Total No. of Questions : 12] [Total No. of Printed Pages : 8

DEC-2008 [3461]-1

F. E. (2003 Course) Examination - 2008

ENGINEERING MATHEMATICS - I

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

Instructions :

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

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

(3) Neat diagrams must be drawn wherever necessary.

(4) 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) Reduce the matrix to normal form and hence find the rank. **[06]**

$$\begin{bmatrix} 2 & -2 & 0 & 6 \\ 4 & 2 & 0 & 2 \\ 2 & -4 & 2 & 4 \\ 1 & -1 & 0 & 3 \end{bmatrix}$$

(B) By considering the ranks of relevant matrices, examine for consistency the system of equations :

$2x - y - z = 2$

$x + 2y + z = 2$

$4x - 7y - 5z = 2$ and solve them if found consistent. **[06]**

(C) Examine for linear dependence or independence for the given vectors and if dependent, find the relation between them : **[05]**

$x_1 = (3, 1, -4)$, $x_2 = (2, 2, -3)$, $x_3 = (0, -4, 1)$

OR

Q.2) (A) Determine the Eigen Values and Eigen Vectors of A :

$$A = \begin{bmatrix} 4 & 6 & 6 \\ 1 & 3 & 2 \\ -1 & -4 & -3 \end{bmatrix}$$ **[07]**

(B) For different values of k, discuss the nature of solution of the following equations. **[05]**

$x + 2y - z = 0$; $3x + (k + 7)\, y - 3z = 0$,

$2x + 4y + (k - 3)\, z = 0$

(C) Is $A = \begin{bmatrix} -8 & 4 & 1 \\ 1 & 4 & -8 \\ 4 & 7 & 4 \end{bmatrix}$ orthogonal. If not, can it be converted into an orthogonal matrix. **[05]**

Q.3) (A) Solve $x^4 - x^3 + x^2 - x + 1 = 0$. **[05]**

(B) If $\sin^{-1}(\alpha + i\beta) = \lambda + i\mu$ prove that $\sin^2\lambda$ and $\cosh^2\mu$ are the roots of the equation $x^2 - (1 + \alpha^2 + \beta^2)\, x + \alpha^2 = 0$. **[06]**

(C) A square lies entirely in second quadrant. If one of the side join points –2 and 2i, find the complex numbers representing other vertices. **[06]**

OR

Q.4) (A) Find the locus of z satisfying $|z + 1| + |z - 1| < 3$. **[06]**

(B) Prove that $\log(e^{i\alpha} + e^{i\beta}) = \log\left[2\cos\left(\frac{\alpha - \beta}{2}\right)\right] + i\left(\frac{\alpha + \beta}{2}\right)$. **[05]**

(C) If α and β are the roots of the equation $x^2 - 2x + 2 = 0$ prove that **[06]**

$$\alpha^n + \beta^n = 2^{n/2+1} \cos\frac{n\pi}{4}$$

Q.5) (A) Find the nth derivative of $e^x \sin 4x \cos 6x$. **[05]**

(B) If $y = y = e^{a\sin^{-1}x}$, prove that

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

(C) Find 'C' of the mean value theorem if

$$f(x) = x^2 - 3x - 1 \text{ in } \left(-\frac{11}{7}, \frac{13}{7}\right)$$ **[05]**

OR

Q.6) (A) If $y = x\log(x + 1)$ prove that

$$Y_n = \frac{(-1)^{n-2}\,(n - 2)!\,(x + n)}{(x + 1)^n}$$ **[06]**

(B) Find nth derivatine of $e^x\,(5x + 6)^3$. **[05]**

(C) Verify Rolle's Theorem for $f(x) = \sin x \cos x$ in $[0, \pi]$ **[05]**

SECTION - II

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

$$1+\frac{3}{2}x+\frac{5}{9}x^2+\frac{7}{28}x^3+\frac{9}{65}x^4+\ldots\ldots \quad \textbf{[05]}$$

(B) Test for convergence of the series : **(Any One)** **[04]**

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

(2) $\frac{1}{1.2.3}+\frac{3}{2.3.4}+\frac{5}{3.4.5}+\ldots\ldots$

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

(1) Expand $\log(1+e^x)$ in powers of x upto x^4.

(2) Use Taylor's Theoren to expand $3x^3-2x^2+x-4$ in powers of $(x+2)$.

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

OR

Q.8) (A) Determine the range of convergence of

$$1+\frac{3}{7}x+\frac{3.6}{7.10}x^2+\frac{3.6.9}{7.10.13}x^3+\ldots\ldots\ldots (x>0) \quad \textbf{[05]}$$

(B) Test for convergence of the series : **(Any One)** **[04]**

(1) $\frac{x}{1.2}+\frac{x^2}{3.4}+\frac{x^3}{5.6}+\frac{x^4}{7.8}+\ldots\ldots$

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

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

(1) Expand xcosecx in ascending powers of x upto x^4.

