the friction force when θ=30° and P = 200 N. **9**

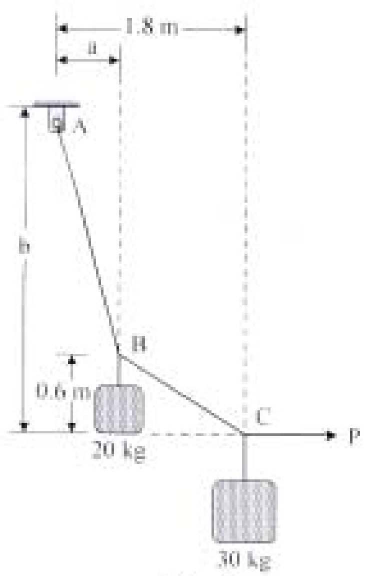

Fig. 6 a

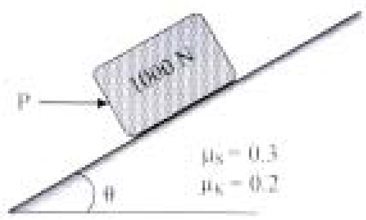

Fig. 6 b

SECTION – II

7. a) A baseball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. **8**

b) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest.
Refer Fig. 7 b. **10**

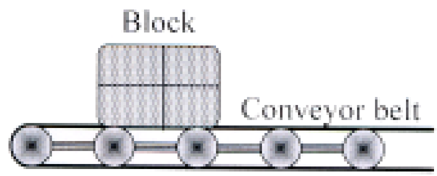

Fig. 7 b

OR

8. a) The velocity of a particle moving along x-axis is defined by $v = k x^3 - 4x^2 + 6x$ where v is in m/s, x is in meter and k is constant. If $k = 1$, determine the value of acceleration when $x = 2$ m. **8**

b) A small block starts from rest at point A and slides down the inclined plane BC as shown in Fig. 8 (b). What distances along the horizontal plane BC will it travel before coming to rest. The coefficient of kinetic friction between the block and the plane is 0.3. Assuming that the initial velocity with which it starts to move along BC is of the same magnitude as that gained in sliding from A to B. **10**

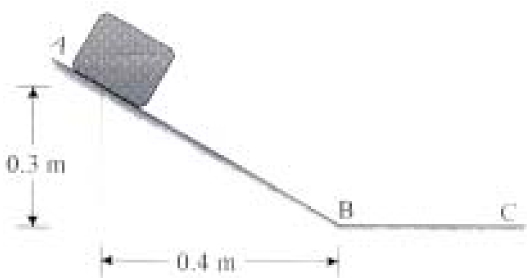

Fig. 8 b

9. a) A particle position is describe by the coordinates $r = (2 \sin 2\theta)$ m and $\theta = (4t)$ rad, where t is in seconds. Determine the radial and transverse components of its velocity and acceleration when t = 1 s. **8**

b) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature $\rho = 800$ m, so that he experiences a maximum acceleration $a_n = 8\ g = 78.5\ m/s^2$. If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer Fig. 9 (b). **8**

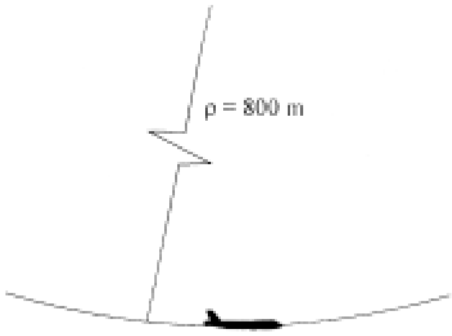

Fig. 9 b

OR

10. a) A golfer hits the golf ball from point A with an initial velocity of 50 m/s at an angle of 25° with the horizontal as shown in Fig. 10 (a). Determine the radius of curvature of the trajectory described by the ball

a) at point A b) at the highest point of the trajectory. **8**

b) The collar has a weight of 25 N and the attached spring has an unstretched length of 1 m. If the collar is positioned on the rod so that $\theta = 30°$ and released from rest, determine the initial acceleration of the collar and the normal force on it. Neglect friction. Refer Fig. 10 (b). **8**

Fig. 10 a

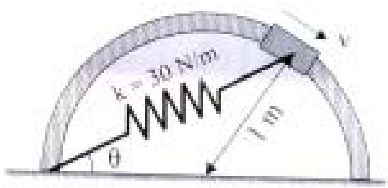

Fig. 10 b

11. a) Blocks A and B have masses of 40 kg and 60 kg respectively. They are placed on a smooth surface and the spring connected between them is stretched 2 m. If they are released from rest, determine the speeds of both blocks the instant the spring becomes unstretched, by work energy method. Refer Fig. 11 (a). **8**

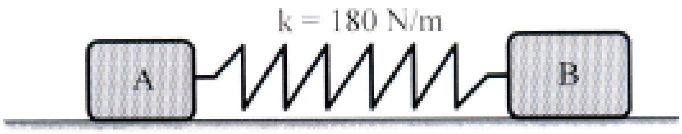

Fig. 11 a

b) A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when t = 0. If the engines provide a resultant horizontal thrust F = (40 + 0.5 t) kN, where t is in seconds. Using impulse-momentum principle determine the time needed for the plane to attain a velocity of 200 m/s. Neglect air resistance and the loss of fuel during the motion. **8**

