Total No. of Questions : 12] [Total No. of Printed Pages : 7

[3761]-101

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

ENGINEERING MATHEMATICS - I

(June 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 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) Figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(5) Use of non-programmable calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Define Rank of a Matrix. Reduce the following matrix to the normal form and hence find its rank : **[06]**

$$A = \begin{bmatrix} 1 & 2 & -1 & 2 \\ -2 & -5 & 3 & 0 \\ 1 & 0 & 1 & 10 \end{bmatrix}$$

(B) Examine consistency of the following system of equations : **[06]**

$2x - y - z = 2,\ x + 2y + z = 2,\ 4x - 7y - 5z = 2.$

(C) Verify Cayley Hamilton Theorem for : **[05]**

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

Hence find A^{-1}.

OR

Q.2) (A) Find eigen values and eigen vectors for the following matrix : **[07]**

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

(B) Examine whether following vectors are linearly dependent. If so find the relation amongst them : **[05]**

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

(C) Show that the transformation : **[05]**

$y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$

is non-singular. Also find the values of x_1, x_2, x_3 if

$y_1 = 1$, $y_2 = 2$, $y_3 = -1$ by using inverse transformation.

Q.3) (A) Find the complex no. z if $\arg(z + 2) = \frac{\pi}{4}$ and

$\arg(z - 2) = \frac{3\pi}{4}$. **[05]**

(B) Prove that $\left(\frac{-1 + i\sqrt{3}}{2}\right)^n + \left(\frac{-1 - i\sqrt{3}}{2}\right)^n = -1$ if $n = 8$

$= 2$ if $n = 9$. **[05]**

(C) Find all fifth roots of unity. Show that all these roots form a geometric progression and also show that continued product of all 5^{th} roots is one. **[06]**

OR

Q.4) (A) Find a and b if $\cos^{-1}\left(\frac{3i}{4}\right) = a + ib$. **[05]**

(B) If $y = \log \tan\left(\frac{\pi}{4} + \frac{x}{2}\right)$, prove that :

(1) $\tanh \frac{y}{z} = \tan x/2$

(2) $\cosh y . \cos x = 1$ **[05]**

(C) Two opposite vertices of a square are represented by complex nos. $(9 + 12i)$ and $(-5 + 10i)$. Find the complex no. representing the other two vertices of the square. **[06]**

Q.5) (A) Test the following series for convergence : **(Any Two)** **[08]**

(1) $\frac{1}{1\cdot 3} + \frac{2}{3\cdot 5} + \frac{3}{5\cdot 7} + \frac{4}{7\cdot 9} + \ldots\ldots\ldots$

(2) $\sum \frac{2^n}{n^4 + 1} x^n \;,\; x > 0$

(3) $\frac{1}{2\cdot 4} + \frac{1\cdot 3}{2\cdot 4\cdot 6} + \frac{1\cdot 3\cdot 5}{2\cdot 4\cdot 6\cdot 8} + \ldots\ldots\ldots$

(B) Find n^{th} derivative of $y = \tan^{-1}x$. **[04]**

(C) If $y = a \cos(\log x) + b \sin(\log x)$, show that

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

OR

Q.6) (A) Test the following series for convergence : **(Any Two)** **[08]**

(1) $x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \dots\dots\dots$, $x > 0$

(2) $1 + \frac{3}{2!} + \frac{3^2}{3!} + \frac{3^3}{4!} + \frac{3^4}{5!} + \dots\dots\dots$

(3) $1 + \frac{3}{7} + \frac{3\cdot 6}{7\cdot 10} + \frac{3\cdot 6\cdot 9}{7\cdot 10\cdot 13} + \frac{3\cdot 6\cdot 9\cdot 12}{7\cdot 10\cdot 13\cdot 16} + \dots\dots\dots$

(B) Find the n^{th} derivative of $y = x^2e^{3x} \sin 4x$ **[04]**

(C) If $y = (\sin^{-1} x)^2$, find the relation between y_{n+2}, y_{n+1} and y_n. **[05]**

SECTION - II

Q.7) (A) Solve **any two** : **[08]**

(1) Expand six x.cosh x in ascending powers of x upto term in x^5.

(2) Use Taylor's Theorem to find $\sqrt{25.15}$.

(3) Expand $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ in ascending powers of x upto term in x^7.

(B) Solve **any two** : **[08]**

(1) Evaluate $\lim_{x\to 0} \frac{\log(\tan x)}{\log x}$

(2) Evaluate $\lim_{x\to 0} x \log x$

(3) Evaluate $\lim_{x\to\infty} \left(\frac{1}{x}\right)^{1/x}$

OR

Q.8) (A) Solve **any two** : **[08]**

(1) Expand $\log(1 + e^x)$ as far as the term in x^2.

(2) Use Taylor's Theorem to expand $2x^3 + 3x^2 - 8x + 7$ in powers of $(x - 2)$.

(3) Prove that $e^x \cos x = 1 + x - \frac{x^3}{3} - \frac{x^4}{6} + \ldots\ldots$

(B) Solve **any two** : **[08]**

(1) If $\lim_{x \to 0} \frac{\sin 2x + p\sin x}{x^3}$ is finite then find the value of p and hence the value of the limit.

(2) Evaluate $\lim_{x \to 0} \frac{(1+x)^n - 1}{x}$.

(3) Evaluate $\lim_{x \to 0} (\cot x)^{\sin x}$

Q.9) (A) If $u = \log(x^2 + y^2)$, verify $\frac{\partial^2 u}{\partial x \partial y} = \frac{\partial^2 u}{\partial y \partial x}$. **[05]**

(B) If $u = \sin^{-1}\left(\frac{x + y}{\sqrt{x} + \sqrt{y}}\right)$, show that $2x \frac{\partial u}{\partial x} + 2y \frac{\partial u}{\partial y} = \tan u$. **[06]**

(C) If $u = f(x^2 - y^2, y^2 - z^2, z^2 - x^2)$, prove that

[06]

OR

Q.10) (A) If $x = r\cos\theta$, $y = r\sin\theta$, show that

$$\left(\frac{\partial r}{\partial x}\right)^2 + \left(\frac{\partial r}{\partial y}\right)^2 = 1.$$ **[05]**

(B) Verify Euler's Theorem on homogeneous function for

$$u = \left(\sqrt{x} + \sqrt{y} + \sqrt{z}\right).$$ **[06]**

(C) If $z = f(x, y)$, where $x = u^2 - v^2$, $y = 2uv$ then show that :

$$u\frac{\partial z}{\partial u} - v\frac{\partial z}{\partial v} = 2\sqrt{x^2 + y^2}\,\frac{\partial z}{\partial x}$$ **[06]**

Q.11) (A) If $ux = yz$, $vy = zx$, $wz = xy$, find $\frac{\partial(u,v,w)}{\partial(x, y, z)}$. **[06]**

(B) Verify whether the following functions are functionally dependent, if so find relation between them $u = \frac{x - y}{x + y}$, $v = \frac{xy}{(x + y)^2}$ **[05]**

(C) Discuss the maxima and minima of the function $x^2 + y^2 + 6x + 12$. **[06]**

OR

Q.12) (A) Verify $JJ' = 1$ for the transformation $x = u.v$, $y = u/v$. **[06]**

(B) In calculating volume of right circular cylinder, errors of 2% and 1% are found in measuring height and base radius respectively. Find the percentage error in calculated volume of the cylinder. **[05]**

(C) If $u = \frac{x^2}{a^3} + \frac{y^2}{b^3} + \frac{z^2}{c^3}$, where $x + y + z = 1$ then prove that the stationary value of u is given by

$$x = \frac{a^3}{a^3 + b^3 + c^3},\ y = \frac{b^3}{a^3 + b^3 + c^3},\ z = \frac{c^3}{a^3 + b^3 + c^3}.$$ **[06]**

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

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F. E. (Semester - I) Examination - 2010
APPLIED SCIENCE - I
(June 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 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, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

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

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

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

$c = 3 \times 10^{8}$ m/sec.

SECTION - I

Q.1) (A) What are the types of Symmetries in crystal ? Discuss them with respect to cubic crystal. **[07]**

(B) Explain the line defects in metallic crystals. State the effects of line defects on the properties of metals. **[06]**

(C) X-ray of Wavelength 1.6 A^o are diffracted by a Bragg's crystal spectrometer at angle 14.2^o in the first order. What is the spacing of atomic layer in the crystal ? **[04]**

OR

Q.2) (A) What is meant by atomic packing factor ? Calculate atomic packing factor for SC, BCC and FCC Structure. **[07]**

(B) Explain the Mesomorphic Phase. Give the types and applications of mesomorphic phase of solids. **[06]**

(C) Define :

(1) Unit Cell

(2) Co-ordination Number

(3) Anisotropy

(4) Crystallography **[04]**

Q.3) (A) Explain the Titration Curve and calculation of pH for 0.1N HCl and 0.1N NaOH. When indicator can be used for this titration ? **[07]**

(B) What is the oxidizing and reducing agent ? Give the types of redox titration and explain any one type of titration. **[06]**

(C) 10 ml H_3PO_4 solution on titration against 0.1N NaOH from burette requires 7.6 ml of NaOH for neutralization using Methyl Orange Indicator. Find the normality and strength of H_3PO_4 solution. **[04]**

OR

Q.4) (A) (1) 50 ml of NaCl solution requires 38.6 ml of M/50 $AgNO_3$ in Mohr's Method. Calculate amount of chloride ion per litre of NaCl solution. **[04]**

(2) 25 ml of a solution containing Ca++ is titrated against 0.03M disodium EDTA from burette to get the end point 14.8ml in the complexometric titration. Calculate the amount of Ca++ ions per litre of the solution. **[03]**

(B) What is the Mohr's Method for precipitation titration ? Give its procedure and formula for calculation. **[06]**

(C) Define the terms :

(1) Equivalence Point

(2) Titration

(3) Normality

(4) Molarity **[04]**

Q.5) (A) Give the Polymerization Reaction, Properties and Applications **any two** of the following : **[06]**

(1) Polystyrene

(2) Phenol - Formaldehyde Resin

(3) Silicon Rubber

(B) What is the Vulcanization of Rubber ? Give the structural changes taking place on vulcanization. State the effects on properties of rubber on vulcanization. **[06]**

(C) Distinguish between thermosoftning and thermosetting resins. **[04]**

OR

Q.6) (A) Account shortly on average molecular weight of polymers and any one method to determine it. [**04]**

(B) Give the cationic mechanism of Polymerisation. **[04]**

(C) What is a Glass transition temperature ? What are the factors affecting on it. State its importance. **[04]**

(D) Write a note on **any one** of the following : **[04]**

(1) Conducting Polymer

(2) Polymer Composite

SECTION - II

Q.7) (A) With the help of neat labelled diagram explain the principle, construction and working of Michelson's Interferometer. Discuss the types of fringes. **[07]**

(B) Explain the Motion of Electron when it is : **[06]**

(1) Parallel to Electric Field and

(2) Perpendicular to Electric Field

(C) In Newton's Ring Experiment the diameter of 4th and 12th dark rings are 0.400 cm and 0.700 cm respectively. Deduce the diameter of 20th ring. **[04]**

OR

Q.8) (A) Explain with a neat diagram the principle, construction and working of Bainbridge Mass Spectrograph. **[07]**

(B) Derive an expression for condition of maxima and minima for reflected light in case of thin transparent film of uniform thickness. **[06]**

(C) Electrons Accelerated by a Potential of 150 volt enter in an electric field at an angle of 50^{o} with the normal to the interface of the higher potential and get refracted at an angle of 35^{o} with the normal find the potential difference between the two regions. **[04]**

Q.9) (A) Explain the Fraunhofer Diffraction at a single slit and obtain the condition for principal maximum and minima. Draw the Intensity Distribution Curve. **[07]**

(B) What is Piezo-Electric Effect ? Draw a neat diagram and explain the Piezo-Electric Generator for the Production of Ultrasonic Waves. **[06]**

(C) What is the highest order spectrum that is visible with light of wavelength 6000A^o by means of a grating having 5000 lines per cm. **[04]**

OR

Q.10) (A) Explaining the Principle of Echo Sounding. Describe any two applications of Ultrasonic Waves. Where this principle is used ? **[07]**

(B) Obtain an expression for the Resolving Power of Grating. On what factors does it depend ? **[06]**

(C) Calculate the Natural Frequency of Cast Iron Rod of 2.6 cm in length. **[04]**

(Given : Density of Rod = 7.23×10^3 kg/m^3,
Young's Modulus = 1.16×10^{11} N/m^3)

Q.11) (A) Explain the term Double Refraction and hence explain in the phenomenon of it on the basis of Huygen's Wave Theory. **[06]**

(B) With the help of a neat labelled diagram explain the construction and working of a Cyclotron. Obtain the expression for the cyclotron frequency and the maximum energy of the particle. **[06]**

(C) A Q.W.P. of thickness 2.275×10^{-3} cm is cut with its faces parallel to optic axis. The emergent beam of light is elliptically polarized. Find the wavelength of the monochromatic light made incident normally on the plate.
(Given : $\mu_o = 1.586$, $\mu_e = 1.592$) **[04]**

OR

Q.12) (A) Explain the principle, construction and working of Betatron. **[06]**

(B) Distinguish between Polarized and Unpolarized Light. Describe the process of production and detection of Circularly Polarized Light. **[06]**

(C) If the frequency of the A.C. Potential applied to the dees of a Cyclotron is 9 MHZ calculate the Magnetic Flux density to accelerate α particles. **[04]**
(Given : Mass of α Particle = 6.643×10^{-27} kg)

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

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

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

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

(3) Figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

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

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) How materials are classified as Conductor, Insulator and Semiconductor. Give two examples of each. **[06]**

(B) An electric pump lifts 60 m^3 of water per hour to a height of 25 meter. The pump efficiency is 86% and motor efficiency is 78%. The pump is used for three hours daily. Find energy consumed per week, if one m^3 of water is 1000 kg. **[06]**

(C) Explain the charging of Lead Acid Battery with chemical reaction. What are the changes taking place during charging ? **[06]**

OR

Q.2) (A) Obtain the expression for $\alpha_2 = \alpha_1/1 + \alpha_1 (t_2 - t_1)$. **[06]**

(B) An electric furnace is used to melt aluminum. Initial temperature of the solid aluminum is 32°C and its melting point is 680°C. Specific heat capacity of aluminum is 0.95 kJ/kg°K and the heat required to melt 1 kg of aluminum at its melting point is 450 kJ. If the input power drawn by the furnace is 20 kW and its overall efficiency is 60%. Find the mass of aluminum melted per hour. **[06]**

(C) What is Insulation Resistance ? What are the factors on which insulation resistance of a single core cable depends ? **[06]**

Q.3) (A) State and explain Superposition Theorem. [08]

(B) Using Kirchhoff's Laws, find the current delivered by 12V battery as shown in the Fig. 1. [08]

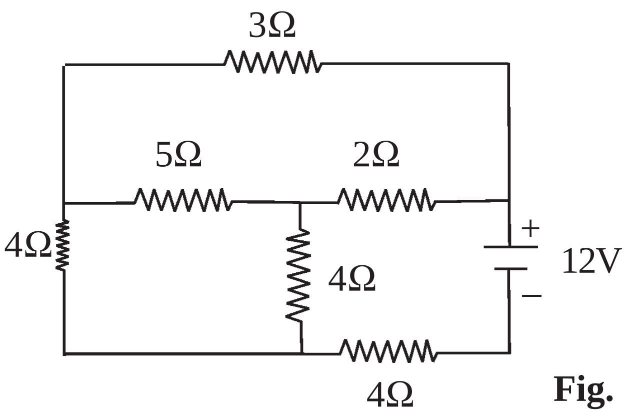

Fig. 1

OR

Q.4) (A) Derive an expression to convert Star Connected Network into its Equivalent Delta Network. [08]

(B) Using Thevenin's Theorem find the current flowing through 1 ohm resistance connected between A-B, as shown in the Fig. 2. [08]

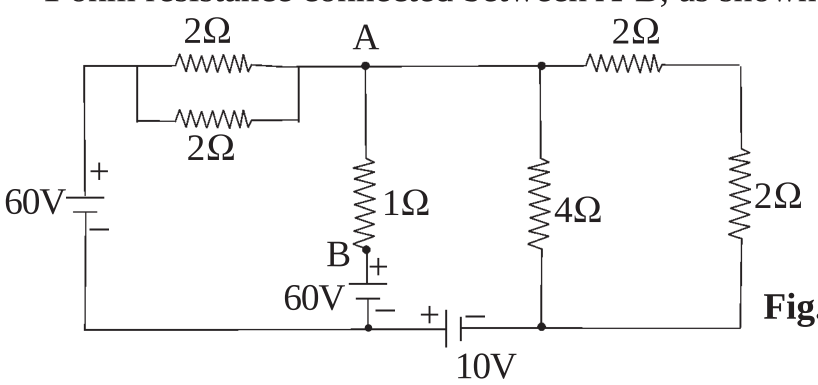

Fig. 2

Q.5) (A) Explain the following terms : [08]

(1) MMF

(2) Reluctance

(3) Pearmeance

(4) Flux Density

(B) A coil M is wound around a magnetic circuit. Explain the phenomenon of self induced emf in it. Define its self inductance and state its unit. Another coil N is wound around the same magnetic circuit. Explain the phenomenon of mutual inductance between the coils and define 'coefficient of coupling' between them. [08]

OR

Q.6) (A) An iron ring wound with 550 turn's solenoid produces a flux density of 0.94 tesla in the ring carrying a current of 2.4 Amp. The mean length of iron path is 80 cm and that of air gap is 1 mm. Determine :

(1) The relative permeability of iron

(2) Self-inductance

(3) Energy stored in the above arrangement, if the cross sectional area of ring is 25 cms^2. **[08]**

(B) Derive the expression for the energy stored in the magnetic field in terms of energy stored per unit volume. **[08]**

SECTION - II

Q.7) (A) At instant t = 0, the instantaneous value of 50Hz sinusoidal current is +5 Amp and increases in magnitude further. Its r.m.s. value is 10 Amp :

(1) Write expression for its instantaneous value.

(2) Find the current at t = 0.01 and t = 0.015 second.