(2) Prove that :

$$\sin x \sinh x = x^2 - 2^3 \frac{x^6}{6!} + 2^5 \frac{x^{10}}{10!} + \ldots\ldots$$

(3) Using Taylor's Theoren, express

$7 + (x + 2) + 3(x + 2)^3 + (x + 2)^4 - (x + 2)^5$ in ascending powers of x.

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

(1) Evaluate

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

(2) Evaluate

$$\lim_{x \to 0} \frac{e^{x \sin x} - \cosh\left(x\sqrt{2}\right)}{x^4}$$

(3) If $\lim_{x \to 0} \frac{a\sin x - \sin 2x}{\tan^3 x}$ is finite, find the value of a and hence the limit.

(B) If $x^2 = au + bv$

$y^2 = bu - av$

Prove that

$$\left(\frac{\partial u}{\partial x}\right)_y \left(\frac{\partial x}{\partial u}\right)_v = \left(\frac{\partial v}{\partial y}\right)_x \left(\frac{\partial y}{\partial v}\right)_u$$ **[04]**

(C) If $u = \sin^{-1}\left(\frac{x^{\frac{1}{3}} + y^{\frac{1}{3}}}{x^{\frac{1}{2}} + y^{\frac{1}{2}}}\right)^{\frac{1}{2}}$ then show that

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2}$$

$$= \frac{\tan u}{144} \{13 + \tan^2 u\}$$ [05]

OR

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

(1) Evaluate

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

(2) Evaluate

$$\lim_{x \to 0} \log_{\tan x}^{(\tan 2x)}$$

(3) Evaluate

$$\lim_{x \to 0} \frac{(1 + x)^{\frac{1}{x}} - e + \frac{ex}{2}}{x^2}$$

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

$$\left(\frac{\partial z}{\partial x}\right)^2 + \left(\frac{\partial z}{\partial y}\right)^2 = 4\left(u^2 + v^2\right)^{\frac{1}{2}} \left[\left(\frac{\partial z}{\partial u}\right)^2 + \left(\frac{\partial z}{\partial v}\right)^2\right]$$ [05]

(C) If $z = x\ f\left(\frac{y}{x}\right) + g\left(\frac{y}{x}\right)$

Prove that

$x^2z_{xx} + 2xy\ z_{xy} + y^2z_{yy} = 0$ **[04]**

Q.11) (A) If $x + y + z = u$

$y + z = uv$

$z = uvw$

Find $\frac{\partial(x, y, z)}{\partial(u, v, w)}$ **[05]**

(B) Find the maximum and minimum values of

$f(x, y) = xy\ (a - x - y)$ **[06]**

(C) The time of swing 't' of a pendulum of length *l* under certain condition is given by $t = 2\pi\sqrt{\frac{L}{g'}}$

where $g' = g\left(\frac{r}{r + h}\right)^2$.

Find then % error in t, due to error p% in h & q% in *l* where r is constant. **[05]**

OR

Q.12) (A) If $u = \sin^{-1}x + \sin^{-1}y$, $v = x\sqrt{1 - y^2} + y\sqrt{1 - x^2}$ verify whether u, v are functionally dependent. If so, find the relation between them. **[06]**

(B) If $x = u + v + w$, $y = u^2 + v^2 + w^2$, $z = u^3 + v^3 + w^3$ then find $\frac{\partial y}{\partial v}$. **[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

$$x = \frac{a^3}{a^3 + b^3 + z^3}, \quad y = \frac{b^3}{a^3 + b^3 + c^3}$$

$$z = \frac{c^3}{a^3 + b^3 + c^3}$$ **[05]**

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

[3461]-2

F. E. (2003 Course) Examination - 2008

APPLIED SCIENCE - I

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

Instructions :

(1) Answer 3 quesitons from section I and 3 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) 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) State two fundamental postulates of special theory of relativity. **[02]**

The length of rocket ship is 100 m on the ground. When it is in flight, its length observed on the ground is 99 m ? Calculate its speed. **[04]**

(C) Explain the method to determine thickness of a thin transparent plate of refractive index 'μ' by using Michelson's Interferometer. **[04]**

OR

Q.2) (A) Explain the formation of Newton's Rings and prove that diameter of bright rings are proportional to square root of odd natural numbers. **[07]**

(B) Derive the Einstein's equation of mass-energy equivalence. **[06]**

(C) Interference brings are produced by mono-chromatic light, falling normally on a wedge shaped film of cellophane whose refractive index is 1.4. The angle of wedge is 20 seconds of an arc and the distance between successive bright fringes is 0.25 cm. Calculate the wavelength of light. **[04]**