OR

12. a) The identical 1.2 kg collars A and B are sliding as shown in Fig. 12 (a) on a frictionless rod. Knowing that the coefficient of restitution is e = 0.65, determine

a) The velocity of each collar after impact,

b) The energy lost during friction. **8**

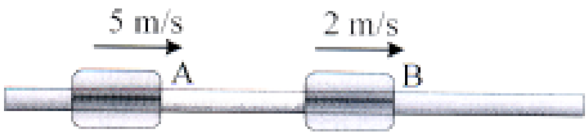

Fig. 12 a

b) Define conservative and non conservative forces with example. Also derive an expression of work-energy principle from Newton's second law of motion. **8**

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F.E. (Semester – II) Examination, 2011
ENGINEERING MECHANICS
(For Students Admitted during the Academic Year 2008-2009)
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

***Instructions**: 1) Attempt 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**, Q. **11** or Q. **12** from Section – **II**.*
*2) Answer to the **two** Sections should be written in **separate** answer books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Figure to the **right** indicates **full** marks.*
*5) Assume suitable data, **if** necessary and **clearly** state.*
*6) **Use** of cell phone is **prohibited** in the Examination hall.*
*7) **Use** of electronic pocket calculator is **allowed**.*

SECTION – I

1. a) Two forces are shown in Fig. 1 (a). Knowing that the magnitude of P is 600 N, determine

   a) The required angle θ if the resultant R of the two forces is to be vertical.

   b) The corresponding value of R. **8**

   b) Determine the position of centroid of the shaded area as shown in Fig. 1 (b) with respect to origin O. **8**

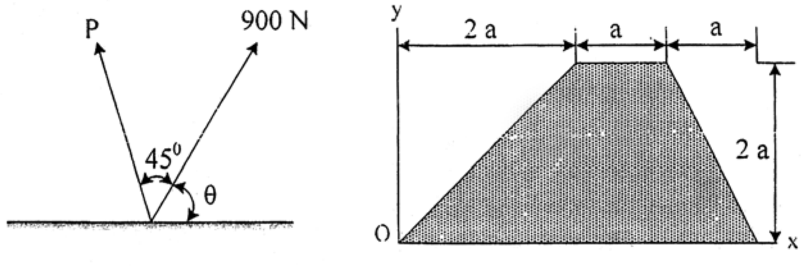

Fig. 1 a **Fig. 1 b**

OR

2. a) Knowing that the tension in cable BC is 145 N, determine the resultant of the three forces exerted at point B of beam AB. Refer Fig. 2 (a). **8**

   b) Two 24 mm diameter pegs are mounted on a steel plate at A and C, and two rods are attached to the plate at B and D. A cord is passed around the pegs and pulled as shown in Fig. 2 (b). The rods exert a force of 2.5 N on the plate. Determine

      a) The resulting couple acting on the plate when T = 9 N

      b) If only cord is used, in what direction should it be pulled to create same couple with the minimum tension in the cord, and

      c) Magnitude of minimum tension. **8**

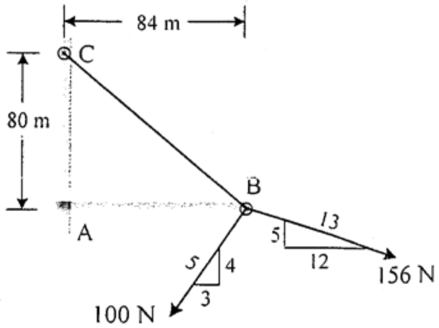

Fig. 2 a

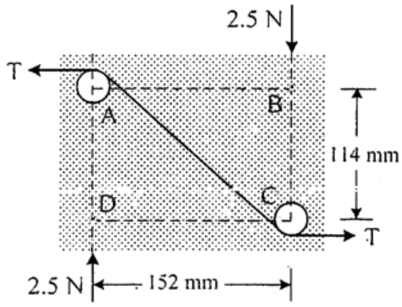

Fig. 2 b

3. a) For the given loading of the beam AB, determine the range of values of the mass of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and the reaction at E must be directed downward. Refer Fig. 3 (a). **8**

   b) A tripod support a load of 30 kg as shown in Fig. 3 (b). Determine the forces in the legs of the tripod, if the length of each leg is 5 m and the distance between any two legs at the base in horizontal plane is 3 m. **8**

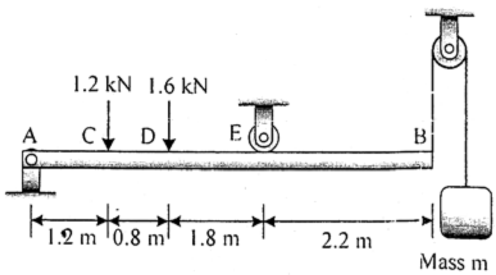

Fig. 3 a

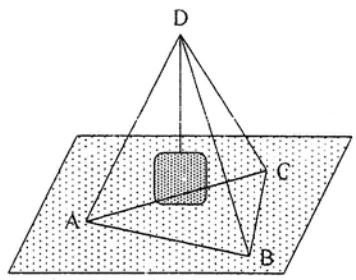

Fig. 3 b

OR

4. a) Determine the magnitude of the resultant and its location with respect to origin O as shown in Fig. 4 (a). **8**

b) The L-shaped member ACB is supported by a pin support at C and by an inextensible cord attached at A and B and passing over a frictionless pulley at D.

