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F. E. (Semester - I) Examination - 2010
ENGINEERING MATHEMATICS - I
(2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

Instructions :

(1) *Answers to the **two sections** should be written in **separate answer books**.*

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

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

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

(5) *Use of electronic pocket calculator is allowed.*

SECTION - I

Q.1) (A) Reduce the following matrix A to its normal form and hence find its rank, where   **[05]**

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

(B) Examine the consistency of the system of the following equations. If consistent, solve system of the equations :   **[06]**

$x + y - z + t = 2$

$2x + 3y + 4t = 9$

$y - 2z + 3t = 2$

(C)   Verify Cayley Hamilton Theorem for the matrix   **[07]**

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

OR

Q.2) (A)   Find Eigen Values and corresponding Eigen Vectors for the matrix   **[07]**

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

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

$X_1 = (2, -2, 4), X_2 = (-1, 3, -3), X_3 = (1, 1, 1)$ **[05]**

(C)   Find values of a, b, c so that the matrix

$$A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & c \end{bmatrix}$$

becomes an orthogonal matrix.   **[06]**

Q.3) (A)   If $\dfrac{Z - 1}{Z + i}$ is a purely imaginary number, then show that the locus of Z is a circle.   **[06]**

(B)   Show that the continued product of all values of $\left(1 + i\sqrt{3}\right)^{\frac{1}{4}}$

is $2\left[\cos \dfrac{4\pi}{3} + i \sin \dfrac{4\pi}{3}\right]$ **[05]**

(C) If α, β are roots of an equation,

$\sin^2\theta\ z^2 - (2\sin\theta\cos\theta)\ z + 1 = 0$, prove that

$\alpha^n + \beta^n = 2\cos n\theta\ \cosec^n\theta$, where n is an integer. **[05]**

OR

Q.4) (A) Find tanhx if $5\ \sinh x - \cosh x = 5$ **[05]**

(B) If $u + iv = \sin(x + iy)$,

prove that :

(a) $u^2\cosec^2x - v^2\sec^2x = 1$

(b) $u^2\sech^2x + v^2\cosech^2x = 1$ **[05]**

(C) A square lies above real axis in Argand's diagram and has two of its vertices at origin and the point $3 + 2i$. Find the rest two vertices of the square. **[06]**

Q.5) (A) If $y = \dfrac{x^3}{x^2 - 1}$,

then find n^{th} order differential coefficient of y w.r. to x. **[05]**

(B) If $y = \sin^{-1}[3x - 4x^3]$,

prove that $(1 - x^2)\ y_{n+2} - (2n + 1)\ xy_{n+1} - n^2y_n = 0$. **[05]**

(C) Test convergence of the series : **(Any One)** **[06]**

(a) $1 + \dfrac{1}{2} + \dfrac{1\cdot 3}{2\cdot 4} + \dfrac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6} + \ldots\ldots$

(b) $\displaystyle\sum_{n=1}^{\infty} \dfrac{(n + 1)\ x^n}{n^2}$

OR

Q.6) (A) If $y = (2x + 1) \log (4x + 3)$,

then find y_{20}. **[05]**

(B) If $y = \left[x + \sqrt{x^2 - 1} \right]^m$,

prove that $(x^2 - 1) y_{n+2} + (2n + 1) xy_{n+1} + (n^2 - m^2) y_n = 0$. **[05]**

(C) Test convergence of the series : **(Any One)** **[06]**

(a) $\dfrac{1}{1^2 + m} + \dfrac{2}{2^2 + m} + \dfrac{3}{3^2 + m} + \ldots$

(b) $\displaystyle\sum_{n=1}^{\infty} \dfrac{4.7.10 \ldots (3n+1)}{1.2.3.4 \ldots n}$

SECTION - II

Q.7) (A) Expand $\dfrac{x}{e^x - 1}$ upto x^4. **[05]**

(B) Use Taylor's Theorem to obtain approximate value of $\sqrt{10}$ to four decimal places. **[05]**

(C) Solve : **(Any One)** **[06]**

(a) Find a and b, if

$$\lim_{x \to 0} \frac{a\sin^2 x + b\log\cos x}{x^4} = -\frac{1}{2}.$$

(b) Evaluate $\displaystyle\lim_{x \to 0} \left(\sin^2 \frac{\pi}{2 - ax} \right)^{\sec^2 \frac{\pi}{2 - bx}}$

OR

Q.8) (A) Expand $\sin^{-1}x$ in ascending powers of x. **[05]**

(B) Expland $3x^2 - 2x^2 + x - 4$ in powers of $(x + 2)$. **[05]**

(C) Solve : **(Any One)** **[06]**

(a) Evaluate $\displaystyle \lim_{x \to 0} \frac{\tanh x - 2\sin x + x}{x^5}$

(b) Evaluate $\displaystyle \lim_{x \to 0} \frac{e^x \sin x - x - x^2}{x^2 + x \log(1-x)}$

Q.9) Solve : **(Any Two)** **[16]**

(A) Find value of n so that $u = r^n(3\cos^2 \theta - 1)$

satisfies $\dfrac{\partial}{\partial r}\left(r^2\, \dfrac{\partial u}{\partial r}\right) + \dfrac{1}{\sin\theta} \cdot \left(\sin\theta\, \dfrac{\partial u}{\partial\theta}\right)$.

(B) If $ux + vy = 0$; $\dfrac{u}{x} + \dfrac{v}{y} = 1,$

show that : $\left(\dfrac{\partial v}{\partial y}\right)_x - \left(\dfrac{\partial u}{\partial x}\right)_y = \dfrac{x^2 + y^2}{x^2 - y^2}$

(C) If $x = e^u \csc v$; $y = e^u \cot v$, then

show that : $\left(\dfrac{\partial z}{\partial x}\right)^2 - \left(\dfrac{\partial z}{\partial y}\right)^2 = e^{-2u}\left[\left(\dfrac{\partial z}{\partial u}\right)^2 - \sin^2 v\left(\dfrac{\partial z}{\partial v}\right)^2\right]$

OR

Q.10) Solve : **(Any Two)** [16]

(A) If $u = (2x + 3y)^n + \dfrac{1}{(x - y)^n}$,

show that : $x^2 u_{xx} + 2xy u_{xy} + y^2 u_{yy} + xu_x + yu_y = n^2 u$.

(B) If $x^3 + y^3 - 3axy = 0$,

show that : $\dfrac{d^2y}{dx^2} + \dfrac{2a^3 xy}{(y^2 - ax)^3} = 0$.

(C) If $f(xy^2, z - 2x) = 0$,

prove that : $x \dfrac{\partial z}{\partial x} - \dfrac{y}{2} \dfrac{\partial z}{\partial y} = 2x$.

Q.11) (A) The area of ΔABC is calculated using the formula $\Delta = \dfrac{1}{2} ab\sin C$. Errors of 2%, 3%, 4% are made in measuring a, b, C respectively. If the correct value of C is 30°, find % error in the calculated value of Δ. [06]

(B) If $x = u + v$; $y = v^2 + w^2$; $z = w^3 + u^3$,

show that : $\dfrac{\partial u}{\partial x} = \dfrac{vw}{vw + u^2}$. [06]

(C) Find Stationary values of $u = x + y + z$ if $xy + yz + zx = 3a^2$. [06]

OR

Q.12) (A) Verify $JJ' = 1$ for $x = e^u \tan v$ and $y = e^u \sec v$. **[06]**

(B) Examine for functional dependence/independence. If dependent, find relation between them :

$$u = \frac{x - y}{x + a} \quad ; \quad v = \frac{x + a}{y + a} \qquad \textbf{[06]}$$

(C) The sum of three positive numbers is 'a'. Determine maximum value of their product. **[06]**

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F. E. (Semester - I) Examination - 2010
APPLIED SCIENCE - I
(CHEMISTRY)
(2008 Pattern)

Time : 2 Hours]   **[Max. Marks : 50**

Instructions :

(1) Answer 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.

Q.1) (A) (a) Define Axis of Symmetry for Crystals. Draw diagrams showing two-fold, three-fold and four-fold axes of symmetry for Cubic Crystals.   **[04]**

(b) Give difference in Schottky and Frenkel point defects in Ionic Crystals.   **[04]**

(B) Derive Bragg's Law Equation for Crystals acting as reflection grating.   **[05]**

(C) What is Atomic Packing Factor (APF) for Crystals ? Calculate APF for Closest Packing Cubic Crystal System.   **[04]**

OR

Q.2) (A) Give Bravais Lattices for Cubic, Orthorhombic and Hexagonal Crystal Systems. Draw diagrams for Bravais Lattices of Cubic Crystal Systems.   **[07]**

(B) What is Luminescence ? Describe structure of ZnS shortly. How is Luminescence of ZnS increased ? Give uses of ZnS as Phosphor.   **[05]**

(C) Give structure and properties of Tetrathiofulvalene. How is Tetrathiofulvalene converted to stable charge-transfer compound ? Give uses of such compound.   **[05]**

Q.3) **(A)** (a) Define a Primary Standard. What are the conditions for a chemical to be the Primary Standard ? **[04]**

(b) 50 ml of a Chloride Water Sample requires 5.7 ml of M/100 $AgNO_3$ in Mohr's Method of Precipitation Titration. Find amount of Chloride Ions per litre in the Water. (Ionic Weight of Cl^- = 35.5) **[03]**

(B) Explain weak acid - strong base titration regarding net reaction, titration curve and suitable indicators. Give formula for calculation of pH of titration mixture at the stage of equivalence point. (Assume strong base solution in burette.) **[06]**

(C) Calculate equivalent weight of $KMnO_4$ oxidising reagent in acidic medium. (Atomic Weights : K = 39, Mn = 55, O = 16) **[03]**

OR

Q.4) **(A)** (a) Show that colour change pH interval of an acid-base titration indicator is about 2 pH-units. **[04]**

(b) Balance **any one** of the following redox reactions by ion-electron or nascent oxygen method : **[03]**

    (i) $KMnO_4 + H_2SO_4 + FeSO_4 \rightarrow MnSO_4 + Fe_2(SO_4)_3 + H_2O$

    (ii) $Fe^{+2} + Sn^{+4} \rightarrow Fe^{+3} + Sn^{+2}$

(B) 25 ml 0.1N HCl is titrated against 0.075N NaOH from burette. Calculate pH of titration mixture at following stages : **[05]**

(a) 10 ml NaOH added.

(b) 40 ml NaOH added.

(C) Explain role of any two indicators for Precipitation Titrations. **[04]**

Q.5) **(A)** Give polymerisation reaction, properties and uses of **any two** of the following polymers : **[08]**

        (a) S.B.R.

        (b) ABS Plastic

        (c) Epoxy Resin

        (d) Polystyrene

    (B) Give a note on compounding of polymers regarding : **[05]**

        (a) Plasticizers

        (b) Fillers

        (c) Stabilizers

    (C) Compare Natural Rubber and Vulcanised Natural Rubber. **[04]**

OR

Q.6) **(A)** (a) Distinguish between LDPE and HDPE. **[04]**

        (b) Classify Co-polymers. **[03]**

    (B) Write a short note on **any one** of the following : **[05]**

        (a) Biodegradable Polymers

        (b) Conducting Polymers

    (C) Give Free Radical Mechanism of Chain Polymerisation. **[05]**

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F. E. (Semester - I) Examination - 2010
APPLIED SCIENCE - I
(PHYSICS)
(2008 Pattern)

Time : 2 Hours]   [Max. Marks : 50

Instructions :

    (1) Answer 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.

    (5) Assume suitable data, if necessary.

Constants : h = 6.63×10^{-34} J.Sec.

            m = 9.1×10^{-31} kg

            e = 1.6×10^{-19} C

            C = 3×10^{8} m/sec.

Q.1) (A) Draw a neat labelled diagram of Michelson's Interferometer and explain how it is used to determine thickness of a thin transparent plate ? [07]

    (B) Derive equation of a displacement produced by an electron when it passes through perpendicular electric field. [06]

    (C) The electric field between the plates of the velocity selector in a Bainbridge Mass Spectrograph is 1200 V/cm. and the magnetic field in both regions is 0.6 wb/m^2. A stream of singly charged neons moves in circular path of radius 7.28 cm. in magnetic field. Determine mass number of the isotope. (Given : Avagadro Number = 6.02×10^{26}/kgmole,

            e = 1.6×10^{-19} C.) [04]

OR

Q.2) (A) In magnetostatic focusing explain motion of electron when it travels in a direction inclined at an angle θ with the direction of magnetic field. Show construction of magnetic lens. **[07]**

(B) Prove that for Newton's Rings in reflected light the diameters of dark rings are proportional to square root of natural number. **[06]**

(C) A parallel beam of light of wavelength 5890 A° is incident on a thin glass plate of refractive index 1.5 such that the angle of refraction into the plate is 60°. Calculate smallest thickness of a glass plate which will appear dark in reflected light. **[04]**

Q.3) (A) Derive equation of resultant intensity of light waves in the Fraunhoffer's diffraction at a single slit. **[06]**

(B) Explain any two applications of Ultrasonic Waves. **[06]**

(C) When the Parallel Waves of Monochromatic Light of Wavelength 5790 A° fall normally on a grating 2.54 cm wide. The first order spectrum is produced at an angle of 19.994° from the normal. Calculate total number of lines of the grating. **[04]**

OR

Q.4) (A) Explain Magnetostriction Oscillator for production of Ultrasonic Waves. **[06]**

(B) What is Resolving Power of Grating. Obtain an expression for it. **[06]**

(C) A slit of width 0.16 mm is illuminated by a monochromatic light of wavelength 5600 A°. Find half angular width of a principal maximum. **[04]**

Q.5) (A) What is Nuclear Fusion ? Explain Proton-Proton and Carbon-Nitrogen Cycle of Fusion Reaction. **[07]**

(B) Which are different methods of production of plane polarized light ? Describe process of production and detection of elliptically polarized light. **[06]**

(C) In a Betatron, having operating frequency of 50 Hz, the maximum magnetic field traversing the electron orbit of radius 0.8 m. is 0.8 wb/m². Calculate Final Energy and Average Energy gained per revolution, assuming maximum possible time for acceleration.
(Given : C = 3 × 10⁸ m/s, e = 1.6 × 10⁻¹⁹ C) **[04]**

OR

Q.6) (A) Explain principle, construction and working of Cyclotron and show that the period of revolution is independent of Velocity of Particle. **[07]**

(B) Explain Huygen's Theory of Double Refraction. **[06]**

(C) Calculate thickness of a mica plate required to make a Quarter Wave Plate and a Half Wave Plate for light of wavelength 5890 A°. (Given : μ_0 = 1.586 and μ_e = 1.592) **[04]**

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

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F. E. (Semester - I) Examination - 2010
BASIC ELECTRICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

Instructions :

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

(2) Answer Q. No. 1 or Q. No. 2, Q. NO. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10 and Q. No. 11 or Q. No. 12.

