[4161] – 103

Seat No.	

F.E. (Semester – I) Examination, 2012
APPLIED SCIENCE – I
Physics
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

Instructions: *1) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, 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**.*

Constants *: $h = 6.63\times10^{-34}$ J.sec.*
$c = 3\times10^{8}$ m/s
$e = 1.6\times10^{-19}$ C
$m_e = 9.1\times10^{-31}$ kg

1. A) Deduce an expression for the displacement produced when an electric field acts perpendicular to electron motion. What is deflection sensitivity ? Give an expression for the deflection sensitivity in this case. **7**

   B) Draw a neat labelled diagram of Michelson's interferrometer and explain with necessary theory how it can be used to measure the wavelength of monochromatic light. **6**

   C) A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes in reflected system are observed through a microscope. The distance between consecutive bright fringes was measured as 0.12 cm. Calculate the wavelength of light. **4**

OR

2. A) Draw a neat labelled diagram showing interference of light in a transparent thin film of uniform thickness. Write down only the conditions for maximum and minimum intensity of light in reflected system. Explain the use of thin film as antireflecting coating. **7**

   B) Explain the principle, construction and working of Bain bridge mass spectrograph with neat diagram. **6**

   C) In Newton's ring experiment, the diameter of 15^{th} dark ring was found to be 0.590 cm and that of 5^{th} dark ring was 0.336 cm. If the radius of curvature of plano convex lens is 100 cm, calculate the wavelength of light used. **4**

3. A) Give the theory of plane transmission grating. Obtain the conditions for maxima and minima. **7**

   B) What is piezo-electric effect ? Draw a neat diagram and explain the working of piezoelectric generator for the production of ultrasonic waves. **6**

   C) A slit of width 2 μm is illuminated by light of wavelength 6500A°. Calculate the angle at which the first minimum will be observed. **4**

OR

4. A) State Rayleigh's criterion of resolution. Hence deduce an expression for resolving power of grating. **7**

   B) Explain echo sounding technique. Discuss any two applications of ultrasonics based on this technique. **6**

   C) Monochromatic light from laser of wavelength 6238A° is incident normally on a diffraction grating containing 6000 lines/cm. Find the angles at which the first and second order maximum are obtained. **4**

5. A) What is double refraction ? Explain it on the basis of Huygen's wave theory. **6**

   B) With a neat labelled diagram, explain the construction and working of betatron. Obtain the betatron condition. **6**

   C) Calculate the thickness of doubly refracting crystal required to introduce a phase difference of π radians between O and E rays. Given that λ = 6000A°, $\mu_0 = 1.55, \mu_e = 1.54$. **4**

OR

6. A) What is nuclear fusion ? Give an account of proton-proton cycle as the cause of stellar energy. **6**

   B) What are retardation plates ? What are their types ? Obtain expression for their thickness. **6**

   C) If the frequency of oscillator applied to the dees of cyclotron is 9 MHz, what must be the magnetic flux density to accelerate α -particles ?

   Given : $m_\alpha = 6.643 \times 10^{-27}$ kg $q_\alpha = 3.2 \times 10^{-19}$ c. **4**

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[4161] – 103

Seat No.	

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APPLIED SCIENCE – I
Physics
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

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[4161] – 107

Seat No.	

F.E. (Semester – II) Examination, 2012
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) **Use** of electronic pocket calculator is **allowed**.*

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

SECTION – I

1. A) Form the differential equation whose general solution is $y = ae^{-2x} + be^{-3x}$, a and b are arbitrary constants. **6**

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

i) (cosx cosy – sinx siny) dy = dx

ii) $\frac{dy}{dx} = \frac{2x + 3y - 1}{6x + 9y + 6}$

iii) $\frac{dy}{dx} - \frac{\tan y}{1+x} = (1+x)e^{x} \sec y$

OR

2. A) Form the differential equation whose general solution is $y = A\cos\left(\frac{4x}{3}\right) + B\sin\left(\frac{4x}{3}\right)$, where A and B are arbitrary constants. **6**

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

   i) $(2x^2y + e^x)\,dx = (e^x + y^3)dy$

   ii) $2xydy = (3y^2 + x^2)dx$

   iii) $\frac{dy}{dx} + (1+2x)y = e^{-x^2}$

3. Solve **any three** : **18**

   i) Water at temperature 100°C cools in 10 minutes to 88°C in a room of temperature 25°C. Find the temperature of water after 20 minutes.

   ii) A particle is moving in a straight line with an acceleration $k\left[x + \frac{a^4}{x^3}\right]$ directed towards origin. If it starts from rest at a distance 'a' from the origin, prove that it will arrive at origin at the end of time $\frac{\pi}{4\sqrt{k}}$.

   iii) The equation of an L-R circuit is given by $L\frac{dI}{dt} + RI = 10\cos t$. If I = 0 at t = 0, express I as a function of t, if L = 5 henries and R = 12 ohms.

   iv) Find the orthogonal trajectories of the family of curves $r^2 = a^2\cos 2\theta$

   OR

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

i) A steam pipe 20 cm in diameter is protected with a covering 6 cm thick for which the coefficient of thermal conductivity is k = 0.0003 cal/cm deg. sec. in steady state. Find the heat lost per hour through a meter length of the pipe, if the inner surface of the pipe is at 200°C and the outer surface of the covering is at 30°C.

ii) A circuit consists of resistance 'R' ohms and a condenser of 'C' Farads connected to a constant e.m.f. E. If $\frac{q}{C}$ is the voltage of the condenser at time 't' after closing the circuit show that the voltage at time 't' is $E(1 - e^{-t/CR})$.

iii) A tank contains 10,000 litres of brine in which 200 kg salt are dissolved. Fresh water runs into the tank at the rate of 100 litres per minute, and the mixture kept uniform by stirring, runs out at the same rate. How long will it be before only 20 kg of salt is left in the tank ?

iv) If 30% of a radio active substance disappeared in 10 days, how long will it take for 90% of it to disappear ?

5. A) Obtain Fourier series expansion for function $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in the interval

$0 \le x \le 2\pi$ and $f(x + 2\pi) = f(x)$.

Hence deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + ... = \frac{\pi^2}{6}$. **7**

B) Prove that $\int_0^{\infty} \frac{x^{m-1}}{(a+bx)^{m+n}}\, dx = \frac{1}{a^n b^m} B(m,n)$. **4**

C) If $I_n = \int_0^{\pi/2} x\cos^n x\, dx$, then obtain the relation between I_n and I_{n-2}. **5**

OR

6. A) Find the harmonics a_0, a_1, a_2, b_1, b_2 of the Fourier series of the following data : **8**

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$
y	1.0	1.4	1.9	1.7	1.5	1.2

B) Evaluate : $\int_0^\infty \sqrt{y}\, e^{-y^3}\, dy$. **4**

C) If $I_n = \int_0^{\pi/4} \cos^{2n}x\, dx$, then

Prove that $I_n = \frac{1}{n2^{n+1}} + \frac{2n-1}{2n} I_{n-1}$. **4**

SECTION – II

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

i) $y^2 = (x - 1)(x - 2)(x - 3)$.

ii) $x^3 + y^3 = 3axy$

iii) $r = \frac{a}{2}(1 + \cos\theta)$

b) Prove that $\int_0^{\infty} \frac{e^{-\alpha x} \sin x}{x} dx = \cot^{-1}\alpha$. **5**

c) Show that the arc length s of the curve y = c cosh $\left(x/c\right)$, measured from its vertex to any point (x, y) is given by $s^2 = y^2 - c^2$. **4**

OR

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

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

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

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

b) Evaluate $\int$ xyds, along the arc s of the curve $x^2/a^2 + y^2/b^2 = 1$, in the first quadrant. **5**

c) Show that $\int_0^{\infty} e^{-(x+a)^2} dx = \frac{\sqrt{\pi}}{2} [1 - \text{erf}(a)]$. **4**

9. a) Find the equation of the sphere, whose centre is in the positive octant, and touching the three co-ordinate/planes and the plane 2x + y + 2z = 6. **6**

b) Find the equation of the right circular cone with vertex at (2, 1, – 3), semi vertical angle 30° and direction ratios of axis are 3, 4, – 1. **5**

c) Determine the radius of the right circular cylinder and hence obtain its equation if the cylinder passes through the point (1, 2, 3) and has $\frac{x}{3} = \frac{y}{2} = \frac{z}{1}$ as the axis. **6**

OR

10. a) Find the equation of the sphere having its centre on the plane $8x – 10y – 4z = 9$, and passing through the circle : **5**

$x^2 + y^2 + z^2 – 2x – 3y + 4z – 8 = 0, x – 2y – z = 8$

b) Find the equation of the right circular cone generated by straight lines drawn from origin to cut the circle passing through the points (1, 2, 2), (2, 1, – 2), (2, – 2, 1). **6**

c) Find the equation of the right circular cylinder of radius 2 and whose axis is

$\frac{x-1}{2} = y = 3 – z.$ **6**

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

a) Evaluate $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x\,dy\,dx}{\sqrt{x^2+y^2}}$

b) Find the area of the region inside the circle $x^2 + y^2 = 2ax$ but lying outside the circle $x^2 + y^2 = a^2$.

c) ABCD is a square plate of side a and O is the midpoint of AB. If the density varies as the square of the distance from O, show that the C.G. of the plate is at a distance $\frac{7a}{10}$ from AB.

OR

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

a) Express the following as a single integral and hence evaluate

$$\int_0^{\frac{a}{2}} \int_0^{x} \frac{dx\,dy}{\sqrt{a^2 - x^2 - y^2}} + \int_{\frac{a}{2}}^{a} \int_0^{\sqrt{ax - x^2}} \frac{dx\,dy}{\sqrt{a^2 - x^2 - y^2}}$$

b) Evaluate $\iiint_V \frac{z^2 dx\ dy\ dz}{(x^2 + y^2 + z^2)}$, where V is the volume of the sphere $x^2 + y^2 + z^2 = 2$.

c) Find the moment of inertia of one loop of the curve $r^2 = a^2 \cos 2\theta$, about the initial line.

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[4161] – 109

Seat No.	

F.E. (Semester – II) Examination, 2012
APPLIED SCIENCE – II
(Physics) (2008 Pattern)

Time : 2 Hours Max. Marks : 50

Constants *: a) Planck's constant, $h = 6.63\times10^{-34}$ J.S.*
b) Charge on electron, $e = 1.6\times10^{-19}$ C.
c) Mass of electron, $m_e = 9.1\times10^{-31}$ Kg.
d) Velocity of light, $C = 3\times10^{8}$ m/s.

1. a) Show that :
   1) Phase velocity of matter wave is c^2/v, where C is the speed of light and v is the velocity of the particle.
   2) Group velocity of a wave packet is equal to particle velocity. **7**

   b) Derive Schroedinger's time independent wave equation. **6**

   c) An electron is trapped in a rigid box of width 2A°. Find its lowest energy level and momentum. **4**

OR

2. a) Derive an equation of energy and wave function when a free particle is trapped in an infinite potential well. **7**

   b) State de Broglie's hypothesis and derive the equation for de Broglie's wavelength in terms of
   1) Energy
   2) For an electron. **6**

   c) If uncertainty in the position of a particle is equal to de Broglie's wavelength, then show that uncertainty in velocity is equal to the velocity of the particle. **4**

3. a) Explain the construction and working of semiconductor laser with the help of Energy band diagram. **6**

   b) What is superconductivity ? Explain BCS theory of superconductors. **6**

   c) Explain the terms :
   1) Meissner effect 2) Population Inversion **4**

OR

P.T.O.