Sketch the waveform indicating these values. **[08]**

(B) Derive Mathematical Expression for capacitor voltage and current at any instant during charging of capacitor through resistance. Also sketch the graph of capacitor voltage and current with respect to time. **[08]**

OR

Q.8) (A) A sinusoidal voltage of $V = V_m \sin(\ t)$ is applied across a series R-L circuit. Derive the expression for current and average power consumed by the circuit. **[08]**

(B) A parallel plate capacitor has plates, each area of $100cm^2$, separated by a distance of 3cms. The dielectric between the plates has relative permittivity of 2.2. The potential difference between the plates is 10kV. Find (1) Capacitance of the Capacitor (2) The Electric Flux Density, (3) The Electric Field strength, (4) Energy Stored. **[08]**

Q.9) (A) Sketch and explain Phasor diagram of an RLC series circuit when (1) $X_C > X_L$ (2) $X_C = X_L$ (3) $X_C < X_L$. **[08]**

(B) A series circuit consisting of a 12Ω resistance, 0.3 henry inductance and a variable capacitor is connected across 100V, 50Hz A.C. Supply. The capacitance value is adjusted to obtain maximum current. Find this capacitance value and the power drawn by the circuit under this condition. Now supply frequency is raised to 60Hz, the voltage remaining same at 100V. Find the value of inductive and capacitive reactance. **[08]**

OR

Q.10) (A) What is admittance of an AC Circuit ? What are its two components ? State the units of these quantities. How is admittance expressed in rectangular and polar form ? **[06]**

(B) Two circuits the impedances of which are given by $Z_1 = (12 + j16)$ Ohm and $Z_2 = (8 - j4)$ Ohm are connected in parallel across the potential difference of (23 + j0) volts. Calculate : (1) The Total Current Drawn (2) Total Power and Branch Power consumed and (3) Overall Power Factor of the circuit. **[10]**

Q.11) (A) Derive and explain with Phasor diagram the relations between Line Values and Phase Values of Current and voltages for a 3-phase balanced delta connected lagging power factor load. **[08]**

(B) The three equal impedances of each of $10\angle 60^{o}$ Ohms are connected in star across 3-phase, 400 volts 50Hz supply. Calculate :

(1) Line Voltage and Phase Voltage

(2) Power Factor and Active Power consumed

(3) If the same three impedances are connected in delta to the same source of supply what is the active power consumed ? **[06]**

(C) Differentiate Shell Type and Core Type Transformer. **[04]**

OR

Q.12) (A) A 25 kVA, 50 Hz, Single Phase Transformer has the iron loss and full load copper loss of 350 and 400 watts respectively. Find the efficiency of the transformer at (1) 50% of full load at unity p.f. and (2) 75% of full load at 0.8 lagging p.f. **[08]**

(B) What is an Auto Transformer ? State the advantages, limitations and applications. **[06]**

(C) Explain the Concept of Balanced Loading. **[04]**

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

BASIC CIVIL AND ENVIRONMENTAL ENGINEERING

(June 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) 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, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) 21st Century is the era of interdisciplinary engineering. Explain the statement. **[06]**

(B) Write a brief note on following and give practical application : **[06]**

(1) Environmental Engineering

(2) Geotechnical Engineering

(C) Enlist and briefly explain the infrastructural facilities that are to be provided in a locality for its development. (Any 4). **[04]**

OR

Q.2) (A) Define the term 'GAUGE' and show this with the help of a sketch. Also, state the various types of gauges with their dimensions. **[06]**

(B) Differentiate between the following w.r.t. any 3 points : **[06]**

(1) Estimation and Valuation

(2) Flexible Pavement and Rigid Pavement

(C) Enumerate the functions, a Civil Engineer has to perform in construction of dams. **[04]**

Q.3) (A) Write notes on : **[06]**

(1) Raft Foundation

(2) Settlement of Foundation

(B) Discuss how smart-materials can be used in construction ? **[06]**

(C) What are Deep Foundations ? What is the difference between End Bearing Pile and Friction Pile ? **[04]**

OR

Q.4) (A) What are the different types of steel sections used in construction ? Explain in brief. **[06]**

(B) Compare Load Bearing, Framed Structure and Composite Structure. **[06]**

(C) Write a note on Recycling of Materials. **[04]**

Q.5) (A) Explain the following : **[06]**

(1) Change Point

(2) Back Sight Reading

(3) Intermediate Sight Reading

(4) Fore Sight Reading

(5) Height of Instrument

(6) GTS Bench Mark

(B) Briefly explain the following instruments : **[04]**

(1) Digital Theodolite

(2) Digital Planimeter

(C) Following staff readings were observed on a continuously sloping ground, along the centre line of a road, with the help of a dumpy level and 4m levelling staff at 20m interval. The first reading was taken on starting point of road having R.L. 300.000m. 0.420, 1.660, 2.880, 0.580, 1.385, 2.190, 2.995 and 3.800.

(1) Enter the readings in a page of level book.

(2) Find R.L's by Rise and Fall Method, apply usual checks.

(3) Determine Longitudinal Gradient of the Road. **[08]**

OR

Q.6) (A) Show following features in contour maps. Show minimum four contour lines for each : **[04]**

(1) Vertical Cliff (with contour interval 0.5m)

(2) Valley Line with contour interval 2m (min. R.L. = 340m)

(B) State the principle on which E.D.M. works. Also give two practical applications. **[04]**

(C) Explain the terms G.I.S. and G.P.S. Also state their applications in Civil Engineering. **[04]**

(D) The levelling work was conducted between T.B.M. 'A' (R.L. 508.905M) and T.B.M. 'B' (R.L. 500.690M)

The readings taken were :

0.750, 1.780, 2.935, 3.410, 0.425, 3,685, 0.680 and 2.975

The instrument was shifted after 4th and 6th reading. Book the entries in tabular form, reduce the levels and exercise the arithmetic check. (Solve by Collimation Plane Method) **[06]**

SECTION - II

Q.7) (A) Explain with a neat sketch : Nitrogen Cycle. **[2+4=06]**

(B) Enlist any 4 methods of carrying out EIA. Explain with a neat sketch : Overlays Method. **[2+4=06]**

(C) Explain in detail : Compositing as a Technique for Management of Solid Waste. **[06]**

OR

Q.8) (A) Enlist any 4 natural resources. Explain in detail, the necessity of conserving natural resources. **[2+4=06]**

(B) Explain in detail, adverse environmental impacts of the solid waste. **[06]**

(C) Explain with a neat sketch, **any two** of the following : **[2x3=06]**

(1) Grassland Ecosystem

(2) Desert Ecosystem

(3) Ocean Ecosystem

Q.9) (A) Enlist any 8 principles of Planning. Explain in detail : Economy and Orientation as Principles of Planning. **[4+2+2=08]**

(B) On a plot of size 24 m $\times$ 35 m, the shorter side is facing the main road. If front margin is 3M and all other margins being 2m each, calculate the possible construction on each of the floors of a G + 2 storeyed building, if full ground coverage (after sparing the margins) is intended. Assume equal construction on 1st and 2nd floor. FSI allowed in the area is 1.5. **[08]**

OR

Q.10) (A) State and explain in detail, any 4 guidelines to be used for achieving green buildings. **[4x2=08]**

(B) A plot owner proposed G + 1 construction with 225 m^2 on each floor, on a plot of size 20m $\times$ 25m. If all margins are 2.5m and FSI allowed is 1.0, calculate additional construction possible on the plot. If maximum possible construction is to be made on the ground floor (after sparing the margins), calculate the possible additional construction on ground floor and first floor, if any. **[08]**

Q.11) (A) Explain in detail, 4 causes of Air Pollution and enlist 4 sources of Air Pollution. **[4+2=06]**

(B) Enlist any 4 remedial measures to abate Land Pollution. Explain any one in detail. **[2+4=06]**

(C) Enlist any 4 non-industrial sources of Noise. Comment on any one of them in brief. **[2+2=04]**

OR

Q.12) (A) “As far as possible, we should utilize non-conventional energy sources.” Explain the above statement. **[06]**

(B) Write a detailed note on : Water Pollution. **[06]**

(C) Explain in detail various possible measures to control Noise Pollution. **[04]**

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

[3761]-105

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

ENGINEERING GRAPHICS - I

(June 2008 Pattern)

Time : 4 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answers **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) Retain all construction lines.

(4) Use of log table, electronic pocket calculator is allowed.

(5) Figure in bracket indicate full marks.

(6) Assume suitable data, if necessary.

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

SECTION - I

UNIT - II : ENGINEERING CURVES

Q.1) (A) Draw an ellipse with the major axis 160 mm and minor axis 120 mm. The portion on the left side of the minor axis is to be drawn by Concentric Circles Method and on the right side of minor axis by Rectangle Method. Draw tangent and normal to the ellipse at a point 70 mm distance from the center of ellipse. **[08]**

(B) A car travels along a road inclined at 35^{o} to the horizontal. Diameter of wheel of the car is 400 mm. Plot the path traced by a point on the circumference of the wheel, initially situated exactly at the point of contact of the wheel and the road. Name the curve. **[07]**

OR

Q.2) (A) Draw an Archimedean spiral of 1.5 convolutions the greatest and least radii being 125 mm and 35 mm respectively. **[07]**

(B) Rod AB, 90 mm long is rotating uniformly about B. During the time rod completes one revolution, point P starts from A and moves along rod uniformly to B and reaches back to point A. Draw the path traced out by point P. Give name of the curve. **[08]**

UNIT - III : ORTHOGRAPHIC PROJECTIONS

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

(a) Sectional Elevation in the direction of arrow 'X' (section along A-A) **[07]**

(b) Plan **[05]**

(c) End View from Right Hand Side **[05]**

Give all dimensions. **[03]**

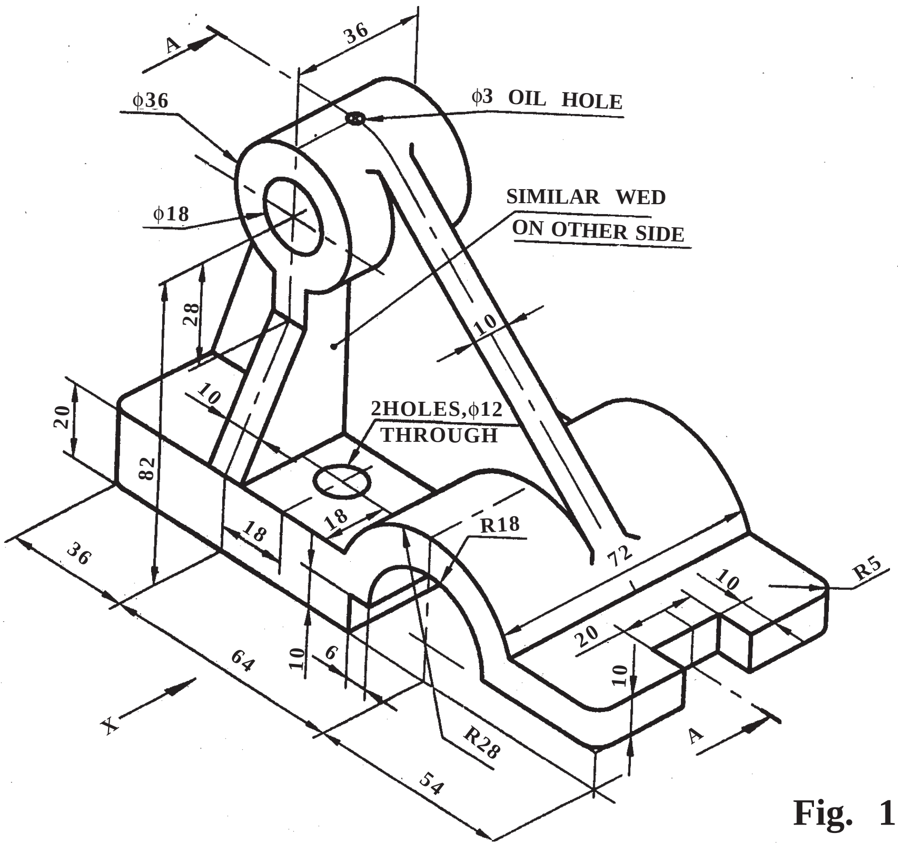


Fig. 1

OR

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

(a) Sectional Elevation looking in the direction of arrow 'X' (Section along A-A) **[07]**

(b) Plan **[05]**

(c) End View from the Left Hand Side **[05]**

Give all dimensions. **[03]**

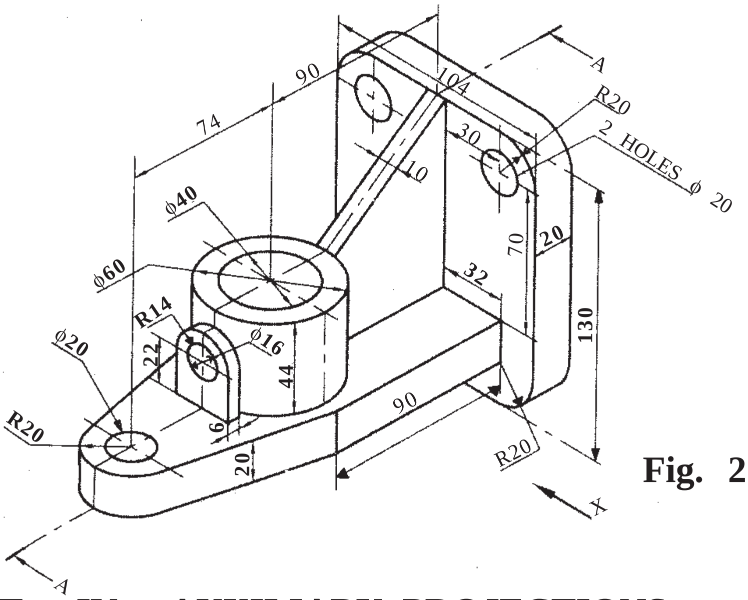


Fig. 2

UNIT - IV : AUXILIARY PROJECTIONS

Q.5) (A) Fig. 3 shows front view, incomplete side view and partial auxiliary view of a machine element :

(1) Redraw the given views **[05]**

(2) Complete the Side View **[08]**

Show all the dimensions. **[02]**

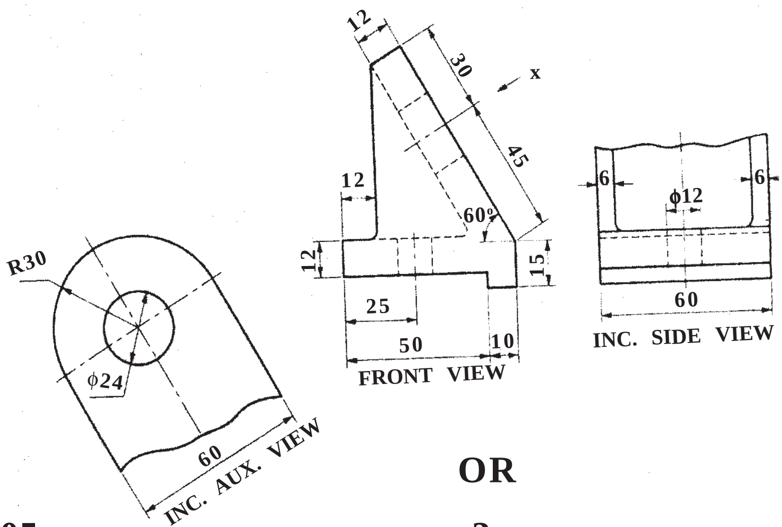


Fig. 3

OR

Q.6) Fig. 4 shows front view, incomplete top view and partial auxiliary view of an object :

(a) Redraw the given views **[05]**

(b) Complete the Top View **[08]**

Show all dimensions. **[02]**

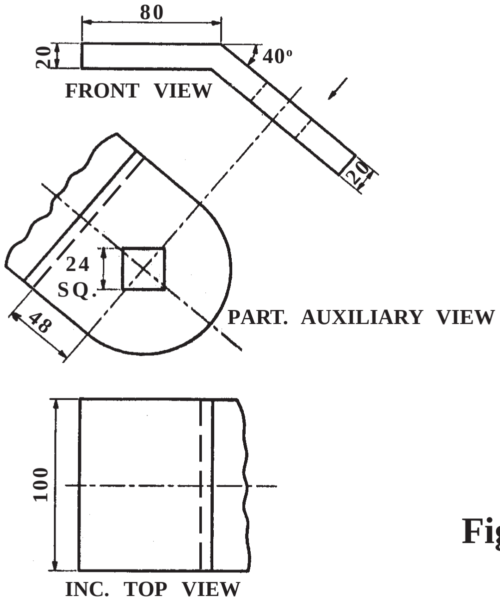


Fig. 4

SECTION - II

UNIT - V : ISOMETRIC

Q.7) Fig. 5 shows the elevation and end view of an object by First Angle Method of Projection. Draw an isometric view taking origin at 'O' and give all dimensions : **[17+3]**

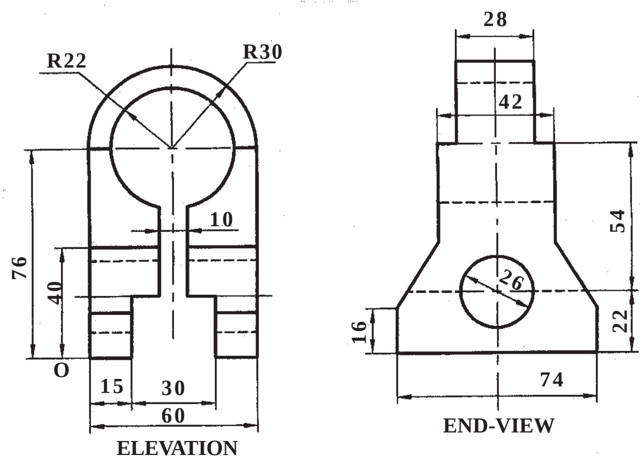


Fig. 5

OR

Q.8) Fig. 6 shows the elevation and plan of an object by First Angle Method of projection. Draw its isometric projection taking origin at 'O'. Construct isometric scale to read 110 mm length.
Give all dimensions. **[15+2+3]**

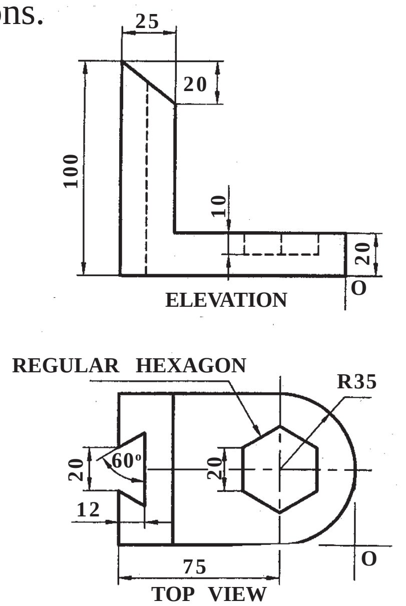


Fig. 6

UNIT - VI : MISSING VIEWS

Q.9) Fig. 7 shows front view and left hand side view of an object. Draw the following views by First Angle Method of Projection :

(a) Sectional Front View (Section along A-A) **[07]**

(b) Top View **[08]**

(c) Left Hand Side View **[03]**

Give all dimensions. **[02]**

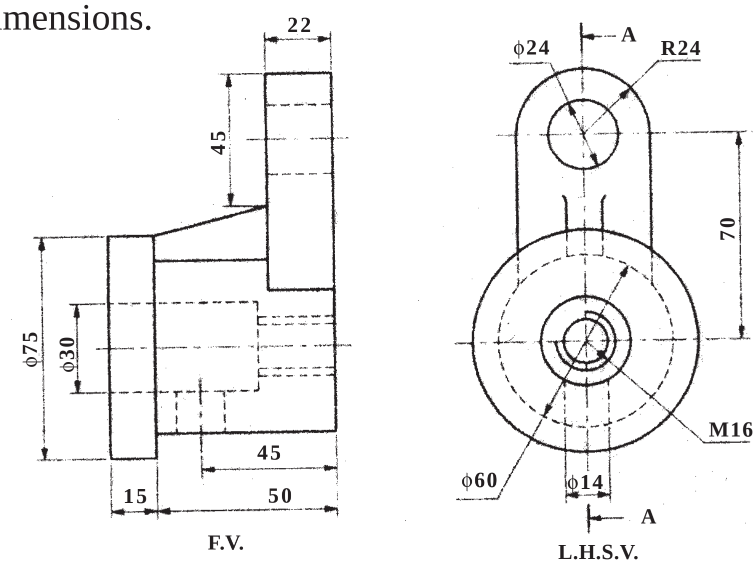


Fig. 7

OR

Q.10) Fig. 8 shows front view and top view of an object. Draw the following views by First Angle Method of Projection :