(3) Figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

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

(6) Assume suitable additional data, if necessary.

SECTION - I

Q.1) (A) What is Insulation Resistance ? State its unit and obtain an expression for Insulation Resistance of the Cable.   [08]

(B) With neat sketch explain Construction and Working of Lead Acid Cell.   [08]

OR

Q.2) (A) A resistance element having cross-sectional area of 10 mm^2 and length of 10 meter takes a current of 4 Amp from 200V supply at temperature of 25°C. Find (i) resistivity of the material and (ii) current it will take when temperature rises to 75°C. Assume α_{25} = .0003/°C.   [06]

(B) If α_1 and α_2 are the two resistance temperature coefficients at t_1 °C and t_2 °C, then prove that $(\alpha_1 - \alpha_2) = \alpha_1 \alpha_2 (t_2 - t_1)$. **[06]**

(C) State applications of Nickel-Iron Cell and Nickel-Cadmium Cell. **[04]**

Q.3) (A) State and explain Superposition Theorem as applied to Simple DC Circuit. **[06]**

(B) State and explain Kirchoff's Laws. **[04]**

(C) Determine resistance between (x) and (y) for the circuit shown in fig. 1 : **[06]**

Fig. 1

OR

Q.4) (A) State and explain Maximum Power Transfer Theorem. **[06]**

(B) Apply Thevenin's Theorem to the circuit show in fig. 2 to calculate current in 01Ω resistance : **[10]**

Fig. 2

Q.5) (A) Compare Electric and Magnetic Circuit. **[08]**

(B) Write short notes : **[10]**

(a) Magnetic Leakage and Fringing.

(b) Energy stored in a Magnetic Field.

OR

Q.6) (A) Explain what do you mean by Statically Induced emf and Dynamically Induced emf ? **[06]**

(B) A steel ring of 25 cm mean diameter and of circular cross-section 3 cm diameter has an air gap of 1.5 mm length. It is wound uniformly with 700 turns of wire carrying a current of 2 Amp. Calculate :

(a) MMF

(b) Flux Density

(c) Reluctance and

(d) Relative Permeability of Steel Ring **[12]**

SECTION - II

Q.7) (A) Define w.r.t. alternating quantities : **[09]**

(a) Instantenous Value

(b) Waveform

(c) Cycle

(d) Amplitude

(e) Periodic Time

(f) Frequency

(B) Sketch Waveforms of Currents and find its rms value and average value for the equation : **[08]**

(a) $i_1 = 15 \sin (314.159 \, t)$ and

(b) $i_2 = 10 \sin (314.159 \, t - \pi/2)$

OR

Q.8) (A) Prove that rms value of the sinusoidal alternating current is 0.707 times its maximum value. **[06]**

(B) Derive expression for energy stored in a capacitor. **[06]**

(C) Two capacitors of 50μF each are connected in parallel with each other and this combination is connected in series with two capacitors of 80μF of 40μF each. Calculate equivalent capacitance of the circuit. **[05]**

Q.9) (A) Define and explain following terms : **[08]**
  (a) Active Power
  (b) Reactive Power
  (c) Impedance
  (d) Admittance

(B) A Circuit consisting of Resistance of 20Ω and Inductance of 0.1 Henry is connected in series across single phase 200V, 50 Hz supply. Calculate :
  (a) Current Drawn
  (b) Power Consumed
  (c) Draw relevant Phasor Diagram **[09]**

OR

Q.10) (A) A Coil of Resistance 50Ω and Inductance of 0.1 H is connected in parallel with a branch which consists of resistance of 45Ω in series with a capacitor of 100 μF across a single phase 230V, 50Hz supply. Calculate Current, Power and p.f. of the Circuit. **[09]**

(B) If a sinusoidal voltage of $v = V_m$ sinwt is applied across R-C series circuit, derive expression for current drawn and power consumed. Draw their waveforms also. **[08]**

Q.11) (A) Write short notes : **[08]**
  (a) Losses taking place in Transformer
  (b) An Autotransformer

(B) Draw a complete phasor diagram for a 3 phase delta connected inductive balanced load supplied for 3-phase symmetrical A.C. supply. State equation for Active Power and Reactive Power consumed by Load. **[08]**

OR

Q.12) (A) A balanced Star Connected Load is supplied by 3-phase, 415V, 50Hz supply. Current in phase is 20 Amp and lags 30° behind its phase voltage. Find :
  (a) Power Consumed by Load
  (b) Circuit Parameters, and
  (c) Load p.f. **[08]**

(B) Explain working principle of transformer and derive expression for emf induced in its winding. **[08]**

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

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F. E. (Semester - I) Examination - 2010
BASIC CIVIL AND ENVIRONMENTAL ENGINEERING
(2008 Pattern)

Time : 3 Hours]　　　　　　　　　　　　　　　　[Max. Marks : 100

Instructions :

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

(2) Answers 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 logarithmic tables, slide rule, mollier charts, elecronic pocket claculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Explain general role of Civil Engineer in any construction work.　　　　　　　　　　　　　　　　　　　**[04]**

(B) Explain with a neat sketch working principle of Remote Sensing Technique.　　　　　　　　　　　　　　　　　　**[04]**

(C) State comparison between Railways and Highways.　　**[04]**

(D) Explain in brief the role of Civil Engineer in a Construction of Expessways.　　　　　　　　　　　　　　　　　　**[04]**

OR

Q.2) (A) State any two applications of :　　　　　　　　　**[04]**

(a) Quantity Surveying

(b) Earthquake Engineering

(B) What do you mean by Infrastructure Development ? Enlist facilities to be provided for the same.　　　　　　　**[04]**

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(C) Define Fluid. State any four Practical Applicatons of Fluid Mechanics. [04]

(D) State any four applications of Environmental Engineering. [04]

Q.3) (A) Define Foundation. State any four functions of Foundation. [04]

(B) Enlist various types of Concretes. Write a short note on Prestressed Cement Concrete. [04]

(C) What is Cement ? State any two types of Special Cements. Also state their suitability. [04]

(D) What are Smart Materials ? Where they are used and why ? [04]

OR

Q.4) (A) Define Settlement. Explain with a neat sketch the Concept of Differential Settlement. [04]

(B) How will you check quality of cement in the field without sending sample of cement to the laboratory ? [04]

(C) What is the importance of Sand in construction ? State any four advantages of Artificial Sand. [04]

(D) Define Automation in Construction. What is the need of Automation in present era ? [04]

Q.5) (A) Define Surveying. State and explain any one Fundamental Principle of Surveying. [06]

(B) What is Map ? Enlist various types of Maps. Explain any one in brief. [04]

(C) Explain in brief various components of GPS. [04]

(D) What is Total Station ? State any four uses of Total Station. [04]

OR

Q.6) (A) State any four characteristics of Contour Lines. [04]

(B) Define the following terms used in levelling : [04]
(a) Station
(b) Level Surface
(c) Line of Collimation
(d) R.L.

(C) The following is a Page of Level Field Book. Find out the missing readings (marked X) and complete page. Apply usual arithmetic checks : [10]

Sr. No.	B.S.	I.S.	F.S.	H.I.	R.L.	Remarks
1.	2.450			X	X	BM I
2.	3.280		0.375	X	X	CP
3.		X			453.805	
4.		2.345			X	
5.		2.990			452.365	
6.	X		3.665	454.415	X	CP
7.	2.110		X	X	453.960	CP
8.		1.370			X	
9.			1.425		X	BM II

SECTION - II

Q.7) (A) Explain with a neat sketch Carbon Cycle. [04]

(B) What is EIA ? State various methods of EIA. [04]

(C) Comment on the statement : "In comming future the disposal of E-waste would be the biggest problem." [04]

(D) Define Ecosystem. What are the various Components of Ecosystem. [04]

OR

Q.8) (A) What do you understand by Sustainable Development ? State its importance in the present context. [04]

(B) What is Solid Waste ? State various methods of Disposal of Solid Waste. [04]

(C) Write short notes : [4x2=08]
(a) Hydrological Cycle
(b) Conservation of Natural Resources

Q.9) (A) Define the following terms : [04]
(a) FSI
(b) Built-up Area
(c) Carpet Area
(d) Building Line

(B)   Write a short note on Use of Eco-friendly Materials in Construction.   **[04]**

(C)   Determine total carpet area of a three storeyed building from the following data :   **[04]**

     (a)   Plot Area = 40m × 30m

     (b)   FSI Allowed = 0.9

     (c)   Ratio of Built-up Area to Carpet Area = 0.8

(D)   Write a short note on Green Building.   **[04]**

OR

Q.10) (A)   What is Circulation ? State its various types. What is the importance of Circulation in Building ?   **[04]**

(B)   Write a short note on Necessity of Building Bye-laws.   **[04]**

(C)   Explain with a neat sketch the following principles of Building Planning :   **[4x2=08]**

     (a)   Aspect

     (b)   Privacy

Q.11) (A)   Define Water Pollution. State various sources and causes of Water Pollution.   **[2+4=06]**

(B)   Explain in brief the role of Green House Gases in Global Warming.   **[04]**

(C)   Write short notes :   **[4x2=08]**

     (a)   Wind Energy

     (b)   Geothermal Energy

OR

Q.12) (A)   Explain in brief causes and ill effects of Noise Pollution.   **[04]**

(B)   What are the Sources of Land Pollution ? What measures would you like to suggest to minimise Land Pollution ?   **[06]**

(C)   Write short notes :   **[4x2=08]**

     (a)   Renewable Sources of Energy

     (b)   Acid Rain

Total No. of Questions : 12]   [Total No. of Printed Pages : 10

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F. E. (Semester - I) Examination - 2010
ENGINEERING GRAPHICS - I
(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) *Figures to the right indicate full marks.*

(4) *Retain all construction lines.*

(5) *Use of electronic pocket calculator is allowed.*

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

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

SECTION - I

UNIT - II : ENGINEERING CURVES

Q.1) (A) Draw an Involute of a square of side 30mm. Also draw a tangent and normal to it at a point 60mm from the center of square.   [07]

(B) A point 'N' moves radially outwards from the centre of a circular disc to the periphery when disc completes one revolution. Radial Movement of the point 'N' and the angular motion of the disc are assumed to be uniform. Take diameter of disc as 120mm. Trace locus of the point 'N' and name curve.   [08]

OR

Q.2) **(A)** A circle of 0.04 meter diameter rolls on another circle of 0.160m diameter with internal contact. Draw locus of point 'J' on the circumference of the rolling circle, situated at the point of contact of both the circles, for one revolution. Draw tangent and normal to the curve at any point. **[08]**

(B) A motor car head lamp is having an aperture (opening) of 0.16 meter and a depth 0.115 meter. If the shape of the reflector is parabolic, draw shape of the parabola. **[07]**

UNIT - III : ORTHOGRAPHIC PROJECTIONS

Q.3) For the object shown in fig. 1, draw the following views, using First Angle Method of Projection :

(a) Elevation in the direction of arrow **[06]**

(b) Plan **[06]**

(c) End View from Right Hand Side **[06]**

(d) Give all dimensions **[02]**
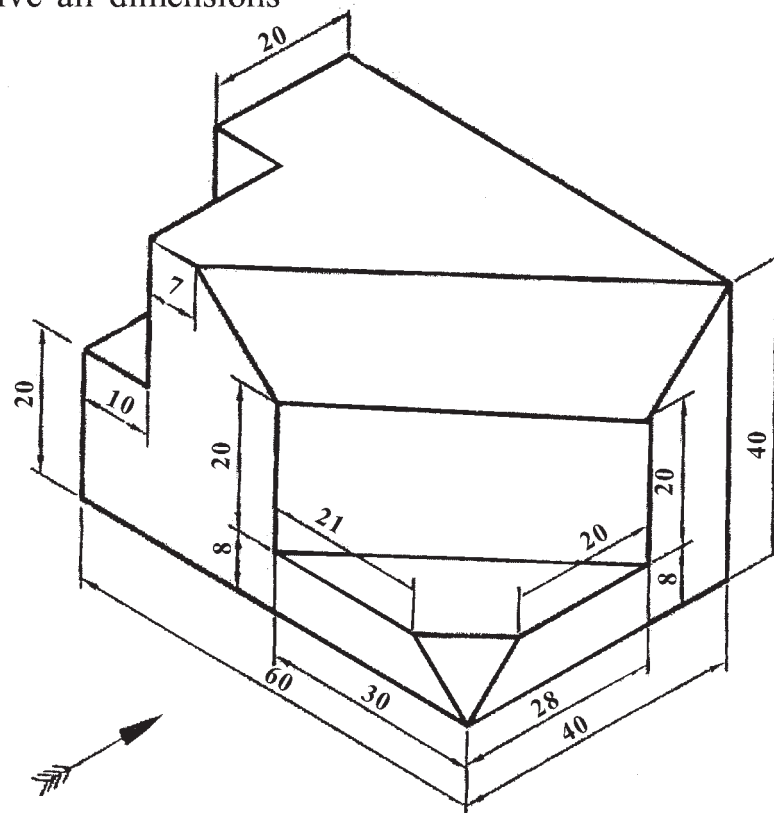
Fig. 1

OR

Q.4) For the object shown in fig. 2, draw the following views, using First Angle Method of Projection :

(a) Sectional Elevation from the direction of arrow 'X' (Section along AA) [06]

(b) Plan [06]

(c) End View from the direction òf arrow 'Y' [06]