Determine the tension in the cord and the reaction at C. Refer Fig. 4 (b). **8**

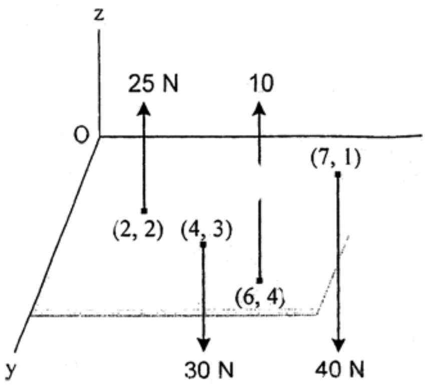

Fig. 4 a

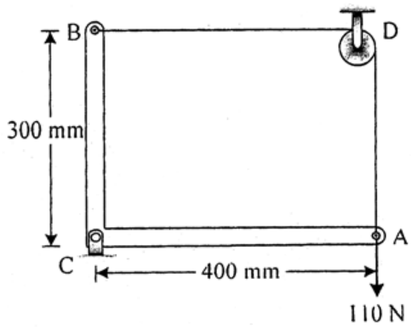

Fig. 4 b

5. a) Indentify zero force members and find magnitude and nature of forces in remaining members of the truss as shown in Fig. 5 (a). **9**

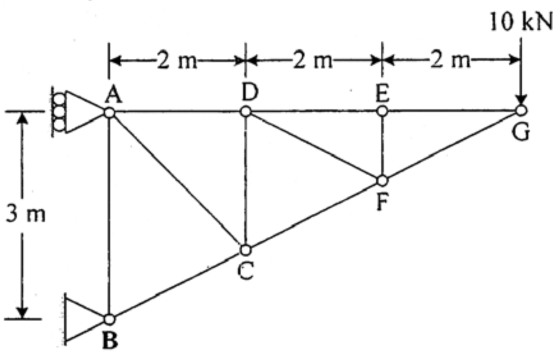

Fig. 5 a

b) A cable passes around three 0.05 m radius pulleys and supports two blocks as shown in Fig. 5 (b). Pulleys C and E are locked to prevent rotation and the coefficient of friction between the cable and pulleys are $\mu_s = 0.2$. Determine the range of values of the weight of block A for which equilibrium is maintained, if the pulley D is free to rotate. **9**

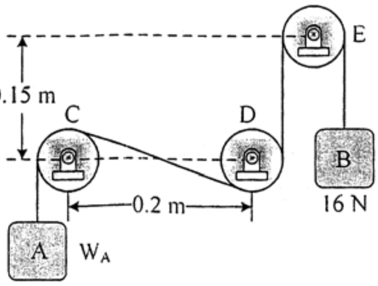

Fig. 5 b

OR

6. a) Cable ABC supports two boxes as shown in Fig. 6 (a). Knowing that b = 2.7 m, determine the required magnitude of the horizontal force P and the corresponding distance a. **9**

b) Determine whether the block shown in Fig. 6 (b), is in equilibrium, and find the magnitude and direction of the friction force when θ=30° and P = 200 N. **9**

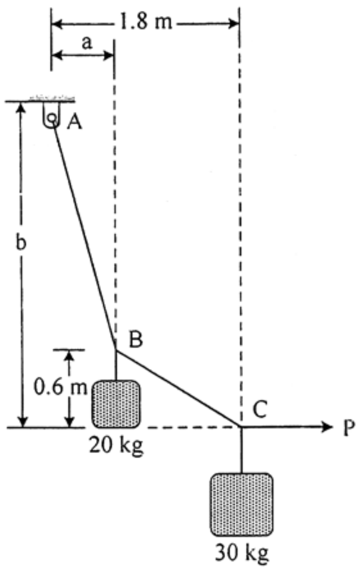

Fig. 6 a

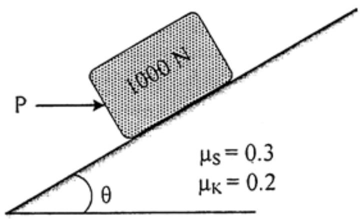

Fig. 6 b

SECTION – II

7. a) A baseball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. **8**

b) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest.
Refer Fig. 7 b. **10**

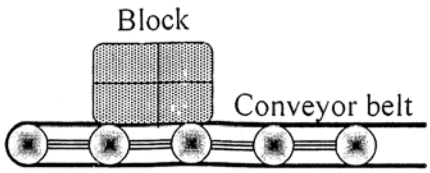

Fig. 7 b

OR

8. a) The velocity of a particle moving along x-axis is defined by $v = k\,x^3 - 4x^2 + 6x$ where v is in m/s, x is in meter and k is constant. If k = 1, determine the value of acceleration when x = 2 m. **8**

b) A small block starts from rest at point A and slides down the inclined plane BC as shown in Fig. 8 (b). What distances along the horizontal plane BC will it travel before coming to rest. The coefficient of kinetic friction between the block and the plane is 0.3. Assuming that the initial velocity with which it starts to move along BC is of the same magnitude as that gained in sliding from A to B. **10**