Q.3) (A) State and explain Rayleigh's criterion of resolution. Dervie an expression for resolving power of a telescope. **[07]**

(B) What is Magnetostriction Effect ? Explain the Magnetostriction Oscillator used for generation of ultrasonic waves. **[06]**

(C) X-rays of wavelength 1.6A° are diffracted by a crystal, mounted on a Bragg's Spectrometer at an angle 14.2° in the first order. What is the spacing of atomic layers in the the crystal ? **[04]**

OR

Q.4) (A) Derive an expression for the intensity at a point in Fraunhoffer's diffraction pattern produced by a single slit. Obtain the condition of principal maxima and minima. **[07]**

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

(C) In a plane transmission grating, the angle of diffraction for the second order principal maximum for the wavelength 5×10^{-5} cm is 30°. Calculate the number of lines/cm of the grating surface. **[04]**

Q.5) (A) Explain principle, construction and working of a Betatron. Obtain the Betatron Condition. **[06]**

(B) (1) What is Half Wave Plate ? Obtain the equation of thickness of a half wave plate for negative crystals. **[03]**

(2) Write Carbon-Nitrogen Cycle for Nuclear Fusion Reaction. **[03]**

(C) A ray of light is incident on the surface of a glass plate of refractive index 1.732 at the polarising angle. Calculate the angle of refraction the ray. **[04]**

OR

Q.6) (A) Describe the construction and working of Nicol's Prism and explain how it can be used as polariser and analyser ? **[06]**

(B) (1) How chain reaction takes place ? Explain why it is not possible in natural uranium. **[03]**

(2) State and explain Law of Malus. **[03]**

(C) A cyclotron with dees of radius 2m has a magnetic field of 0.75 wb/m^2. Calculate the maximum energies to which it can accelerate :

(1) Protons

(2) α-particles

(Given : $m_p = 1.67 \times 10^{-27}$ kg, $m_\alpha = 6.643 \times 10^{-27}$ kg) **[04]**

SECTION - II

Q.7) (A) How are solids classified on the basis of types of Bonding ? Give detailed account on any one of them. **[06]**

(B) What is the Law of Symmetries in Crystals ? Give the various symmetries in cubic crystals. **[06]**

(C) Briefly account for Liquid Crystals. **[04]**

OR

Q.8) (A) Explain the point defects in Solids. **[06]**

(B) Give the important properties of mica and talc, on the basis of their structures. **[06]**

(C) What is Atomic Packing Factor ? Calculate the APF for BCC Crystals. **[04]**

Q.9) (A) How is alkalinity in a water sample determined ? State the type of Alkalinities. **[06]**

(B) What is a Secondary Pollutant ? Explain the formation reaction and effects, of any one secondary pollutant. **[06]**

(C) A zeolite bed gets exhausted on treatment of 2000 litres of a water sample. The exhausted bed requires 20 litres of 12% NaCl Solution for Regeneration. Calculate the hardness of the water sample. **[05]**

OR

Q.10) (A) Give the difference in sludge and scales in Boiler. Explain any one method of internal treatment for scales. **[06]**

(B) What are the steps involved in treatment of municipal waste ? Explain the aerobic oxidation by activated sludge process. **[06]**

(C) 100 ml of a water sample containing chloride salts dissolved, requires 15 ml of M/50 $AgNO_3$ in titration by Mohr's Method. Calculate the amount of Chloride Ion per litre in the water sample. **[05]**

Q.11) (A) Give formation reaction, important properties and uses of,

(1) PVC

(2) ABS Plastics. **[06]**

(B) Give the free radical mechanism of chain polymerisation of an alkene. **[05]**

(C) Give a note on Compounding of Plastics. **[06]**

OR

Q.12) (A) Give a note on Conducting Polymers. **[06]**

(B) What is Vulcanisation of a Rubber ? Give the structural change taking place on vulcanisation of Natural Rubber. Give the differences in vulcanised and unvulcanised rubbers. **[06]**

(C) Give any two methods for expressing Average Molecular Weight of Polymers. **[05]**

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

[3461]-3

F. E. (2003 Course) Examination - 2008

BASIC MECHANICAL ENGINEERING

Time : 3 Hours] [Max. Marks : 100

Instructions :

(1) Answer any 3 questions from section - I and any 3 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) Assume suitable data, if necessary.

SECTION - I

UNIT - I

Q.1) (A) Explain various types of Thermodynamic Systems with suitable example. [06]

(B) State and explain Zeroth Law of Thermodynamics. [04]

(C) A certain quantity of air has a volume of 0.028 m^3 at a pressure of 1.25 bar and 25°C. It is compressed to a volume of 0.0042 m^3 according to the law PV^{13} = constant. Find the final temperature and work done during compression. Also determine the reduction in pressure at a constant volume required to bring the air back to its original temperature. [08]

OR

Q.2) (A) Explain the Intensive and Extensive Property. Classify following properties into intensive and extensive.