4. a) Explain the construction and working of He-Ne Laser with neat, labelled diagram. **6**

   b) Distinguish between Type I and Type II superconductors. **6**

   c) What are the advantages of Fibre Optic Communication ? **4**

5. a) Explain Hall Effect in semiconductors. Derive equation for Hall voltage and Hall coefficient. **7**

   b) Explain any two properties of nanoparticles. **6**

   c) Calculate the number of acceptors to be added to a Germanium sample to obtain the resistivity of $10\,\Omega$ -cm.

   Given : μ = 1700 cm^2/volt.sec. **4**

OR

6. a) Define Fermi level in conductors and semiconductors. Show that the Fermi level lies at the centre of Energy gap in an intrinsic semiconductor. **7**

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

   c) The resistivity of copper wire of diameter 1.03 mm is 6.51 ohm per 300m. The concentration of free electrons in copper is $8.4 \times 10^{28}/m^3$. If current is 2A, find the mobility of free electrons. **4**

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[4161] – 109

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[4161] – 101

Seat No.	

F.E. Semester – I Examination, 2012
ENGINEERING MATHEMATICS – I
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions : *I) Attempt Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** from Section **I** and Q. **7** or Q. **8**, Q. **9** or Q. **10**, Q. **11** or Q. **12** from Section **II**.*

*II) Answers to the **two** Sections should be written in **separate** books.*

III) Neat diagrams must be drawn wherever necessary.

IV) Black figures to the right indicate full marks.

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

VI) Assume suitable data, if necessary.

SECTION – I

1. A) Define Rank of the matrix. Find the rank of matrix A by reducing it to its normal form. **6**

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

B) Show that the system **5**

$3x + 4y + 5z = \alpha$

$4x + 5y + 6z = \beta$

$5x + 6y + 7z = \gamma$

is consistent only when α, β, γ are in geometric progression.

C) Verify Cayley Hamilton theorem for the matrix

$$A=\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$$ and hence find A^{-1}. **7**

OR

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

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

B) Examine whether the following vectors are linearly dependent. If so find the relation between them $x_1 = (1, 1, 1, 3)$, $x_2 = (1, 2, 3, 4)$, $x_3 = (2, 3, 4, 7)$. **6**

C) Given the transformation

$$Y=\begin{bmatrix} 4 & -5 & 1 \\ 3 & 1 & -2 \\ 1 & 4 & 1 \end{bmatrix}\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Find the co-ordinates (x_1, x_2, x_3) corresponding to (2, 9, 5) in Y. **5**

3. A) Prove that

$$\frac{1+\cos\alpha+i\sin\alpha}{1-\cos\alpha+i\sin\alpha}=\left(\cot\frac{\alpha}{2}\right)\left[e^{i\left(\alpha-\frac{\pi}{2}\right)}\right].$$ **5**

B) Solve the equation $x^7 – x^4 + x^3 – 1 = 0$ by using De Moivre's theorem. **5**

C) Prove that

$$\log\left[\frac{1}{1-e^{i\theta}}\right]=\log\left(\frac{1}{2}\operatorname{cosec}\frac{\theta}{2}\right)+i\left(\frac{\pi}{2}-\frac{\theta}{2}\right).$$ **6**

OR

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

$$\frac{1}{z_1^2}+\frac{1}{z_2^2}=\frac{1}{z_1z_2}$$

B) If $\operatorname{cosec}\left(\frac{\pi}{4}+ix\right)$ = u + iv then prove that

$(u^2 + v^2)^2 = 2(u^2 – v^2)$. **5**

C) If $a=e^{i\alpha}, b=e^{i\beta}, c=e^{i\gamma}$ then prove that

$$\frac{(a+b)(b+c)(c+a)}{abc}=8\cos\left(\frac{\alpha-\beta}{2}\right)\cos\left(\frac{\beta-\gamma}{2}\right)\cos\left(\frac{\gamma-\alpha}{2}\right).$$ **5**

5. A) If $y=\frac{1}{(x-2)(x-1)^2}$

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

B) If x = tan (log y) prove that,

$(1 + x^2)y_{n+2} + [2(n + 1) x – 1]y_{n+1} + [n^2 – n – 2]y_n = 0$. **5**

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

1) $\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{9}}+\frac{1}{\sqrt{28}}+\frac{1}{\sqrt{65}}+.....$

2) $\frac{1}{2}x+\frac{1}{2}.\frac{3}{4}x^2+\frac{1.3.5}{2.4.6}x^3+.....$

OR

6. A) Find n^{th} order differential coefficient of y w.r.t. x **5**

$$y=\tan^{-1}\left[\frac{\sqrt{1+x^2}-1}{x}\right]$$

B) If $y = (\sin^{-1}x)^2$ then prove that

$(1 – x^2)\, y_{n+2} – (2n + 1)xy_{n+1} – n^2y_n = 0.$ **5**

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

1) $\frac{1}{2}-\frac{2}{5}+\frac{3}{10}-\frac{4}{17}+.....$

2) $\sum_{n=1}^{\infty}\frac{2^n n!}{n^n}$

SECTION – II

7. A) Using Taylor's theorem express

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

B) Expand $(1+\sin x)^{1/2}$ upto x^6. **5**

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

1) Evaluate $\lim_{x\to 0}\left(\frac{\sinh x}{x}\right)^{1/x^2}$

2) Evaluate $\lim_{x\to\frac{1}{2}}\frac{\cos^2\pi x}{e^{2x}-2xe}$

OR

8. A) Show that $\frac{x}{e^x-1}=1-\frac{x}{2}+\frac{x^2}{12}-\frac{x^4}{720}+\ldots$ **5**

B) Expand $\tan^{-1}x$ in powers of $(x-1)$ as far as the term in $(x-1)^3$. **5**

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

1) Evaluate $\lim_{x\to 0}\frac{\sin x.\sin^{-1}x-x^2}{x^6}$

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

9. Attempt **any two** : **16**

A) If $f(x, y)=\frac{1}{x^2}+\frac{1}{2xy}+\frac{\log x-\log y}{x^2+y^2}$ then prove that

$xf_x+yf_y+2f=0$.

B) If $x=r\cosh\theta,\ y=r\sinh\theta$ then show that

$(x-y)(z_x-z_y)=rz_r-z_\theta$

C) If $u = \log (x^3 + y^3 – x^2y – xy^2)$ prove that

$$u_{xx} + 2u_{xy} + u_{yy} = \frac{-4}{(x+y)^2}$$

OR

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

A) If $x = u \tan v$, $y = u \sec v$ prove that

$$(u_x)_y \, (v_x)_y = (u_y)_x \, (v_y)_x.$$

B) If $u = f(x^2 – y^2, y^2 – z^2, z^2 – x^2)$ show that

$$\frac{1}{x}u_x + \frac{1}{y}u_y + \frac{1}{z}u_z = 0 .$$

C) If $x^m + y^m = b^m$ then prove that

$$\frac{d^2y}{dx^2} = -(m-1)b^m \frac{x^{m-2}}{y^{2m-1}}$$

11. A) If $u = x + y + z$, $uv = y + z$, $uvw = z$, show that

$$\frac{\partial(x,y,z)}{\partial(u,v,w)} = u^2v$$ **6**

B) Discuss the maxima and minima of $f(x, y) = x^3 + y^3 – 3\,axy$. **6**

C) Examine for functional dependence $u = \frac{x+y}{1-xy}$, $v = \tan^{-1} x + \tan^{-1} y$. Find the relation between them if functionally dependent. **6**

OR

12. A) For the transformation $x = u(1 - v)$, $y = uv$ prove that

$$\frac{\partial(x,y)}{\partial(u,v)} \cdot \frac{\partial(u,v)}{\partial(x,y)} = 1.$$ **6**

B) Divide 120 into three parts so that the sum of their products taken two at a time shall be maximum. **6**

C) Find the percentage error in the area of an ellipse when the errors of 2% and 3% are made in measuring its major and minor axis respectively. **6**

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[4161] – 102-C

Seat No.	

F.E. (Semester – I) (2008 Course) Examination, 2012
APPLIED SCIENCE – I
(Chemistry)

Time : 2 Hours Max. Marks : 50

Instructions : *1) Solve Q. **1** or Q. **2**, Q. **3** or Q. **4**, 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 the type of symmetries for crystals ? Explain them for a cubic crystal. **7**

   b) i) Draw following planes in a cubic system ; a) 1 0 0 b) 1 1 1

   ii) Define :
   a) Atomic packing factor
   b) Co-ordination number
   c) Radius ratio
   d) Unit cell **6**

   c) Derive Bragg's law of diffraction. **4**

OR

2. a) What is a liquid crystal phase ? State types of liquid crystals and applications of liquid crystal. **7**

   b) i) Show that radius ratio for ionic crystal with co-ordination number 4 is 0.225. **4**

   ii) Explain electrical conductivity in polythiophene. **2**

   c) Compare : SC, BCC and FCC unit cell regarding :
   i) Co-ordination number ii) AP
   iii) Atomic radius iv) Atoms per unit cell. **4**

P.T.O.

3. a) How are the pH of titration mixture calculated at various stages during strong acid strong base titration ? **6**

   b) i) 20 ml of standard solution of 0.04 M KCI takes 35.5 ml of $AgNO_3$ from burette, during standardization of the $AgNO_3$. 100 ml of water sample requires 12.5 ml of the $AgNO_3$ solution. Calculate chloride content per litre in the given water sample. **4**

   ii) 50 ml of a solution containing Ca^{++} is titrated against 0.035 M disodium EDTA from burette to get the end point 20.4 ml, in the complexometric titration. Calculate the amount of Ca^{++} ions per litre of the solution. **2**

   c) Explain the different indicators used in direct titration method. **4**

OR

4. a) What is precipitation titration ? Explain Mohr's method for determination of CI^- ions. **6**

   b) i) Find the pH of the solution when 10 ml of 0.2 N HCI is added to 25 ml of 0.1N NH_4OH in a titration. **4**

   ii) 50 ml sample water containing Mg salts, when titrated with 0.05 M EDTA requires 41.5 ml for the end point. Calculate Mg ions present per litre of the water sample. **2**

   c) Define: i) Titrant ii) Titrand iii) Indicator iv) Equivalence point. **4**

5. a) What is addition polymerization ? Explain cationic mechanism with example. **7**

   b) Give synthesis, properties and applications of **any two** : **6**

   i) Poly Vinyl Choride (PVC)

   ii) Acrylonitrile butadiene styrene (ABS) plastics

   iii) Styrene – butadiene rubber (SBR)/ GR-S.

   iv) Poly propylene (PP).

   c) Write a note on liquid crystal polymers. **4**

OR

6. a) What is Glass transition temperature ? What are the factors affecting it ? State its importance. **7**

   b) Distinguish: i) Addition and condensation ii) LDPE and HDPE **6**

   c) Give preparation, properties and uses of Epoxy resin. **4**

[4161] – 102

Seat No.	

F.E. (Semester – I) Examination, 2012
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 Calculators and Steam Tables is* ***allowed****.*
5) Assume suitable data, if ***necessary****.*

1. A) State law of symmetry. Explain various elements of symmetries for a cubic crystal with figures. **7**

   B) Explain structure, properties and applications of fullerene. **6**

   C) At what glancing angle would the first order diffraction from (110) plane KCI observed using X-rays of wavelength 160 pm. The dimension of the unit cell is 320 pm. **4**

OR

2. A) What are crystal defects ? What are the effects of crystal defects on the properties of crystal ? Distinguish between Schottky and Frenkel defects in ionic crystals. **7**

   B) Define radius ratio for ionic crystals and give its significance. **6**

   C) What is a liquid crystal phase ? Give its applications. **4**

P.T.O.