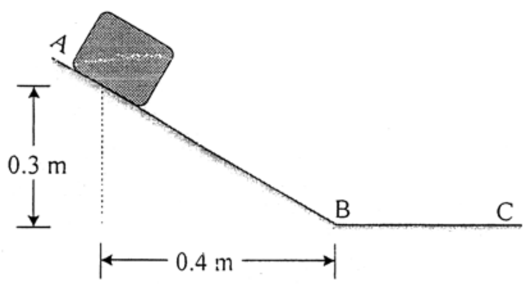

Fig. 8 b

9. a) A particle position is describe by the coordinates $r = (2 \sin 2\theta)$ m and $\theta = (4t)$ rad, where t is in seconds. Determine the radial and transverse components of its velocity and acceleration when t = 1 s. **8**

b) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature $\rho = 800$ m, so that he experiences a maximum acceleration $a_n = 8\,g = 78.5\ m/s^2$. If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer Fig. 9 (b). **8**

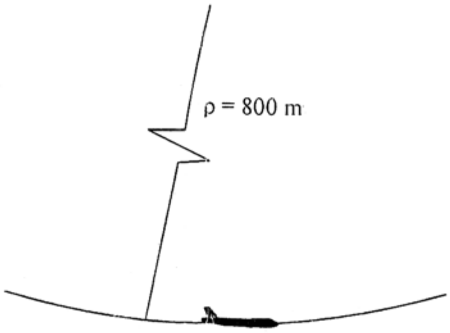

Fig. 9 b

OR

10. a) A golfer hits the golf ball from point A with an initial velocity of 50 m/s at an angle of 25° with the horizontal as shown in Fig. 10 (a). Determine the radius of curvature of the trajectory described by the ball

a) at point A b) at the highest point of the trajectory. **8**

b) The collar has a weight of 25 N and the attached spring has an unstretched length of 1 m. If the collar is positioned on the rod so that $\theta = 30°$ and released from rest, determine the initial acceleration of the collar and the normal force on it. Neglect friction. Refer Fig. 10 (b). **8**

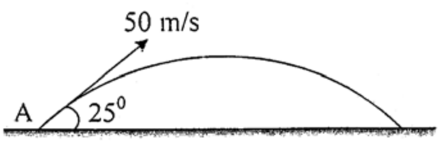

Fig. 10 a

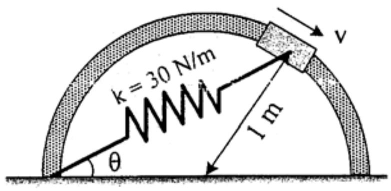

Fig. 10 b

11. a) Blocks A and B have masses of 40 kg and 60 kg respectively. They are placed on a smooth surface and the spring connected between them is stretched 2 m. If they are released from rest, determine the speeds of both blocks the instant the spring becomes unstretched, by work energy method. Refer Fig. 11 (a). **8**

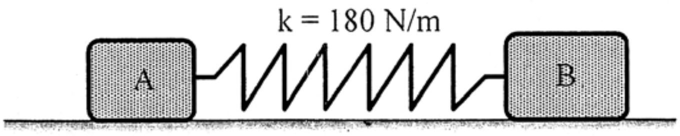

Fig. 11 a

b) A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when t = 0. If the engines provide a resultant horizontal thrust F = (40 + 0.5 t) kN, where t is in seconds. Using impulse-momentum principle determine the time needed for the plane to attain a velocity of 200 m/s. Neglect air resistance and the loss of fuel during the motion. **8**

OR

12. a) The identical 1.2 kg collars A and B are sliding as shown in Fig. 12 (a) on a frictionless rod. Knowing that the coefficient of restitution is e = 0.65, determine

a) The velocity of each collar after impact,

b) The energy lost during friction. **8**

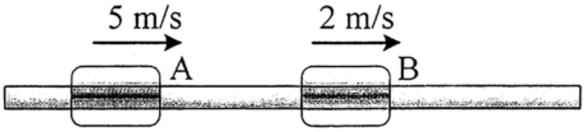

Fig. 12 a

b) Define conservative and non conservative forces with example. Also derive an expression of work-energy principle from Newton's second law of motion. **8**

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F.E. (Semester – II) Examination, 2011
ENGINEERING MECHANICS
(For Students Admitted during the Academic Year 2009-2010 and Onwards)
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions : *1) **Attempt** Q.**1** or Q.**2**, Q.**3** or Q.**4** and Q.**5** or Q.**6**.*
*2) Answer should be written in **one** answer book.*
*3) **Neat** diagram must be drawn **wherever** necessary.*
*4) Figure to the **right** indicates **full** marks.*
*5) **Assume** suitable data, **if necessary** and clearly state.*
*6) **Use** of cell phone is **prohibited** in the examination hall.*
*7) **Use** of electronic pocket calculator is **allowed**.*