(a) Sectional Front View (Section along AA) **[07]**

(b) Top View **[03]**

(c) Right Hand Side View **[08]**

Give all dimensions. **[02]**

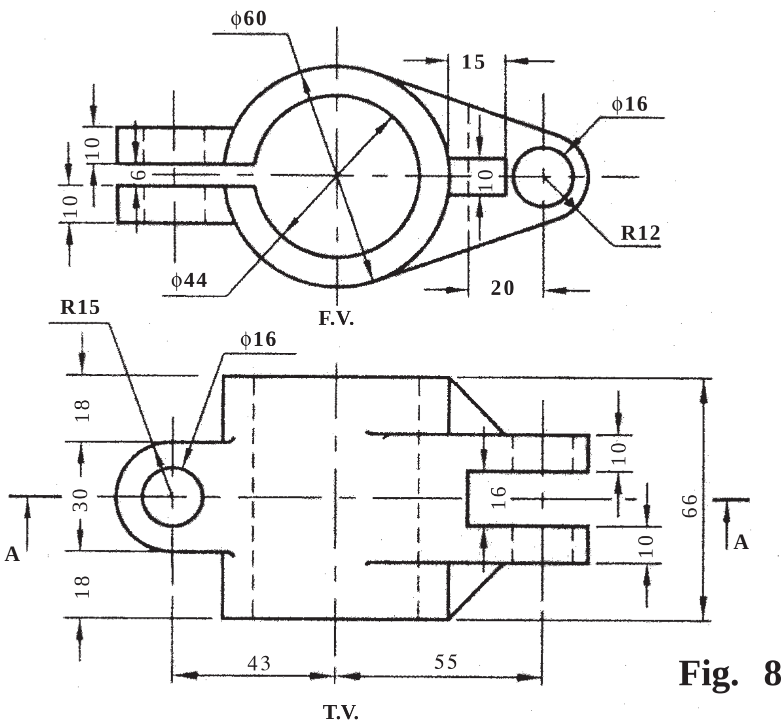


Fig. 8

UNIT - VII : FREE HAND SKETCHES

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

(a) Acme Thread Profile **[03]**

(b) Oldham's Coupling **[03]**

(c) Rag Foundation Bolt **[04]**

OR

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

(a) Woodruff Key **[03]**

(b) Cylindrical Helical Torsion Spring of Circular Cross-section Wire **[03]**

(c) Double V-Butt and Single Bevel Butt Welded joints. **[04]**

Total No. of Questions : 12] [Total No. of Printed Pages : 7

[3761]-106

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

ENGINEERING MATHEMATICS - II

(June 2008 Pattern)

Time : 3 Hours] [Max. Marks : 100

Instructions :

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

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

(3) Figures to the right indicate full marks.

(4) Neat diagram must be drawn wherever necessary.

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

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Form a Differential Equation whose general solution is

$xy = ae^x + be^{-x} + x^3$ **[05]**

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

(1) $(x^2y - 2xy^2)\, dx = (x^3 - 3x^2y)\, dy$

(2) $\tan y \dfrac{dy}{dx} + \tan x = \cos y \cos^2 x$

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

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

OR

Q.2) (A) Form a Differential Equation whose general solution is $y = \log \cos(x - a) + b$ **[05]**

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

(1) $x\dfrac{dy}{dx} + 3y = x^4 e^{1/x^2} y^3$

(2) $\left[\log\left(x^2 + y^2\right) + \dfrac{2x^2}{x^2 + y^2}\right] dx + \dfrac{2xy}{x^2 + y^2}\, dy = 0$

(3) $\left(\dfrac{y}{x} \sec y - \tan y\right) dx = (x - \sec y \log x)\, dy$

(4) $\dfrac{dy}{dx} = \dfrac{2x - 3y + 1}{3x + 4y - 5}$

Q.3) Solve **any three** :

(a) A body originally at 80°C cools down to 60°C in 20 minutes, the temperature of air being 40°C. What will be the temperature of the body after 40 minutes from the original ? **[05]**

(b) In a circuit containing inductance L, resistance R and voltage E, the current I is given by $E = RI + L\dfrac{dI}{dt}$. Given L = 640H, R = 250 ohms, E = 500 volts, I being zero when t = 0, find the time that elapses, before I reaches 90% of its maximum value. **[06]**

(c) A particle of mass m is projected upward with velocity V. Assuming the air resistance is k times its velocity, write the equation of motion and show it will reach maximum height in time $\dfrac{m}{k}\log\left(1 + \dfrac{kV}{gm}\right)$. Find also the distance travelled at any time t. **[06]**

(d) A particle executes S.H.M. When it is 2 cm from the mid path, its velocity is 10cm/sec. and when it is 6 cm., from centre its velocity is 2 cm/sec. Find its period and greatest acceleration. **[05]**

OR

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

(a) A steam pipe 20 cm in diameter is protected with a covering 6cm thick for which the coefficient of thermal conductivity is k = 0.0003. 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. Also, find temperature at a distance 12 cm from the centre of the pipe. **[06]**

(b) The charge Q on a plate of condenser of capacity C is charged through a resistance R, by steady voltage V. If Q = 0 at t = 0, find charge as a function of t. **[05]**

(c) 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 $\frac{\pi}{4\sqrt{k}}$. **[06]**

(d) Find the orthogonal trajectories of $r = a\,(1 - \cos\theta)$. **[05]**

Q.5) (A) Expand f(x) = xsinx as a Fourier Series in the interval $0 \le x \le 2\pi$. **[08]**

(B) Show that $B(m, n) = \int_0^1 \frac{x^{m-1} + x^{n-1}}{(1 + x)^{m+n}}\, dx$. **[04]**

(C) If $I_n = \int_0^{\pi/2} \cos^n x \cos nx\, dx$ prove that $I_n = \frac{1}{2} I_{n-1} = \frac{\pi}{2^{n+1}}$. **[05]**

OR

Q.6) (A) Obtain the constant term and the coefficient of first sine and cosine terms in the Fourier Expansion of y as given in following table : **[07]**

x	0	1	2	3	4	5	6
y	9	18	24	28	26	20	9

(B) If $I_n = \int_{\pi/4}^{\pi/2} \cot^n\theta \, d\theta$, prove that $I_n = \frac{1}{n-1} - I_{n-2}$.

Hence evaluate $\int_{\pi/4}^{\pi/2} \cot^6\theta \, d\theta$ **[06]**

(C) Evaluate $\int_0^{\infty} x^7 e^{-2x^2} dx$ **[04]**

SECTION - II

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

(1) $y^2 (4 - x) = x (x - 2)^2$

(2) $r = a \cos 2\theta$

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

(B) Prove that $\int_0^{\infty} \frac{1}{x^2} \log (1 + ax^2) \, dx = \pi \sqrt{a}$ $(a>0)$

Deduce that $\int_0^{\infty} \frac{1}{x^2} \log \left(1 + x^2\right) dx = \pi$ **[04]**

(C) Find the length of the arc of the cardioide $r = a (1 - \cos\theta)$, which lies outside the circle $r = a \cos\theta$ **[05]**

OR

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

(1) $yx^2 = a^2 (a - y)$

(2) $x = a (t + \sin t)$

$y = a (1 + \cos t)$

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

(B) Show that $\frac{d}{dt}\left(\text{erf}\left(\sqrt{t}\right)\right) = \frac{e^{-t}}{\sqrt{\pi t}}$.

Hence evaluate $\int_0^\infty e^{-t}\,\text{erf}\left(\sqrt{t}\right) dt$ **[05]**

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

Q.9) (A) Find the equation of the sphere passing through the circle $x^2 + y^2 + z^2 - 2x + 3y - 4z + 6 = 0,\ 3x - 4y + 5z - 15 = 0$ and intersecting the sphere $x^2 + y^2 + z^2 + 2x + 4y - 6z + 11 = 0$ orthogonally **[05]**

(B) Obtain the equation of the right circular cone, which passes through (1, 3, 4) with vertex (2, 2, 1) and axis parallel to the line . **[05]**

(C) Find the equation of the right circular cylinder whose guiding curve is $x^2 + y^2 + z^2 = 9,\ x - y + z = 3$. **[06]**

OR

Q.10) (A) Find the equation of the sphere which is tangential to the plane $2x - 2y - z + 16 = 0$ at $(-3, 4, 2)$ and passing through the point $(-2, 0, 3)$. **[06]**

(B) Obtain the equation of the right circular cylinder of radius 5 and axis $\frac{x-2}{3} = \frac{y-3}{1} = \frac{z+1}{1}$. **[05]**

(C) The axis of a right circular cone whose vertex is origin 'O' makes equal angles with the co-ordinate axes, and the cone passes through the line drawn from O with direction cosines proportional to 1, –2, 2. Find the equation of the cone. **[05]**

Q.11) (A) Evaluate $\int_0^1 \int_{y^2}^{y} \frac{y\,dxdy}{(1-x)\sqrt{x-y^2}}$ **[06]**

(B) Find the area common to the circles $x^2 + y^2 = 9$ and $x^2 + y^2 = 6x$. **[05]**

(C) Find the C.G. (Centre of Gravity) of the area enclosed by the curves $y^2 = 4ax$, $y = 2x$. **[06]**

OR

Q.12) (A) Evaluate $\iint_R \frac{\sqrt{x^2 + y^2}}{x^2}\,dxdy$, where R is the region enclosed by the curves $x^2 + y^2 = 2x$, $y = x$ and $y = 0$, in the first quadrant. **[05]**

(B) Find the volume bounded by the sphere $x^2 + y^2 + z^2 = 4$ and the paraboloid $x^2 + y^2 = 3z$. **[06]**

(C) Show that the Moment of Inertia (M.I.) of a loop of the curve $r^2 = a^2\cos 2\theta$, about a line through the pole perpendicular to its plane, is $\frac{Ma^2\pi}{8}$, where M is the mass of the loop. **[06]**

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

[3761]-107

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

APPLIED SCIENCE - II

(June 2008 Pattern)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **three** questions from section I and **three** questions from Section II.*

*(2) Answers to the **two sections** should be written in **separate 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, electronic pocket calculator and stream tables is allowed.

(6) Assume suitable data, if necessary.

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

$c = 3 \times 10^{8}$ m/s.

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

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

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

SECTION - I

Q.1) (A) Write a note on Proximate Analysis of Coal. **[07]**

(B) What is Rocket Propellant ? Explain different types of Propellants used in Rocket. **[06]**

(C) Observations in the Boy's gas calorimeter experiment on a gaseous fuel are given below, find the G.C.V. and N.C.V. of the Fuel.

Volume of Gas burnt (STP) = 0.08 m^3

Mass of Cooling Water used = 29.5 kg

Rise in temperature of circulating water = 9.1^{o}C

Mass of steam condensed = 0.04 kg **[04]**

OR

Q.2) (A) Describe how the calorific value of a solid fuel is determined using Bomb calorimeter. **[07]**

(B) A sample of coal requires 20% excess air for complete combustion. Calculate weight of air for 250 gm of the coal, if its composition is C = 81%, H = 4%, N = 1.5%, S = 1.2%, O = 3%, ash = 9.3%. **[06]**

(C) Write the Chemical Reactions for :

(1) Production of Hydrogen gas by steam reforming of hydrocarbons.

(2) Production of Biodiesel. **[04]**

Q.3) (A) Explain the factors affecting the Corrosion. **[07]**

(B) Explain electrochemical corrosion in acidic and basic medium. **[06]**

(C) Explain cathodic protection of metals. **[04]**

OR

Q.4) (A) Define corrosion. Explain Atmospheric corrosion by Oxygen for Sodium, Aluminium and Silver. **[07]**

(B) Explain corrosion of Zinc coated steel and Tin coated steel. Which is more protective ? Why ? **[06]**

(C) Describe electroplating of metals. **[04]**

Q.5) (A) What is alkalinity of water ? State the types of alkalinities. How alkalinity in a water sample is determined ? **[06]**

(B) Explain :

(1) Supercooled water and metastable equilibrium in water system.

(2) Triple Point in Water System. **[06]**

(C) Find the number of phases and number of components in the following :

(1) Solution of Sodium Chloride in Water

(2) Mixture of N_2 and O_2 Gases **[04]**

OR

Q.6) (A) What is meant by 'Scale' in Boiler ? How is it formed ? Give any one internal treatment method along with reactions, for treatment of scales. **[06]**

(B) Draw and explain phase diagram for Sulphur System. **[06]**

(C) Explain Zeolite Process of softening of water. **[04]**

SECTION - II

Q.7) (A) Explain the concept of group velocity and wave velocity. Show that group velocity is equal to the velocity of particle. **[06]**

(B) Deduce Schroedinger's time independent wave equation. **[07]**

(C) Calculate de-Broglie wavelength of 10 keV Protons in eV. **[04]**

OR

Q.8) (A) Obtain an expression for energy and wave function of a particle trapped in rigid box. **[07]**

(B) State and explain Heisenberg's uncertainty principle. Illustrate the same with electron diffraction at a single slit. **[06]**

(C) Calculate first two energy eigen values of an electron trapped in an infinite potential well of length $1A^o$. **[04]**

Q.9) (A) (1) Explain the terms - Optical pumping and Resonant cavity.

(2) With the help of energy band diagram explain construction and working of Semiconductor Laser. **[07]**

(B) State and explain : **[06]**

(1) Meissner Effect and

(2) Isotope Effect

(C) With the help of neat energy level diagram explain the technique used to achieve population inversion in He-Ne Laser. **[04]**

OR

Q.10)(A) Explain Type-I and Type-II Superconductors. **[06]**

(B) With the help of neat diagram explain construction and working of Ruby Laser. Also comment on 'Ruby Laser is pulsed Laser'. **[07]**

(C) Explain BCS Theory of Superconductivity. **[04]**

Q.11)(A) Explain classification of Solids into conductors, semiconductors and insulators on the basis of energy band theory. **[06]**

(B) Explain synthesis of metal nanoparticles by colloidal route. **[06]**

(C) Draw energy band diagram for P-N junction diode in forward and reverse biased Condition. **[04]**

OR

Q.12)(A) Explain optical properties and electrical properties of nanoparticles. **[06]**

(B) What is Hall Effect ? Obtain an expression for the Hall Voltage and Hall coefficient. State applications of Hall Effect. **[06]**

(C) Calculate the band gap energy in Germanium. Give that it is transparent to radiation of wavelength greater than 17760 A^o. **[04]**

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

[3761]-108

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

ENGINEERING MECHANICS

(June 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 and 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 rights indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

(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.

SECTION - I

Q.1) (A) Determine the resultant force in magnitude and direction for concurrent force system as shown in **Fig. 1(A).** **[08]**

(B) Locate the centroid of the shaded area as shown in **Fig. 1(B)** with respect to origin O. **[08]**

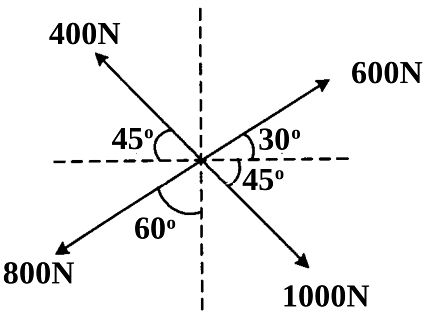


Fig. 1(A)

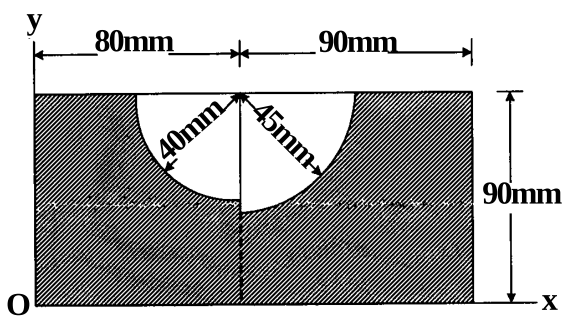


Fig. 1(B)

OR

Q.2) (A) Two forces F_1 = 500N and F_2 = 300N are acting at point A as shown in **Fig. 2(A).** If the resultant of two force has a magnitude of 750N and acts vertically downward, determine the angle θ and ϕ. **[08]**

(B) A 600N force is applied at an angle $\theta = 20^o$. Determine the equivalent force couple system at point A and O. For what value of θ the results at point A and O should be identical. Refer **Fig. 2(B).** **[08]**

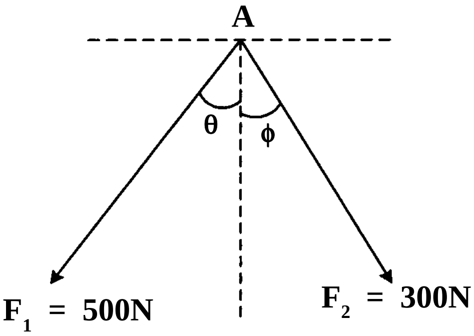


Fig. 2(A)

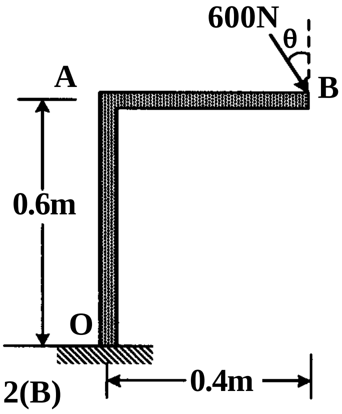


Fig. 2(B)

Q.3) (A) Two identical prismatic bars each of weight 5N, AB and CD are welded together in the form of T as shown in **Fig. 3(A).** Find angle θ that the CD will make with vertical when vertical load P = 10N is applied at B. **[08]**

(B) The tower is held in place by three cables. If the force of each cable acting on the tower is shown in **Fig. 3(B),** determine the resultant. **[10]**

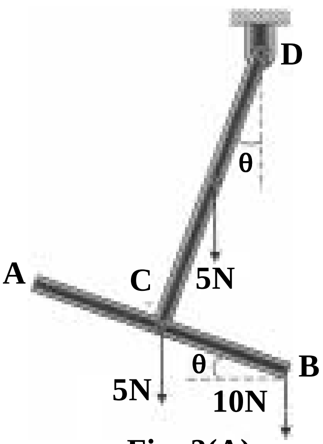


Fig. 3(A)