(d) Give all the dimensions. [02]
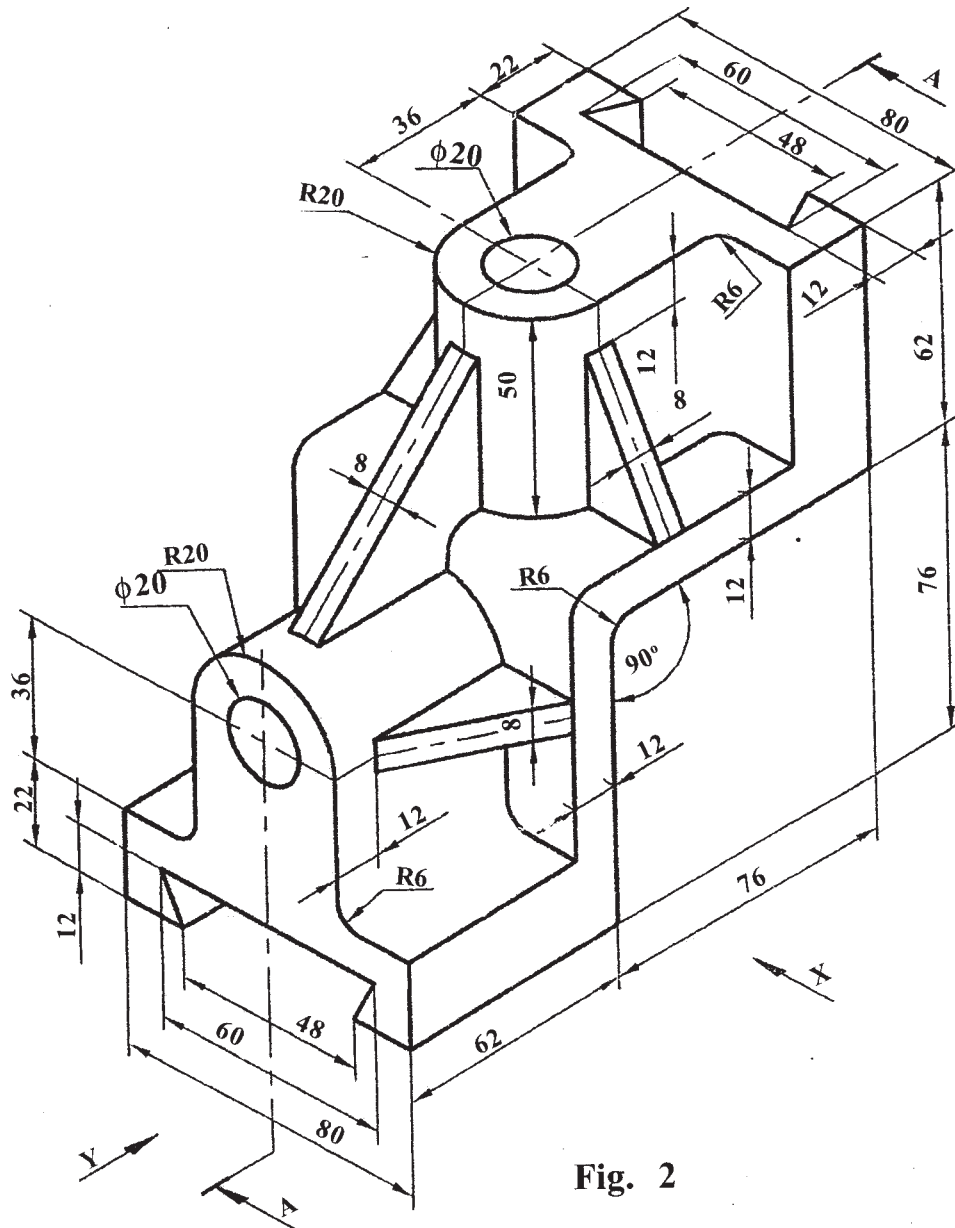
Fig. 2

UNIT - IV : AUXILIARY PROJECTIONS

Q.5) Fig. 3 shows elevation and auxiliary views of a bent plate. By using First Angle Method of Projections :

(a) Redraw the given views [05]

(b) Add the plan [08]

(c) Give all dimensions. [02]
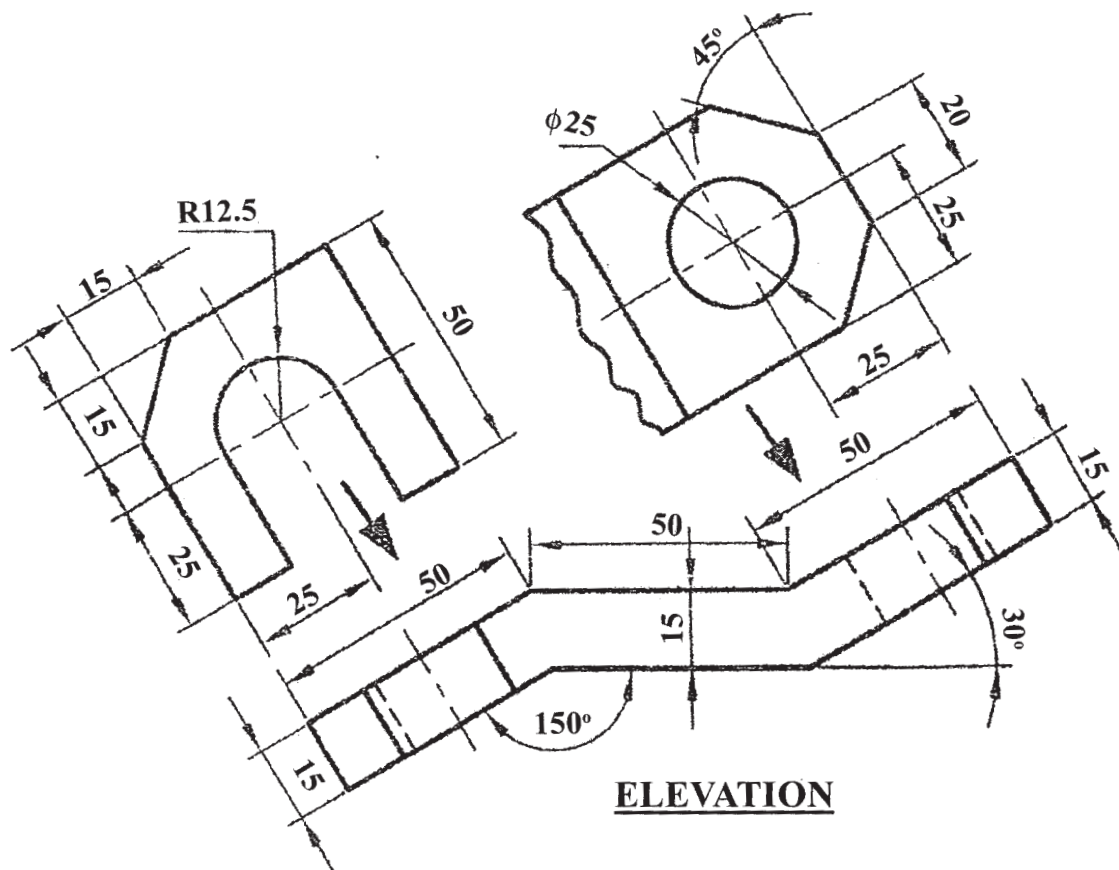
Fig. 3

OR

Q.6) Fig. 4 shows elevation, incomplete plan and auxiliary views of a Cast Iron Bracket. Draw the following views :

(a) Given Elevation   **[05]**

(b) Add plan using the same method of projections.   **[08]**

(c) Give all dimensions.   **[02]**
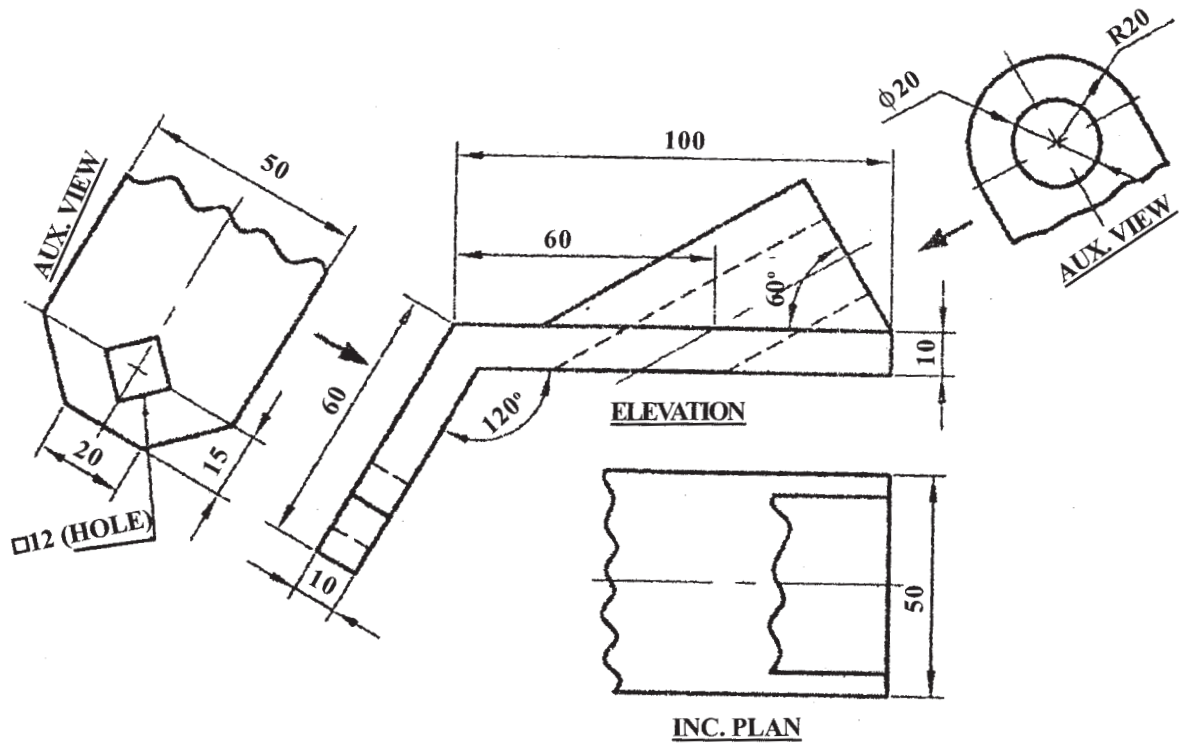
Fig. 4

SECTION - II

UNIT - V : ISOMETRIC

Q.7) Fig. 5 shows orthographic views of an object by First Angle Method of Projection. Draw its Isometric Projection taking origin at 'O' and give all dimensions. **[18+2]**

ELEVATION

PLAN
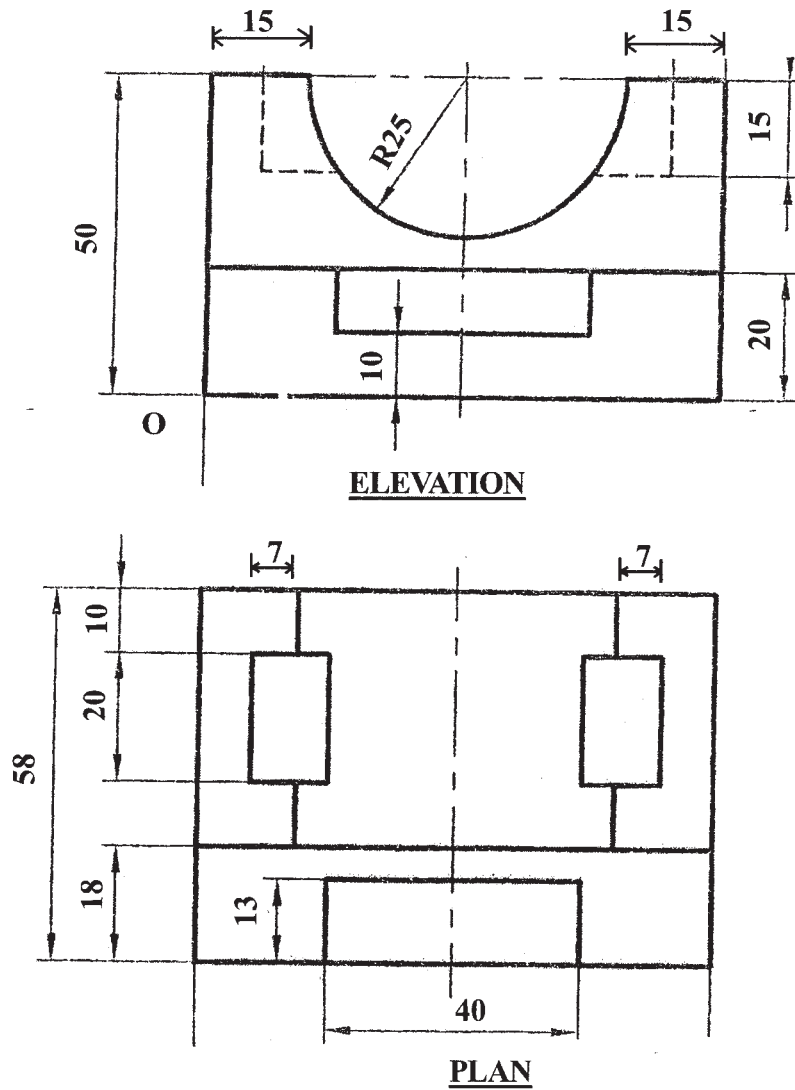
Fig. 5

OR

Q.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 all dimensions : **[18+2]**
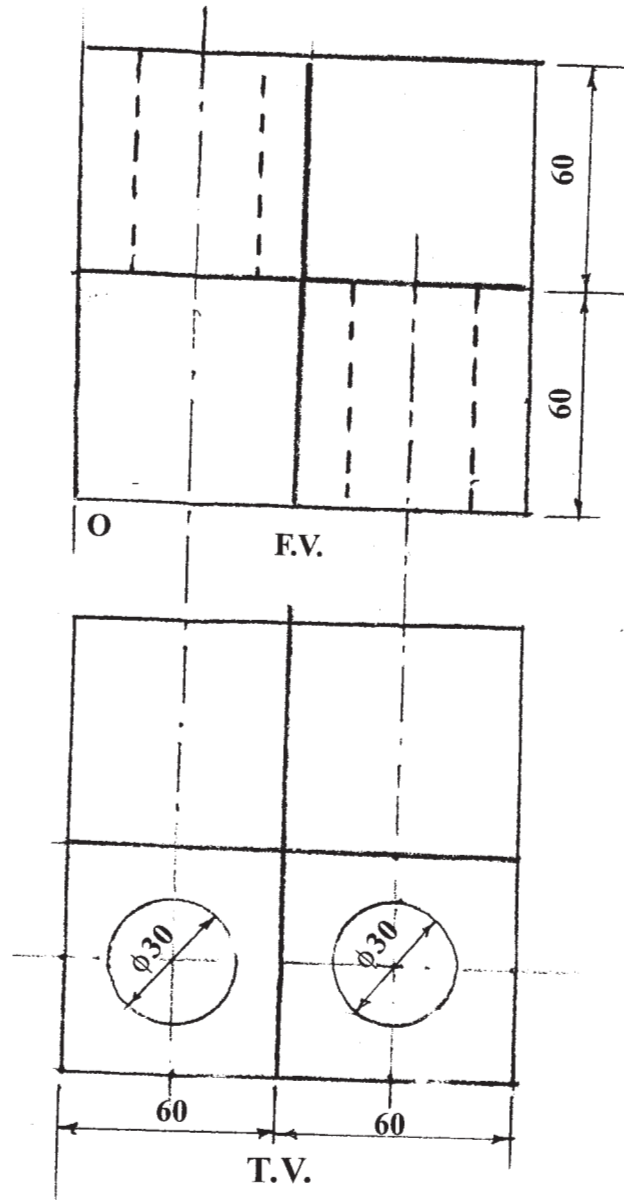
Fig. 6