1. a) Two forces are shown in Fig. 1a. Knowing that the magnitude of P is 600 N, determine (a) the required angle θ if the resultant R of the two forces is to be vertical, (b) the corresponding value of R. **6**

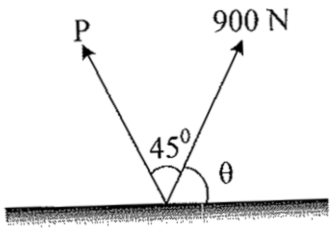

Fig. 1 a

b) A base ball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. **6**

OR

2. a) Determine the position of centroid of the shaded area as shown in Fig. 2 a with respect to origin O. **6**

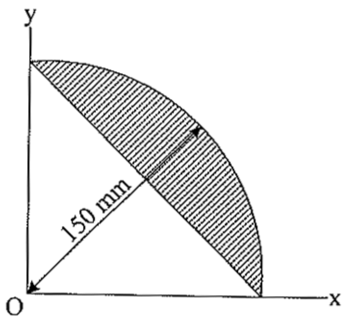

Fig. 2 a

b) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer Fig. 2 b. **6**

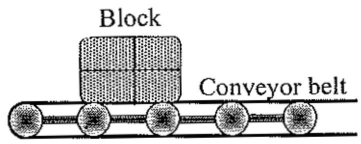

Fig. 2 b

3. a) For the given loading of the beam AB, determine the range of values of the mass 'm' of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and the reaction at E must be directed downward. Refer Fig. 3 a. **6**

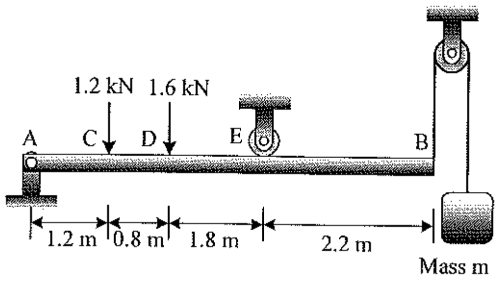

Fig. 3 a

b) A vertical load of 50 kg is supported by three rods as shown in Fig. 3 b. Determine the force in each rod for the co-ordinates of points as below.

A(– 4, – 1, 0), B (3, 3, 0), C(3, – 2, 0) and D(0, 0, 6). **7**

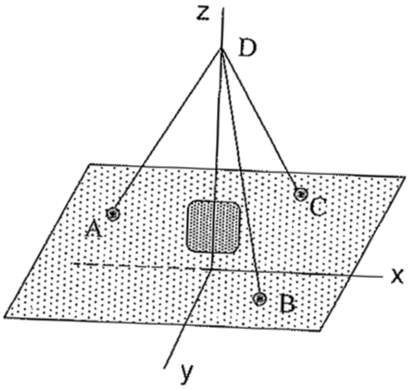

Fig. 3 b

c) A particle position is describe by the co-ordinates $r = (2\sin 2\theta)$ m and $\theta = (4t)$rad, where t is in seconds. Determine the radial and transverse components of its velocity and acceleration when t = 1s. **6**

OR

4. a) The L-shaped member ACB is supported by a pin support at C and by an inextensible cord attached at A and B and passing over a frictionless pulley at D. Determine the tension in the cord and the reaction at C. Refer Fig.4 a. **7**

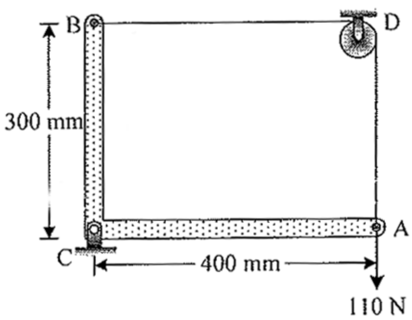

Fig. 4 a

b) Determine the magnitude of the resultant and its location with respect to origin O as shown in Fig.4 b. **6**

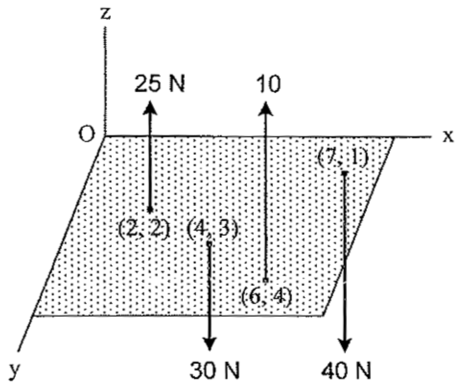

Fig. 4 b

c) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature $\rho = 800$ m, so that he experiences a maximum acceleration $a_n = 8g = 78.5$ m-s^2. If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer Fig. 4 c. **6**

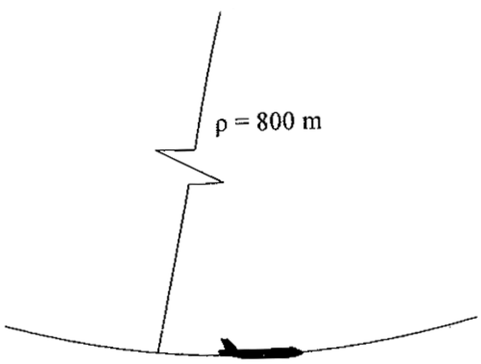

Fig. 4 c

5. a) Blocks A and B have masses of 40 kg and 60 kg respectively. They are placed on a smooth surface and the spring connected between them is stretched 2 m. If they are released from rest, determine the speeds of both blocks the instant the spring becomes unstretched, by work energy method. Refer Fig. 5 a. **6**