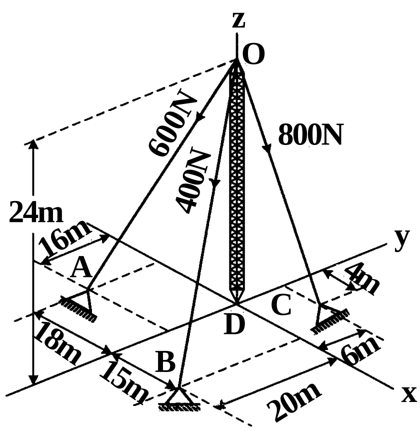


Fig. 3(B)

OR

Q.4) (A) Determine the support reactions for beam AB loaded and supported as shown in **Fig. 4(A)**. **[08]**

(B) A uniform rod of weight W is bent into a circular ring of radius R and is supported by three wires as shown in **Fig. 4(B)**. Determine the tension in each wire. **[10]**

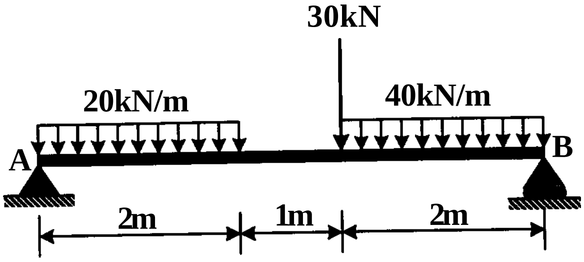


Fig. 4(A)

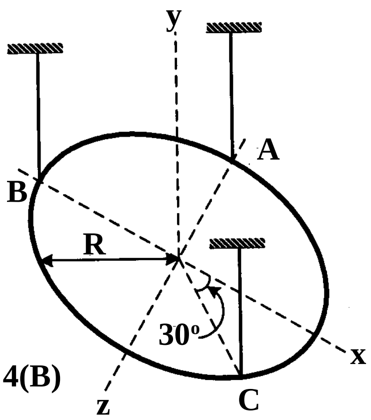


Fig. 4(B)

Q.5) (A) Determine the forces in each member of the truss loaded and supported as shown in **Fig. 5(A).** **[08]**

(B) A 120 kg block is supported by a rope which is wrapped one and half times around a horizontal rod. The coefficient of static friction between the rod and the rope is $\mu_s = 0.15$, determine the range of values of P for which equilibrium is maintained. Refer **Fig. 5(B)**. **[08]**

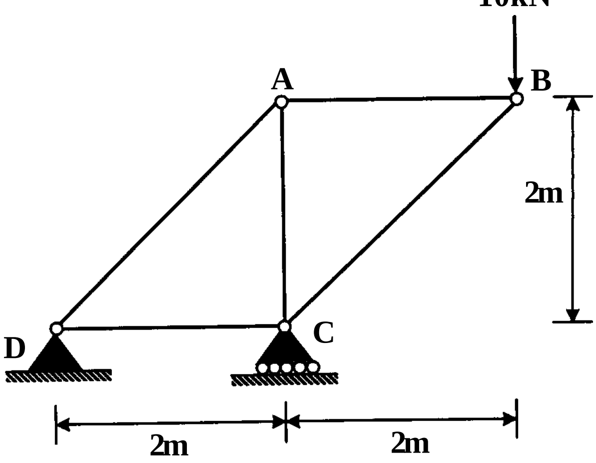
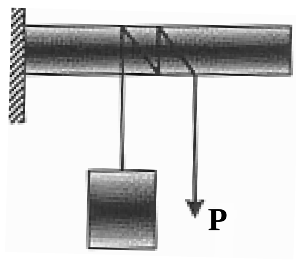


Fig. 5(A)



120 kg Block

Fig. 5(B)

OR

Q.6) (A) Knowing that $W_A = 25N$ and $\theta = 30^o$, determine the range of values of W_B for which the system is in equilibrium. Refer **Fig. 6(A)**. **[08]**

(B) Determine the horizontal and vertical components of force that pins A and C exert on the frame. Refer **Fig. 6(B)**. **[08]**

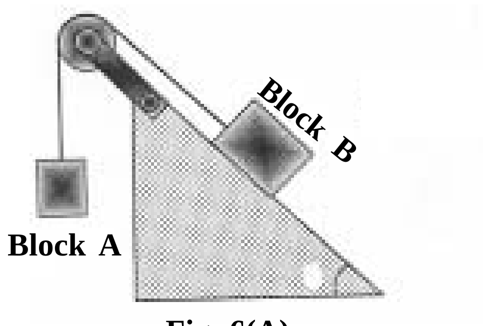


Fig. 6(A)

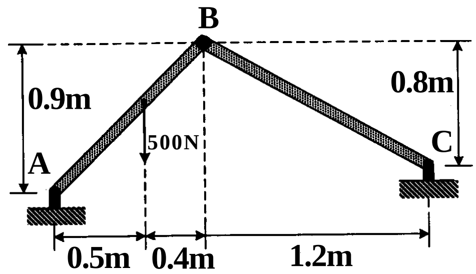


Fig. 6(B)

SECTION - II

Q.7) (A) The v-t diagram for the motion of the train as it moves from station A to station B is shown in **Fig. 7(A)**. Determine the average speed for the train and the distance between the stations. Also draw the a-t curve. **[08]**

(B) Determine the constant force F which must be applied to the cord in order to cause the 150N block A to have a speed of 3.6 m/s when it has been displaced 1 m upward starting from rest. Neglect the weight of the pulleys and cord. Refer **Fig. 7(B)**. **[10]**

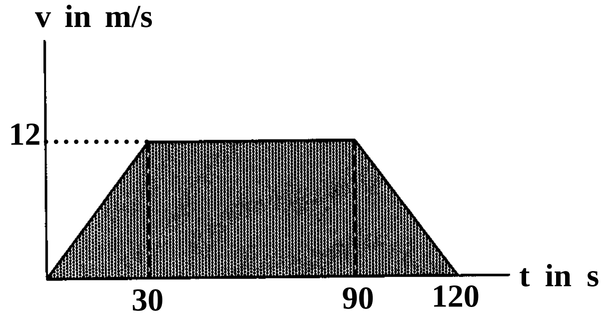


Fig. 7(A)

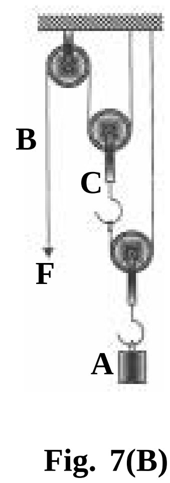


Fig. 7(B)

OR

Q.8) (A) A car attained a speed of 24 m/s after traveling 150 m along a straight road. Determine the constant acceleration and the time of travel when a car (a) starts from rest, (b) starts with initial velocity of 12 m/s. **[08]**

(B) The 50 kg crate shown in **Fig. 8(B)**, rest on horizontal plane for which the coefficient of kinetic friction is $\mu_k = 0.3$. If the crate does not tip over when it is subjected to a 400N force, determine the velocity of the crate in 5 s starting from rest. **[10]**

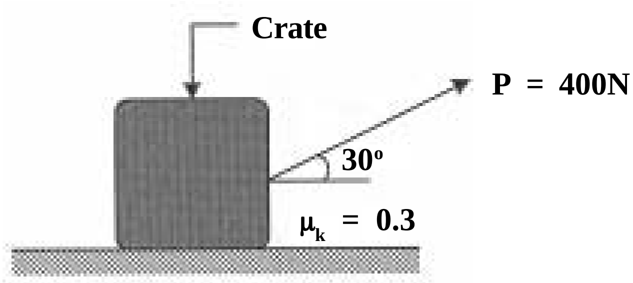


Fig. 8(B)

Q.9) (A) A particle moves along the path $r = \{ (8\,t^2)i + (t^3 + 5)j \}$ m, where t is in seconds. Determine the magnitudes of particle velocity and acceleration when t = 3s. **[08]**

(B) Determine the maximum constant speed at which the pilot can travel around the vertical curve having a radius of curvature $\rho = 800$ m, so that he experience a maximum acceleration $a_n = 8g = 78.5$ m/s^2. If he has a mass of 70 kg, determine the normal force he can exerts on the seat of the airplane when the plane is traveling at this speed and is at its lowest point. Refer **Fig. 9(B)**. **[08]**

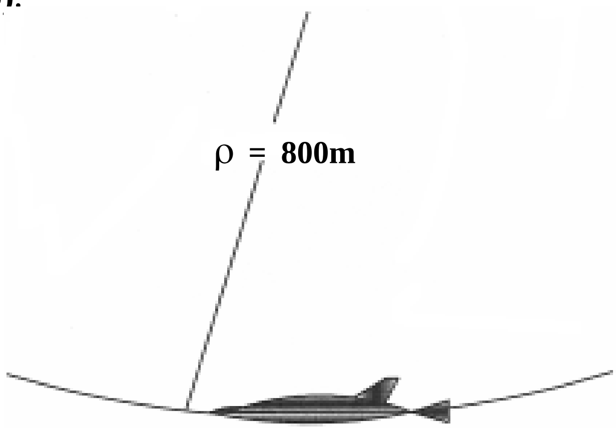


Fig. 9(B)

OR

Q.10) (A) For a short distance the train travels along a track having a shape of spiral, $r = (1000/\theta)$ m, where θ is in radians. If it maintains a constant speed $\nu = 20$ m/s, determine the radial and transverse components of its velocity when $\theta = (9\pi/4)$ radian. **[08]**

(B) Determine the constant speed of the passengers on the amusement park ride if it is observed that the supporting cable are at $\theta = 30^o$ from the vertical. Each chair including its passengers has a mass of 80kg. Refer **Fig. 10(B).** **[08]**

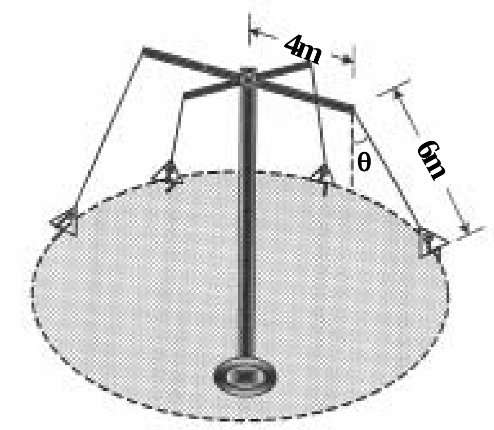


Fig. 10(B)

Q.11)(A) Define Conservative and Non-conservative Forces with example. **[04]**

(B) State the principle of Conservation of Energy and derive an expression for the same. **[04]**

(C) The force acting on the 250N crate has a magnitude of $F = (12t^2)$ N, where t is in seconds. If the crate starts from rest, determine its speed when t = 5s. The coefficient of static and kinetic friction between the floor and crate are 0.3 and 0.2 respectively. Refer **Fig. 11(C)**. **[08]**

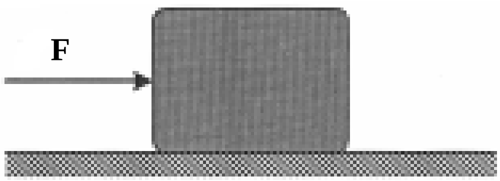


Fig. 11(C)

OR

Q.12)(A) The double spring bumper is used to stop the 7500N steel billet in a rolling mill. Determine the stiffness $k = k_1 = k_2$ of each spring so that no spring is compressed more than 0.06 m after it is struck by the billet travelling with a speed of 2.4 m/s. Neglect the mass of the springs, rollers and the plates A and B. Refer **Fig. 12(A)**. **[08]**

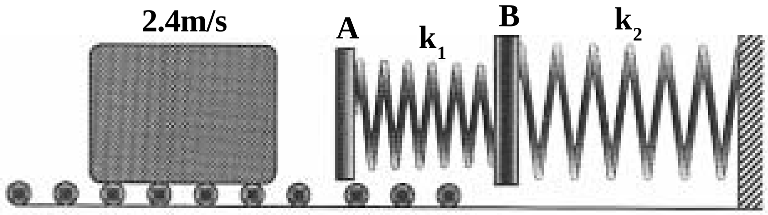


Fig. 12(A)

(B) Block A has a mass of 250 kg and is sliding on a smooth surface with an initial velocity of 2 m/s. It makes a direct impact with block B, which has a mass of 175 kg and is originally at rest. If both blocks are of the same size and the impact is perfectly elastic (e = 1), determine the velocity of each block just after impact. Show that the kinetic energy of the blocks before and after impact is the same. **[08]**

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

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

BASIC ELECTRONICS ENGINEERING

(June 2008 Pattern)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **three** questions from section I and **three** questions from section II.*

*(2) Answers to the **two sections** should be written in **separate 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, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Draw and explain Forward and Reverse Characteristics of Zener Diode. **[06]**

(B) Write short note on Multiplexed Display. **[06]**

(C) A Bridge Rectifier Circuit has Secondary Voltage of $16V_{rms}$. Assume Secondary Resistance and Diode Forward Resistance negligible. Load Resistance is 1kΩ. Calculate Peak Load Current, D. C. Load Current, RMS Load Current and P.I.V. of each Diode. **[06]**

OR

Q.2) (A) For Half Wave Rectifier drive equation of Ripple Factor and Efficiency. **[06]**

(B) Explain in detail following L.E.D. Configurations : **[06]**

(1) Discrete

(2) 7-Segment

(C) What is Voltage Regulator ? Explain the working of Zener Voltage Regulator. **[06]**

Q.3) (A) Compare CE, CB and CC BJT Configurations. **[06]**

(B) The datasheet of 2N5459 JFET gives I_{DSS} = 9mA and $V_{GS(off)}$ = –8V. Using these values, determine the drain current for V_{GS} = 0V, –1V and –4V. **[06]**

(C) List applications of SCR, DIAC and TRIAC. **[04]**

OR

Q.4) (A) Draw the construction diagram and explain operation of n-channel EMOSFET. **[06]**

(B) Draw the practical frequency response of CE Amplifier and justify its nature. **[06]**

(C) Give and explain specifications of JFET. **[04]**

Q.5) (A) Draw and explain the block diagram of Op-Amp. **[08]**

(B) With the help of neat circuit diagram and waveforms explain Triangular Wave Generator. Also give equation of Output Frequency. **[08]**

OR

Q.6) (A) With neat circuit diagram explain Operation of Grounded Load V to I Convertor. Give its application. **[08]**

(B) In the Non-inverting Summing Amplifier V_1 = 1V, V_2 = 2V and V_3 = 3V. Input resistor for all three inputs are same equal to 1kΩ, the feedback resister is 2kΩ. **[08]**

(1) Draw neat circuit diagram

(2) Find Output Voltage.

SECTION - II

Q.7) (A) What is MUX ? Give the relation between Member of Inputs and Number of Select Lines. Draw the block schematic of 2 : 1, 4 : 1 Multiplexer with Strobe Input. **[08]**

(B) Draw and explain block diagram of Microprocessor and Microcontroller. **[08]**

OR

Q.8) (A) Explain the operation of CMOS AND Gate with the help of neat circuit diagram. **[08]**

(B) What is Full Adder ? Give its truth table and equation for Sum and Carry. Implement it by using Logic Gates. **[08]**

Q.9) (A) Draw the block diagram of Digital Thermometer and explain its operation. **[08]**

(B) Compare Thermocouple, RTD and Thermistor. **[08]**

OR

Q.10)(A) Draw and explain the block diagram of PLC and give its applications. **[08]**

(B) What is Strain Gauge ? What are its different types ? Briefly explain working of Semiconductor Strain Gauge. **[08]**

Q.11)(A) Write short note on IEEE Frequency Spectrum. **[06]**

(B) Write the expression of FM. Define Modulation Index and draw Waveform of FM. **[06]**

(C) Explain in detail working of AM Superheterodyne Receiver with the help of neat block diagram. **[06]**

OR

Q.12)(A) What is need of Modulation ? Explain. Also give comparison between AM and FM. **[06]**

(B) Draw the block diagram of FM Transmitter and explain its working. **[06]**

(C) Compare Coaxial Cable Media with Fiber Optic Cable Media. **[06]**

Total No. of Questions : 12] [Total No. of Printed Pages : 7

[3761]-11

F. E. Examination - 2010

ENGINEERING MATHEMATICS - I

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

*(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 electronic pocket calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Define normal form of a matrix. Reduce the following matrix to its normal form and hence find its rank, where **[06]**

$$A = \begin{bmatrix} 3 & -6 & 4 & -3 & 2 \\ 2 & -4 & 3 & 1 & 0 \\ 0 & 1 & -1 & 3 & 1 \\ 4 & -7 & 4 & -4 & 5 \end{bmatrix}$$

(B) Given the linear transformation $Y = AX$, where

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 5 \\ 1 & 3 & 3 \end{bmatrix}$$, find the co-ordinates

(x_1, x_2, x_3) corresponding to $(2, 0, 5)$ in Y. **[05]**

(C) Verify Cayley - Hamilton Theorem for

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

and use it to find A^4. **[06]**

OR

Q.2) (A) Find the eigen values and the corresponding eigen vectors of the following matrix : **[07]**

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -5 & -2 \end{bmatrix}$$

(B) If A is an orthogonal matrix then show that A^{-1} and A^t are also orthogonal. **[04]**

(C) Examine for linear dependence, the system of vectors $X_1 = (1, 2, 3)$, $X_2 = (3, -2, 1)$, $X_3 = (1, -6, -5)$. If dependent, find relation between them. **[06]**

Q.3) (A) Show that the roots of $(x + 1)^6 + (x - 1)^6 = 0$ are given by $-i \cot\left(\frac{2r+1}{12}\right)\pi$, $r = 0, 1, 2, 3, 4, 5$. **[06]**

(B) Find real and imaginary parts of $\tanh^{-1}(x + iy)$. **[06]**

(C) Prove that $\log\left(\frac{a+ib}{a-ib}\right) = 2i\tan^{-1}\left(\frac{b}{a}\right)$ and hence evaluate $\cos\left[i\log\left(\frac{a+ib}{a-ib}\right)\right]$. **[05]**

OR

Q.4) (A) A square lies above real axis in Argand's Diagram and two of its adjacent vertices are the origin and the point $5 + 6i$. Find the complex numbers representing other vertices. **[06]**

(B) If $\tan(x + iy) = i$, where x and y are real, prove that x is indeterminate and y is infinite. **[06]**

(C) By considering principal value, express in the form $a + ib$ the expression $\left(1 + i\sqrt{3}\right)^{\left(1 + i\sqrt{3}\right)}$ **[05]**

Q.5) (A) Find the n^{th} derivative of the function $e^{2x}\sin x\cos x$. **[05]**

(B) If $x = \sin\theta$, $y = \sin 2\theta$, then prove that

$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 - 4)y_n = 0$ **[06]**

(C) Prove that : $\frac{b-a}{1+b^2} < \left(\tan^{-1}b - \tan^{-1}a\right) < \frac{b-a}{1+a^2}$, if $a < b$. **[05]**

OR

Q.6) (A) If $y = \frac{\sinh^{-1}x}{\sqrt{1+x^2}}$, then prove that,

$(1 + x^2)y_{n+2} + (2n + 3)xy_{n+1} + (n + 1)^2 y_n = 0$. **[06]**

(B) If $I_n = \frac{d^n}{dx^n}\left(x^n \log x\right)$, prove that

$I_n = n\,I_{n-1} + (n - 1)\,!$ and hence show that

$I_n = n!\left[\log x + 1 + \frac{1}{2} + \frac{1}{3} + \ldots\ldots + \frac{1}{n}\right]$. **[06]**

(C) If $f(x) = \frac{1}{x^2}$, $g(x) = \frac{1}{x}$, prove that 'C' of Cauchy's Mean Value Theorem is the harmonic mean between a and b. **[04]**

SECTION - II

Q.7) (A) Determine the range of convergence of

$$\sum_{n=1}^{\infty} \frac{n+1}{2n+1} \cdot \frac{(x-3)^n}{2^n}.$$ **[05]**

(B) Discuss the convergence of **any one** of the following : **[04]**

(1) $\left(\frac{1}{4}\right)^2 + \left(\frac{1\cdot 5}{4\cdot 8}\right)^2 + \left(\frac{1\cdot 5\cdot 9}{4\cdot 8\cdot 12}\right)^2 + \ldots\ldots$

(2) $\frac{2\cdot 1^3 + 5}{4\cdot 1^5 + 1} + \frac{2\cdot 2^3 + 5}{4\cdot 2^5 + 1} + \ldots\ldots + \frac{2\cdot n^3 + 5}{4\cdot n^5 + 1} + \ldots\ldots$

(C) Attempt **any two** of the following : **[08]**

(1) Expand $\frac{x}{e^x - 1}$ up to x^4.