UNIT - VI : MISSING VIEWS

Q.9) Two Orthograhic Views of an object, drawn by First Angle Method of Projection are given in fig. 7. Using First Angle Method of Projection, draw the following :

(a)   Elevation   **[03]**

(b)   Plan   **[09]**

(c)   Sectional End-View (Left Hand), section along A-A   **[06]**

(d)   Give all dimensions.   **[02]**
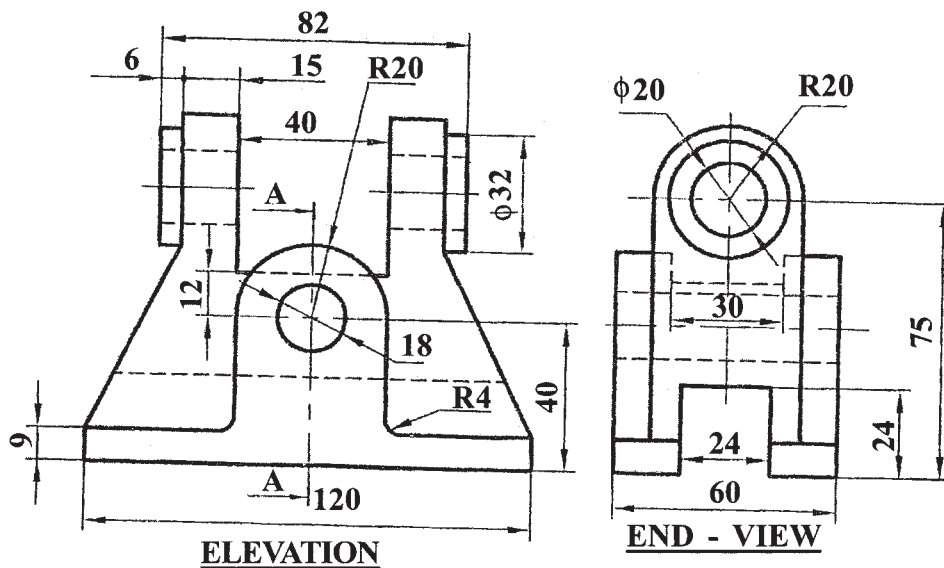
Fig. 7

OR

Q.10) Two Orthographic Views of an object, drawn by First Angle Method of Projection are given in fig. 8. Using First Angle Method of Projection, draw the following :

    (a)   Elevation   **[04]**

    (b)   Plan   **[10]**

    (c)   End-View from Right Hand   **[04]**

    (d)   Give all dimensions.   **[02]**

R.S. END - VIEW   **ELEVATION**
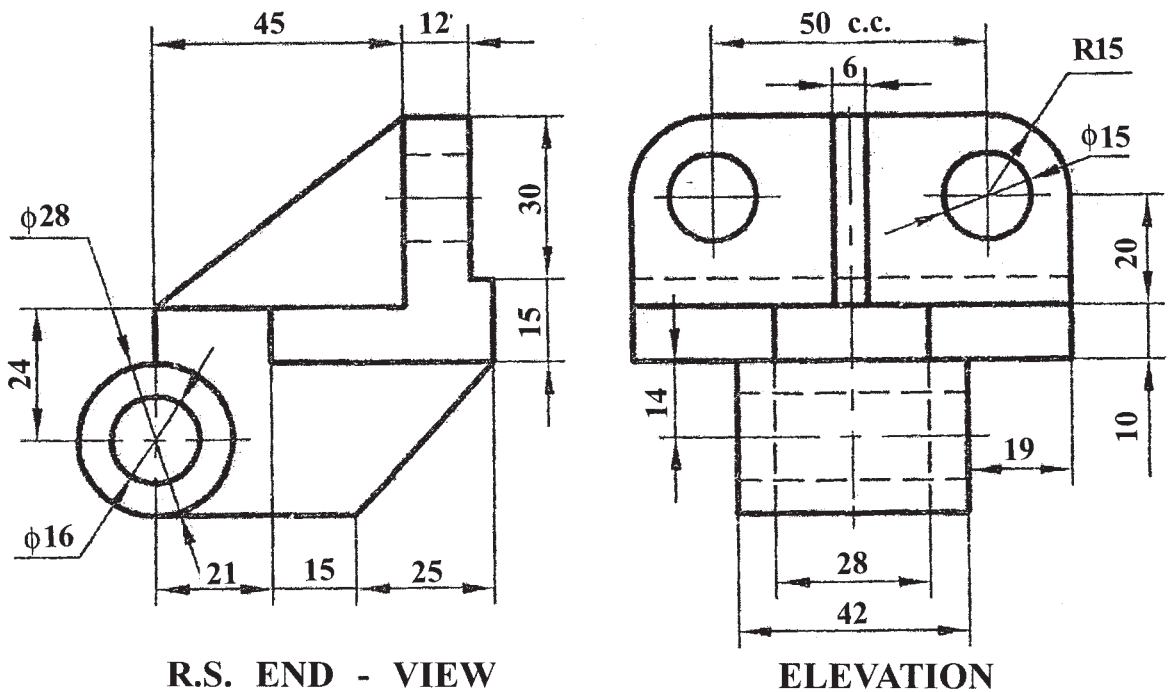
Fig. 8

UNIT - VII : FREE HAND SKETCHES

Q.11) Draw proportionate free hand sketches of the following :

    (a)   Hexagonal Headed Bolt   **[04]**

    (b)   Conical Helical Spring   **[03]**

    (c)   Metric Thread Profile   **[03]**

OR

Q.12) Draw proportionate free hand sketches of the following :

    (a)   Splined Shaft   **[03]**

    (b)   Single Riveted Lap Joint   **[03]**

    (c)   Flanged Coupling   **[04]**

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F. E. (Semester - II) Examination - 2010
ENGINEERING MATHEMATICS - II
(2008 Pattern)

Time : 3 Hours]　　　　　　　　　　　　　　[Max. Marks : 100

Instructions :

(1) In section I, solve Q. No. 1 or No. 2, Q. No. 3 or Q. No. 4, Q. No. 5, or Q. No. 6 and 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 books**.*

(4) Black figures to the right indicate full marks.

(5) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Form the differential equation whose general solution is $Ax^2 + By^2 = 1$ (A, B are arbitrary constants). **[05]**

(B) Solve : **(Any Three)** **[12]**

(a) $(x + y)^2 \left(x \dfrac{dy}{dx} + y \right) = xy \left(1 + \dfrac{dy}{dx} \right)$

(b) $(x + 2y - 3)\, dx - (3x + 6y - 1)\, dy = 0$

(c) $y \log y \, dx + (x - \log y)\, dy = 0$

(d) $\dfrac{dy}{dx} = - e^{x-y} \left(e^x + e^y \right)$

OR

Q.2) (A) Form the differential equation whose general solution is $y = e^x (c_1 \cos x + c_2 \sin x)$, where c_1, c_2 are arbitrary constants. **[05]**

(B) Solve : **(Any Three)** **[12]**

(a) $(1 + y^2) + \left(x - e^{-\tan^{-1} x} \right) \dfrac{dy}{dx} = 0$.

(b) $\left(y^2 e^{xy^2} + 4x^3 \right) dx + \left(2xye^{xy^2} - 3y^2 \right) dy = 0$.

(c) $(x^2 y + y^4) \, dx + (2x^3 + 4xy^3) \, dy = 0$.

(d) $\cos x \dfrac{dy}{dx} + y \sin x = \sqrt{y \sec x}$.

Q.3) Attempt **any three** of the following :

(a) The temperature of water initially is 100°C and that of surrounding is 20°C. If the water cools down to 60°C in first 20 minutes, what will be the time required to fall temperature up to 30°C ? **[05]**

(b) Form the differential equation for the circuit containing a resistance 'R' and a condensor of capacity 'C' in series with emf $E_o \sin wt$. Find current at any instant t.

(Given $i = 0$ at $t = 0$) **[06]**

(c) For steady heat flow through the wall a hollow sphere of inner and outer radii r_1 and r_2 respectively, the temperature u at a distance r ($r_1 < r < r_2$) from the centre of sphere is given by

$$r \dfrac{d^2 u}{dr^2} + 2 \dfrac{du}{dr} = 0.$$

If u_1 and u_2 are the temperatures at inner and outer surfaces respectively. Find u in terms of r. **[06]**

(d)   A bullet is fired into sand tank, its retardation is proportional to square root of its velocity. Show that the bullet will come to rest in time $\dfrac{2\sqrt{v}}{k}$, where v is initial velocity. **[05]**

OR

Q.4) Attempt **any three** of the following :

(a)   Find orthogonal trajectories for the family of parabolas $y^2 = 4ax$. **[05]**

(b)   A resistance of 100 ohms and an inductance of 0.5H are connected in series with a battery of 20 volts. Find the current in the circuit when initially i = 0 at t = 0. **[05]**

(c)   A point executing S.H.M. has velocities v_1 and v_2 and acceleration a_1 and a_2 in two positions respectively. Show that distance between two positions is $\left| \dfrac{v_1^2 - v_2^2}{a_1 - a_2} \right|$. **[06]**

(d)   In a chemical reaction in which two substances A and B initially of amounts a and b respectively are concerned. The velocity of transformation $\dfrac{dx}{dt}$ at any time t is known to be equal to the product "(a − x) (b − x)" of the amounts of the two substances then remaining untransformed. Find t in terms of x if a = 0.7, b = 0.5 and x = 0.3 when t = 300 seconds. **[06]**

Q.5) **(A)**   Obtain Fourier series for

$$f(x) = \begin{cases} \pi x, & 0 \le x \le 1 \\ \pi(2 - x), & 1 \le x \le 2 \end{cases} \quad \text{with period 2.}$$ **[07]**

(B)   If $I_n = \int\limits_{0}^{\pi/4} \dfrac{\sin (2n - 1)x}{\sin x}\, dx$, then prove that

$I_{n+1} - I_n = \dfrac{1}{n} \sin \dfrac{n\pi}{2}$ and hence evaluate I_3. **[05]**

(C)   Evaluate : $\int\limits_{0}^{\infty} x^2\, e^{-h^2 x^2}\, dx$. **[04]**

OR

Q.6) (A) A turning moments y units of the crank of a steam engine is given for the series of values of crank angle θ in degrees :

θ	0	30	60	90	120	150	180
y	0	5224	8097	7850	5499	2626	0

Find first four moments in the series of sines to represent y. [08]

(B) Evaluate : $\int_{0}^{\pi} x \sin^7 x \cos^4 x\, dx$ [04]

(C) Prove that :

$$\int_{0}^{1} x^{m-1} \left(1 - x^2\right)^{n-1} dx = \frac{1}{2} \beta\left(\frac{m}{2}, n\right)$$ [04]

SECTION - II

Q.7) (A) Trace the following curves : **(Any Two)** [08]

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

(b) $x^3 + y^3 = 3axy \ (a > 0)$

(c) $r = a \cos 3\theta$

(B) Find length of arc of the curve $x^{2/3} + y^{2/3} = a^{2/3}$ intercepted in the positive quadrant. [04]

(C) Show that :

$$\int_{0}^{\infty} \frac{e^{-x} - e^{-ax}}{x.\sec x}\, dx = \frac{1}{2} \log\left(\frac{a^2 + 1}{2}\right).$$ [05]

OR

Q.8) (A) Trace the following curves : **(Any Two)** [08]

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

(b) $x = a\cos^3 t$, $y = a\sin^3 t$

(c) $r^2 = a^2\cos 2\theta$.

(B) If $\alpha(x) = \sqrt{\dfrac{2}{\pi}} \displaystyle\int_0^x e^{-t^2/2}\, dt$, then show that $erf(x) = \alpha\left(x\sqrt{2}\right)$. [04]

(C) If $\phi(a) = \displaystyle\int_{\frac{\pi}{6a}}^{\frac{\pi}{2a}} \dfrac{\sin ax}{x}\, dx$, then find $\phi'(a)$ and show that $\phi(a)$ is independent of a. [05]

Q.9) (A) Find equation of sphere which has its centre at $(2, 3, -1)$ and touches line $\dfrac{x+1}{-5} = \dfrac{y-8}{3} = \dfrac{z-4}{4}$. [05]

(B) Find equation of cone whose vertex is at $(1, 1, 3)$ and passes through guiding curve $4x^2 + z^2 = 1$, $y = 4$. [05]

(C) Find equation of right circular cylinder of radius 2, whose axis passes through $(1, 2, 3)$ and has direction ratios proportional to $(2, 1, 2)$. [06]

OR

Q.10) (A) Find equation of sphere which passes through the points $(1, 0, 0)$; $(0, 1, 0)$; $(0, 0, 1)$ and having radius as small as possible. [05]

(B) Find equation of right circular cone with vertex at $(1, -1, 1)$, semivertical angle is $45°$ and its axis is perpendicular to the plane $2x + y - 2z + 1 = 0$. [06]

[3861]-157   5   P.T.O.