3. A) Explain the titration curve for the titration of acetic acid and sodium hydroxide . Suggest the suitable indicator for this titration and give formulae to calculate pH at different stages of titration. (Assume sodium hydroxide solution in burette.) **7**

   B) i) 50 ml water sample containing Ca salts, when titrated with 0.02 M EDTA requires 20.5 ml for the end point. Calculate amount of Ca^{+2} ions present per litre of the water sample.

   ii) The given chloride ion solution was diluted with distilled water to 1 litre. 25 ml of this diluted solution when titrated with 0.25 N $AgNO_3$ required 22 ml for the end point in Fajan's method. Calculate amount of Cl^- ions present per litre in the given solution. **6**

   C) Define :

   i) Redox titrations

   ii) Equivalence point

   iii) Oxidizing agent

   iv) Normality. **4**

OR

4. A) What is meant by precipitation titration ? Explain Mohr's method for determination of Cl^- ions with chemical equations, procedure and calculation. **7**

   B) Calculate equivalent weights of following :

   i) Potassium permangnate ($KMnO_4$) in acidic medium.

   ii) Oxalic acid ($H_2C_2O_4 \cdot 2H_2O$)

   iii) Calcium chloride ($CaCl_2$). **6**

   C) 25 ml of 0.2 N HCl is titrated against 0.2 N KOH. Calculate the pH of the titration mixture at following stages

   i) 20 ml KOH added

   ii) 30 ml KOH added **4**

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

   B) Give synthesis, properties and applications of **any two** :

      i) Polyvinyl chloride

      ii) Acrylonitrile Butadiene Styrene (ABS) plastic

      iii) Styrene- Butadiene Rubber (SBR)

      iv) Silicone Rubber. **6**

   C) What are polymer composites ? Give in brief properties and applications of polymer composites. **4**

OR

6. A) What is vulcanisation of rubber ? Give structural changes taking place on vulcanisation. State the effects on properties of rubber on vulcanisation. **6**

   B) Differentiate between

      i) Addition polymerisation and condensation polymerisation

      ii) Thermoplastics and thermosetting polymer. **6**

   C) Explain the factors which increase thermal stability of polymers with suitable example. **4**

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[4161] – 104

Seat No.	

F.E. (Semester – I) Examination, 2012
BASIC ELECTRICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions *:* 1) *Answer* ***3*** *questions from Section* ***I*** *and* ***3*** *questions from Section* ***II****.*

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.*

SECTION – I

Q1. A) Field coil of a DC motor takes a current of 1.6 A from 400 V supply, after running for several hours. If temperature rise is 40°C, what value of extra resistance is required in the field circuit to maintain a field current equal to 1.6A ? Assume that motor is started from cold at 20°C and $\alpha_{20} = 0.0043 / ^{\circ} C$. **6**

B) Explain lead acid battery with respect to construction and maintenance. **6**

C) Explain following terms with respect to electrical. **4**

i) Energy ii) Power

OR

Q2. A) How long it takes to raise the temperature of 880 grm of water from 16°C to boiling point ? The heater takes 2A at 220V supply and has an efficiency of 90%. Assume the specific heat of water to be 4190 J/kgK and 1 liter of water to have a mass of 1 kg. **6**

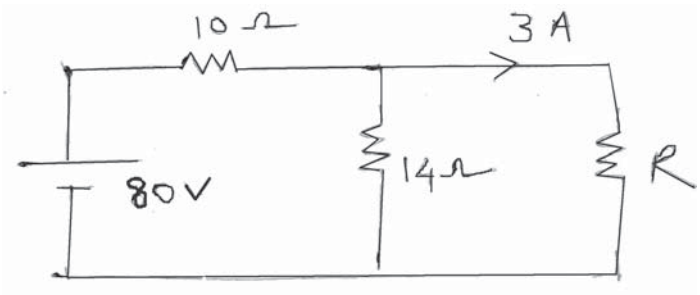
B) Derive expression for insulation resistance of a single core cable. **6**

C) Define temperature coefficient of resistance and state its unit. **4**

Q3. A) State and explain following laws. (i) KVL (ii) maximum power transfer theorem. **6**

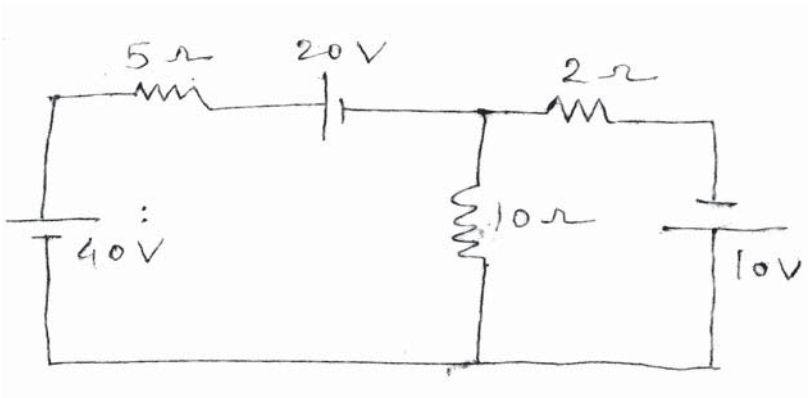
B) Derive an expression to convert star connected network in to its equivalent delta connected network. **6**

C) Find value of R using KCL and KVL. **4**



OR

Q4. A) Find current in 2-ohm resistance by using superposition theorem. **6**



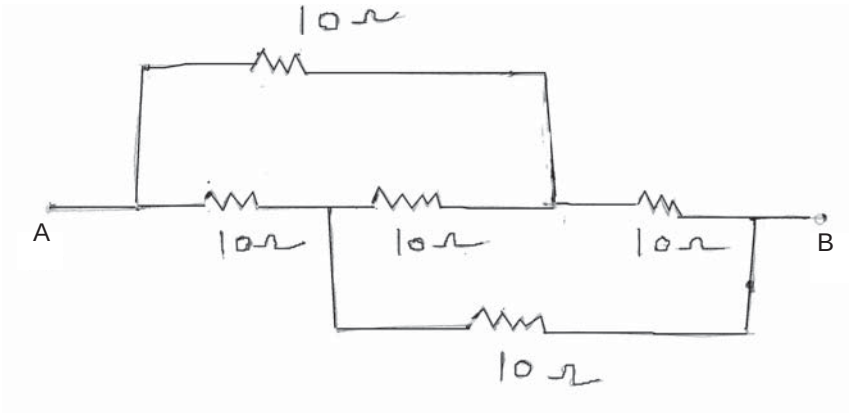
B) Explain following terms. **6**

i) Linear and non linear networks.

ii) Active and passive networks.

iii) Unilateral and bilateral networks.

C) Find equivalent resistance between A and B (All values in ohm). **4**



Q5. A) Define following terms and state its unit. **6**

i) Magnetic flux

ii) Flux density

iii) Permeability of free space.

B) A coil of 450 turns is uniformly wound around a ring of an iron alloy of mean circumference of 100 cm and cross sectional area 1.125 cm^2. When a current of 0.5A is linearly reduced to zero in 0.01 sec, the emf induced in coil is 2V. Find relative permeability of the iron alloy and the inductance of coil. **6**

C) Write any four applications of magnetic circuit and draw series magnetic circuit. **6**

OR

Q6. A) Compare electric and magnetic circuit. **6**

B) A magnetic circuit has the mean length of flux path of 20 cm and cross-sectional area of 1 cm^2. Relative permeability of its material is 2400. Find the mmf required to produce a flux density of 2 tesla in it. If an air gap of 1 mm is introduced in it, find the mmf required for the air gap as a fraction of the total mmf to maintain the same flux density. **6**

C) Derive the equation $L= N^2/S$ where L is self inductance of a coil, N is number of turns of coil and S is reluctance of magnetic circuit. **6**

SECTION – II

Q7. A) Two capacitors are connected in parallel having equivalent capacitance of $10\,\mu F$ while the same capacitors when connected in series have equivalent capacitance of $2\,\mu F$. Find the values of two capacitors. **6**

B) Define w.r.t. alternating quantities **4**

i) Form factor

ii) Crest factor

C) An alternating current is given by i = 14.14 sin 377t find (i) RMS value of current (ii) frequency (iii) Instantaneous value of current when t = 3 m sec (iv) time taken by current to reach 10 Amp for first time after passing through zero and increasing positively. **6**

OR

Q8. A) A $80\,\mu F$ capacitor in series with $1000\,\Omega$ resistor is connected suddenly across 110 V supply. Find

(i) Initial value of current

(ii) time constant of circuit

(iii) equation of current

(iv) value of current at t = 0.08 sec. **6**

B) Derive the expression for average value of an alternating current. **4**

C) Find the resultant of three voltages given by

$v_1 = 10 \sin \omega t$, $v_2 = 20 \sin \left(\omega t - \pi/4\right)$

$v_3 = 30 \cos \left(\omega t + \pi/6\right)$. **6**

Q9. A) A resistance of $25\,\Omega$, inductance of 64mH and capacitor of $80\,\mu F$ are connected in series across 110 V 50 Hz single phase a.c. supply. Calculate the current, voltage across individual element and overall power factor of the circuit. Draw neat phasor diagram taking current as reference axis and show all the voltage vectors. **10**

B) Define (i) admittance (ii) conductance (iii) susceptance of A.C. circuit. Express admittance in rectangular and polar form. Draw admittance triangle. State unit of admittance. **8**

OR

Q10. A) Two circuits A and B are connected in parallel across the supply of 230 V. The circuit A consists of resistance of 12Ω in series with inductive reactance of 5Ω. The circuit B consists of resistance of 8Ω in series with capacitive reactance of 4Ω calculate :

i) Total current drawn

ii) Power consumed by A

iii) Power consumed by B

iv) Total power consumed

v) Overall power factor of the circuit. **10**

B) Sketch the waveform of voltage, current and power if $v = V_m \sin \omega t$ volts is applied to a R-L series circuit. Also draw phasor diagram. State expression of power in this case. **8**

Q11. A) A 500 KVA transformer has iron losses of 2 kw and full load copper losses of 5 kw. Calculate **6**

1) Efficiency at 75% of full load, unity p.f.

2) Efficiency at full load 0.8 p.f. lag.

B) Differentiate core type and shell type transformer. **4**

C) Derive the relationship between the line current and phase current, line voltage and phase voltage for a balanced 3 phase star connected inductive load connected across 3 phase supply. **6**

OR

Q12. A) State and explain different losses taking place in the transformer. **6**

B) Derive the expression for emf induced in the transformer. **4**

C) Three inductive coils each with resistance of 15 Ω and inductance of 0.03H are connected in delta across 3 phase 400 V 50 Hz supply. Calculate line current and power consumed by the load. **6**

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[4161] – 105

Seat No.	

F.E. (Semester – I) Examination, 2012
BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks :100

Instructions : *1) Attempt Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** from Section – **I** and Q. **7** or Q. **8**, Q. **9** or Q. **10**, Q. **11** or Q. **12** from Section **II**.*
*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) Describe the role of Civil Engineer in the activities required for the construction of a big factory building. **6**

   b) How the study of Environmental Engineering helps in day to day life. **6**

   c) Briefly explain any two application of following :
      i) Geotechnical Engineering
      ii) Surveying. **4**

OR

2. a) Explain the need of infrastructure development with example. Also state activities in such development. **6**

   b) Bring out the difference between Roadways and Railways with respect to various points. **6**

   c) Define the term 'GAUGE'. Draw neat sketch to show it properly. Also, state its various types with their dimensions. **4**

P.T.O.