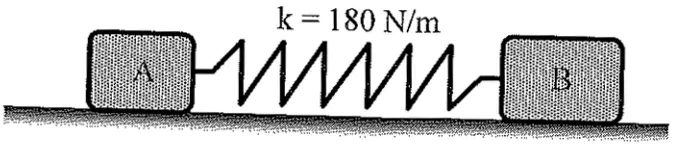

Fig. 5 a

b) A cable passes around three 0.05 m radius pulleys and supports two blocks as shown in Fig. 5 b. Pulleys C and E are locked to prevent rotation and the coefficient of friction between the cable and pulleys are $\mu_s = 0.2$. Determine the range of values of the weight of block A for which equilibrium is maintained, if the pulley D is free to rotate. **7**

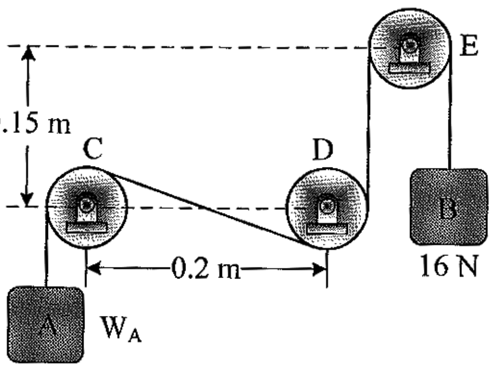

Fig. 5 b

c) Identify zero force members and find magnitude and nature of forces in remaining members of the truss as shown in Fig. 5 c. **6**

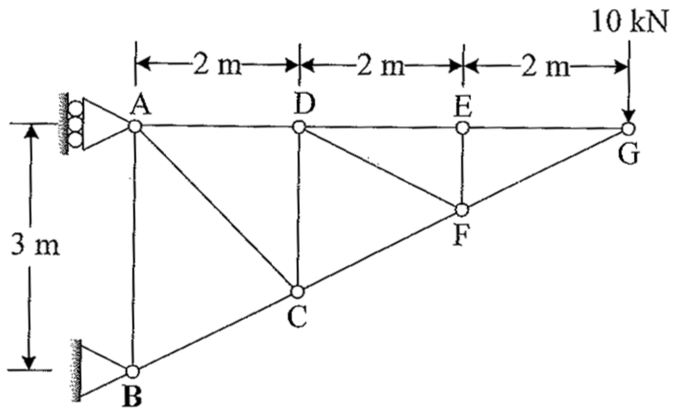

Fig. 5 c

OR

6. a) Cable ABC supports two boxes as shown in Fig. 6 a. Knowing that b = 2.7 m, determine the required magnitude of the horizontal force P and the corresponding distance a. **6**

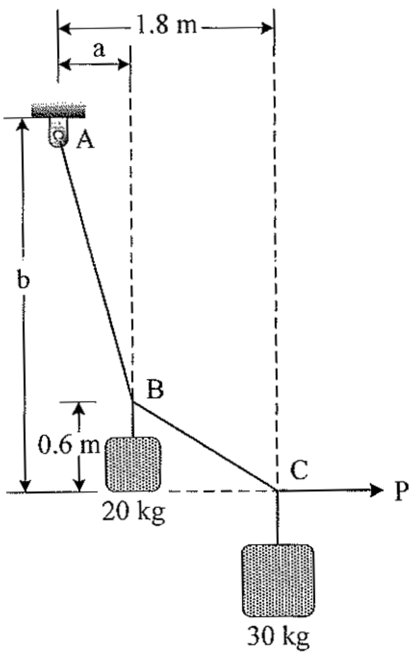

Fig. 6 a

b) Determine whether the block shown in Fig. 6 b, is in equilibrium, and find the magnitude and direction of the friction force when $\theta = 30°$ and $P = 200$ N. **7**

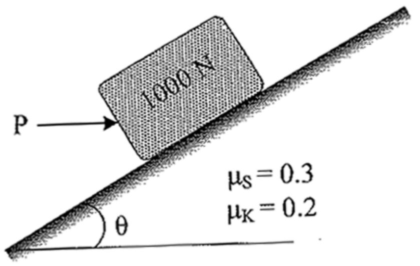

Fig. 6 b

c) A jet plane has a mass of 250 Mg and a horizontal velocity of 100 m/s when t = 0. If the engines provide a resultant horizontal thrust F = (40 + 0.5t) kN, where t is in seconds. Using impulse momentum principle determine the time needed for the plane to attain a velocity of 200 m/s. Neglect air resistance and the loss of fuel during the motion. **6**

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F.E. (Semester – II) Examination, 2011
ENGINEERING MECHANICS
(For Students Admitted during the Academic Year 2009-2010 and Onwards)
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions : 1) ***Attempt*** *Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6.*
2) *Answer should be written in* ***one*** *answer book.*
3) ***Neat*** *diagram must be drawn* ***wherever*** *necessary.*
4) *Figure to the* ***right*** *indicates* ***full*** *marks.*
5) ***Assume*** *suitable data,* ***if necessary*** *and clearly state.*
6) ***Use*** *of cell phone is* ***prohibited*** *in the examination hall.*
7) ***Use*** *of electronic pocket calculator is* ***allowed.***