(C)   Find equation of cylinder whose guiding curve is
        $ax^2 + by^2 = 2z$, $lx + my + nz = p$ and generators are parallel
        to z-axis.   [05]

Q.11) (A)   Express the following integral as single integral and hence

        evaluate $\int_0^1 \int_0^y \left(x^2 + y^2\right) dxdy + \int_1^2 \int_0^{2-y} \left(x^2 + y^2\right) dxdy$.   [06]

(B)   Find area of the upper half of the cardiode $r = a\,(1 + \cos\theta)$.   [05]

(C)   Evaluate :

        $\int_0^1 \int_{y^2}^1 \int_0^{1-x} x\, dz\, dx\, dy$ [06]

<div align="center">

OR

</div>

Q.12) (A)   Find mean value of the function $e^{-\left(x^2 + y^2\right)}$ over the area
        of the circle $x^2 + y^2 = 1$.   [05]

(B)   Find the centroid of the area bounded by the curve
        $y^2\,(2a - x) = x^3$ and its asymtote.   [06]

(C)   Find the moment of inertia of a Lamina with uniform thickness
        bounded by $x^2 = y$ and $y = x + 2$ about y–axis.   [06]

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F. E. (Semester - II) Examination - 2010
APPLIED SCIENCE - II
(CHEMISTRY)
(2008 Pattern)

Time : 2 Hours]   [Max. Marks : 50

Instructions :

    (1) All questions are compulsory.

    (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.

    (5) Assume suitable data, if necessary.

Q.1) (A) Explain different types of Calorific Values of Fuel. How it can be determined by using Boy's Gas Calorimeter. **[07]**

(B) Explain Octane Number and Cetane Number of Fuel. **[06]**

(C) One gram of coal sample was burnt in oxygen. Carbon Dioxide was absorbed in KOH and water vapour in $CaCl_2$. The increase in weight of KOH and $CaCl_2$ was 3.157 and 0.504 gm respectively. Determine %C and %H in the sample. **[04]**

OR

Q.2) (A) Explain in brief the process with diagram for distillation of Crude Petroleum. Give composition, boiling range and uses of any three fractions obtained. **[07]**

(B) Give composition, properties and applications of :

    (a) CNG

    (b) LNG **[06]**

(C) Volumetric Analysis of Producer Gas is H_2 = 20%, CO = 22%, N_2 = 50%, CH_4 = 2%, CO_2 = 6%.

Find volume of air required for complete combustion of $1m^3$ of gas. [04]

Q.3) (A) Explain mechanism of corrosion by oxygen with respect to Mg, Au, Cr and Mo metals and state Pilling - Bedworth Rule. [07]

(B) Explain H_2 Evolution and O_2 Absorption Mechanism. [06]

(C) Why Anodic Coatings are better than Cathodic Coatings ? [04]

OR

Q.4) (A) Discuss various factors affecting Corrosion. [07]

(B) Explain Galvanic Corrosion with the help of Galvanic Series. [06]

(C) Write a note on Electroplating. [04]

Q.5) (A) What are the causes, disadvantages and prevention of Scales and Sludges in Boiler ? [06]

(B) In water system, name 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) O°C and 1 atm. pressure [06]

(C) A water sample is not alkaline to phenolphthalein. However, 100 ml of the sample on titration with N/50 HCl required 16.9 ml to obtain end point using methyl orange as indicator. What are the types and amount of alkalinity present in the sample ? [04]

OR

Q.6) (A) What is Hardness of Water ? Give reasons behind it and explain EDTA Method for the determination of Hardness of Water. **[06]**

(B) State Gibb's Phase Rule. Explain the terms involved in it. What are the limitations of Phase Rule ? **[06]**

(C) Write a note on Caustic Embrittlement. **[04]**

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Total No. of Questions : 6]   [Total No. of Printed Pages : 3

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F. E. (Semester - II) Examination - 2010

APPLIED SCIENCE - II

(PHYSICS)

(2008 Pattern)

Time : 2 Hours]   [Max. Marks : 50

Instructions :

    (1) All questions are compulsory.

    (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.

    (5) Assume suitable data, if necessary.

Constants : $h = 6.63 \times 10^{-34}$ J-S

$C = 3 \times 10^8$ m/sec.

$m_e = 9.1 \times 10^{-31}$ kg

$m_p = 1.67 \times 10^{-27}$ kg

$e = 1.6 \times 10^{-19}$ C

Q.1) **(A)** What do you understand by the Wave Function of a Moving Particle ? What does square of the Wave Function signify ? **[06]**

    (B) Explain Group Velocity and Phase Velocity. Derive expression for Group Velocity with which a Wave Group Travels. **[07]**

    (C) At what Kinetic Energy an Electron will have a Wavelength of 5000A° ? **[04]**

OR

Q.2) (A) Obtain three dimensional time independent Schrödinger's Wave Equation. [07]

(B) State and explain Heisenberg's Uncertainty Principle. Illustrate this principle by diffraction of a beam of electrons by a narrow slit. [06]

(C) Compute energy difference between the ground state and first excited state for an electron in a one-dimensional rigid box of length 10^{-8} cm. [04]

Q.3) (A) Explain construction and working principle of Ruby LASER. [07]

(B) Explain what is the significance of critical temperature, critical magnetic field and critical current density for Superconductors. [06]

(C) Elaborate on any two applications of Superconductors. [04]

OR

Q.4) (A) Explain how BCS Theory explains Superconductivity ? [07]

(B) Describe propagation mechanism of light wave in Optical Fibres. [06]

(C) Explain the terms : Optical Pumping, Population Inversion [04]

Q.5) (A) Explain Chemical Vapour Deposition Method for Manufacturing Nano Particles. [06]

(B) What is Hall Effect ? Derive relation for Hall Voltage and Hall Coefficient. [06]

(C) Write down an expression for the probability of occupancy of a particular energy state of an electron in an intrinsic semiconductor. Represent it graphically at 0°k and at room temperature. [04]

OR

Q.6 (A) Describe any two properties of Nano Particles. **[06]**

(B) Derive an expression for conductivity in an Intrinsic and Extrinsic Semiconductor. **[06]**

(C) Explain applications of Nano Particles in the field of Medicine and Electronics. **[04]**

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F. E. (Semester - II) Examination - 2010
BASIC MECHANICAL ENGINEERING
(2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

Instructions :

(1) Solve Q. No. *1* or *2*, Q. No. *3* or *4*, Q. No. *5* or *6*, Q. No. *7* or *8*, Q. No. *9* or *10*, Q. No. *11* or *12*.

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

(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

Q.1) (A)   Define : System, Isothermal Process, Specific Properties, Specific Heat, Internal Energy.   [1x5=05]

(B)   Explain : COP and Efficiency with its relation.   [3+3=06]

(C)   In a certain thermodynamic process of an ideal gas, the volume changes from $0.2 m^3$ to $0.5 m^3$, while pressure changes as per $P = 150 \left[\left(V/100 \right) + 1 \right]$, where P is in N/m^2 and V is in m^3.

Find work done by gas in kJ.   [05]

OR

Q.2) (A)   Derive equation for work done in Constant Volume and Constant Pressure Process.   [05]

(B)   Classify the following into Intensive and Extensive Properties : Pressure, Enthalpy, Energy, Volume, Weight.   [1x5=05]

(C) Heat Pump is used to maintain house at 23°C. The house is losing heat to outside air through walls at 60,000 kJ/hr. While energy generated in house by various appliances is 4,000 kJ/hr. For a COP of 1.5, find required power input in kW, supplied to the heat pump. **[06]**

Q.3) (A) Draw labelled sketch of any one Boiler. **[05]**

(B) Explain principle of working of a Reciprocating Compressor with block diagram. **[3+3=06]**

(C) Draw labelled sketch of Vapour Compression Refrigeration System. Define COP. **[5+1=06]**

OR

Q.4) (A) Draw labelled sketch of Two Stroke SI Engine. **[05]**

(B) How boilers are classified ? **[06]**

(C) State uses of Compressed Air. **[06]**

Q.5) (A) Explain use of Solar Energy for any one application. **[05]**

(B) State advantages and disadvantages of Thermal Power Plant. **[3+3=06]**

(C) A wire 1.5mm in diameter and 150mm long is submerged in fluid. An electric current is passed through wire and is increased until the fluid reaches 100°C. Under the condition if convective heat transfer coefficient is 4500 W/m²°C, find how much electrical power must be supplied to wire to maintain wire surface at 120°C ? **[06]**

OR

Q.6) (A) Draw labelled sketch of Nuclear Power Plant. **[3+2=05]**

(B) State advantages and disadvantages of Hydro-power Plant. **[3+3=06]**

(C) Calculate rate of heat transfer per m² through wall of 200 mm thick inner layer of 'A', a central layer of 'B' 100mm thick and a outer layer of 'C' 100mm thick. Temperature of gas in the furnance is 1670°C with h_{in} = 74 W/m²°C and outside surface temperature of 'C' is 70°C.

Given :

K_A = 1.25 W/m°C

K_B = 0.074 W/m°C

K_C = 0.55 W/m°C

Assume steady state, 1-D flow of heat. [06]

SECTION - II

Q.7) (A) What is Brake ? How it differs from Clutch ? Explain Internal Expanding Brake with figure. [2+2+4=08]

(B) Explain four bar mechanism. What do you mean by inversions of mechanism ? Explain. [4+4=08]

OR

Q.8) Explain with neat sketch : [4x4=16]

(a) Bevel Gears

(b) Ball Bearing

(c) Open Belt Drive

(d) Transmission Shaft

Q.9) (A) Explain Stress-Strain Diagram for Ductile Material. Show its salient features. [4+4=08]

(B) Describe any four properties of Engineering Materials. [4x2=08]

OR

Q.10) (A)   Draw neat sketches of the following Sheet Metal Working
Processes :   [4x2=08]

        (a)   Embossing

        (b)   Punching

        (c)   Bending

        (d)   Perforating

    (B)   Describe any four Non-metallic Materials.   [4x2=08]

Q.11) (A)   Draw block diagram of Lathe Machine and explain functions
of its various parts.   [4+5=09]

    (B)   Draw block diagram of Vertical Milling Machine and explain
functions of its basic elements.   [4+5=09]

OR

Q.12) (A)   Draw labelled sketch of Radial Drilling Machine. State its
applications.   [5+1=06]

    (B)   Draw neat sketch of Power Saw, name its parts and explain
its working.   [3+3=06]

    (C)   State advantages, limitations and applications of CNC Machine
Tool.   [2+2+2=06]

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F. E. (Semester - II) Examination - 2010
BASIC ELECTRONICS ENGINEERING
(2008 Pattern)

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 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

Q.1) (A) The reverse saturation current at 300°K of a P-N junction Ge diode is $5\mu A$. Find voltage to be applied across the junction to obtain a forward current of 50 mA.   **[05]**

(B) The input signal voltage to the full wave rectifier is $160 \sin [2\pi (60)t]$ V. Assume $V_r = 0.7V$ for each diode, calculate :

   (a) Required turn ratio of the transformer to produce a peak output voltage 25V

   (b) PIV of each diode

   (c) Output Frequency   **[05]**

(C) Write short notes :   **[06]**

   (a) Seven Segment Display

   (b) Multiplexed Display

OR

Q.2) (A) Explain how the D.C. Output Voltage of a Full Wave Rectifier is improved when capacitor filter is used ? Draw waveforms of the load voltage and diode currents.   **[06]**

(B) A loaded zener regulator is shown in fig. 1. V_z = 5.1V, at I_{zt} = 49mA, I_{zk} = 1mA, Z_2 = 7Ω and I_{zm} = 70 mA. Determine minimum and maximum input voltage that can be regulated. [10]
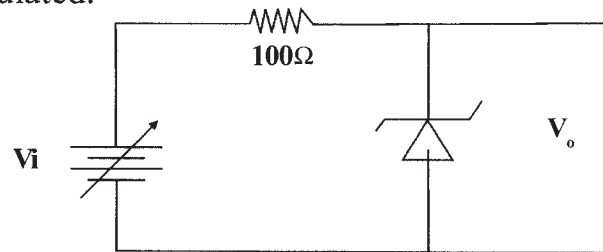
Fig. 1

Q.3) (A) Draw common-base input characteristics of a transistor. What is Early Effect ? How can it account for the CB input characteristics ? [08]

(B) Determine whether or not the transistor in fig. 2 is in saturation. Assume $V_{CE(Sat)}$ = 0.2V. [08]
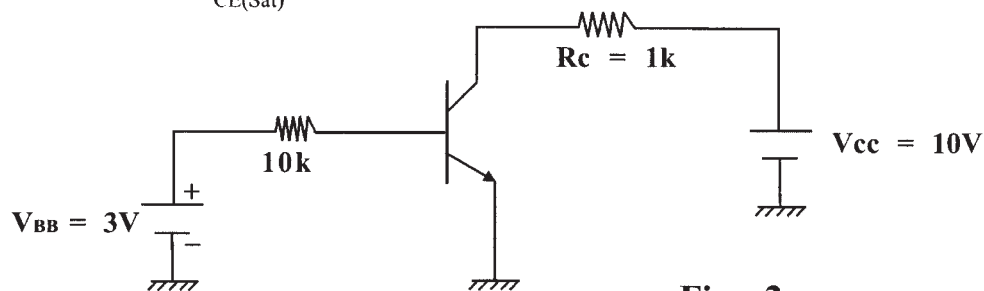
Fig. 2

OR

Q.4) (A) When is the channel of a JFET is said to be pinched off ? Define pinch off voltage. Give relationship between the pinch off voltage, the saturation current and the gate to source voltage. Draw drain characteristics of n-channel JFET. [08]

(B) Show structure and circuit representation of a silicon controlled rectifier. Explain its principle of operation. Draw V-I characteristics. Define holding and latching current. [08]

Q.5) (A) Describe use of an Op-Amp as adder. What type of feedback is used in an Op-Amp adder ? Justify your answer. [06]

(B) Draw block diagram of Op-Amp. [04]

(C) Draw neat diagram of basic differentiator. Give its limitations. How they are overcome in practical differentiator. [08]

OR

Q.6) **(A)** What is meant by V-I Converter. Draw circuit diagram of V-I Converter using floating load and mention use of this circuit. **[08]**

(B) State characteristics of an ideal Op-Amp. A certain Op-Amp has an open loop gain of 1,00,000 and a common mode gain of 0.2. Determine CMRR and express in dB. **[04]**

(C) Find output voltage V_o of the Op-Amp circuit shown in fig. 3. **[06]**
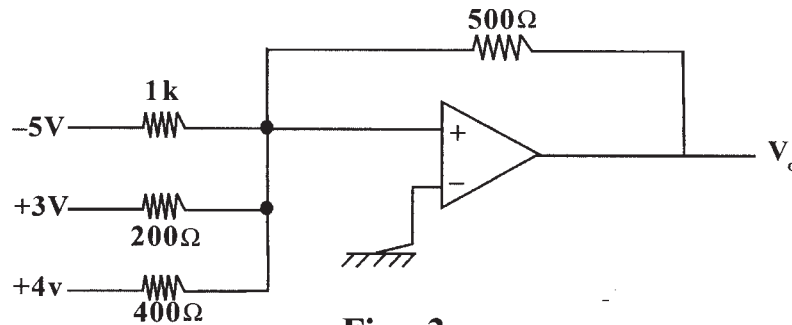
Fig. 3

SECTION - II

Q.7) **(A)** A burglar alarm should activate when two conditions given below are simultaneously satisfied.