(2) Arrange in powers of x using Taylor's Theorem

$7 + (x+2) + 3(x+2)^3 + (x+2)^4 - (x+2)^5$

(3) Prove that $e^{\cos^{-1}x} = e^{\pi/2}\left[1 - x + \frac{x^2}{2} - \frac{x^3}{3} + \ldots\ldots\right]$

OR

Q.8) (A) Obtain the range of convergence of the series

$$\sum \frac{\sqrt{n}}{\sqrt{n^2+1}}\, x^n$$ **[05]**

(B) Discuss the convergence of **any one** of the following : **[04]**

(1) $\frac{1}{2} + \frac{2}{3}x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \ldots\ldots$

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

(C) Attempt **any two** of the following : **[08]**

(1) Prove that

$$e^{e^x} = e\left[1 + x + x^2 + \frac{5}{6}x^3 + \frac{5}{8}x^4 + \ldots\right]$$

(2) Expand $(1 + x)^{(1+x)}$ upto term containing x^3.

(3) Using Taylor's Theorem show that :

$$\sqrt{1 + x + 2x^2} = 1 + \frac{x}{2} + \frac{7}{8}x^2 - \frac{7}{16}x^3 + \ldots$$

Q.9) (A) Attempt **any two** of the following : **[08]**

(1) Evaluate : $\lim_{x\to 0}\left[\frac{1}{x^2} - \cot^2 x\right]$

(2) Evaluate : $\lim_{x\to 0}\left(\frac{a^x + b^x + c^x}{3}\right)^{1/x}$

(3) Evaluate : $\lim_{x\to 0}\left[\frac{\sin^{-1}x - x}{x^3}\right]$

(B) If $x = e^r\cos\theta$, $y = e^r\sin\theta$ P.T. **[04]**

$$\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = e^{-2r}\left[\left(\frac{\partial u}{\partial r}\right)^2 + \left(\frac{\partial u}{\partial \theta}\right)^2\right]$$

(C) If $u = \log (x^3 + y^3 - x^2y - xy^2)$ prove that : **[05]**

(1) $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = 3$

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

OR

Q.10) (A) Attempt **any two** of the following : **[08]**

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

$$\lim_{x \to 0} \frac{ae^x - b\cos x + ce^{-x}}{x \sin x} = 2.$$

(2) Evaluate : $\lim_{x \to 1} \left(1 - x^2\right)^{1/\log(1-x)}$

(3) Evaluate : $\lim_{x \to 0} \log_{\tan x} \tan 2x$

(B) If $u = ax + by$, $v = bx - ay$, find the value of **[04]**

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

(C) Find $\frac{dy}{dx}$ when $y^{x^y} = \sin x$. **[05]**

Q.11) (A) If u, v, w are the roots of equation

$(\lambda - x)^3 + (\lambda - y)^3 + (\lambda - z)^3 = 0$ find $\frac{\partial(u, v, w)}{\partial(x, y, z)}$ **[06]**

(B) Prove that error in calculating the power $W = V^2/R$ generated in the resistor is $\frac{V}{R^2}(2R\delta V - V\delta R)$. If there are errors of 1% and 2% in measuring the voltage V and resistance R, find % error in calculating of work $W = V^2/R$. **[05]**

(C) Examine for stationary values

$f(x, y) = \sin x + \sin y + \sin(x + y)$ **[05]**

OR

Q.12) (A) If $v^2 + w^2 = x$, $y = w^2 + u^2$, $z = u^2 + v^2$

prove that $JJ' = 1$. **[06]**

(B) Examine whether the functions

$u = x + y + z$

$v = x^2 + y^2 + z^2$

$w = x^3 + y^3 + z^3 - 3xyz$

are functionally dependent. If dependent find the relation between them. **[05]**

(C) Use Lagranges Method of Undertermined Multipliers to find the maximum and minimum distance of the point (3, 4, 12) from the sphere $x^2 + y^2 + z^2 = 1$. **[05]**

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

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

BASIC MECHANICAL ENGINEERING

(June 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 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 books.***

(3) Neat diagrams must be drawn wherever necessary.

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

(5) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Draw sketch and explain Joule's experiment with its conclusion. **[3+3+2=08]**

(B) State :

(1) Zeroth law

(2) Second law of thermodynamics

(3) Law of Energy Conservation

(4) Ideal Gas Equation **[2×4=08]**

OR

Q.2) (A) Differentiate between Heat Pump and Refrigerator. Also prove that $(COP)_{\text{Heat Pump}} - (COP)_{\text{Refrigerator}} = 1$ **[4+4=08]**

(B) Define and write equations for the following : **[2×4=08]**

(1) Adiabatic Index

(2) Enthalpy

(3) Polytropic process

(4) Isothermal process

Q.3) (A) Define Tons of Refrigeration. Draw sketch and explain Household Refrigerator. **[2+3+3=08]**

(B) Draw block diagram and state applications of : **[4+4=08]**

(1) Reciprocating Compressor

(2) Impulse Turbine

OR

Q.4) (A) Draw and label two stroke petrol engine. Compare four stroke engine with two stroke engine. **[4+4=08]**

(B) Draw block diagram and explain : **[4+4=08]**

(1) Water Tube Boiler

(2) Air Motor

Q.5) (A) Describe Thermal Power Plant with block diagram. **[4+5=09]**

(B) What is composite wall ? Derive equation for heat flow through composite wall in series and parallel. **[3+3+3=09]**

OR

Q.6) (A) What is hybrid power plant ? State its advantages. Explain use of Solar Energy with block diagram. **[2+2+5=09]**

(B) State Newton's Law of Cooling and Stefan Bottzmann's Law with their equations. Calculate rate of heat transfer by convection between roof of area 20×20 (m^2) and ambient air, if roof temperature is 10^oC and air temperature is 40^oC. Assume average heat transfer coefficient for convection as 10 W/m^2K. Comment about heat flow. **[3+3+3=09]**

SECTION - II

Q.7) (A) Draw diagrams and state applications of : **[4+4=08]**

(1) Single Plate Clutch

(2) Flange Coupling

(B) Compare flat belt and V belt. Draw and explain open and cross belt drive. **[4+4=08]**

OR

Q.8) (A) List different types of Brakes and explain any two with neat sketch. **[2+3+3=08]**

(B) Describe with neat sketch : **[4+4=08]**

(1) Woodruff Key

(2) Governor

Q.9) (A) Explain any four operations on Drilling Machine with suitable sketch. **[2×4=08]**

(B) Explain Lathe Machine with block diagram. State various operations performed on it. **[3+3+2=08]**

OR

Q.10) (A) Explain NC and CNC Machine with neat sketch. **[4+4=08]**

(B) Draw block diagram of Horizontal Column and Knee Milling Machine. Explain its working. **[4+4=08]**

Q.11) (A) Explain different mechanical properties of a material. **[4×2=08]**

(B) Explain different steps in design process. **[05]**

(C) Explain soldering and brazing in brief. **[05]**

OR

Q.12) (A) Draw sketch and explain shearing, bending, squeezing and drawing operations on sheet metal. **[2×4=08]**

(B) Write short note an plastic materials. **[05]**

(C) What do you mean by engineering design ? Why there is need of design ? **[2+3=05]**

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

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

ENGINEERING MECHANICS

(June 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) Figures to the right indicate full marks.

(4) Neat diagram must be drawn wherever necessary.

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

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

(7) Assume suitable data, if necessary.

Q.1) (A) Three forces of magnitude 100N each are acting along the sides of an equilateral triangle as shown in **Fig. 1(A)**. Determine resultant in magnitude and direction with reference to point A. **[06]**

(B) A sphere is fired into a medium with an initial velocity of 27 m/s. If it experiences a deceleration $a = (-6t)$ m/s^2, where t is in second, determine distance travelled before it stops. **[06]**

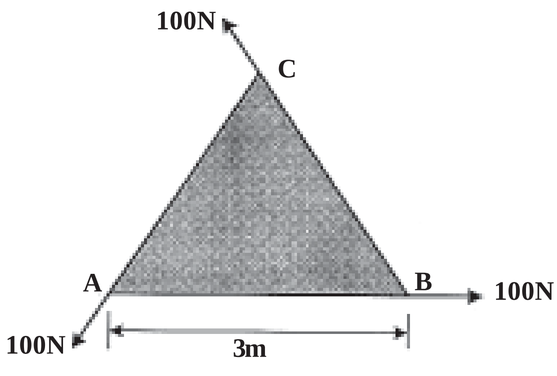

Fig. 1(A)

OR

Q.2) (A) Determine position of the centroid C of the shaded area which is part of the circle having a radius r. Refer **Fig. 2(A).** **[06]**

(B) Block A of weight 100N is resting on block B of weight 150N. The coefficients of static and kinetic frictions at all contact surfaces are $\mu_s = 0.4$ and $\mu_k = 0.3$ respectively. Determine acceleration of each block, if block A is pushed horizontally with a force : (a) F = 30N, (b) F = 250N. **[06]**

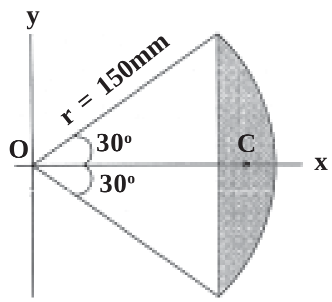

Fig. 2(A)

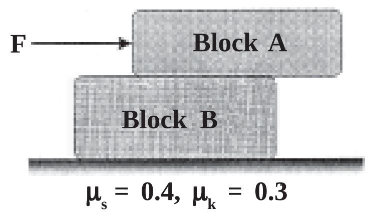

Fig. 2(B)

Q.3) (A) If rope BC fails when the tension becomes 50 kN, determine greatest vertical load F that can be applied to the beam AB. Also determine reaction components at A. Refer **Fig. 3(A).** **[06]**

(B) The uniform concrete slab has a weight of 5500N. Determine tension in each of the three parallel supporting cables when the slab is held in horizontal plane as shown in **Fig. 3(B).** **[07]**

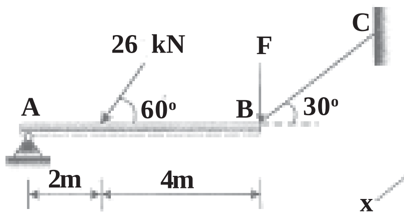

Fig. 3(A)

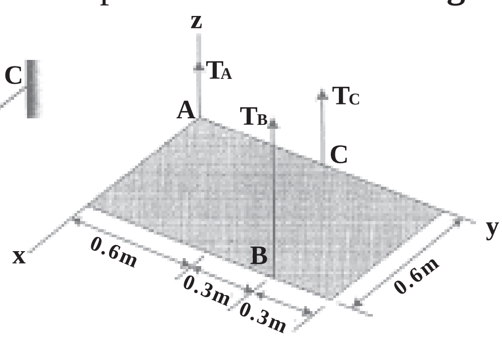

Fig. 3(B)

(C) A particle moves along the path $\mathbf{r} = \{(8\,t^2)\mathbf{i} + (t^3 + 5)\mathbf{j}\}$ m, where t is in seconds. Determine magnitudes of particle velocity and acceleration when t = 3s. **[06]**

OR

Q.4) (A) The maximum allowable value of each of the reactions is 360N neglecting the weight of the beam; determine range of values of distance 'd' for which the beam is safe. Refer **Fig. 4(A).** **[07]**

(B) The cable exerts forces F_{AB} = 100N and F_{AC} = 120N on the ring at A as shown in **Fig. 4(B)**. Determine magnitude of the resultant force acting at A. **[06]**

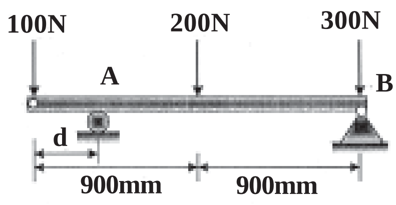

Fig. 4(A)

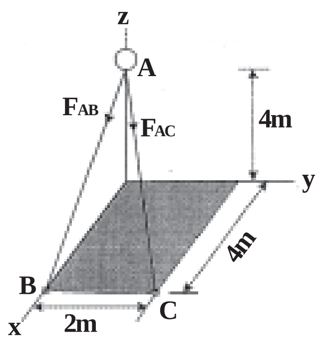

Fig. 4(B)

(C) The bob of a 2m pendulum describes an arch of a circle in a vertical plane. If the tension in the cord is 2.5 times the weight of the bob for the position shown in **Fig. 4(C)**, find velocity and acceleration of the bob in that position. **[06]**

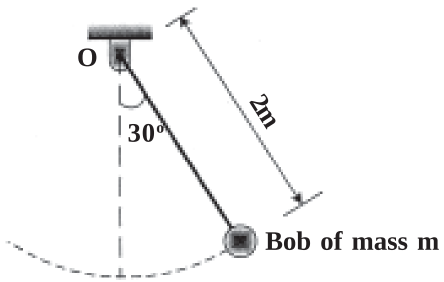

Fig. 4(C)

Q.5) (A) Identify zero force members and determine forces in the members of the truss as shown in **Fig. 5(A)**. **[07]**

(B) A cord having weight of 0.5 N/m and a total length of 10m is supported over a peg P as shown in **Fig. 5(B)**. If the coefficient of static friction between the peg and cord is μ_s = 0.5, determine longest length h which one side of the suspended cord can have without causing motion. Neglect size of peg and length of cord draped over it. **[06]**

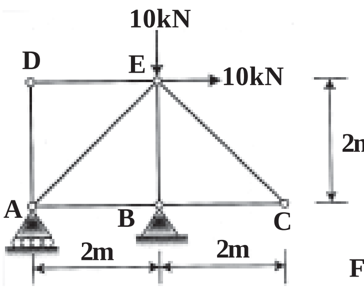

Fig. 5(A)

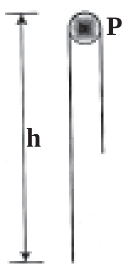

Fig. 5(B)

(C) Block A has a weight of 300N and block B has a weight of 50N. Determine distance block A must descend from rest before it obtains a speed of 2.5 m/s. Neglect mass of pulleys and cord. **[06]**

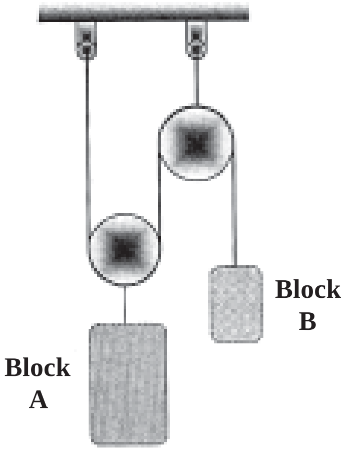

Fig. 5(C)

OR

Q.6) (A) Determine components of reaction at pin C for the pin jointed frame loaded and supported as shown in **Fig. 6(A)**. **[06]**

(B) A block of mass 150 kg is resting on a plane inclined at 30^o with horizontal as shown in **Fig. 6(B)**. Determine range of an external force P to maintain equilibrium. Assume μ_s = 0.25. **[07]**

(C) Disk A has a mass of 250 g and is sliding on a smooth horizontal surface with an initial velocity of 2 m/s. It makes a direct collision with disk B, which has a mass of 175 g and is originally at rest. If both the disks are of the same size and the collision is perfectly elastic, determine velocity of each block just after collision. **[06]**

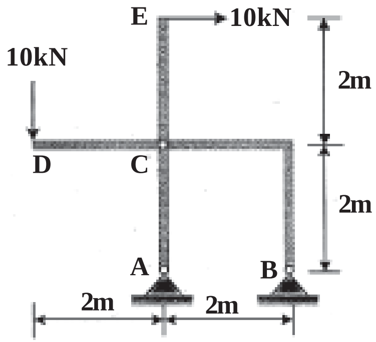

Fig. 6(A)

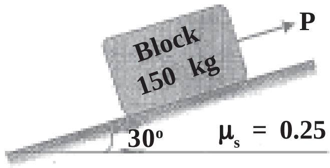

Fig. 6(B)

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

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

BASIC ELECTRONICS ENGINEERING

(June 2008 Pattern)

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

Instructions :

*(1) You are advised to attempt not more than **3** questions.*

(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) Neat diagrams must be drawn wherever necessary.

(5) Assume suitable data, if necessary.