3. a) How do you differentiate between shallow and deep foundation ? Also state important functions of foundation. **6**

   b) Compare natural sand with artificial sand. Also mention role of cement in construction. **6**

   c) Explain the importance of recycling of materials. **4**

OR

4. a) What is superstructure ? State various loads considered for design of foundation. Also mention functions of plinth. **6**

   b) What is Masonary ? State various fundamental requirements of masonary. **6**

   c) Enlist various construction materials and state their functions in construction. **4**

5. a) Compare the following : **8**
      i) Simple levelling and differential levelling.
      ii) Height of collimation and Rise and fall method.
      iii) GPS and GIS.
      iv) Map and plan.

   b) Define level line and contour line. **2**

   c) Readings taken successively on staff position in a levelling work are 2.065, 1.470, 1.250, 3.195, 2.455. Level was shifted after second reading. If R.L. of first position of staff is 250.00 M, find R.L of other staff positions. Use rise and fall method. Show arithmetical check and sample calculations. **8**

OR

6. a) What are the points to be remembered while entering records in a level book ? **4**

   b) Define surveying. Explain any one principle of surveying. **4**

   c) Write short note on digital planimeter. **6**

   d) State the advantages of Electronic Distance measurement over the conventional measurement methods. **4**

SECTION – II

7. a) What is nitrogen cycle ? Explain with neat sketch. **4**

   b) How solid waste of a town is collected ? Explain composting method of solid waste disposal. **6**

   c) Discuss in brief biotic and abiotic components of ecosystem. **4**

   d) What is EIA ? What is need of it ? **2**

OR

8. a) Explain with a neat sketch carbon cycle. **4**

   b) Discuss in detail various ill effects of technological advancements on Nature. **4**

   c) Enlist various natural resources. Also mention need of conversing natural resources. **4**

   d) Write note on E-waste and its management to avoid pollution. **4**

9. a) Explain following principles of building planning with neat sketches. **6**
      i) Grouping ii) Privacy

   b) Define F.S.I and state its necessity. Also find out how much area can be constructed on 2^{nd} floor when a plot is having dimensions 30 m $\times$ 40 m. A building constructed on it occupies 400 m^2 on ground and 350 m^2 on first floor. Permissible F.S.I is 0.80. **6**

   c) With the help of sketches state the necessity of set back distance and side margins for a building. **4**

OR

10. a) Write a brief note on the following principles of planning. **6**
      i) Aspect ii) Prospect

   b) Explain with examples, how grouping, privacy and circulation are interrelated and are therefore to be achieved by proper planning. Draw sketches if necessary. **6**

   c) Write a note on ‘necessity of building by laws’. **4**

11. a) Differentiate between Conventional and Non-conventional energy sources with reference to various points. **6**

    b) State the sources of noise pollution. Mention various effects of noise pollution. Also state the methods of controlling the noise pollution. **6**

    c) Define air pollution. Describe in brief various measures adopted for controlling air pollution. **6**

OR

12. a) Explain in detail the effects of Industrialisation and urbanization on Environment. **6**

    b) Comment on "Need for harnessing alternative energies to meet the increased demand". **6**

    c) Write note on : **6**

    i) Green House Effect

    ii) Land Pollution.

[4161] – 106

Seat No.	

F.E. (Semester – I) Examination, 2012
ENGINEERING GRAPHICS
(2008 Pattern)

Time : 4 Hours Max. Marks : 100

***Instructions** : 1) Answer **one** question from **each** Unit. Answer **three** questions from Section **I** and **three** questions from Section – **II**.*

*2) Answers to the **two** Sections should be drawn on **separate** drawing sheet.*

*3) **Use** only **half** imperial size drawing papers as answer sheets.*

*4) Assume suitable data **if** necessary and retain **all** construction lines.*

SECTION – I

Unit – II

Engineering Curves

1. A) Draw the Archimedean spiral of 1½ convolutions with the greatest radius of 120 mm and smallest radius of 30 mm. Draw the tangent and normal to the curve at a point 80 mm from the pole. **8**

   B) The focii of an ellipse are 110 mm apart and the minor axis is 90 mm long. Draw an ellipse and determine length of major axis. **7**

OR

2. A) Construct a parabola with base 90 mm and axis 80 mm by tangent method. **7**

   B) A circle of 40 mm diameter rolls over the outside surface of another circle of 120 mm diameter. Draw the curve traced by the initial point of contact for one complete rotation of the smaller circle. **8**

Unit – III

Opthographic Projections

3. Using first angle method, draw following views for the object shown in Fig. 1

   a) Sectional Elevation from the direction of arrow 'X' (Section A – A). **6**

   b) Plan. **6**

   c) LHSV. **6**

   d) Give all dimensions. **2**

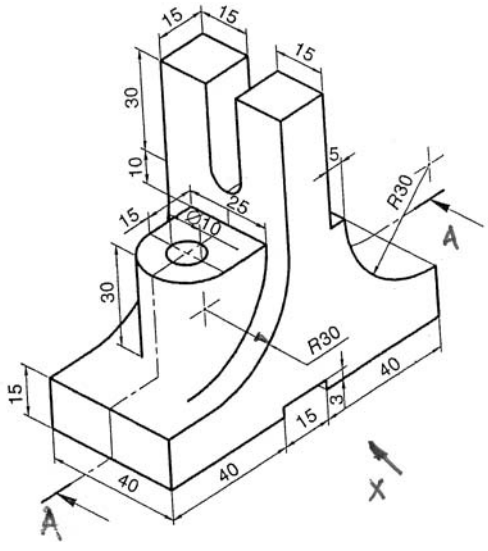

Fig. 1

OR

4. Using first angle method of projection, draw following views for the object shown in Fig. 2

   a) Sectional Elevation from the direction of 'X' (Section A – A). **6**

   b) Plan. **6**

   c) LHSV. **6**

   d) Give all dimensions. **2**

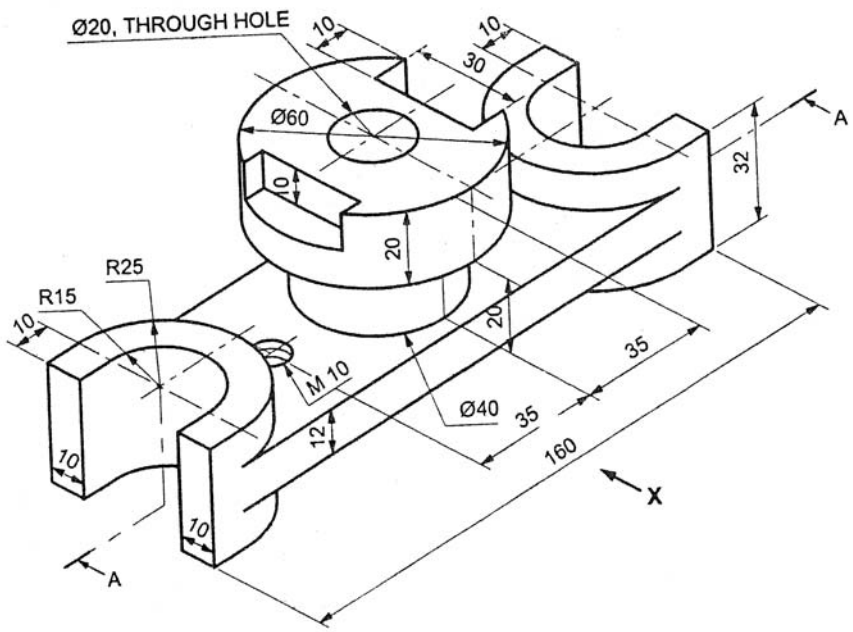

Fig. 2

Unit – IV

Auxiliary Projections

5. Fig. 3 shows FV and RHSV of a block. Draw the following :
   a) Redraw the given views. **5**
   b) Draw an auxiliary view in the direction of 'M'. **8**
   c) Give all dimensions. **2**

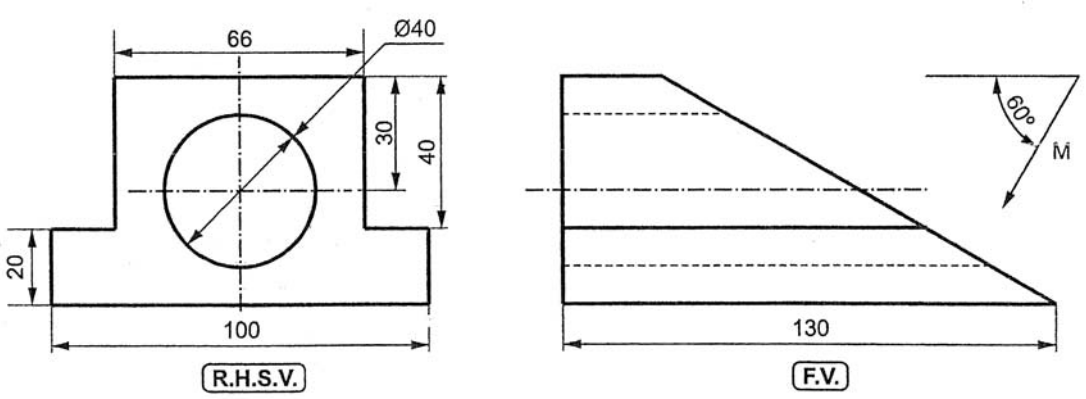

Fig. 3

OR

6. Fig. 4 shows incomplete elevation and auxiliary views. Draw the following :

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

b) Elevation. **8**

c) Give all dimensions. **2**

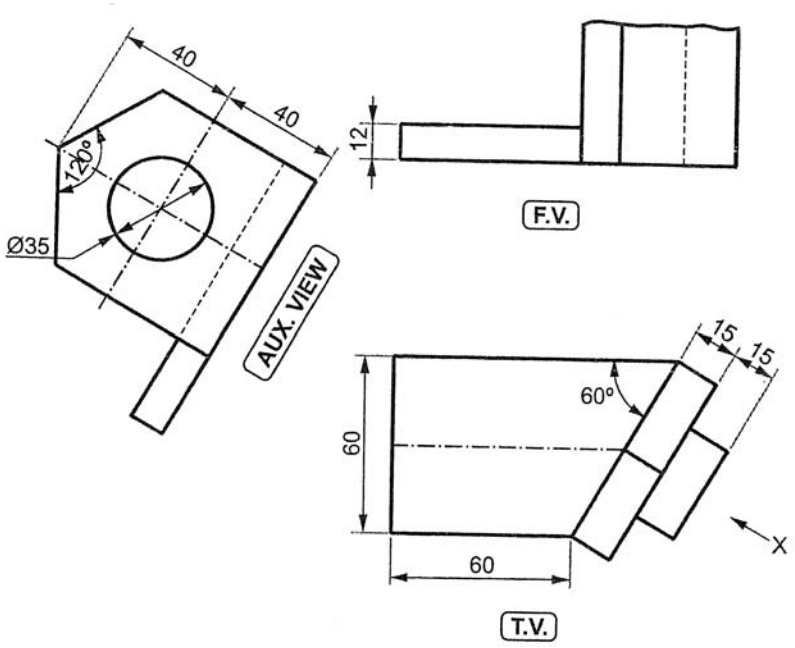

Fig. 4

SECTION – II

Unit – V

Isometric

7. The Figure 5 shows elevation and end view of a machine part. Draw its isometric view by using natural scale and show overall dimensions. **20**