(a) the main entrance door of the building is open, and

(b) the bedroom door and/or the kitchen door is open.

Write truth table and construct logic circuit to operate alarm using one AND gate and one OR gate. **[06]**

(B) What is a Shift Resistor ? Explain operation of a 4-bit shift resistor with serial-in, serial-out data. **[06]**

(C) How does a Micro-processor differ from a Micro-controller ? Explain importance of Micro-processor. **[04]**

OR

Q.8) **(A)** Synchronous Counters are more advantageous than Asynchronous Counters. Explain. Describe in brief some important applications of Counters. **[04]**

(B) Give CMOS Implementation of : **[06]**

(a) AND Gate

(b) OR Gate

(C) The boolean expressions of the two variables X and Y in terms of the three input A, B and C are given by :

$$X = ABC + A\overline{B}\,\overline{C} + \overline{A}B\overline{C}$$

$$Y = (\overline{A} + \overline{B} + \overline{C}) \cdot (\overline{A} + B + C) \cdot (A + \overline{B} + C).$$

Write relationship between X and Y. [06]

Q.9) (A) Give classification of Controllers. Explain advantages and disadvantages of each. [06]

(B) Compare different types of Temperature Transducers. [06]

(C) Draw and explain Two-wire Transmitter. [04]

OR

Q.10) (A) Draw block diagram of PLC and explain various blocks. [06]

(B) Explain principle and operation and working of Displacement Transducer. [06]

(C) Mention factors to be considered while selecting a tranducer for an application. [04]

Q.11) (A) (a) What is the difference between Analog Communication and Digital Communication ? Mention advantages of Digital Communication. [04]

(b) Write a short note on RG Standard for Co-axial Cables. [02]

(B) A carrier frequency of 1200 kHz is modulated by a sinusoidal wave with a frequency of 25 kHz by standard amplitude modulator. Determine Output Frequency Spectrum. Calculate Band Width. [06]

(C) Draw basic block diagram of Superhetrodyne Receiver and explain function of each block. [06]

Q.12) (A) An audio frequency signal $10 \sin 2\pi 500t$ is used to amplitude modulate, a carrier of $50 \sin 2\pi \times 10^5$, calculate :
(a) Modulation Index
(b) Side Band Frequencies
(c) Amplitude of each Side Band Frequency [06]

(B) (a) What are the main sections of an Optical Fiber ? Explain function of each section. [03]

(b) Explain problems associated with Twisted Pair Cables. State different types of Twisted Pair Cables. [03]

(C) Explain with diagram the working of Cellular Telephone System. [06]

Total No. of Questions : 6]   [Total No. of Printed Pages : 4

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F. E. (Semester - II) Examination - 2010
BASIC ELECTRONICS ENGINEERING
(2008 Pattern)

Time : 2 Hours]   [Max. Marks : 50

Instructions :

    (1) Answers should be written in one answer book.

    (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.

    (5) Assume suitable data, if necessary.

Q.1) (A) (a) Explain with diagram and graphs, way of Biasing of P-N Junction Diode. Also write Volt-Ampere Equation of P-N Junction Diode. **[05]**

      (b) A diode, whose internal resistance is 20 ohms, is to supply power to 1000 ohms load from a 110V rms source of supply. Calculate :

        (i)   Peak Load Current

        (ii)   DC Load Current

        (iii) AC Load Current

        (iv) DC Load Voltage **[04]**

    (B) (a) Draw output characteristics of BJT in CE Configuraton. Indicate all the three regions of operation on it. Explain operation of BJT as a switch. **[05]**

      (b) Explain constructional details and V-1 Characteristics of SCR. **[04]**

OR

Q.2) (A) (a) Determine minimum and maximum load currents for which the Zener Diode in figure 1 will maintain regulation. What is the minimum R_1 that can be used ?

Given :

$V_z = 12V$, $I_{zk} = 1mA$, $I_{zm} = 50mA$.

Assume $Z_z = 0\Omega$ over the range of current values. **[06]**
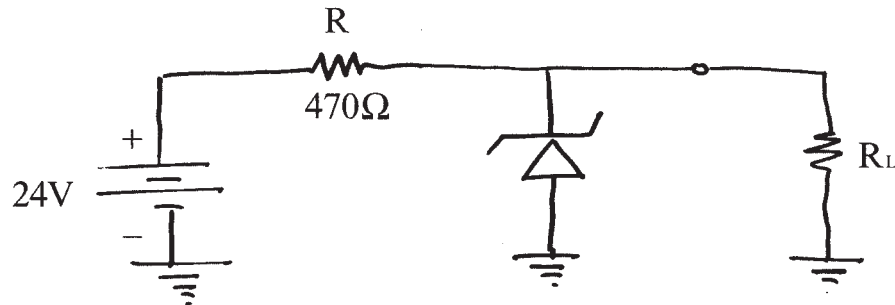
(b) Give advantages of Multiplexed Display. **[03]**

(B) (a) Sketch JFET Drain and Transfer Characteristics and indicate following parameters : **[05]**

    (i) Pinch-Off Voltage

    (ii) Drain Self Saturating Current

    (iii) $V_{GS(OFF)}$

    (iv) Regions of Operation

(b) What is β_{DC} of a BJT if $I_C = 20.5mA$ and $I_E = 20.3$ mA ? What is α_{DC} if $I_C = 5.35mA$ and $I_B = 50 \mu A$? **[04]**

Q.3) (A) (a) Draw and explain functional block diagram of Operational Amplifier. **[04]**

(b) In the Non-inverting Summing Amplifier $V_1 = 2V$, $V_2 = 4V$, $V_3 = 5V$, input resistors for all three input signals are the same and are equal to $1k\Omega$. The feedback resistor R_f is $2k\Omega$. Determine output voltage. **[04]**

(B) (a) Draw neat circuit diagram of CMOS NAND gate and explain its operation with truth table. **[04]**

(b) What is Multiplexer ? What is the relation between number of select lines and inputs ? Draw diagram of 4 : 1 MUX and explain significance of STROBE pin ? Give application of Multiplexers. **[04]**

OR

Q.4) **(A)** (a) Define and give typical values of the following Op-Amp parameters : **[04]**

(i) Voltage Gain

(ii) CMRR

(iii) Input Offset Voltage

(iv) Slew Rate

(b) Draw neat circuit of Square Wave Generator using Op-Amp and explain its operation. **[04]**

(B) (a) Prove the following using DeMorgan's Theorem : **[04]**

(i) $AB + CD = \overline{\overline{AB} \cdot \overline{CD}}$

(ii) $\overline{(A + B) \cdot (C + D)} = (\overline{A} \cdot \overline{B}) + (\overline{C} \cdot \overline{D})$

(b) Give comparison between Micro-controller and Micro-processor. **[04]**

Q.5) **(A)** (a) What is RTD ? Draw its constructional diagram and explain its operation. **[04]**

(b) Draw block diagram and write a brief note on PID Controller. **[04]**

(B) (a) Write expression of AM ? Draw and explain Frequency Spectrum for AM. **[04]**

(b) Differentiate between AM and FM. **[04]**

OR

Q.6) **(A)** (a) Draw and explain Construction of a LVDT. Explain its principel of operation. State its applications. **[04]**

(b) Draw block diagram of PLC and explain function of each block. **[04]**

(B) (a) With the aid of block diagram explain Superheterodyne Receiver. **[04]**

(b) Write a short note on RG Standard of Cables. **[04]**

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[3861]-163

F. E. (Semester - II) Examination - 2010
ENGINEERING MECHANICS
(2008 Pattern)

Time : 3 Hours]   [Max. Marks : 100

Instructions :

(1) Answer Q.1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 from section I and Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12 from section II.

*(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 logarithmic tables, slide rules, electronic pocket calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Explain Principle of Transmissibility of Force.   [02]

(B) Determine components of the 1000N Force shown along the aa' and bb' axes shown in fig.   [08]
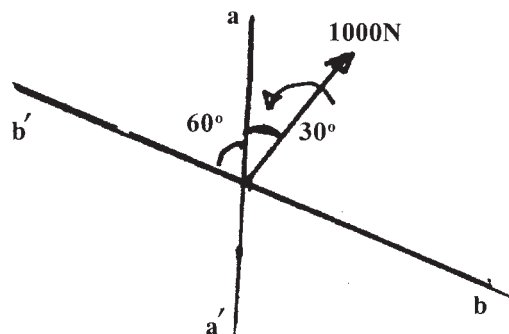
(C) A plate in the shape of a parallelogram is acted upon by two couples, as shown in fig.

Determine :

(a) The moment of the couple formed by the two 21N forces.

(b) The perpendicular distance between the 12N forces if the resultant of the two couples is zero.

(c) The value of 'α' if the resultant couple is 1.5N.m clockwise and d = 1.05m. **[08]**
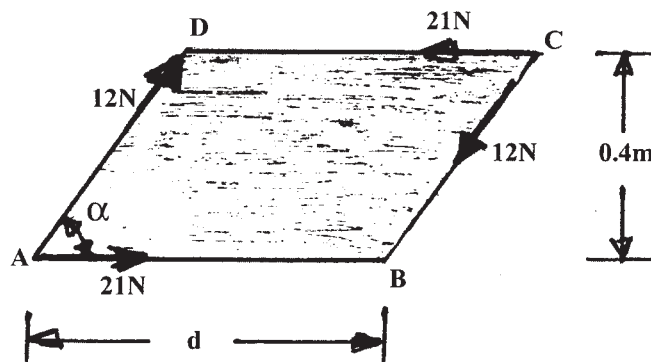
OR

Q.2) (A) Explain Varignon's Theorem. **[02]**

(B) A boat is moved uniformly along a canal by two horses pulling with forces P = 890N and Q = 1068N acting at an angle α = 60° as shown in fig.

Determine magnitude of the resultant pull on the boat and the angle 'β' and 'γ' as shown in fig. **[08]**
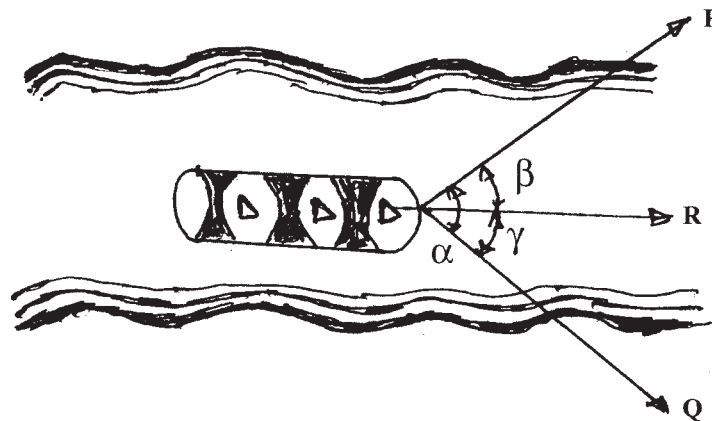
(C)   Locate Centroid of the shaded three-quarters of the area of a square of dimension 'a' as shown in fig.   **[08]**
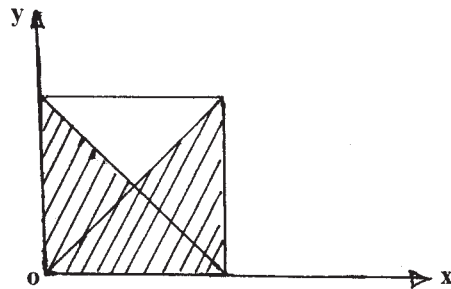
Q.3)   (A)   Find the angle of tilt 'θ' with the horizontal so that the contact force at 'B' will be one-half that at A for smooth cylinder.   **[08]**
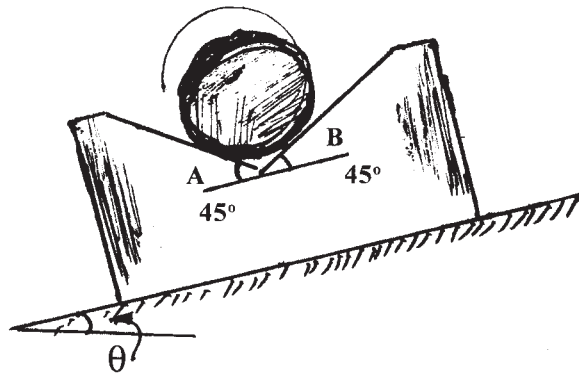
(B)   A tower guy is anchored by means of a bolt at 'A'. The tension in the wire is 2500N.