Q.1) (A) Explain with neat circuit diagram and graphs the Way of Biasing P-N Junction Diode. **[05]**

(B) Give and explain any three Specifications of Zener Diode. **[03]**

(C) With the help of neat diagram explain Operation of a n-channel JFET. Sketch a typical output characteristics for the same. **[05]**

(D) Derive the expression for α interms of β. **[04]**

OR

Q.2) (A) For a Centre-tap Transformer Full Wave Rectifier derive the expression for following parameters :

(1) I_{dc}

(2) V_{dc}

(3) P_{dc}

(4) Ripple Factor **[05]**

(B) Explain the basic principle of working of LED with necessary diagram. **[03]**

(C) Draw construction diagram and explain working with the help of Transistor Equivalent Circuit of SCR. Also draw V-I Characteristics. **[05]**

(D) Determine weather or not the transistor shown in fig. 2(D) is in Saturation. Assume $V_{CE(sat.)} = 0.2V$. **[04]**

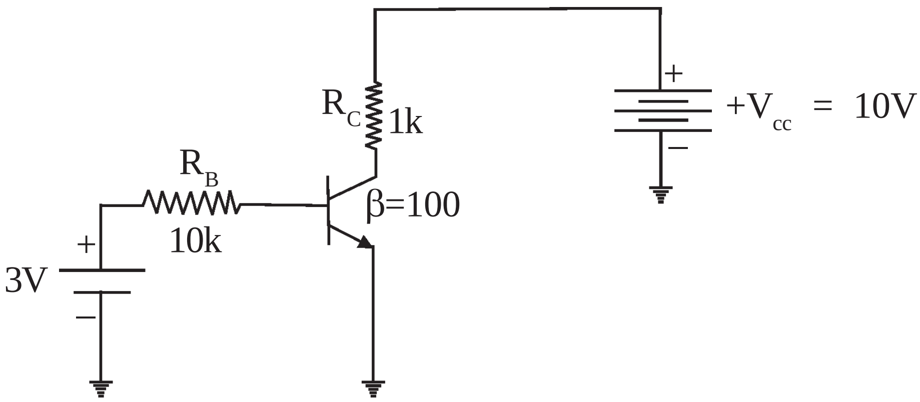

Fig. 2(D)

Q.3) (A) Draw neat circuit diagram of an ideal differentiator and explain its operation. Draw Output Waveforms for Sinusoidal and Square Wave Inputs. Also give any two applications of the same. **[08]**

(B) What is Shift Register ? What are the modes of operation in a Shift Register ? Explain the operation of 4-bit PIPO Shift Register. **[05]**

(C) Draw and explain the circuit diagram of CMOS NOR Gate. **[04]**

OR

Q.4) (A) Write short note on RC Phase Shift Oscillator. Determine the value of R_f and Frequency of Oscillations if $R = 10k\Omega$ and $C = 0.001\mu F$. **[08]**

(B) What is the difference between Half Adder and Full Adder ? Explain in detail the working of Full Adder with the help of truth table and give equations for Sum and Carry. **[05]**

(C) Write short note on Digital IC Classification. **[04]**

Q.5) (A) Draw and explain the block diagram of Alarm Annunciator. **[04]**

(B) With the help of neat circuit diagram explain construction and working of LVDT. **[04]**

(C) Write short note on Superheterodyne FM Receiver. **[08]**

OR

Q.6) (A) What is the need of Modulation ? Explain working of AM Transmitter with the help of neat block diagram. [**08]**

(B) What is RTD ? Draw its construction diagram and explain its operation. **[04]**

(C) Write short note on **any one** : **[04]**

(1) Electronic Weighing Machine

(2) CNC Machine

[3761]-12

F. E. Examination - 2010

APPLIED SCIENCE - I

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **three** questions from section I and **three** questions 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, electronic pocket calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

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

$h = 6.63 \times 10^{-34}$ J-s.

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

$c = 3 \times 10^{8}$ m/s.

Q.1) (A) A thin film of uniform thickness is illuminated by a monochromatic light. Derive the equation of path difference and conditions of maxima and minima in case of reflected light. **[07]**

(B) Write down Lorentz Transformation Equations. Derive Lorentz Fitzgerald Contraction Equation. Discuss the result. **[06]**

(C) A transparent film of refractive index 1.5 is introduced normally in the path of one of the interfering beams of Michelson's Interferometer, which is illuminated by light of wavelength 5000A°. If 450 dark fringes sweep across the field, calculate the thickness of the film. **[04]**

OR

Q.2) (A) Draw a neat, labelled diagram of experimental set up to obtain Newton's Rings in Laboratory.

Prove that in Newton's Rings diameters of dark rings in reflected system are proportional to square root of natural numbers. **[07]**

(B) Deduce Einstein's Expression for Mass-Energy Equivalence. **[06]**

(C) A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between consecutive bright fringes is 0.12 cm. Calculate the wavelength of light used. **[04]**

Q.3) (A) State and explain Rayleigh's criterion of resolution of two point objects.

Derive an expression for the resolving power of a telescope. **[06]**

(B) What is Magnetostriction Effect ? Explain with neat diagram the magnetostriction oscillator for generating ultrasonic waves. **[06]**

(C) In a grating spectrum, which spectral line in the fourth order will overlap with the third order line of λ = 5416A° ? **[04]**

OR

Q.4) (A) Explain the Theory of Plane Diffraction Grating. Obtain the condition for the formation of principal maxima. **[06]**

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

(C) Light of Wavelength 6×10^{-5} cm falls on a screen at a distance of 100 cm from norrow slit. Find the width of the slit if the first minima lie 1.5 mm on either side of the central maxima. **[04]**

Q.5) (A) How do you analyse the given beam of light. **[06]**

(B) With the help of a neat labelled diagram explain the principle, construction and working of a Cyclotron. **[06]**

(C) Write down the Proton - Proton and Carbon Nitrogen Cycles for fusion reactions. **[05]**

OR

Q.6) (A) Explain the phenomenon of double refraction using Huygen's Wave Theory. [**06]**

(B) Define and explain Q Value of a Nuclear Reaction. Derive an expression for it. **[06]**

(C) State and explain Law of Malus. Two Nicols are oriented with their principal planes making an angle 60^{o}. What percentage of the incident unpolarized light will pass through the system. **[05]**

SECTION - II

Q.7) (A) Define Unit Cell. How the planes in crystal designated by Miller's and Weiss Methods ? **[07]**

(B) Write a note on Bravis Lattice. **[06]**

(C) Describe the different types of defects in Crystals. **[04]**

OR

Q.8) (A) What is Liquid Crystal Phase ? State types of Liquid Crystals and applications of Liquid Crystals. **[07]**

(B) Define Atomic Packing Factor. Explain hexagonal close packing and face central cubic packing of atoms with suitable diagrams. **[06]**

(C) Differentiate between Crystalline Solids and Amorphous Solids. **[04]**

Q.9) (A) Define Scale and Sludge. What are the effects of scale and sludge in the boiler and give methods for the prevention from the same. **[07]**

(B) What is Water Pollution ? Give various methods for the Treatment of Industrial Waste Water. Explain any one in detail. **[06]**

(C) Write a note on Catalytic Converter. **[04]**

OR

Q.10) (A) What is Hardness of Water ? Describe Ion Exchange Method for Water Softening. **[07]**

(B) Define Air Pollution. What do you understand by Primary and Secondary Pollutants ? Explain their formation with suitable examples. **[06]**

(C) A zeolite bed gets exhausted on softening 1500 liter of a water sample. The exhausted bed requires 7 liter of 10% NaCl for regeneration, calculate Hardness of Water Sample. **[04]**

Q.11) (A) Give preparation, properties and applications of **any two** of the following : **[06]**

(1) Epoxy Resins

(2) Polystyrene

(3) PVC

(B) Define Polymer. Discuss the methods used to calculate the Molecular Weight of a Polymer. **[06]**

(C) Distinguish between LDPE and HDPE. **[04]**

OR

Q.12) (A) Define Vulcanization of Rubber. Explain the Vulcanization Process with suitable reaction and properties of Vulcanized Rubber. **[06]**

(B) Give preparation, properties and uses of **any two** of the following : **[06]**

(1) Polyethylene

(2) Phenol Formaldehyde

(3) Silicone Rubber

(C) Write a note on Biodegradable Polymers. **[04]**

Total No. of Questions : 12] **[Total No. of Printed Pages : 3**

[3761]-13

F. E. Examination - 2010

BASIC MECHANICAL ENGINEERING

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

*(2) Answers to the **two sections** should be written in **separate 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 : Process, Path, State, Cycle, System. **[05]**

(B) Explain Bourdon Pressure Gauge with sketch. **[06]**

(C) The casting of mass 12 kg has original temperature of 200^{o}C. If it loses heat of 801.36 kJ, find final temperature of casting. (Given : Specific Heat of Casting Material = 477 J/kgk). **[05]**

OR

Q.2) (A) Explain First Law of Thermodynamics with an example. **[05]**

(B) State steady flow energy equation, explain various terms and convert it for nozzle application. **[05]**

(C) Define and explain : PMMI, Isothermal Process, Enthalpy. **[06]**

Q.3) (A) Draw neat sketch and name various parts of a Refrigerator Cycle. **[06]**

(B) State applications of Compressed Air. **[05]**

(C) State classification of Boiler. **[05]**

OR

Q.4) (A) Compare 2-stroke and 4-stroke IC Engine. **[05]**

(B) List any four mounting of Boiler and state their functions. **[05]**

(C) Draw sketch and explain Centrifugal Pump. **[06]**

Q.5) (A) Describe Hydroelectric Plant with sketch. **[06]**

(B) What is Fin ? Explain types of Fin and list its applications. **[06]**

(C) What is Counter Flow and Parallel Flow Heat Exchanger ? **[06]**

OR

Q.6) (A) Describe Nuclear Power Plant with sketch. **[06]**

(B) Derive expression for heat conduction through composite slab. **[06]**

(C) What is Insulator ? Why they are needed ? State name of Insulators. **[06]**

SECTION - II

Q.7) (A) How drilling machines are classified ? **[05]**

(B) Draw only sketch and show various parts of Lathe Machine. **[06]**

(C) Compare Soldering and Brazing. **[05]**

OR

Q.8) (A) Explain arc welding with its applications. **[05]**

(B) State advantages of CNC Machine. **[05]**

(C) Compare Power Sawing and Hand Sawing with its applications. **[06]**

Q.9) (A) State and explain any three modes of failure used in Design. **[06]**

(B) State factors considered for selection of material. **[05]**

(C) What are ergonomic considerations of Design ? **[05]**

OR

Q.10) (A) Explain Limits and Tolerance with sketch. **[06]**

(B) Compare hot and cold working of Metal. **[05]**

(C) What are Aesthetic Considerations ? **[05]**

Q.11) (A) Compare Individual and Group Drive. **[06]**

(B) Explain any one type of Clutch with sketch. **[06]**

(C) Explain Flexible Coupling with sketch. **[06]**

OR

Q.12) (A) Compare Belt and Gear Drive. **[06]**

(B) Explain various types of Keys. **[06]**

(C) What is Flywheel ? State its use and applications. **[06]**

[3761]-14

F. E. Examination - 2010

BASIC ELECTRICAL ENGINEERING

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **three** questions from section I and **three** questions from section II.*

*(2) Answers to the **two sections** should be written in **separate 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, electronic pocket scientific calculator and steam tables is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Define Insulation Resistance and derive its expression for a Cable. **[06]**

(B) Write a short note on Nickel-Cadmium Cell. **[05]**

(C) A piece of silver has a resistance of 1Ω. What will be the resistance of manganin wire of one-third of the length and one-third the diameter if the resistivity of manganin is 30 times that of silver ? **[06]**

OR

Q.2) (A) An electric water heater raises the temperature of 20 liters of water from 16^{o}C to 100^{o}C. If the efficiency of the heater is 85%, calculate the energy consumed by the heater in (i) Joules (ii) in kwh. The sp. heat capacity of water is 4190 J/kgK. **[06]**

(B) Define and explain Work, Power and Energy. **[06]**

(C) Discuss the effect of temperature on the resistance of various materials. **[05]**

Q.3) (A) State and explain Kirchoff's Laws. **[06]**

(B) Derive the formulae to convert a delta connected network into its equivalent star connected network. **[06]**

(C) State and explain Maximum Power Transfer Theorem. **[05]**

OR

Q.4) (A) State Superposition Theorem and use it to calculate the current in branch X-Y of the circuit shown in fig. 1. **[12]**

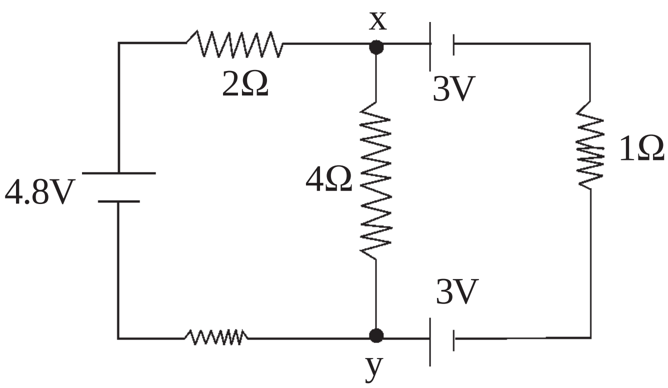

Fig. 1

(B) State and explain Thevenin's Theorem. **[05]**

Q.5) (A) Define and explain the following as related with Magnetic Circuit : **[06]**

(1) Magnetic Flux Density

(2) Permeability

(B) Write a short note on Magnetic Leakage and Fringing. **[06]**

(C) Explain Hysteresis Loss. **[04]**

OR

Q.6) (A) A magnetic core, in the form of a closed ring has mean length of 20 cm and cross section of 1 cm^2. The relative permeability of iron is 2400. Calculate the current which will be required in a coil of 2,000 turns uniformly wound on the ring to create a flux of 0.2 mwb in the iron. **[06]**

(B) State and explain Faraday's Laws of Electromagnetic Induction. **[06]**

(C) Define Self and Mutually Induced e.m.f. **[04]**

SECTION - II

Q.7) (A) Derive expression of Energy stored in Capacitor in terms of Capacitance and Voltage. **[06]**

(B) Derive the expression for Average Value of the Sinusoidally Varying Current in terms of its Peak Value. **[06]**

(C) An alternating current is given by i = 14.14 sin 377 t.

Find its –

(1) R.M.S. Value

(2) Frequency and sketch its Waveform. **[05]**

OR

Q.8) (A) Derive the expression for the RMS Value of the Sinusoidally Varying Current in terms of its Peak Value. **[06]**

(B) Define and explain :

(1) Form Factor and

(2) Peak Factor **[06]**

(C) Two capacitors of 8μF and 2μF are connected in series across a 400V d.c. supply.

Calculate :

(1) Resultant Capacitance

(2) p.d. across each capacitor **[05]**

Q.9) (A) A Coil of Resistance 15Ω and inductance 0.05H is connected in series with 100μF capacitor a cross a 230V, 50Hz supply. Find :

(1) Current Drawn

(2) Phase Angle

(3) Voltage Drop Across Coil and Capacitor **[08]**

(B) Two impedances $(8 + j6)\Omega$ and $(3 - j4)\Omega$ are connected in parallel across a.c. supply. If the total current drawn is 25 Amp then calculate current and power taken by each impedance. **[08]**

OR

Q.10) (A) Explain following terms :

(1) Active Power

(2) Reactive Power

(3) Admittance Triangle and

(4) Impedance Triangle **[08]**

(B) A 200V, 50 Hz single phase supply is connected to a load consisting of 50Ω resistance, 75 mH inductance of $500\mu F$ capacitance all in series. Calculate the current drawn. What will be new value of current if supply frequency is reduced to 25 Hz. **[08]**

Q.11) (A) Explain with neat connection diagram how direct load test is performed on single phase transformer to determine its regulation and efficiency. **[08]**

(B) Define :

(1) Phase Sequence

(2) Balanced Load

(3) Symmetrical Supply **[06]**

(C) State the equations for 3 phase active power, reactive power and apparent power. **[03]**

Q.12) (A) A 3300/250 50Hz Single Phase Transformer has cross sectional area of core of $125 cm^2$ and 70 turns on low voltage side. Calculate :

(1) The value of maximum flux density.

(2) The no. of turns on high voltage side. **[05]**

(B) Derive the expression of Active Power in a Delta connected balanced load in a three phase circuit. Draw connection diagram and relevant phasor diagram. **[12]**

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

[3761]-15

F. E. Examination - 2010

BASIC CIVIL ENGINEERING

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

(2) Answers to the ***two sections*** *must be written in* ***separate books****.*

(3) Figures in the bracket to the right indicate full marks.

(4) Draw neat labelled diagrams wherever necessary.

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

(6) Assume suitable data if necessary and state it clearly.

SECTION - I

Q.1) (A) Write four differences between each of the following in the form of columns : **[4x2=08]**

(1) Roads - Railways

(2) Surveying - Levelling

(B) What is meant by Infrastructure Development ? Explain various activities involved with an example (sketch). **[1+3=04]**

(C) State two applications of : **[2+2=04]**

(1) Transportation Engineering

(2) Quantity Surveying

(D) Briefly mention the role of Civil Engineering for the branch of Chemical Engineering. **[02]**

OR

Q.2) (A) With a neat sketch, explain role of Civil Engineering for a new hydroelectric power plant set up. **[04]**

(B) Write two applications of : **[08]**

(1) Earthquake Engineering

(2) Fluid Mechanics

(3) Structural Engineering

(4) Environmental Engineering

(C) State the significance and need of Infrastructure Development. Enlist the works and activities to be undertaken for Infrastructure Development. Give practical example. **[06]**

Q.3) (A) State two principles of Surveying. Explain the need of any one of them with neat sketch or sketches. **[05]**

(B) Write notes on : **[06]**

(1) Open Cross Staff

(2) Types of Bearings Based on Meridian

(Draw sketches also)

(C) A clockwise triangular traverse is an equilateral triangle with back bearing of line CA = $149^o\ 30'$. Find F. B. and B. B. of lines AB, BC and CA. Give your answer in tabular form. Show all calculations. **[05]**

OR

Q.4) (A) State the need of sign conventions for maps. Draw six standard sign conventions and name them. **[04]**

(B) Write a note on types of Offsets. Draw relevant sketch. **[04]**

(C) Observed bearings for a closed compass traverse are given in the table. Determine : **[08]**

(1) Stations affected by Local Attraction

(2) Interior Angles of Traverse and

(3) Corrected bearings of all lines of Traverse. Show all calculations and usual check.

Line	**F. B.**	**B. B.**
AB	93^o 00	268^o 00'
BC	37^o 30'	220^o 00'
CD	260^o 00	80^o 00'
DA	160^o 00	342^o 30'

Q.5) (A) Draw neat labelled sketch of Dumpy Level. **[04]**

(B) Knowing that point A has R.L. of 340.560m and reading on it is 0.775m, determine rise or fall of next station B on which reading from the same level position is taken as 1.225m. Hence find its R.L. Write the formulae involved. **[04]**

(C) State four characteristic of Contours with sketches. **[04]**

(D) State one application of : **[04]**

(1) Digital Planimeter

(2) G.P.S.

(3) G.I.S.

(4) Digital Theodolite

OR

Q.6) (A) State four uses of Contour Maps with sketches. **[04]**

(B) State two uses of : **[04]**

(1) Geographical Information System

(2) Electronic Total Station

(C) The first reading in a levelling work was taken on a point of R.L. 370.560 meters and successive readings taken were recorded as : 2.490, 3.170, 1.455, 2.640, 2,190, 3.180 and 1.080. If dumpy level was shifted after second reading, enter the readings in appropriate columns for rise and fall method, calculate R.L. of remaining stations and show arithmetical check. **[08]**

SECTION - II

Q.7) (A) Write three differences between : **[09]**

(1) P.C.C. – R.C.C.

(2) Dead Loads – Live Loads

(3) Natural Sand – Artificial Sand

(B) Draw neat sketch of elevation of un-plastered brick wall. Why vertical joints should not be continuous in it ? State clearly. **[03]**

(C) Write the steps in cast-in-situ concreting. (Do not explain) **[04]**

(D) State four functions of Building Foundation. **[02]**

OR

Q.8) (A) Draw plan and elevation of a trapezoidal combined column footing. State the situations when it is used. **[04]**

(B) State two uses of : **[04]**

(1) Sand

(2) P.C.C.

(3) Stones

(4) R.C.C.

(C) Write a note on Pre-stressed Concrete, its types and uses. **[04]**

(D) State two types of windows and their specific applications. Also state two types of doors and their specific applications. **[04]**

(E) Show friction pile in a neat sketch. **[02]**

Q.9) (A) Write notes on : **[08]**

(1) Necessity of Building Bylaws

(2) Privacy as Planning Principle

Draw sketches wherever possible.