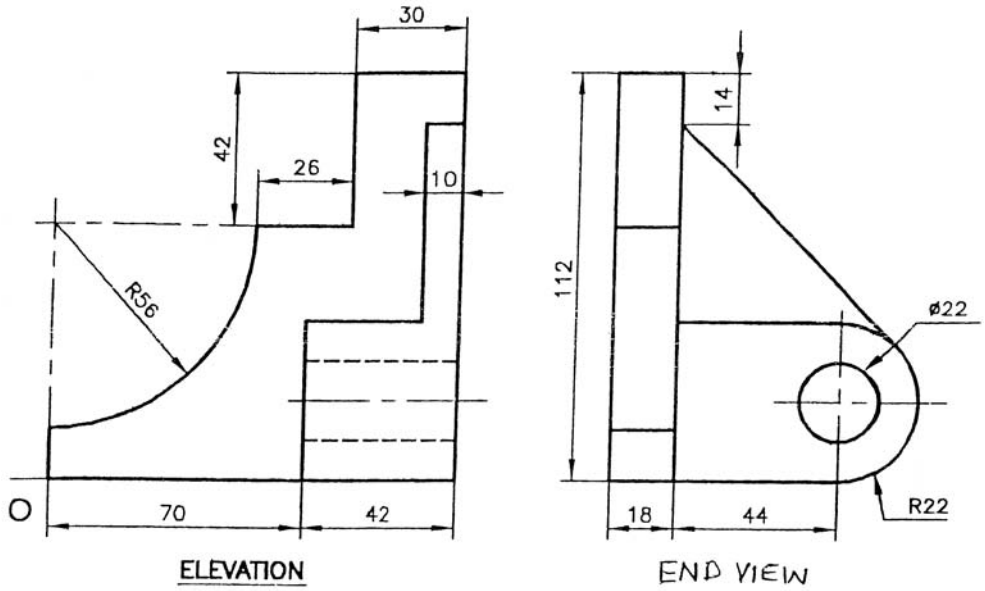

Fig. 5

OR

8. The Figure 6 shows front view and left hand side view of a machine part. Draw its isometric projections by using isometric scale. **20**

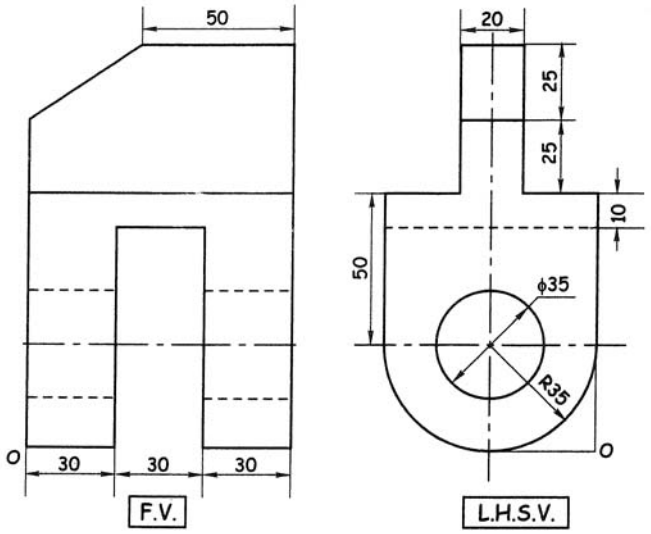

Fig. 6

Unit – VI

Missing Views

9. The Figure 7 shows elevation and plan of a machine part. Draw

a) Sectional Front View, along section A – A. **7**

b) Top View. **3**

c) Left Side View. **7**

d) Dimensioning. **3**

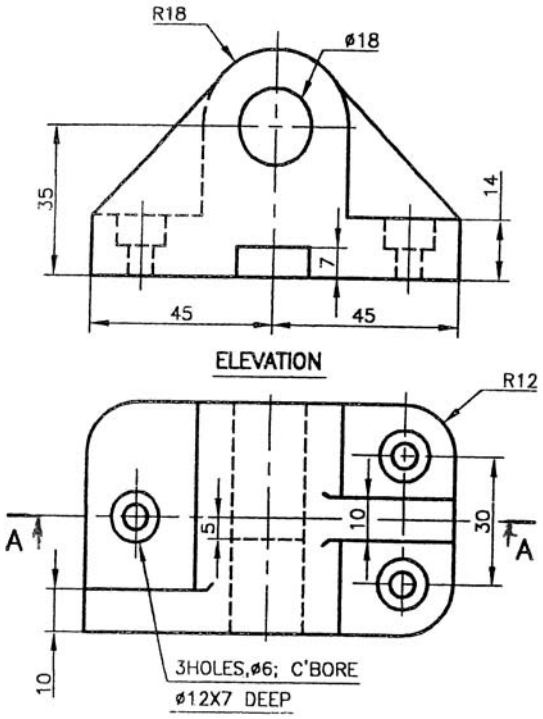

Fig. 7

OR

10. The Figure 8 shows front view and left side view of a machine part. Draw
    a) Sectional Front View, along section A – A. **7**
    b) Top View. **7**
    c) Left Side View. **3**
    d) Dimensioning. **3**

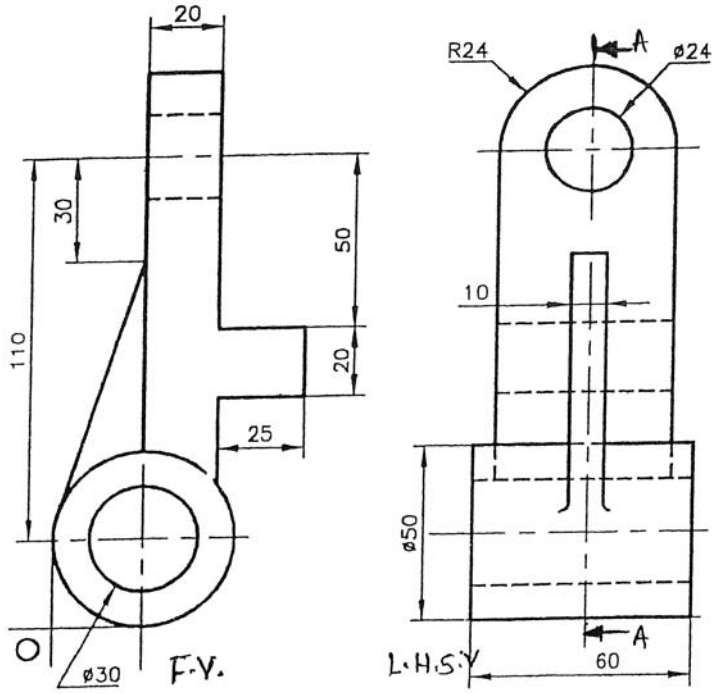

Fig. 8

Unit – VII

Free Hand Sketches

11. Draw proportionate freehand sketches of the following :
    a) Splined shaft. **3**
    b) Square thread. **3**
    c) Rag Foundation bolt. **4**

OR

12. Draw proportionate freehand sketches of the following :
    a) Hexagonal Headed Nut. **3**
    b) Gib-headed Key assembled in shaft and hub. **3**
    c) Flanged coupling. **4**

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[4161] – 106

Seat No.	

F.E. (Semester – I) Examination, 2012
ENGINEERING GRAPHICS
(2008 Pattern)

Time : 4 Hours Max. Marks : 100

***Instructions** : 1) Answer **one** question from **each** Unit. Answer **three** questions from Section **I** and **three** questions from Section – **II**.*

*2) Answers to the **two** Sections should be drawn on **separate** drawing sheet.*

*3) **Use** only **half** imperial size drawing papers as answer sheets.*

*4) Assume suitable data **if** necessary and retain **all** construction lines.*

SECTION – I

Unit – II

Engineering Curves

1. A) Draw the Archimedean spiral of 1½ convolutions with the greatest radius of 120 mm and smallest radius of 30 mm. Draw the tangent and normal to the curve at a point 80 mm from the pole. **8**

   B) The focii of an ellipse are 110 mm apart and the minor axis is 90 mm long. Draw an ellipse and determine length of major axis. **7**

OR

2. A) Construct a parabola with base 90 mm and axis 80 mm by tangent method. **7**

   B) A circle of 40 mm diameter rolls over the outside surface of another circle of 120 mm diameter. Draw the curve traced by the initial point of contact for one complete rotation of the smaller circle. **8**

Unit – III

Opthographic Projections

3. Using first angle method, draw following views for the object shown in Fig. 1

   a) Sectional Elevation from the direction of arrow 'X' (Section A – A). **6**

   b) Plan. **6**

   c) LHSV. **6**

   d) Give all dimensions. **2**

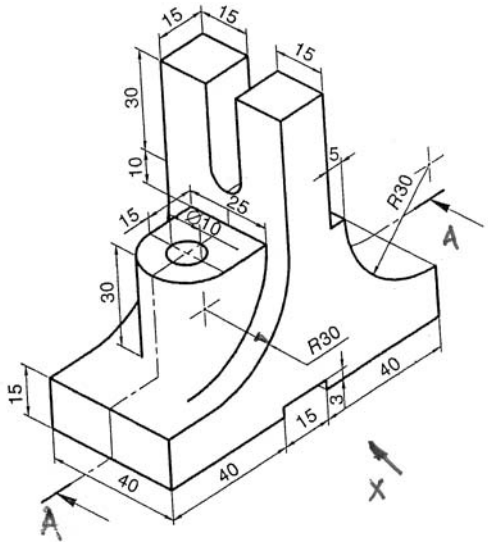

Fig. 1

OR

4. Using first angle method of projection, draw following views for the object shown in Fig. 2

   a) Sectional Elevation from the direction of 'X' (Section A – A). **6**

   b) Plan. **6**

   c) LHSV. **6**

   d) Give all dimensions. **2**

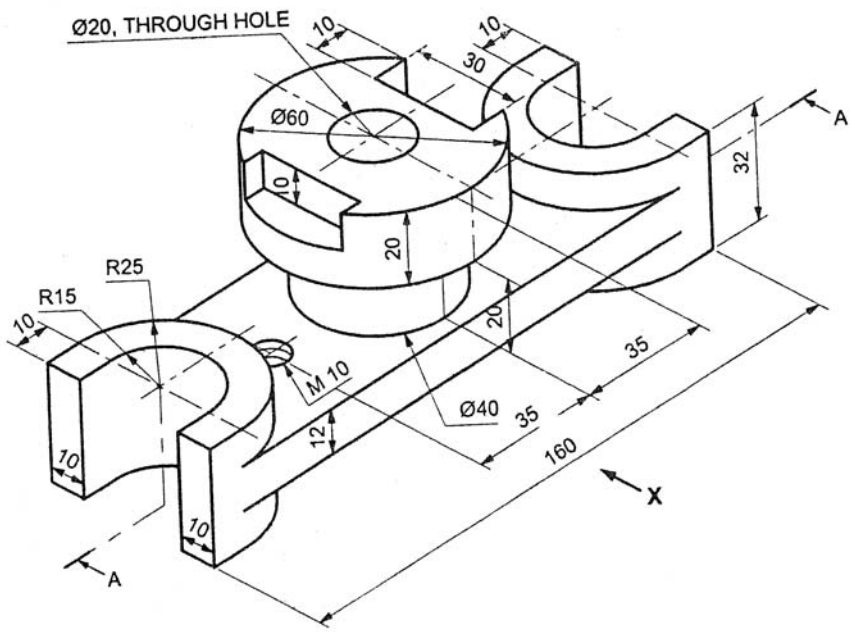

Fig. 2

Unit – IV

Auxiliary Projections

5. Fig. 3 shows FV and RHSV of a block. Draw the following :
   a) Redraw the given views. **5**
   b) Draw an auxiliary view in the direction of 'M'. **8**
   c) Give all dimensions. **2**