Determine :

(a)   The components F_x, F_y and F_z of the force acting on bolt.

(b)   The angle Q_x, Q_y and Q_z defining direction of force.   **[08]**
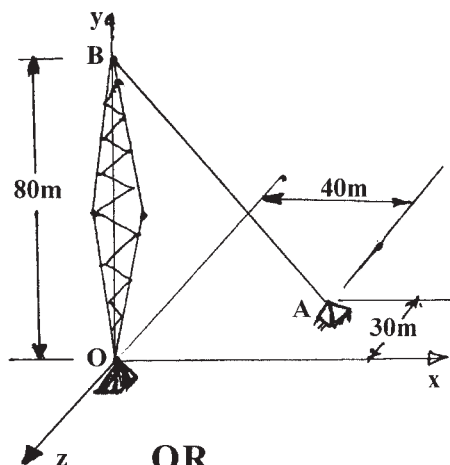
OR

Q.4) **(A)** Determine reactions R_A and R_B at support A and B of horizontal beam AB due to action of vertical loads applied as shown in fig. **[08]**
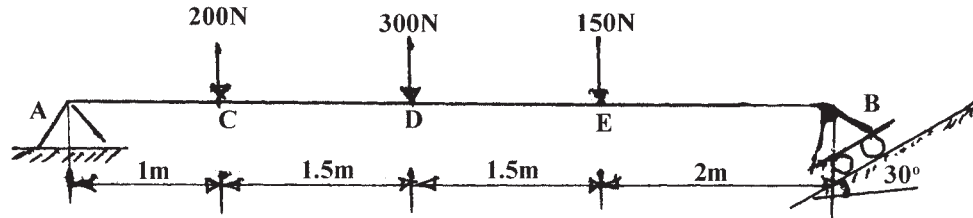
(B) A square foundation mat supports four columns as shown. Determine magnitude, direction and point of application of resultant of the four loads, as shown in fig. **[08]**
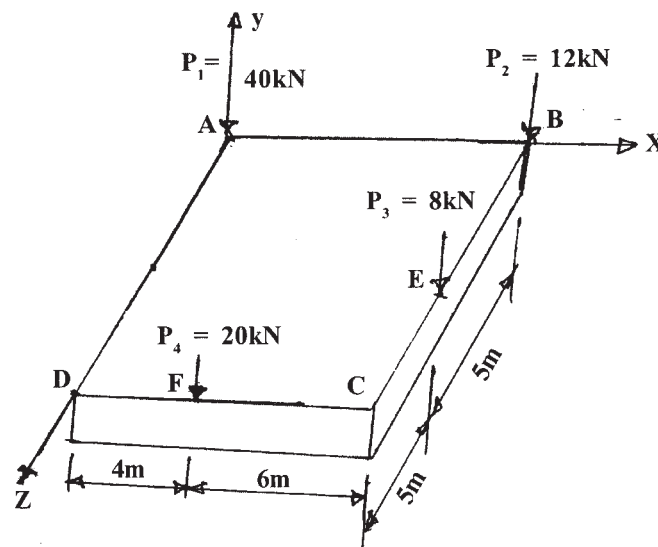
Q.5) **(A)** Determine force in each member of the joint 'G' of truss and state if the members are in tension or compression. Take $P_1 = 2.22kN$, $P_2 = 6.66kN$. **[08]**
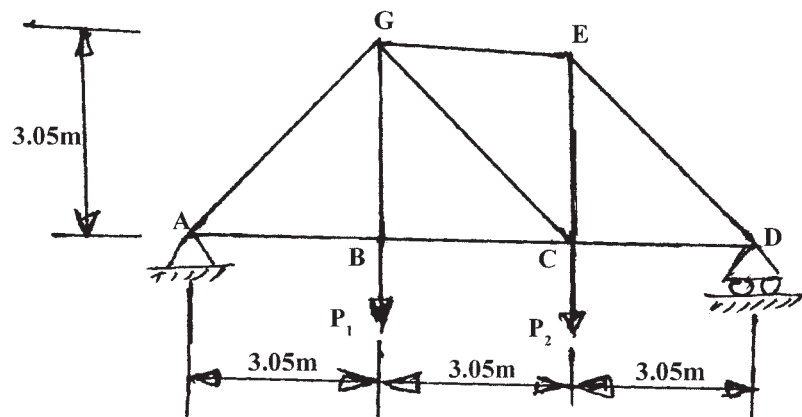
(B)   A heavy concrete block weighing 10kN is to be shifted away from the wall with the help of a 15° wedge as shown in fig. Calculate magnitude of the vertical force that has to be applied to the top of the wedge for achieving this objective, if the coefficient of friction between all the rubbing surfaces is 0.25.   [08]
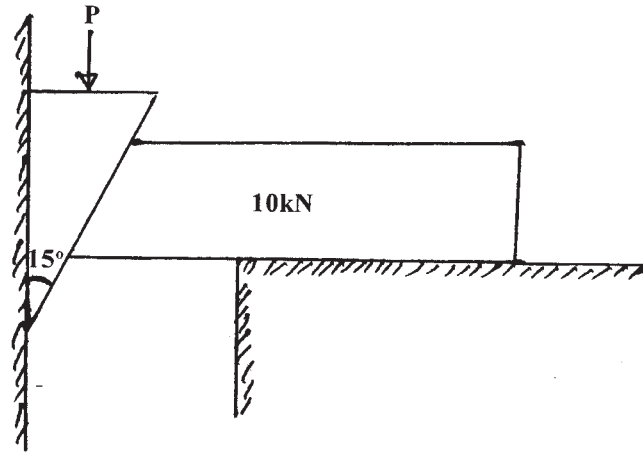
OR

Q.6)   (A)   'ACE' and 'BCD' are two rigid rods connected by string 'FG' and the pin at 'C' as shown in fig.

Find reaction at 'A' and 'B' and force on pin at 'C'.

Also find force in string 'FG'.   [08]
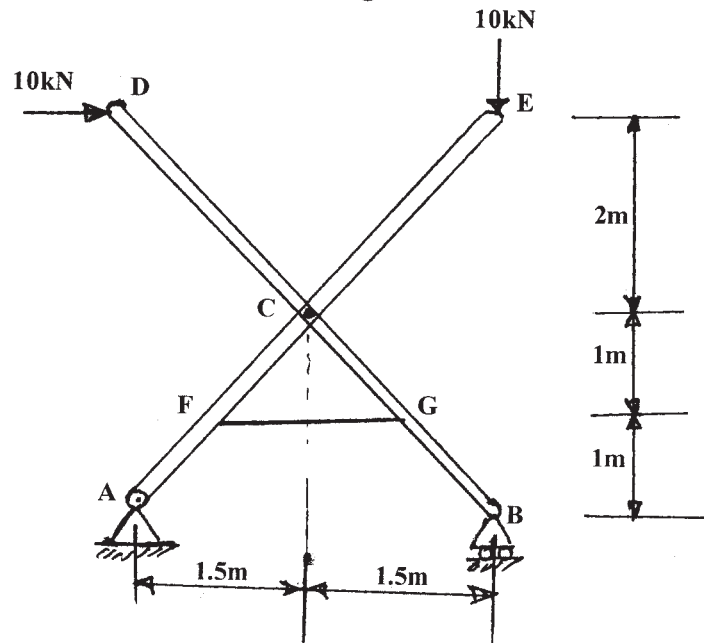
(B)   The brakeband encircles drum 'D' and is connected to the horizontal lever at 'Q' and 'R' as shown in fig.

Calculate braking torque if drum is rotating (i) clockwise (ii) anticlockwise. Take μ = 0.33 for all the rubbing surfaces. **[08]**
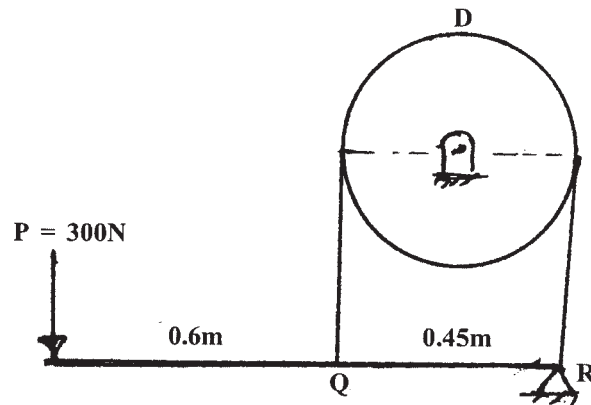
SECTION - II

Q.7) (A)   Acceleration of Particle is defined by relation a = –4 m/s^2.

If at t = 0, v = 24 m/s and x = 0, determine :

(a)   velocity and position when t = 8 sec.

(b)   time and position when v = 0. **[08]**

(B)   The 50 kg crate moves along the floor with an initial speed of 7m/s at x = 0. The coefficient of kinematic friction is 0.40. Calculate time required for the crate to come to rest and corresponding distance 'x' travelled. **[09]**
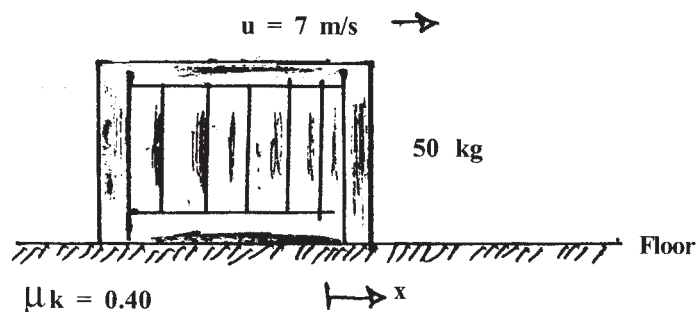
OR

Q.8) **(A)** An automobile 'A' starts from '0' and accelerates at constant rate of 0.75 m/s². A short time latter it is passed by bus 'B' which is travelling in opposite direction at constant speed of 6m/s. Knowing that bus 'B' passes point '0' 20 sec. after automobile 'A' started from there, determine when and where vehicle passed each other. **[08]**

(B) Two blocks of weights 'P' and 'Q' are connected by a flexible but inextensible cord and supported as shown in fig. If the coefficient of friction between the block 'P' and the horizontal surface is 0.33, find :

(a)   acceleration of the system.

(b)   the tensile force in the cord.

Take P = 53.4N, Q = 26.7N **[09]**
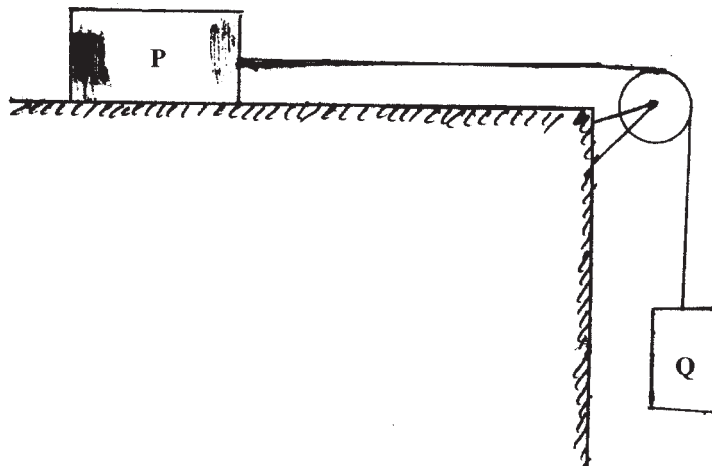
Q.9) **(A)** At the instant t = 0, a locomotive starts to move with uniformly accelerated speed along a circular curve of radius r = 600m and acquires by the end of the first 60 sec. of motion a speed equal to 24 kmph. Find tangential and normal acceleration at the instant t = 30 sec. **[08]**

(B)   The bob of pendulum 3.5m long describes an arc of a circle
       in vertical plane as shown in fig. If the tension in the string
       is 2.5 times the weight of the bob for the position shown,
   find velocity and acceleration of the bob in that position.   [08]
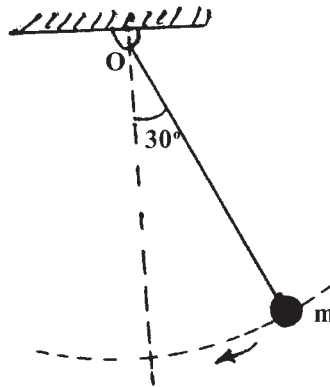
OR

Q.10) (A)   An air-craft moving horizontally at a speed of 720 kmph at
             a height of 1000m towards a target on the ground, releases
             a bomb which hits target. Find :
             (a)   time required for the bomb to reach target on the ground.
             (b)   the horizontal distance of the air-craft from the target
                    when it released bomb.   [08]

      (B)   Rod 'OA' rotates about 'O' in a horizontal plane. The motion
             of 400 gm collar 'B' is defined by the relations -

             $r = 500 + 300 \sin\pi t$ and $\theta = 2\pi (t^2 - 2t)$,

             where r is expressed in mm, t is in seconds and 'θ' is in
             radians.

             Determine radial and transverse components of the force exerted
             on the collar when t = 0.   [08]
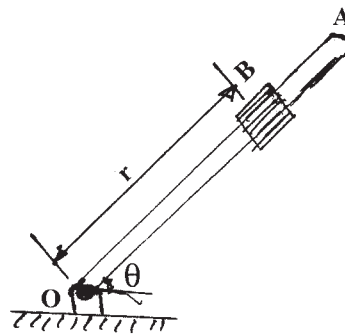
Q.11) (A)   A 45 kg block is sliding a distance of 3m along horizontal surface by a constant force P = 200N, inclined at 30° to the horizontal as shown in fig. The coefficient of sliding friction is 0.30.

   (a)   Determine total work done on the block.