(B) State the objectives of : **[04]**

(1) Land Acquisition Act, 1894

(2) Environment Protection Act, 1986

(C) On a plot of 12m 20m, a bungalow is constructed with ground floor area $80m^2$. Find F.S.I. utilized. If all margins are 2m each, find maximum ground coverage. **[04]**

OR

Q.10) (A) Explain the following with neat sketches : **[06]**

(1) Roominess

(2) Open Spaces and Setback Distance

(B) Define : **[05]**

Carpet Area, F.S.I., Built up Area, Ground Coverage and Plinth.

(C) Explain with sketch or example five factors you will consider for selecting a plot for residential building. **[05]**

Q.11) (A) State the meaning and examples of Biotic and Abiotic Factors of the Environment. **[04]**

(B) State four advantages of Non-conventional Sources of Energy. **[04]**

(C) State four drawbacks or disadvantages of Conventional Energy Sources. **[04]**

(D) Enlist the sources of Air Pollution. State two effective ways to control or abate air pollution. **[04]**

OR

Q.12) (A) Explain the effect of exploitation of Conventional Energy Sources on the Natural Environment. **[04]**

(B) State the ill-effects of Noise Pollution on Humans. **[04]**

(C) Write notes on : **[08]**

(1) Solid Waste Disposal

(2) Sources and Effects of Water Pollution

Total No. of Questions : 12] [Total No. of Printed Pages : 7

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F. E. Examination - 2010

ENGINEERING MATHEMATICS - II

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

*(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 electronic pocket calculator is allowed.

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Form the differential equation for which $y = ae^{3x} + be^{x}$ is the solution. **[05]**

(B) Solve **any three :** **[12]**

(1) $(x + 2y)(dx - dy) = dx + dy$

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

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

(4) $x \dfrac{dy}{dx} + y \log y = xye^x$

OR

Q.2) (A) Form a differential equation for which $y = A \cos x + B \sin x$ is the solution. **[05]**

(B) Solve **any three** : **[12]**

(1) $x^4 \dfrac{dy}{dx} + x^3 y - \sec(xy) = 0$

(2) $(2xy + x^2) \dfrac{dy}{dx} = 3y^2 + 2xy$

(3) $\dfrac{dy}{dx} = \dfrac{x + 2y - 3}{2x + y - 3}$

(4) $(2x \log x - xy)\, dy + 2y\, dx = 0$

Q.3) Solve **any three** :

(a) Find orthogonal trajectories of $r = a(1 - \cos\theta)$ **[05]**

(b) A moving body is opposed by a force per unit mass of value cx and resistance per unit mass of value bv^2 where x and v are displacement and velocity of the particle at that instant. Find the velocity of the particle in terms of x, if it starts from rest. **[06]**

(c) Uranium disintegrates at a rate proportional to the amount present at any instant. If m_1 and m_2 grams of uranium are present at time t_1 and t_2 respectively show that half life of uranium is

$$\frac{(t_1, - t_2) \log 2}{\log \dfrac{m_1}{m_2}}.$$ **[05]**

(d) Solve the equation $L\frac{di}{dt} + Ri = E_o \sin\omega t$ where L, R and E_o are constants and discuss the case when t increases indefinitely. **[06]**

OR

Q.4) Solve **any three** :

(a) The rate at which a body cools is proportional to the difference between the temperature of the body and that of surrounding air. If a body in air at 25°C will cool from 100°C to 75°C in one minute, find its temperature at the end of 3 minutes. **[05]**

(b) A particle falls in a vertical line under gravity and the force of air resistance to its motion is proportional to its velocity. Show that its velocity cannot exceed a particular limit. **[06]**

(c) When switch is closed in a circuit containing a battery E, a resistance R and an inductance L, the current i builds up at a rate given by $L\frac{di}{dt} + Ri = E$. Find i as a function of t.

How long will t be, before the current has reached one half its maximum value, if E = 6V, R = 100Ω and L = 0.1 henry ? **[05]**

(d) Under certain conditions, cane sugar is converted into dextrose at a rate, which is proportional to the amount unconverted at any time. If out of 75 gms of Sugar at t = 0, 8 gms are converted during the first 30 minutes, find the amount converted in $1\frac{1}{2}$ hours. **[06]**

Q.5) (A) Find the equation of the sphere which touches the sphere $4(x^2 + y^2 + z^2) + 10x - 25y - 2z = 0$ at the point (1, 2, –2) and passes through (–1, 0, 0). **[06]**

(B) Find the equation of right circular cone which passes through the point (1, 1, 2) and has its axis as the line $6x = -3y = 4z$ and vertex as origin. **[05]**

(C) Find the equation of right circular cylinder whose axis is $x = 2y = -z$ and radius is 4. **[05]**

OR

Q.6) (A) Prove that the circles

$$x^2 + y^2 + z^2 - 2x + 3y + 4z - 5 = 0; \; 5y + 6z + 1 = 0$$

$$x^2 + y^2 + z^2 - 3x - 4y + 5z - 6 = 0; \; x + 2y - 7z = 0$$

lie on the same sphere and find its equation. **[06]**

(B) Find the equation of right circular cone which has its vertex at the point (0, 0, 12), whose intersection with the plane $z = 0$ is a circle of diameter 10. **[05]**

(C) Find the equation of right circular cylinder whose generator passes through (0, 0, 5) and axis passes through (1, 1, 3) and is perpendicular to z-axis. **[05]**

SECTION - II

Q.7) (A) Expand $f(x) = x - x^2, 0 < x < 1$ in a half range (i) cosine series, (ii) sine series. Hence deduce from sine series that

$$\frac{1}{1^3} - \frac{1}{3^3} + \frac{1}{5^3} - - - - - - - - - - \frac{\pi^2}{32}$$ **[08]**

(B) Show that $\int_0^1 \frac{y^{m-1} + y^{n-1}}{(1+y)^{m+n}} \, dy = B(m, n)$ **[04]**

(C) If $I_n = \int_0^{\pi/4} \frac{\sin(2n-1)x}{\sin x} dx$, then prove that

$n(I_{n+1} - I_n) = \sin \frac{n\pi}{2}$ and hence find I_3. **[05]**

OR

Q.8) (A) Obtain the constant term and the coefficients of the first sine and cosine terms in the Fourier expansion of y as given in the following table. Also obtain amplitude of the first harmonic. **[08]**

x	0	1	2	3	4	5
y	07	16	22	24	26	18

(B) Evaluate $\int_0^{\infty} \sqrt[4]{x} \cdot e^{-\sqrt{x}} dx$ **[04]**

(C) If $I_n = \int_0^{\pi/2} x \cos^n x \, dx$, obtain the relation between I_n and I_{n-2}. Hence find I_4. **[05]**

Q.9) (A) Prove that $\int_0^1 \frac{x^a - 1}{\log x} dx = \log(a+1), \ a > 0$. **[05]**

(B) Trace the following curves : **(Any Two)** **[08]**

(1) $x(x^2 + y^2) = a(x^2 - y^2), \ a > 0$

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

(3) $r = 2a\cos\theta$

(C) Prove that $\int_a^b e^{-x^2} dx = \frac{\sqrt{\pi}}{2} [\mathrm{erf}(b) - \mathrm{erf}(a)]$ **[04]**

OR

Q.10) (A) If $f(x) = \int_0^x (x-t)^2 \, G(t) \, dt$ then

prove that $\frac{d^3f}{dx^3} = 2 \, G(x)$. **[04]**

(B) Trace the following curves : **(Any Two)** **[08]**

(1) $a^2y^2 = x^2 \, (a^2 - x^2)$

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

(3) $r = a \, \sin 2\theta$

(C) Find the arc length of the cycloid $x = a \, (\theta + \sin\theta)$, $y = a \, (1 - \cos\theta)$ from cusp $\theta = -\pi$ to another cusp $\theta = \pi$. **[05]**

Q.11) (A) Evaluate $\iint_R \sqrt{xy \, (2 - x - y)} \, dxdy$ where R is the area bounded by $x = 0, \; y = 0, \; x + y = 2$. **[05]**

(B) Evaluate $\int_0^\infty \int_0^\infty \int_0^\infty \frac{dxdydz}{(1+x^2+y^2+z^2)^2}$ **[05]**

(C) Find the centroid of the region in the first quadrant bounded by $\frac{x}{2} + \frac{y}{3} = 1$. **[06]**

OR

Q.12) (A) Find the total area of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$ **[05]**

(B) Find the volume common to cylinders
$x^2 + y^2 = a^2$, $x^2 + z^2 = a^2$ **[05]**

(C) Find the moment of inertia about the line $\theta = \frac{\pi}{2}$ of the area enclosed by $r = a\,(1 + \cos\theta)$. **[06]**

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

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F. E. Examination - 2010

APPLIED SCIENCE - II

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

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

(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) Neat diagrams must be drawn wherever necessary.

(5) Assume suitable data, if necessary.

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

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

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

$c = 3 \times 10^{8}$ m/sec.

SECTION - I

Q.1) (A) Explain De-Broglie's Concept of Matter Waves. Derive an Expression for the De-Broglie Wavelength in terms of Energy. **[06]**

(B) Derive Expressions for Energy and Wave Function of a Particle in a Rigid Box. **[07]**

(C) An electron is bound by a potential box of infinite height having a width 2.5A^{o}. Calculate the minimum uncertainty in its velocity. **[04]**

OR

Q.2) (A) Derive Schrodinger's Time independent wave equation. **[06]**

(B) State Heisenberg's Uncertainty Principle. Illustrate the same with the help of Electron Diffraction Experiment at a Single Slit. **[06]**

(C) Write short note on Physical Significance of ψ. **[05]**

Q.3) (A) Explain construction and working of He-Ne Gas Laser with neat labelled diagram. **[06]**

(B) What is Holography ? Write a note on Holography Recording. **[04]**

(C) State and explain : **[07]**

(1) Meissner Effect

(2) Critical Fields

(3) Zero Resistance

OR

Q.4) (A) (1) Explain the Process of Stimulated Emission and Population Inversion. **[04]**

(2) Explain special properties of Laser. **[04]**

(B) What are Ferrates ? Discuss their properties and uses. **[06]**

(C) Discuss applications of Superconductors. **[03]**

Q.5) (A) Show that the Fermi-Level lies exactly at the centre of the energy gap in an Intrinsic Semiconductor. **[06]**

(B) Obtain an expression for the displacement produced when an electric field acts perpendicular to the motion of an electron. **[06]**

(C) Draw energy band diagrams of P-N Junction Diode under Forward Bias and Reverse Bias Conditions. **[04]**

OR

Q.6) (A) Derive an Expression for Conductivity in an Intrinsic and Extrinsic Semiconductors. **[06]**

(B) Give the principle, construction and working of an Electron Microscope. **[06]**

(C) Electrons accelerated by a potential of 250V enter the electric field at an angle of incidence 50^o and get refracted through an angle of 30^o. Find the potential difference between the two regions. **[04]**

SECTION - II

Q.7) (A) What is Proximate Analysis ? Explain the method of analysis of each of these constituents along with the significance ? **[07]**

(B) Give composition, boiling range and uses of fractions obtained in distillation of crude oil. **[06]**

(C) 0.72 gm of a fuel containing 80% carbon when burnt in a bomb calorimeter, increased the temperature of water from 27.3^oC to 29.1^oC. If the calorimeter contains 250 gm of water and its water equivalent is 150 gm. Calculate HCV in kJ/kg. **[04]**

OR

Q.8) (A) What is meant by Natural Gas ? Give composition, properties and applications of LPG and CNG. **[07]**

(B) What is Biodiesel ? Explain the process to get it from animal oil. State advantages of it over conventional diesel. **[06]**

(C) A producer gas has the following percentage composition by volume CH_4 = 3.5%, CO = 25%, H_2 = 10%, CO_2 = 10.8%, N_2 = 50.7%. Calculate theoretical air required per m^3 of the gas. **[04]**

Q.9) (A) What is Dry Corrosion ? Discuss the role of nature of oxide film formed in oxidation corrosion of metal. State and explain Pilling Bedworth Rule. **[07]**

(B) How are Metals Coated by Hot Dipping Technique ? Give the applications of Galvanising and Tinning. **[06]**

(C) Distinguish between Cathodic Protection and Anodic Protection. **[04]**

OR

Q.10) (A) What is Wet Corrosion ? Discuss the mechanism of Wet Corrosion. **[07]**

(B) Explain Corrosion in Zn Coated Iron and Tin Coated Iron, which is more protective ? And Why ? **[06]**

(C) What happens when ? **[04]**

(1) Impurity is present in metal.

(2) Iron Rod is buried in moist soil.

(3) Zn Rod is dipped in $CuSO_4$ Solution.

(4) A Metal under water drop.

Q.11) (A) Give instrumentation involved in UV Visible Spectroscopy. **[06]**

(B) State the principle and technique involved in Paper Chromatography. **[06]**

(C) Define the terms : **[04]**

(1) Wavelength

(2) Frequency

(3) Wavenumber

(4) Energy

OR

Q.12) (A) Describe principle and experimental setup of Column Chromatography. **[06]**

(B) Give applications of IR Spectroscopy. **[06]**

(C) Define the terms : **[04]**

(1) R_f

(2) R_x

(3) Chromatogram

(4) Elution

Total No. of Questions : 12] [Total No. of Printed Pages : 8

[3761]-18

F. E. Examination - 2010

ENGINEERING MECHANICS

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **any three** questions from each section.*

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

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

(4) Neat diagrams must be drawn wherever necessary.

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

(6) Use of electronic pocket calculator is allowed.

(7) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) Five forces are acting at a point 'O'. Find values of forces P_1 and P_2 required to keep point 'O' in equilibrium. Refer Fig.1. **[09]**

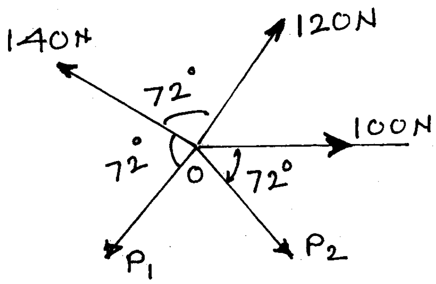


Fig. 1

(B) A person whose mass is 70 kg, represented by 'M', holds 25 kg mass as shown in Fig. 2. The pulley is assumed frictionless. The platform on which the person is standing is suspended by two ropes at 'A' and two ropes at 'B'. What is the tension in one rope at points A and B ? **[08]**

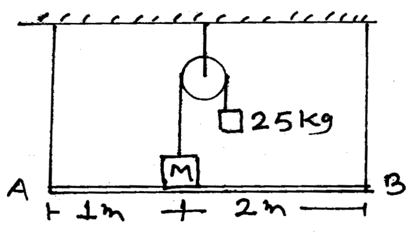


Fig. 2

Q.2) (A) A wedge A of 50N is to be driven between inclined plane and block B of 2000N as shown in Fig. 3. The coefficient of friction between all surfaces of contact is 0.30. Determine magnitude of the force 'P' required to start motion of the wedge A. **[09]**

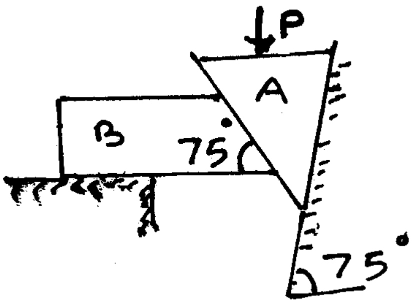


Fig. 3

(B) A semicircle of radius 60mm is removed from a trapezium. Locate centroid of the shaded portion that remained. Refer Fig. 4. All dimensions are in mm. **[08]**

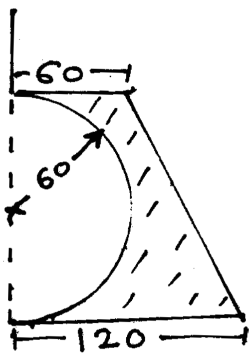


Fig. 4

Q.3) (A) Horizontal and Vertical Links are hinged to a wheel and force 'P' is applied to the link as shown in Fig. 5. Determine value of 'P' and reaction at 'A' for equilibrium. **[08]**

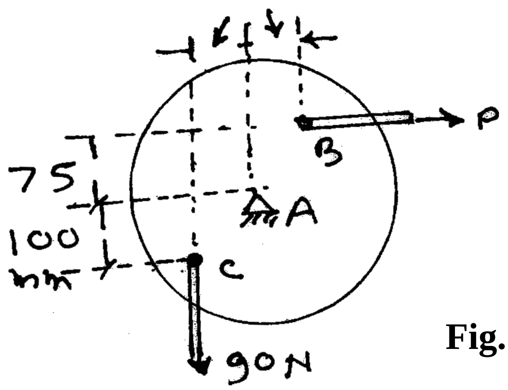


Fig. 5

(B) Find forces in all members of truss due to vertical force of 500N at C and horizontal force at B as shown in Fig. 6. **[08]**

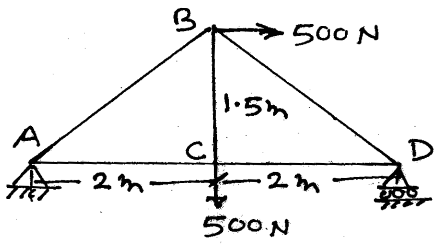


Fig. 6

Q.4) (A) A rectangular plate of 0.6m × 0.8m is kept such that, one of its diagonals is horizontal, as shown in Fig. 7. Locate resultant of this force system w.r.t. line AB. **[08]**

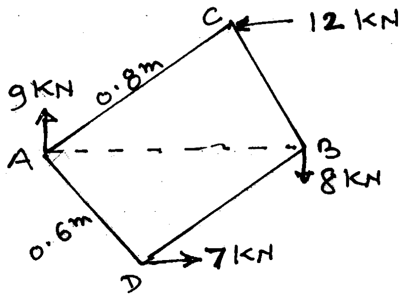


Fig. 7

(B) Derive relation between tight side and slack side of the flat belt using usual notations. **[08]**

Q.5) (A) Using Virtual Work Method find support reactions of the beam shown in Fig. 8. **[08]**

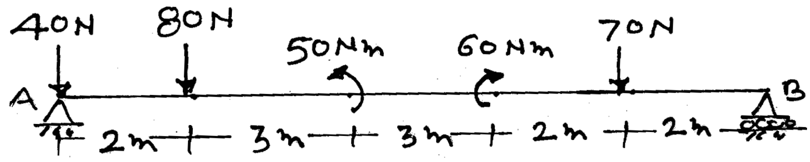


Fig. 8

(B) The circular table, 1.8m in diameter shown in Fig. 9, supports a load of 400N, located at point D on a diameter through the support A, and 300mm from centre on the opposite side of R_A. The support reaction R_A, R_B, R_C are equally spaced along the circumference. Determine magnitude of the reactions. **[09]**

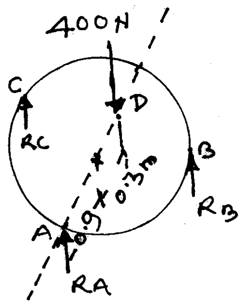


Fig. 9

Q.6) (A) A homogeneous ladder having a mass 'm' and length 'L' is held in equilibrium by the horizontal force 'P' as shown in Fig. 10. Using Virtual Work Method only, express force 'P' in terms of mass 'm'. **[08]**

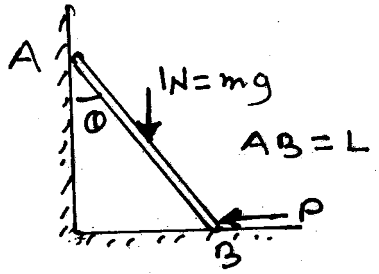


Fig. 10

(B) A 80 kg mass as shown in Fig. 11, is supported by three wires concurrent at D(2, 0, –1). The wires are attached to the point A(1, 3, 0), B(3, 3, –4) and C(4, 3, 0). Determine tension in each wire. **[09]**

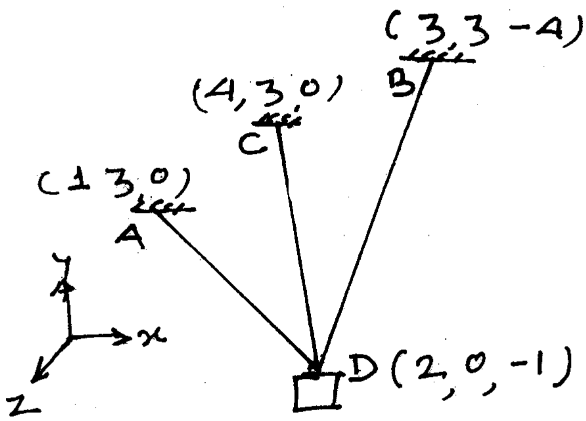


Fig. 11

SECTION - II

Q.7) (A) The motion of a particle is defined by the relation $x = t^3 - 6t^2 + 9t + 5$, where x, m, t in sec.