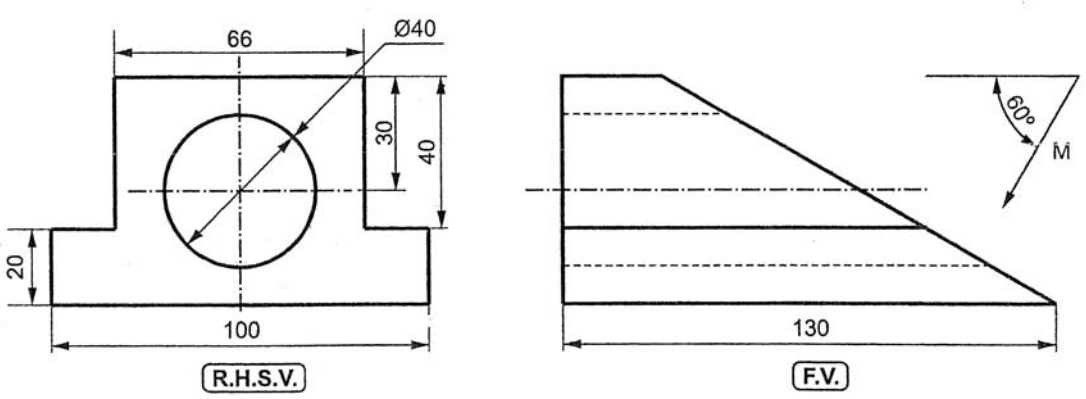

Fig. 3

OR

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

b) Elevation. **8**

c) Give all dimensions. **2**

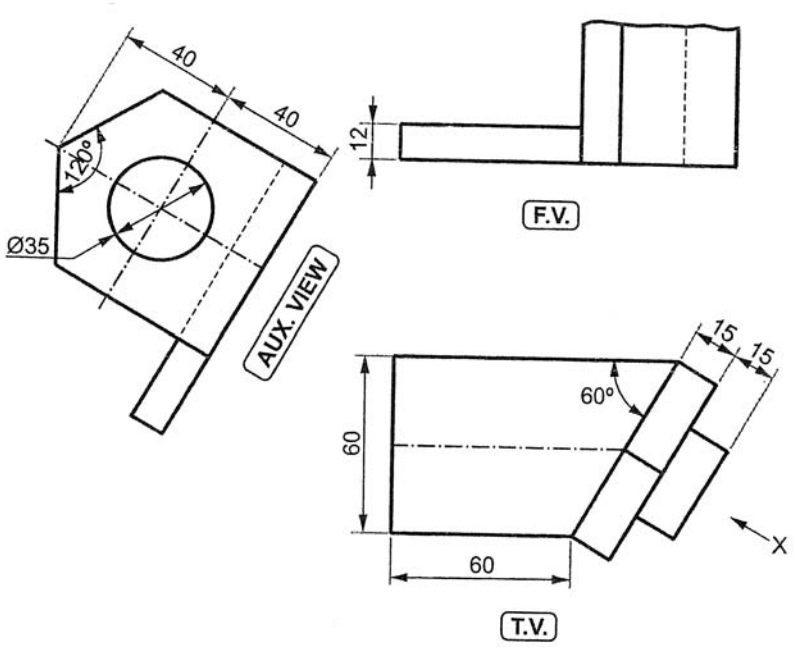

Fig. 4

SECTION – II

Unit – V

Isometric

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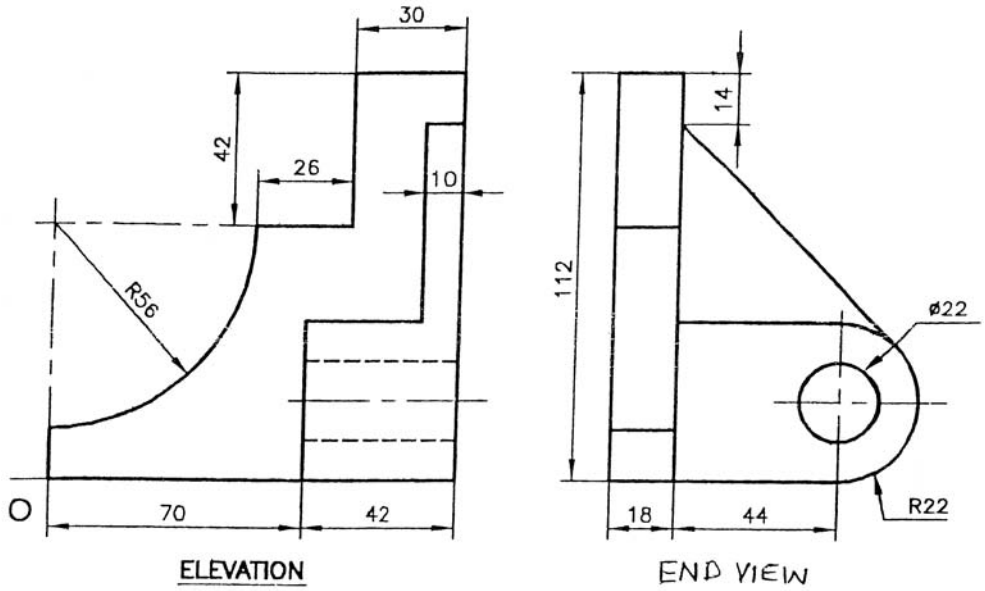

Fig. 5

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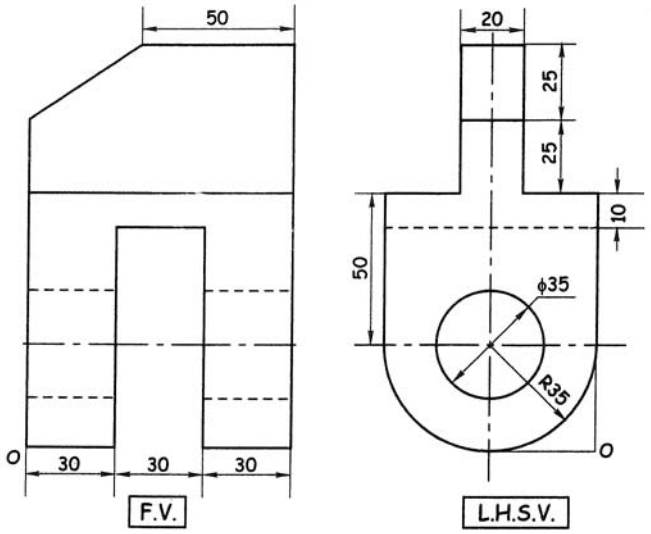

Fig. 6

Unit – VI

Missing Views

9. The Figure 7 shows elevation and plan of a machine part. Draw

a) Sectional Front View, along section A – A. **7**

b) Top View. **3**

c) Left Side View. **7**

d) Dimensioning. **3**

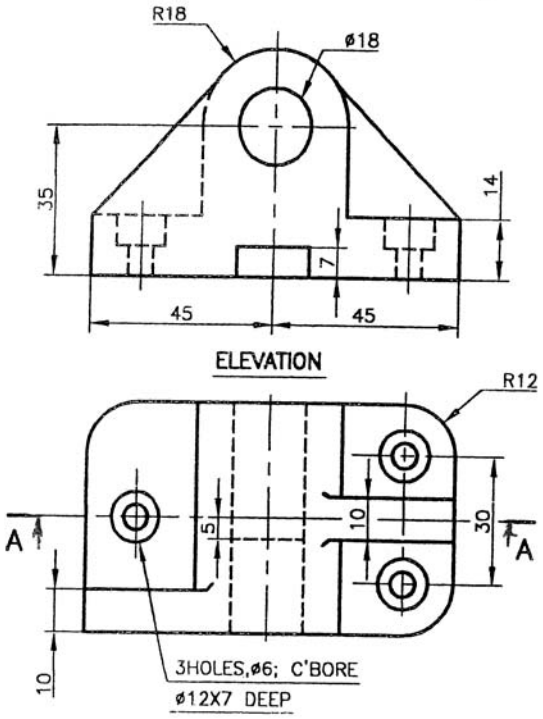

Fig. 7

OR

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    b) Top View. **7**
    c) Left Side View. **3**
    d) Dimensioning. **3**

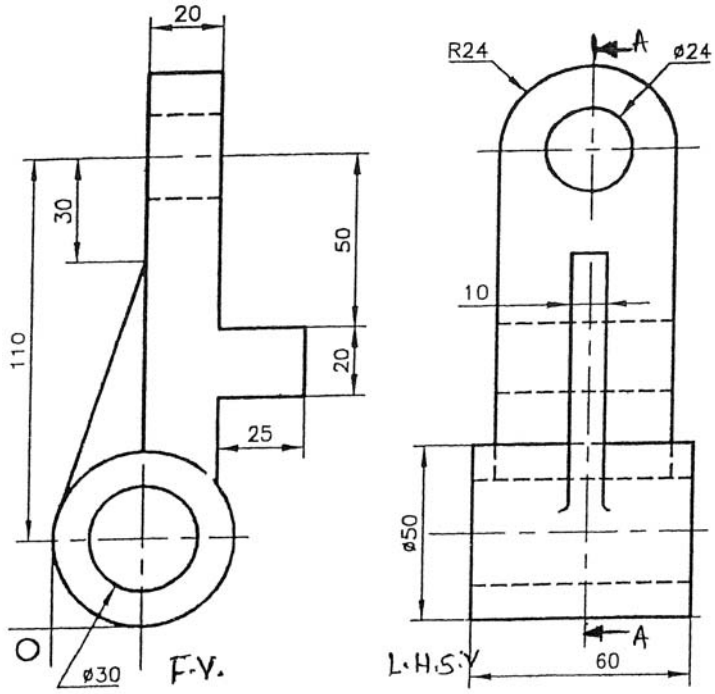

Fig. 8

Unit – VII

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    b) Gib-headed Key assembled in shaft and hub. **3**
    c) Flanged coupling. **4**

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[4161] – 108

Seat No.	

F.E. (Semester – II) Examination, 2012
APPLIED SCIENCE – II (Chemistry)
(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.*

1. a) Draw neat labelled diagram and give the construction, working of Bomb calorimeter to determine G.V.C. of a fuel. State the formula with corrections to calculate GVC. **7**

   b) What is the composition of natural gas ? Give its properties and uses. How is hydrogen gas produced by steam reforming process ? Give reactions involved . **7**

   c) A gas has following composition by volume.
   H_2 = 20%, CH_4 = 6%, CO = 22%, CO_2 = 4%, O_2 = 4%, N_2 = 44%.
   Find the volume of air if 5% excess is supplied per m^3 of this gas. **4**

   OR

2. a) What are rocket propellants ? Explain the working of rocket propellant. Give its types with example of each. **7**

   b) What do you understand by knocking of IC engine ? Define octane number and explain the effect of chemical structure of fuel on knocking characteristics of petrol. **7**

   c) 0.5 gm of a coal sample on burning in a combustion chamber in the current of pure oxygen was found to increase weight of 'U' tube with anhydrous $CaCl_2$ by 0.145 gm and of KOH 'U' tube by 0.90 gm. Find 'C' and 'H' percentage in coal. **4**

P.T.O.