1. a) Two forces are shown in Fig. 1a. Knowing that the magnitude of P is 600 N, determine (a) the required angle θ if the resultant R of the two forces is to be vertical, (b) the corresponding value of R. **6**

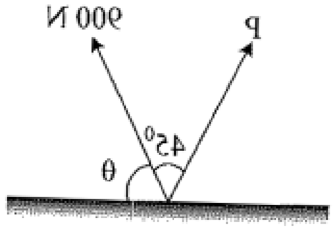


Fig. 1 a

b) A base ball is thrown downward from a 15 m tower with an initial speed of 5 m/s. Determine the speed at which it hits the ground and the time of travel. **6**

OR

P.T.O.

2. a) Determine the position of centroid of the shaded area as shown in Fig. 2 a with respect to origin O. **6**

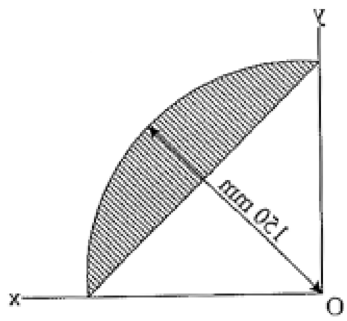


Fig. 2 a

b) The conveyor belt is designed to transport packages of various weights. Each 10 kg package has a coefficient of kinetic friction $\mu_k = 0.15$. If the speed of the conveyor is 5 m/s, and then it suddenly stop, determine the distance the package will slide on the belt before coming to rest. Refer Fig. 2 b. **6**

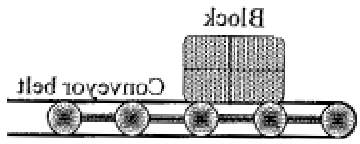


Fig. 2 b

3. a) For the given loading of the beam AB, determine the range of values of the mass 'm' of the crate for which the system will be in equilibrium, knowing that the maximum allowable value of the reactions at each support is 2.5 kN and the reaction at E must be directed downward. Refer Fig. 3 a. **6**

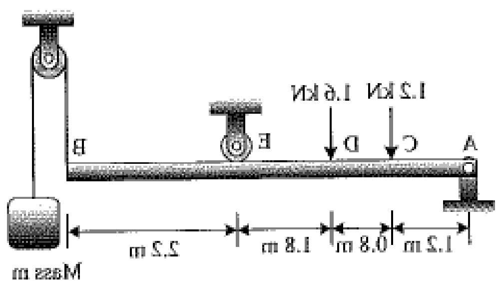


Fig. 3 a

b) A vertical load of 50 kg is supported by three rods as shown in Fig. 3 b. Determine the force in each rod for the co-ordinates of points as below.

A(– 4, – 1, 0), B (3, 3, 0), C(3, – 2, 0) and D(0, 0, 6). **7**

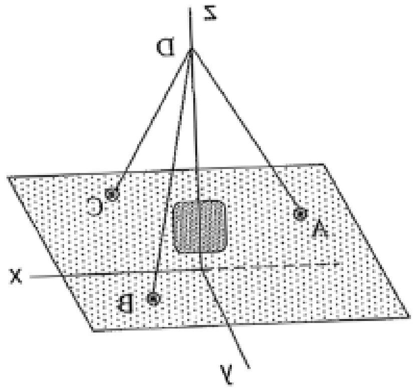


Fig. 3 b

c) A particle position is describe by the co-ordinates r = (2sin 2θ) m and θ = (4t)rad, where t is in seconds. Determine the radial and transverse components of its velocity and acceleration when t = 1s. **6**

OR

4. a) The L-shaped member ACB is supported by a pin support at C and by an inextensible cord attached at A and B and passing over a frictionless pulley at D. Determine the tension in the cord and the reaction at C. Refer Fig.4 a. **7**

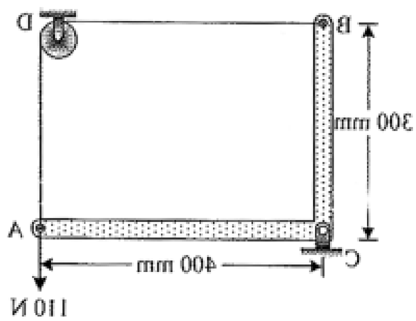


Fig. 4 a

b) Determine the magnitude of the resultant and its location with respect to origin O as shown in Fig.4 b. **6**

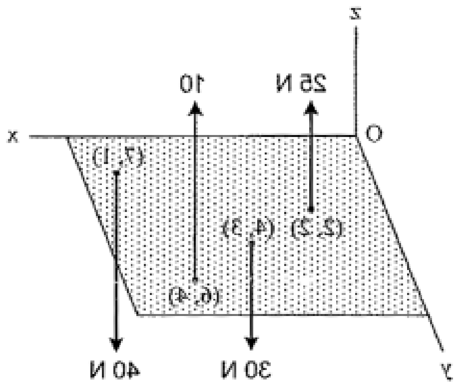


Fig. 4 b

c) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature ρ = 800 m, so that he experiences a maximum acceleration $a_n = 8g = 78.5\ m\text{-}s^{-2}$. If he has a mass of 70 kg, determine the normal force he exerts on the seat of the airplane when the plane is traveling at this speed and is at the lowest point. Refer Fig. 4 c. **6**