Find :

(1) When the velocity is zero.

(2) At t = 8, position and acceleration.

(3) Total distance travelled in 0 to 8 sec. **[09]**

(B) A bag having 8 kg mass is released from rest from a position 'A' when $\theta = 0$. It strikes a box 'B' of mass 20 kg when $\theta = 90^\circ$. Find velocities of bag 'A' and box 'B' after impact, if the coefficient of restitution is half. **[08]**

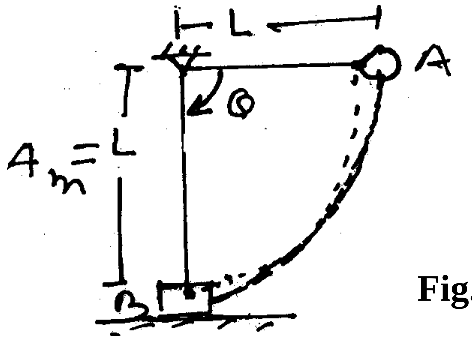


Fig. 12

Q.8) (A) Ships 'A' and 'B' leave a port at the same time. The ship 'A' is travelling North West at 36 kmph and ship 'B' at 40° South of West at 24 kmph.

Determine :

(1) Speed of ship 'B' relative to 'A'.

(2) At what time they will be 160 km apart ? **[08]**

(B) Three blocks A, B, C of weight 250N, 1000N, 500N respectively are connected by inextensible string. Determine constant force 'P' that will give system of blocks shown in Fig., a velocity of 3m/s after moving a distance of 4.5m from rest. All the blocks are moving with constant acceleration. Take coefficient of friction = 0.20 and assume pulleys as frictionless. **[09]**

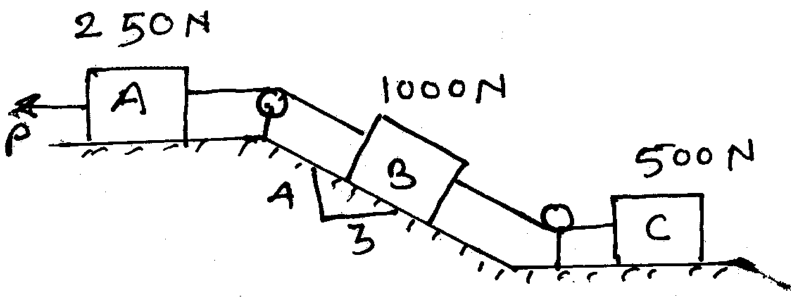


Fig. 13

Q.9) (A) A projectile is fired with an initial velocity of 260m/s at a target B, located at 700m above the ground, at a horizontal distance of 3600m from the gun as shown in Fig. 14. Neglecting air resistance, determine values of the firing angle α. **[08]**

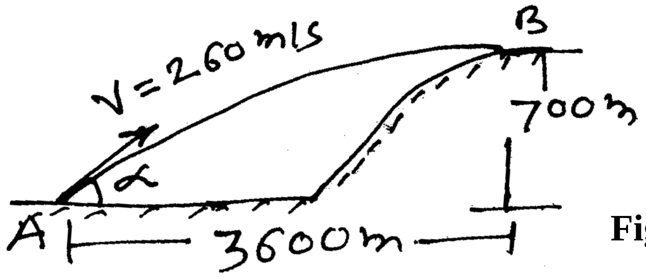


Fig. 14

(B) A ball of weight 10N starts from rest from the origin 'O' of the curve OAB and rolls under gravity as shown in Fig. 15. Find reaction exerted on the ball at a point A, if curve is defined by the equation $y = \sin\left(\frac{x}{L}\right)$ **[08]**

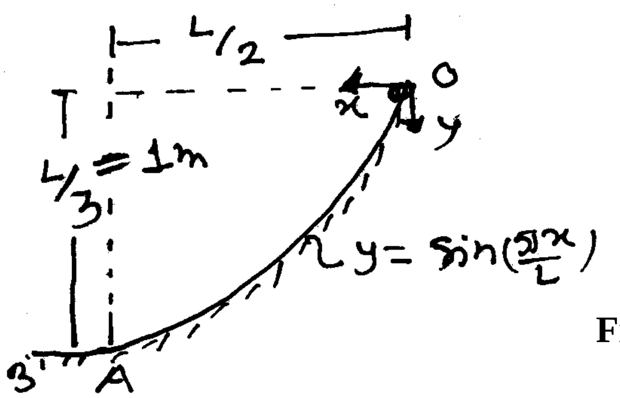


Fig. 15

Q.10) (A) A particle moving along a path defined by the polar co-ordinate $r = (3 \sin t)$ .... m and $\theta = 2t^3$ .... rad where 't' is in seconds and argument for the sinC is in radians. Determine components of its velocity and acceleration, when t = 1 sec. **[08]**

(B) A block assumed to be a particle and weighing 40N rests on a plane which can turn about the y axis as shown in Fig. 16. The length of cord is 2m. What is the tension in the cord when angular velocity of the plane and the block is 10 rev./min. **[08]**

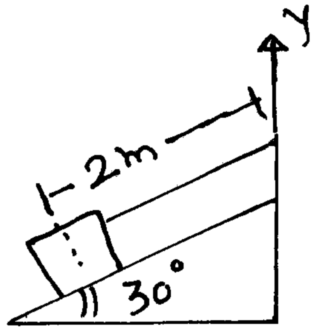
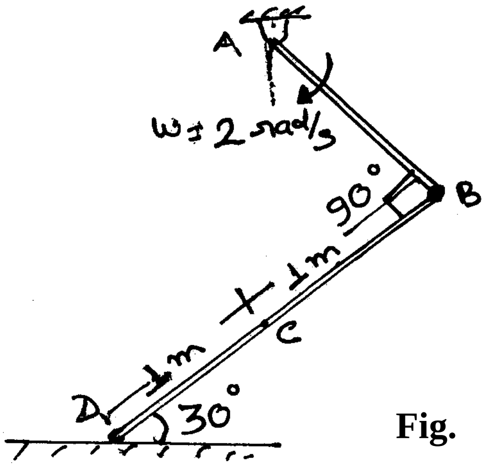


Fig. 16

Q.11)(A) As shown, rod AB of 1m length is rotating clockwise at 2 rad/s. End 'D' of the rod BD = 2m length, is free to move on a horizontal surface. Determine linear velocity of the points in its magnitude and direction for : (i) midpoint of BD. (ii) point D. **[09]**



AB = 1m
BC = CD = 1m

Fig. 17

(B) Derive expression for mass moment of inertia of a bar about an axis through one end and perpendicular to the bar whose length is L. Assume that the mass 'm' and the cross section is small in comparison with length. **[04]**

(C) Explain concept of Dynamic Equilibrium in case of rigid body motion. **[04]**

Q.12)(A) Explain equations defining the rotation of rigid body about a fixed axis with angular displacement ‘θ’ in time ‘t’ in the following cases :

(1) Uniform Rotation

(2) Uniform Accelerated Rotation

(3) Variable Acceleration ‘α’ **[08]**

(B) In Fig. 18, a box ‘C’ of weight W is accelerating down at the rate of 5 m/s^2. It is connected by weightless, flexible, inextensible rope which passes over a smooth drum to homogenous cylinder B of weight 250N. The cylinder is acted upon by a moment M = 50Nm counterclockwise. Determine weight ‘W’ of the box ‘C’ and components of reactions at A on the cylinder. **[09]**

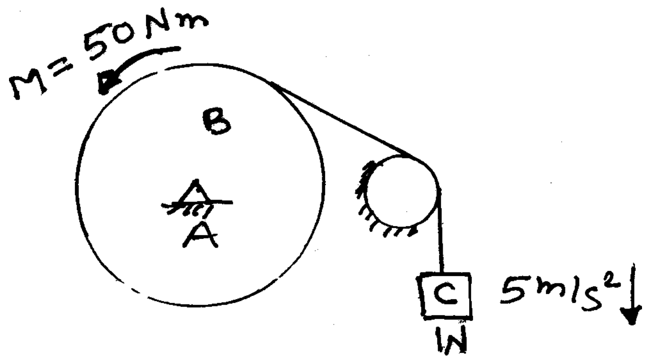


Fig. 18

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

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F. E. Examination - 2010

BASIC ELECTRONICS ENGINEERING

(2003 Course)

Time : 3 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **three** questions from section I and **three** questions from section II.*

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

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

(4) Neat diagrams must be drawn wherever necessary.

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

(6) Assume suitable data, if necessary.

SECTION - I

Q.1) (A) If I_E = 12 mA, I_B = 100 μA. Calculate α and β. **[06]**

(B) With neat circuit diagram and waveforms explain the Operation of Half Wave Rectifier. **[06]**

(C) Differentiate between Zener Breakdown and Avalanche Breakdown. **[06]**

OR

Q.2) (A) A bridge rectifier is applied with input from a Stepdown

Transformer having turns ratio 8 : 1 and input 230V, 50Hz. If the $R_f = 1\Omega$, $R_s = 10\Omega$ and $R_L = 2k\Omega$.

Find :

(1) D. C. Power Input

(2) PIV across each diode

(3) %η (efficiency) **[06]**

(B) Draw construction diagram and explain working of n-p-n transistor with and without biasing. **[06]**

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

(1) Photodiode

(2) Varactor Diode

Q.3) (A) What is D.C. Load Line ? Give its significance and derive its equation for Common Emitter Amplifier. **[08]**

(B) Draw and explain black diagram of Series Regulator. **[08]**

OR

Q.4) (A) With the help of neat circuit diagram and input, output waveforms explain working of Single Stage R-C Coupled Amplifier. **[08]**

(B) For the circuit shown in fig. 4(B) find the Maximum and Minimum Values of Zener Diode Current : **[08]**

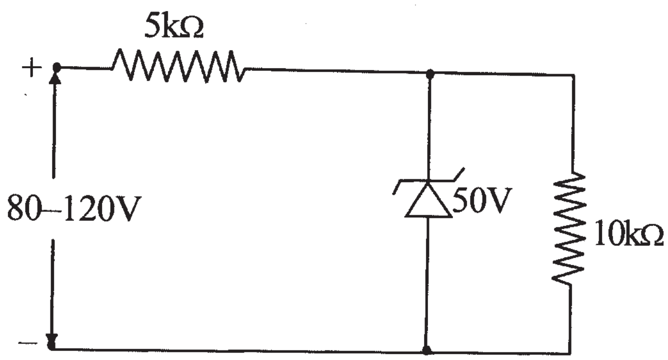

Fig. 4(B)

Q.5) (A) State and prove DeMorgans Theorems. **[08]**

(B) Simplify the following expression and implement it by using NAND Gates only.

$$\overline{W}XY\overline{Z} + XY\overline{Z} + X\overline{Y}\,\overline{Z} + X\overline{Y}Z$$ **[08]**

OR

Q.6) (A) Design and implement Full Adder using K-map. **[08]**

(B) Design One Bit Comparator using K-map and realize it using basic gates. **[08]**

SECTION - II

Q.7) (A) Draw the circuit diagram of Inverting Amplifier and explain its working. Also derive expression for Closed Loop Gain. **[08]**

(B) Draw and explain the Operation of Wein Bridge Oscillator **[08]**

OR

Q.8) (A) Explain following Op-Amp Parameters : **[08]**

(1) C.M.R.R.

(2) Input Offset Voltage

(3) Input Bias Current

(4) Slew Rate

(B) What is Difference Amplifier ? Draw its circuit diagram and derive the expression for output. **[08]**

Q.9) (A) With the help of neat block diagram explain Instrumentation System. **[08]**

(B) On which Basic Principle Thermocouple Works. With neat diagram explain its operation. Also give its applications. **[08]**

OR

Q.10)(A) Explain following characteristics of Transducer : **[08]**

(1) Precision

(2) Hysteresis

(3) Sensitivity

(4) Linearity

(B) Write short note on Piezoelectric Transducer. **[08]**

Q.11)(A) Draw and explain block diagram of Single Channel C.R.O. **[06]**

(B) What is Multivibrator ? Draw the circuit diagram and explain the Operation of Astable Multivibrator using IC 555. **[06]**

(C) With neat block diagram explain Operation of Electronic Weighing Machine. **[06]**

OR

Q.12)(A) Explain following Front Panel Controls of C.R.O. : **[06]**

(1) Alternate

(2) Chop

(B) Write short notes on : **[12]**

(1) Batch Counter

(2) Burglar Alarm

Total No. of Questions : 12] **[Total No. of Printed Pages : 3**

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F. E. Examination - 2010

ENGINEERING GRAPHIC - II

(2003 Course)

Time : 4 Hours] **[Max. Marks : 100**

Instructions :

*(1) Answer **any one** question from each unit.*

*(2) Answer to the **two sections** should be drawn on **separate drawing sheets,** use back side of sheet also.*

(3) Figures to the right indicate full marks.

(4) Use of log table, electronic pocket calculator is allowed.

(5) Assume suitable data, dimensions if necessary.

*(6) **Retain all construction lines;** marks are reserved for dimensioning and good presentation.*

SECTION - I

UNIT - I

Q.1) A line MN has its end point M 20mm in front of the V.P. and end point N 60mm in front of the V.P. Line is inclined to H.P. at 30^o. Distance between the projectors of M and N is 75mm. Vertical trace of the line is 10mm above the H.P. Draw projections of the line and find its inclination with V.P. and its true length. Locate H.T. **[16]**

OR

Q.2) Two bulbs P and Q in a decoration of room are 0.5 meter and 1 meter above the ground respectively. 'R' and 'S' are two walls of room at right angles. Bulb P is 0.3 meter from wall 'R' and 0.6 meter from the wall 'S'. Bulbs Q is 1.5 meter from wall 'R' and 2 meter from the wall S. Draw the projections of bulb and determine the true distance between the bulbs P and Q. **[16]**

UNIT - II

Q.3) A trapezium ABCD having larger parallel side AB=60mm, smaller parallel side CD=30mm and height 50mm is kept in H.P. on its side AB in such a way that its top view appears as another trapezium of same parallel sides but of height 30mm. Draw the projections of the trapezium when the side in H.P. makes an angle of 50^{o} with V.P. **[17]**

OR

Q.4) A regular pentagon of 30mm sides is resting on one of its sides on V.P. such that it is parallel to and 15mm above the H.P. If the highest corner of the pentagon rests on the H.P., draw its projections and find the angle made by the plane with the V.P. **[17]**

UNIT - III

Q.5) A hexagonal pyramid, side of base 30mm and axis length 60mm is kept on the H.P. on one of its base edges in such a way that the triangular face containing that base edge is vertical. Draw the projections of the pyramid when the triangular face which is vertical is parallel to V.P. and away from it. **[17]**

OR

Q.6) A square prism, side of base 30mm and axis length 60mm is kept on the V.P. on a corner of its base such that one of the solid diagonals of the prism is parallel to V.P. and inclined at 30^{o} to the H.P. Draw the projections of the prism. **[17]**

SECTION - II

UNIT - IV

Q.7) A cone of base diameter 50mm and axis length 70mm is kept on the ground on one of its generators so that the axis is parallel to the V.P. It is cut by a section plane perpendicular to the H.P., inclined at 30^{o} to the V.P. and intersecting the axis at a point 25mm from apex. Draw the T.V., sectional F.V. and the true shape of the section. **[16]**

OR

Q.8) A equilateral triangular prism, side of base 40mm and axis length 75mm is lying on the H.P. on one of its longer edges with its axis parallel to V.P. It is cut by an AVP in two equal halves in such a way that true shape of the section is an isosceles triangle of base 70mm. Draw T.V., sectional F.V. and true shape of the section. **[16]**

UNIT - V

Q.9) A cylinder of diameter 40mm and axis length 70mm is kept on the H.P. on its base. A square hole of side 20mm, the axis of which is parallel to both H.P. and V.P. is drilled through the cylinder. Axis of the square hole is at center height and is 10mm in front of the axis of the cylinder and all rectangular faces of the square hole are equally inclined to H.P. Draw the DLS of the cylinder. **[17]**

OR

Q.10) A frustum of a hexagonal pyramid, side of base 40mm, side of the top edge 20mm and height 45mm is resting on its base in H.P., with one of its edges of base perpendicular to V.P. A piece of wire is stretched round the slant surface from the corner of base nearest to the observer to the point on the top-face opposite to the corner point on the base. Show the wire in the elevation and plan. **[17]**

UNIT - VI

Q.11) A vertical square prism of 40mm edge of the base and 80mm axis is resting on its base on the H.P. in such a way that one of the edges of the base makes an angle of 30^o with the V.P. The prism is penetrated by a cylinder with the axis parallel to H.P. and V.P. The diameter of the cylinder is 50mm and axis is 10mm in front of the axis of the prism and is 40mm away from the H.P. Draw three views of arrangement showing the curves of intersection. **[17]**

OR

Q.12) A cone of base diameter 50mm and height 60mm is resting on the H.P. on its base. A square prism of side of base 25mm and axis length 65mm penetrates the cone horizontally. Axis of the prism is parallel to V.P., 25mm above H.P. and 6mm in front of the axis of the cone. All the rectangular faces of the prism are equally inclined to V.P. Draw the projections of solids showing curves of intersection. **[17]**