3. a) Explain hydrogen evolution mechanism and oxygen absorption mechanism of wet corrosion. **6**

   b) Describe cathodic protection method to prevent corrosion. **6**

   c) When coating is ruptured, iron is protected in galvanized sheet but not in tin coated sheet ? Explain why ? **4**

OR

4. a) Define corrosion and explain dry corrosion due to oxygen. Explain with examples how nature of oxide film affects corrosion. **6**

   b) Discuss the factors affecting the rate of corrosion based on nature of metal. **6**

   c) What is blacodizing ? Give its advantages and applications. **4**

5. a) Explain causes, disadvantages and prevention of **6**
      i) Priming and foaming in boilers.
      ii) Caustic embrittlement in boilers.

   b) State Gibb's phase rule ? Define the terms involved in it. Explain with example. **6**

   c) 50 ml of an alkaline water sample requires 5.2 ml of $N/50$ HCl up to phenolphthalein end point and 15.4 ml for complete neutralisation. Find the type and amount of alkalinity in the water sample. **4**

OR

6. a) Draw phase diagram for water system and explain with respect to areas, curves and triple point. **6**

   b) Explain EDTA method of determining total hardness of water sample. Draw metal EDTA complex and give chemical reactions involved. **6**

   c) A zeolite bed exhausted by softening 4000 liters of water requires 10 liters of 15% NaCl solution for regeneration. Calculate the hardness of water sample. **4**

[4161] – 108

Seat No.	

F.E. (Semester – II) Examination, 2012
APPLIED SCIENCE – II (Chemistry)
(2008 Pattern)

Time : 2 Hours Max. Marks : 50

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

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   b) What is the composition of natural gas ? Give its properties and uses. How is hydrogen gas produced by steam reforming process ? Give reactions involved . **7**

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   H_2 = 20%, CH_4 = 6%, CO = 22%, CO_2 = 4%, O_2 = 4%, N_2 = 44%.
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   c) 0.5 gm of a coal sample on burning in a combustion chamber in the current of pure oxygen was found to increase weight of 'U' tube with anhydrous $CaCl_2$ by 0.145 gm and of KOH 'U' tube by 0.90 gm. Find 'C' and 'H' percentage in coal. **4**

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[4161] – 110

Seat No.	

F.E. (Semester – II) Examination, 2012
ENGINEERING MECHANICS
(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** diagrams must be drawn **wherever** necessary.*
*4) Figures to the **right** indicate **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) Resolve the 60 N force in to components acting along the u and ν axes and determine the magnitudes of the components. Refer Fig. 1 a. **6**

   b) If block A of the pulley system is moving downward with a speed 1 m/s while block C is moving up at 0.5 m/s, determine the speed of block B. Also determine the relative velocity of A with respect to C. Refer Fig. 1 b. **6**

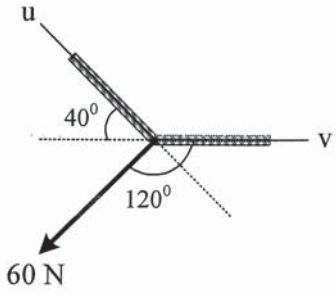

Fig. 1 a

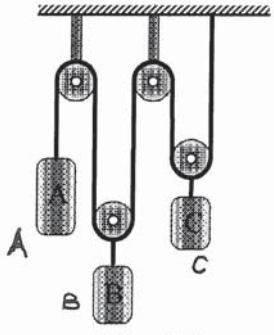

Fig. 1 b

OR

2. a) Determine the distance y to the centroid of the trapezoidal area in terms of the dimensions shown in Fig. 2 a. **6**

   b) The 400 Kg mine car is hoisted up the incline using the cable and motor M. For a short time, the force in the cable is F = (3200 t^2) N, where t is in seconds. If the car has an initial velocity $v_0 = 2$ m/s when t = 0, determine the distance it moves up the plane when t = 2 s. Ref. Fig. 2 b. **6**

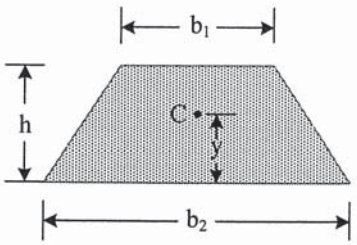

Fig. 2 a

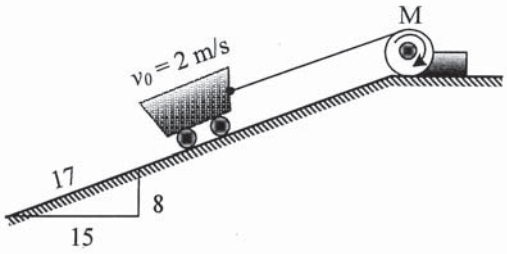

Fig. 2 b

3. a) The 500 N crate is hoisted using the ropes AB and AC. Each rope can withstand a maximum tension of 2500 N before it breaks. If AB always remains horizontal, determine the smallest angle θ to which the crate can be hoisted. Refer Fig. 3 a. **6**

   b) Three parallel bolting forces act on the rim of the circular cover plate of radius r = 0.8 m as shown in Fig. 3 b. Determine the magnitude and direction of a resultant force equivalent to the given force system and locate its point of application on the cover plate. **7**

   c) A rocket follows a path such that its acceleration is defined by **a = (4i + tj)** m/s^2. If it starts from rest at **r = 0**, determine the speed of the rocket and the radius of curvature of its path when t = 10 s. **6**

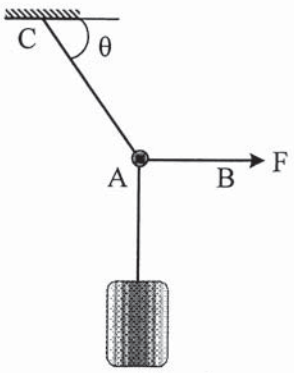

Fig. 3 a

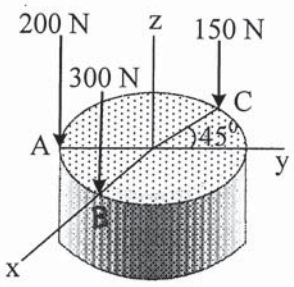

Fig. 3 b

OR

4. a) Determine the reaction at A and B for the member ACB loaded and supported as shown in Fig. 4 a when $\alpha = 30°$. **6**

   b) Determine the force developed in cable AB, AC and AD used to support the 40 N crate as shown in Fig. 4 b. **7**

   c) The bottle rests at a distance of 0.9 m from the centre of the circular horizontal platform. If the coefficient of static friction between the bottle and the platform is $\mu_s = 0.3$, determine the maximum speed that the bottle can attain before slipping. **6**

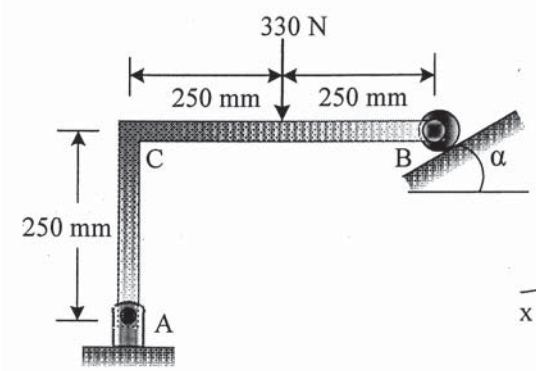

Fig. 4 a

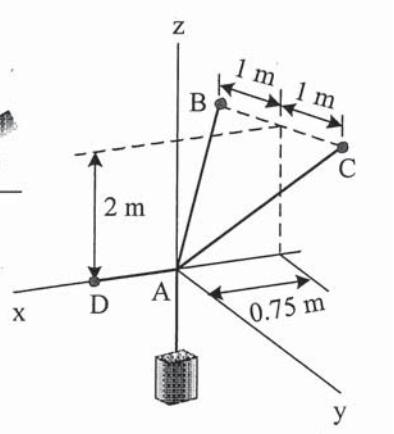

Fig. 4 b

5. a) Determine the force in each member of the truss and state if the members are in tension or compresion. Refer Fig. 5 a. Assume L = 2 m and P = 10 kN. **7**

   b) Determine whether the 10 kg block shown in Fig. 5 b is in equilibrium, and find the magnitude and direction of the friction force when P = 40 N and $\theta = 20°$. **6**

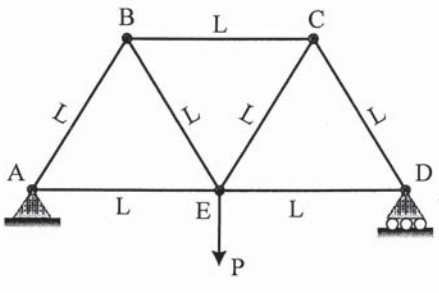

Fig. 5 a

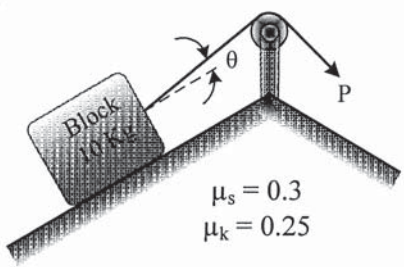

Fig. 5 b

c) A 2 kg stone is dropped from a height h and strikes the ground with a velocity of 24 m/s. Using work energy principle find the kinetic energy of the stone as it strikes the ground and the height h from which it was dropped. **6**

OR

6. a) Determine the horizontal and vertical components of reaction at pin B and C for the frame shown in Fig. 6 a. **7**

b) Determine the maximum tension in the rope at points A and B that is necessary to maintain equilibrium. Take $\mu_s = 0.3$ between the rope and the fixed post D. Refer Fig. 6 b. **6**

c) A truck is traveling on a level road at a speed of 90 km/h when its brakes are applied to slow it down to 30 km/h. An antiskid breaking system limit the breaking force to a value at which the wheels of the truck are just about to slide. The coefficient of kinetic friction between the road and the wheels is $\mu_k = 0.65$, Using impulse momentum principle determine the shortest time needed for the truck to slow down. **6**

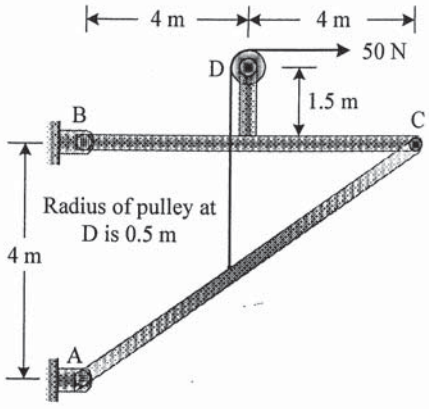

Fig. 6 a

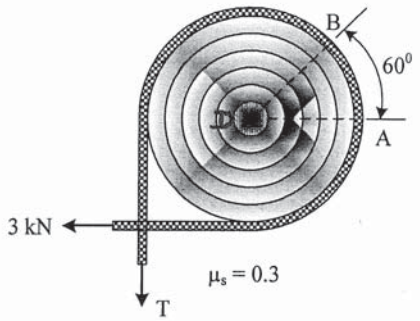

Fig. 6 b

[4161] – 111

Seat No.	

F.E. (Semester – II) Examination, 2012
BASIC MECHANICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions *:* 1) *Answer* ***any one*** *question from* ***each*** *Unit.*
2) *Answer to the* ***two*** *Sections should be written in* ***separate*** *answer books.*
3) *Black figures to the* ***right*** *indicate full marks*
4) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
5) ***Use*** *of electronic pocket calculator is* ***allowed****.*
6) *Assume suitable data, if necessary.*

SECTION – I

UNIT – I

1. A) What do you understand by Reversible and Irreversible process ? State the causes which make any process Irreversible . **6**

B) Define and write equations for the following :
i) Adiabatic Index
ii) Enthalpy. **4**

C) A system contains 0.15 m^3 of air at 5 bar and 350° K. A reversible adiabatic expansion takes place till the pressure falls to 1 bar . The gas is then heated at constant pressure till enthalpy increases by 70 KJ. Calculate
i) Work done in individual process.
ii) Index of expansion if the above processes are replaced by a single reversible polytropic process giving the same initial and final states.