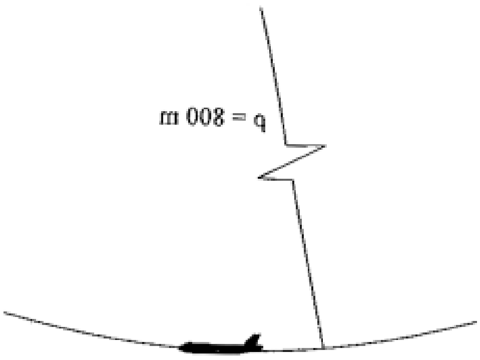
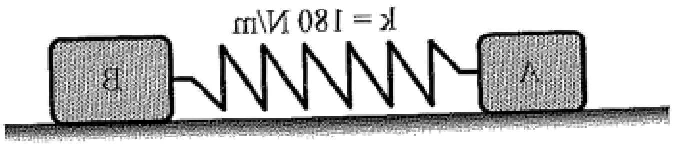


Fig. 4 c

5. a) Blocks A and B have masses of 40 kg and 60 kg respectively. They are placed on a smooth surface and the spring connected between them is stretched 2 m. If they are released from rest, determine the speeds of both blocks the instant the spring becomes unstretched, by work energy method. Refer Fig. 5 a. **6**



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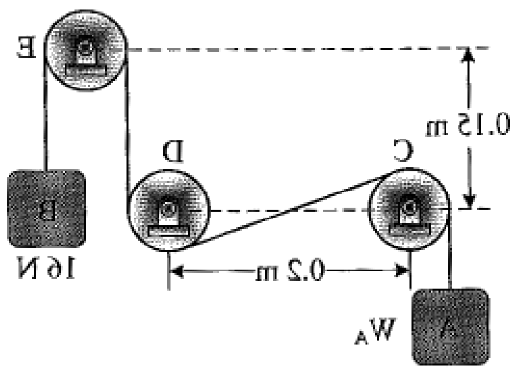

Fig. 5 b

c) Identify zero force members and find magnitude and nature of forces in remaining members of the truss as shown in Fig. 5 c. **6**

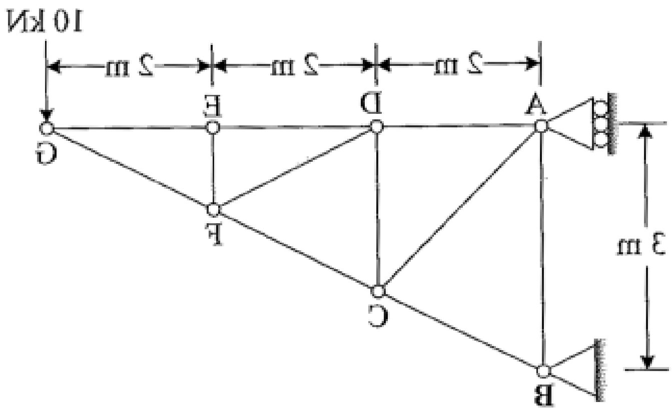

Fig. 5 c

OR

6. a) Cable ABC supports two boxes as shown in Fig. 6 a. Knowing that b = 2.7 m, determine the required magnitude of the horizontal force P and the corresponding distance a. **6**

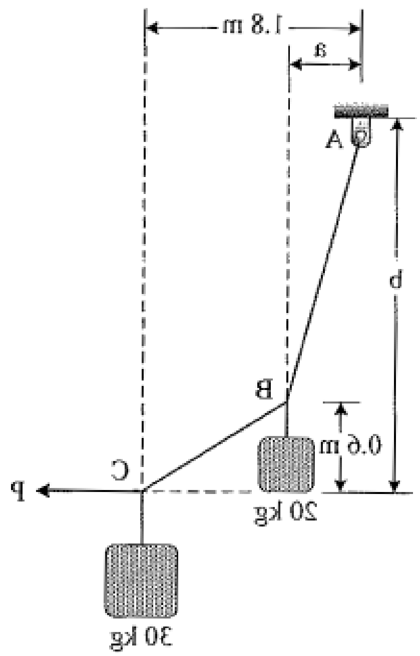

Fig. 6 a

b) Determine whether the block shown in Fig. 6 b, is in equilibrium, and find the magnitude and direction of the friction force when $\theta = 30°$ and $P = 200$ N. **7**

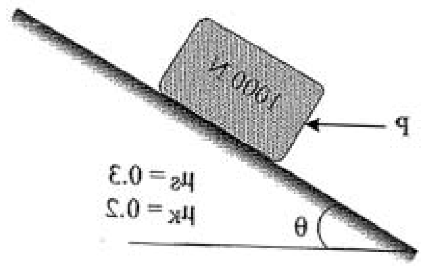

Fig. 6 b

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