   (b)   Assuming that the block starts from rest, determine speed of the block when it has travelled 3m.   **[09]**
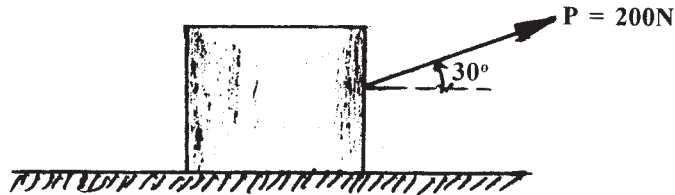
   (B)   A bullet of mass 100 gm is fired into a freely suspended target of mass 10 kg. Due to impact, the bullet gets imbedded in the target and the target with bullet moves with a velocity of 7m/s. Find velocity of bullet before impact and the loss of kinetic energy.   **[08]**

OR

Q.12) (A)   A 50N block is released from rest on an inclined plane as shown in fig. The block starts from 'A', slides down a distance of 1.2m and strikes a spring with a stiffness of 8 kN/m. The coefficient of friction between the block and inclined plane is 0.25.

   Determine :

   (a)   amount the spring gets compressed.

   (b)   distance the block will rebound up the plane from the compressed position.   **[09]**
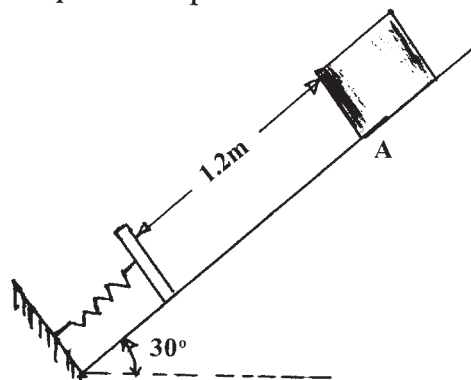
(B)   A handball of mass m = 0.050 kg is dropped on a floor from a height h = 2m. The coefficient of restitution for the impact between the ball and the floor is 0.75.

(a)   Determine velocity of the ball at the instant before it strikes the floor.

(b)   Determine velocity of the ball at the instant it rebounds.   [08]

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Total No. of Questions : 6]   [Total No. of Printed Pages : 5

[3861]-164

F. E. (Semester - II) Examination - 2010
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 only.*

(3) *Neat diagram must be drawn wherever necessary.*

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

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

(6) *Use of cell phone is prohibited in the examination hall.*

(7) *Use of electronic non-programmable pocket calculator is allowed.*

Q.1) **(A)** Determine Magnitude 'F' and direction 'θ' of force 'F', so that the resultant of three forces acting on hook is zero.   **[06]**
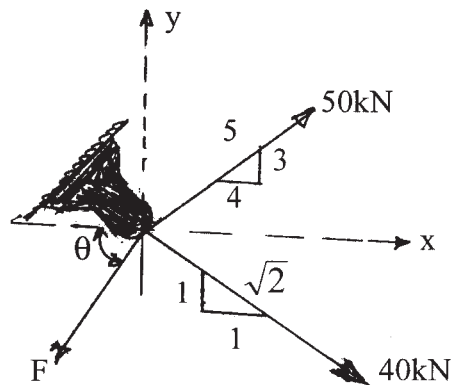
(B) A stone is thrown vertically upward from a point on bridge located 40m above water level. Knowing that it strikes water 4 sec. after release, determine :

(i) the speed at which stone was thrown upward.

(ii) the speed with which it strikes water.   **[06]**
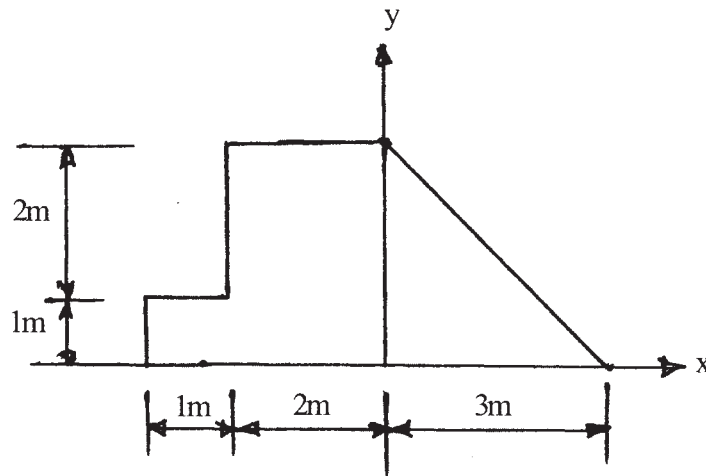
OR

[3861]-164   1   **P.T.O.**
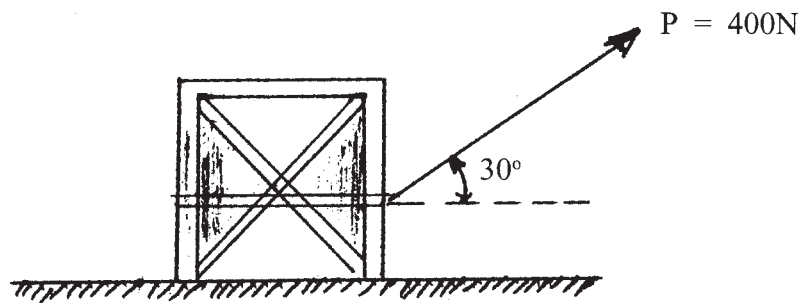
**Q.2)** (A)   Locate Centroid of the plate as shown in fig.   **[06]**

(B)   The 50 kg crate as shown in fig. rests on a horizontal plane
for which the coefficient of kinetic friction is $\mu k = 0.3$. If the
crate is subjected to a 400N towing force, as shown, determine
velocity of the crate in 5 sec. starting from rest.   **[06]**

P = 400N

30°

Q.3) (A)   Find support reactions at support 'D' and 'E' for the beam
system as shown in fig.   **[06]**

2kN

1.4kN

2.5m   1m

A

B

D

E

0.5m   1m   0.5m
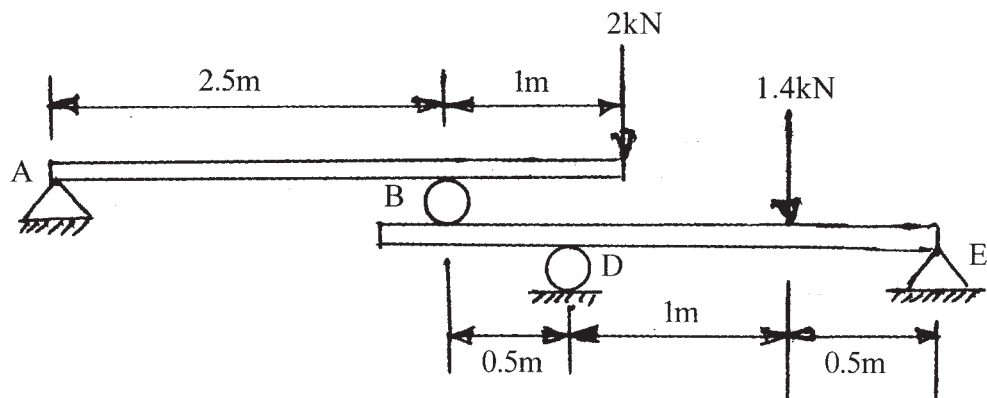
(B)   Two identical rollers each of weight 445N are supported by an inclined plane and a vertical wall as shown in fig. Assuming smooth surfaces, find reactions induced at the points of support A, B and C.   [07]
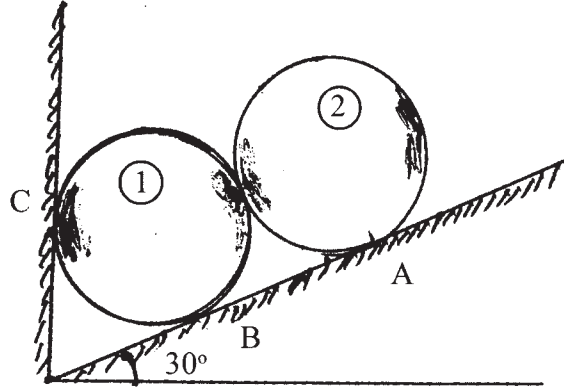

(C)   A shot is fired at an elevation of 60° with a velocity of 60 m/s. State position of the shot at 2 sec. after firing. What will be the velocity at that instant ?   [06]

OR

Q.4) (A)   A ball of weight Q = 53.4N rests in a right-angled trough as shown in fig. Determine forces exerted on the sides of the trough at D and E if all surfaces are perfectly smooth.   [06]
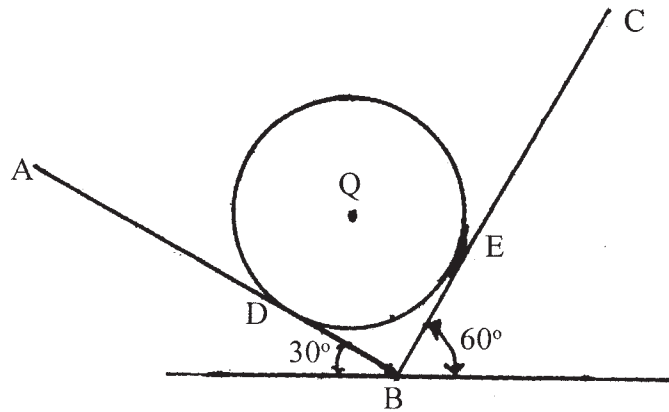
(B) A rectangular plate of negligible weight is held horizontally by four wires of equal length at A, B, C and D as shown in fig. A point load of 16 kN acts on the plate at 150 mm from AB and 200mm from AD. If the minimum force in any of the wires is 2.2 kN, find forces in remaining wires. **[07]**

16kN

A

200mm

150 mm

B

400mm

D

C

500mm
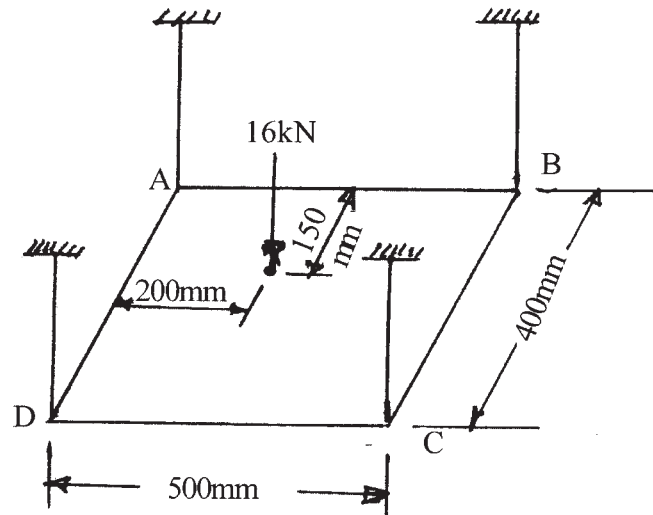
(C) A car starts from rest on a circular curve of radius 250m and accelerates at a constant tangential acceleration of $1.2 m/s^2$. Determine distance travelled and time taken when the magnitude of the total acceleration is $1.5 m/s^2$. **[06]**

Q.5) (A) Calculate axial forces in each bar of the simple truss supported and loaded as shown. The triangle ACB is isosceles with $30°$ angles at A and B and P = 5 kN. **[12]**

C

A

60°

B

P
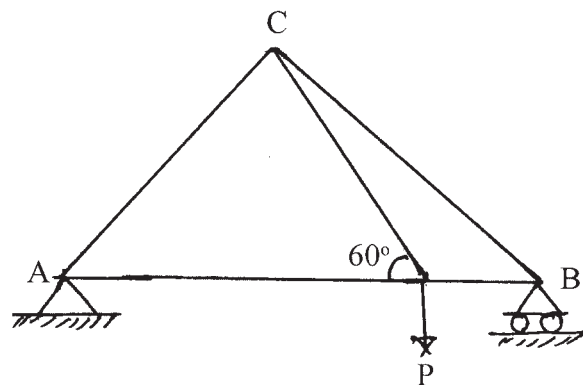
(B) Calculate velocity 'V' of the 50 kg crate when it reaches bottom of the chute at 'B' if it is given an initial velocity of 4m/s down the chute at A. The coefficient of kinetic friction is 0.30.
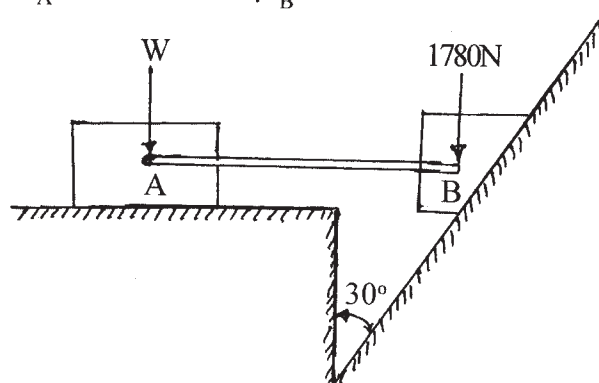
[07]
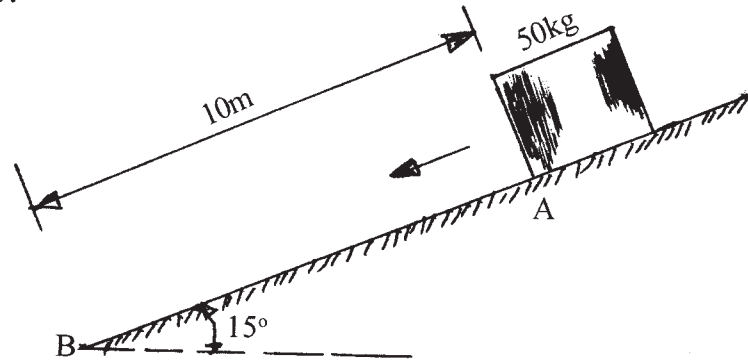
OR

Q.6) (A) Two blocks connected by a horizontal link AB are supported on two rough planes as shown. What is the smallest weight 'W' of block A for which equilibrium of the system can exist ?

Take μ_A = 0.4 and μ_B = 0.27

[12]

(B) A ball 'A' of mass 0.25 kg moving on smooth horizontal table with velocity of 10 m/s strikes on identical stationary ball 'B' on the table. Find velocity of the ball 'B' just after the impact. The impact is perfectly plastic.

[07]