Take for air, C_P = 1.005 KJ/kgK, Cv = 0.718 kJ/kgk,

R = 0.287 kJ/kgk. **6**

OR

2. A) State and explain Second Law of Thermodynamics. **6**

   B) Define the following :
      i) Heat Engine
      ii) Heat Pump. **4**

   C) A 'Closed vessel' contains 2 kg of carbondioxide at temperature 20°C and pressure 0.7 bar. Heat is supplied to the vessel till the gas acquires a pressure of 1.4 bar. Calculate
      i) Final temperature
      ii) Work done on or by gas
      iii) Heat added
      iv) Change in internal energy.

      Assume, Cv = 0.657 kJ/kg. K. **6**

UNIT – II

3. A) Give classification of I.C. Engine with applications. **6**

   B) Explain with neat sketch working of Window Air Conditioning System. How does split Air conditioner differ from Window Air conditioner ? **10**

OR

4. A) How Boilers are classified ? State any four mounting and their functions. **6**

   B) Describe with a block diagram and state the applications of the following : **10**
      i) Double Acting Reciprocating Pump
      ii) Reciprocating Air compressor.

UNIT – III

5. A) Explain concept of series and parallel thermal resistances in composite slab. **5**

   B) Derive an expression for heat conduction through an infinitely long hollow cylinder. **5**

   C) Compare Thermal and Nuclear Power plants on any four parameters. Draw sketch of Nuclear power plant. **8**

OR

6. A) Explain concept of Thermal Resistance with Electrical analogy for two slabs. **5**

   B) Explain working of 'Solar-Wind Hybrid Power Plant' with sketch. **5**

   C) A steam pipeline having internal diameter 150 mm and external diameter 160 mm, is carried with an insulating material of thickness 100 mm having a thermal conductivity of 0.08 W/m-°K. The temperature of outside surface of the insulating material is 50°C and that of inside surface of the pipeline is 400°C. If the thermal conductivity of the pipe material is 50 W/m-°K, then find the loss of heat per meter length of the pipe and the temperature at the interface of the tube and insulation ? **8**

SECTION – II

UNIT – IV

7. A) Define 'Machine' and 'Machine element'. How machine elements are classified ? Difference between 'Line shaft' and 'Counter shaft' with diagram. **(2+2+4=8)**

   B) How the couplings are classified and write short notes on 'Oldham's coupling' and 'Universal coupling' ? **(2+3+3=8)**

OR

8. A) What is a flywheel ? State its functions. What are types of flywheel and their applications ? **(4+4=8)**

   B) Define 'Gear Ratio' and explain with neat sketches ' Herringbone gears' and 'Worm and worm wheel'. **(2+3+3=8)**

UNIT – V

9. A) Explain Resistance welding. What are advantages, limitations and applications of resistance welding ? Explain types of resistance welding in brief. **(3+3+3=9)**

   B) Explain the various design consideration in machine design. Explain aesthetic and ergonomic consideration in product design. **(3+3+3=9)**

OR

10. A) Explain stress strain diagram for mild steel with neat sketch. Show its salient features.
Explain factor of safety and parameters affecting selection of factor of safety. **(3+3+3=9)**

B) Explain the following sheet metal processes :
i) Punching
ii) Perforating
iii) Lancing
iv) Blanking
Explain the curling and wire drawing process. **(4+3+2=9)**

UNIT – VI

11. A) Explain following operations carried out on Lathe machine with neat sketches,
i) Eccentric turning
ii) Taper Turning
iii) Knurling
iv) Thread cutting. **(2+2+2+2=8)**

B) Draw a neat sketch of 'column and knee type milling machine'. Explain its basic elements and their working. **(3+5=8)**

OR

12. A) What is CNC machine tool ? Explain the working of CNC machine tool with neat block diagram. What are the advantages and disadvantages of CNC machine tool ? **(4+2+2=8)**

B) Explain the following operations performed on milling machine with neat sketches :
i) Up milling
ii) Down milling
iii) Gang milling
iv) Profile milling. **(2+2+2+2=8)**

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[4161] – 111

Seat No.	

F.E. (Semester – II) Examination, 2012
BASIC MECHANICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours Max. Marks : 100

Instructions *:* 1) *Answer* ***any one*** *question from* ***each*** *Unit.*
2) *Answer to the* ***two*** *Sections should be written in* ***separate*** *answer books.*
3) *Black figures to the* ***right*** *indicate full marks*
4) ***Neat*** *diagrams must be drawn* ***wherever*** *necessary.*
5) ***Use*** *of electronic pocket calculator is* ***allowed****.*
6) *Assume suitable data, if necessary.*

SECTION – I

UNIT – I

1. A) What do you understand by Reversible and Irreversible process ? State the causes which make any process Irreversible . **6**

B) Define and write equations for the following :
i) Adiabatic Index
ii) Enthalpy. **4**

C) A system contains 0.15 m^3 of air at 5 bar and 350° K. A reversible adiabatic expansion takes place till the pressure falls to 1 bar . The gas is then heated at constant pressure till enthalpy increases by 70 KJ. Calculate
i) Work done in individual process.
ii) Index of expansion if the above processes are replaced by a single reversible polytropic process giving the same initial and final states.

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      i) Final temperature
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UNIT – II

3. A) Give classification of I.C. Engine with applications. **6**

   B) Explain with neat sketch working of Window Air Conditioning System. How does split Air conditioner differ from Window Air conditioner ? **10**

OR

4. A) How Boilers are classified ? State any four mounting and their functions. **6**

   B) Describe with a block diagram and state the applications of the following : **10**
      i) Double Acting Reciprocating Pump
      ii) Reciprocating Air compressor.

UNIT – III

5. A) Explain concept of series and parallel thermal resistances in composite slab. **5**

   B) Derive an expression for heat conduction through an infinitely long hollow cylinder. **5**

   C) Compare Thermal and Nuclear Power plants on any four parameters. Draw sketch of Nuclear power plant. **8**

OR

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   B) Explain working of 'Solar-Wind Hybrid Power Plant' with sketch. **5**

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SECTION – II

UNIT – IV

7. A) Define 'Machine' and 'Machine element'. How machine elements are classified ? Difference between 'Line shaft' and 'Counter shaft' with diagram. **(2+2+4=8)**

   B) How the couplings are classified and write short notes on 'Oldham's coupling' and 'Universal coupling' ? **(2+3+3=8)**

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   B) Define 'Gear Ratio' and explain with neat sketches ' Herringbone gears' and 'Worm and worm wheel'. **(2+3+3=8)**

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OR

10. A) Explain stress strain diagram for mild steel with neat sketch. Show its salient features.
Explain factor of safety and parameters affecting selection of factor of safety. **(3+3+3=9)**

B) Explain the following sheet metal processes :
i) Punching
ii) Perforating
iii) Lancing
iv) Blanking
Explain the curling and wire drawing process. **(4+3+2=9)**

UNIT – VI

11. A) Explain following operations carried out on Lathe machine with neat sketches,
i) Eccentric turning
ii) Taper Turning
iii) Knurling
iv) Thread cutting. **(2+2+2+2=8)**

B) Draw a neat sketch of 'column and knee type milling machine'. Explain its basic elements and their working. **(3+5=8)**

OR

12. A) What is CNC machine tool ? Explain the working of CNC machine tool with neat block diagram. What are the advantages and disadvantages of CNC machine tool ? **(4+2+2=8)**

B) Explain the following operations performed on milling machine with neat sketches :
i) Up milling
ii) Down milling
iii) Gang milling
iv) Profile milling. **(2+2+2+2=8)**

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[4161] – 112 B

Seat No.	

F.E. (Semester – II) Examination, 2012
BASIC ELECTRONICS ENGINEERING
(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) What is Earthy effect, explain in detail. **4**

   B) Determine $IC_{(sat)}$ for the transistor in figure 1. What is the value of I_B necessary to produce saturation ? What is the minimum value of V_{IN} is necessary for saturation ? Assume $V_{CE\ (sat)} = 0V$. **6**

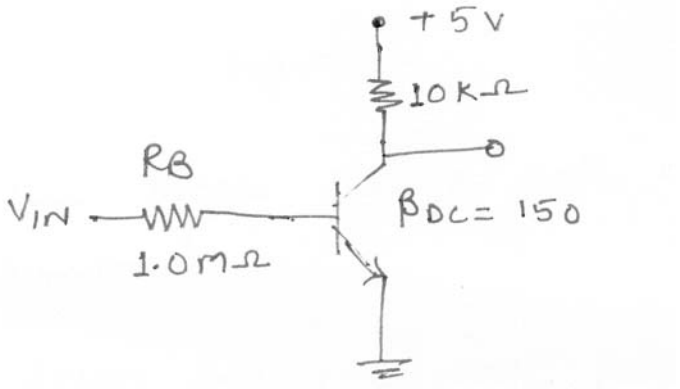

Figure – 1

C) Explain the operation of P channel JFET. How MOSFET can be used as a switch ? **7**

OR

2. A) With the help of neat circuit diagram, explain how you will use the zener diode as a voltage regulator. What is the minimum and maximum limit for the load current ? **6**

B) With the help of neat circuit diagram explain how BJT can be used as an amplifier in CE configuration. Explain the function of each component in the circuit. **6**

C) Explain constructional details and V-I characteristics of SCR. **5**

3. A) Find V_0 for the circuit shown in figure 2. **5**

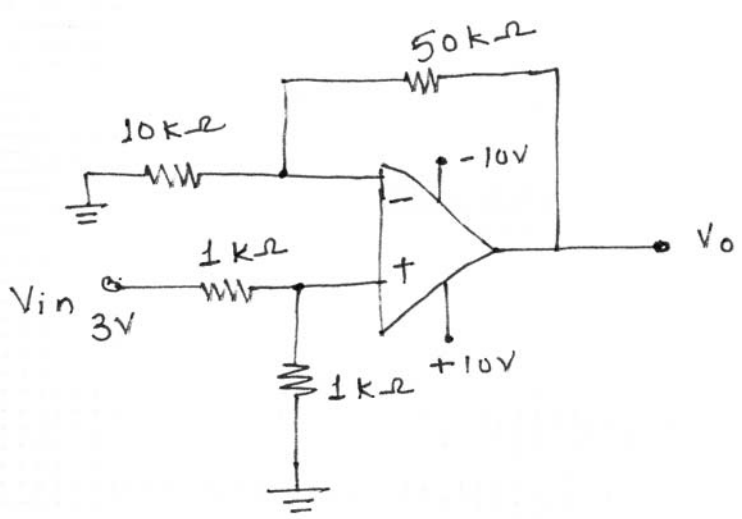

Figure 2

B) How single EX-OR gate can be used as inverter ? **3**

C) Design and implement full adder circuit with minimum number of NAND gates. **9**

OR

4. A) Draw neat circuit diagram of an ideal integrator and explain its operation. Give the drawbacks of this circuit. How they are overcome in practical integrator ? **7**

   B) Draw and explain functional block diagram of operational amplifier. **4**

   C) Write down the truth table for **6**

      i) Three input NAND gate

      ii) Three input NOR gate.

      Realize the above three input gates using two input gates.

5. A) State the principle of operation, material used and two applications of a thermistor and also explain principle of operation of RTD. **8**

   B) Draw the block diagram of communication system and explain each block in detail. **4**

   C) Compare AM and FM. **4**

      OR

6. A) Draw the AM waveforms for **8**

      i) Modulation index = 0

      ii) Modulation index = 1

      iii) Modulation index > 1

      iv) Modulation index < 1.

   B) Draw and explain IEEE electromagnetic spectrum. **4**

   C) Write short note on PLC. **4**

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