Specific enthalpy, pressure, volume, temperature [06]

(B) Explain Joule's Experiment. [04]

(C) In a steady flow system, the working fluid flowing at 5 kg/sec. enters the system at 6 bar with a velocity of 300 m/sec. Its internal energy is 150 kJ/kg and specific volume is 0.4 m^3/kg. The pressure, velocity, internal energy and specific volume values at exit are 1.5 bar, 150 m/sec., 100 kJ/kg and 1.26 m^3/kg respectively. The substance loses 5 kJ/kg heat as it passes through the system. Determine the power of the system and state whether it is power producing or power absorbing ? **[08]**

UNIT - II

Q.3) (A) Explain working of Centrifugal Pump with neat sketch. What is the function of Foot Valve ? What is Priming ? **[08]**

(B) With neat sketch explain the working of a four stroke petrol engine. Differentiate between a two stroke petrol engine and a four stroke petrol engine. **[08]**

OR

Q.4) (A) With a neat sketch explain the working of reciprocating air compressor. Also write some specific applications of compressed air (minimum six). **[08]**

(B) What is Air Conditioning ? Explain with neat sketch working of Window Air Conditioner. **[08]**

UNIT - III

Q.5) (A) A composite wall consists of 1.5 mm thick steel sheet and 10 mm plywood sheet separated by 2mm thick glasswool in between. Calculate the rate of heat flow per m^2 if the temperatures on the steel sheet and plywood sides are 25°C and –15°C respectively. Also calculate interface temperatures.

k for steel = 23.23 W/mK

k for plywood = 0.052 W/mK

k for glasswool = 0.014 W/mK **[08]**

(B) Write and explain the meaning of parameters used in Newton's Law of Cooling. **[02]**

(C) What are the advantages of Wind Energy ? Explain a simple modern wind mill with a neat sketch. **[06]**

OR

Q.6) (A) A steel pipe of 100 mm internal diameter and 7 mm wall thickness carries steam at 260°C. The atmospheric temperature is 25°C and heat transfer coefficient on the atmospheric side is 15 W/m^2K. Neglect heat transfer coefficient on the inside. If the thermal conductivity of steel pipe is 50 W/mK, calculate (i) temperature of outside surface of the pipe and (ii) heat loss per meter length. [08]

(B) Write a short note on Solar Water Heater. [04]

(C) Write a short note on Geothermal Energy. [04]

SECTION - II

UNIT - IV

Q.7) (A) Explain any four operations performed on drilling machine with suitable sketches. [08]

(B) Explain Soldering and Brazing in brief. [04]

(C) Explain the working of NC Machine. State its advantages. [04]

OR

Q.8) (A) Draw a neat labelled diagram of Centre Lathe Machine. [06]

(B) Draw a labelled sketch for Reciprocating Power Saw. Explain briefly. [06]

(C) What is Resistance Welding ? Name any three resistance welding methods. [04]

UNIT - V

Q.9) (A) What do you mean by Factor of Safety ? What are the parameters affecting selection of factor of safety ? [04]

(B) Explain with suitable sketches of the following : [06]

(i) Blanking

(ii) Notching

(C) Explain stress strain diagram for mild steel with a suitable sketch. Show its salient features. [08]

OR

Q.10) (A) Write a short note on Ergonomic Considerations in Design. **[06]**

(B) Explain with neat sketches : **[06]**

(i) Clearance Fit

(ii) Transition Fit

(C) Explain 'V' bending, 'U' bending and Edge bending. **[06]**

UNIT - VI

Q.11) (A) Suggest suitable elements for the following : **[04]**

(i) To transmit power when the axes of the shafts are neither parallel nor intersecting.

(ii) To transmit power when the axes of shafts are intersecting.

(iii) To transmit power when the axes of the shafts are parallel with slight misalignment.

(iv) To transmit power when the distance between shafts is 2-4 meters.

(B) Compare Gear Drive and Chain Drive. **[04]**

(C) Explain with neat labelled diagrams the following : **[08]**

(i) Woodruff Key

(ii) Gib Head Key

(iii) Hollow Saddle Key

(iv) Parallel Key

Q.12) (A) What is Bearing ? How bearings are classified ? Explain with neat sketch any one type of bearing. **[08]**

(B) Differentiate between Flat Belt and V Belt Drive. Show their cross-sections. **[04]**

(C) Explain the Construction and Working of Single Plate Friction Clutch. **[04]**

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

[3461]-4

F. E. (2003 Course) Examination - 2008

BASIC ELECTRICAL ENGINEERING

Time : 3 Hours] [Max. Marks : 100

Instructions :

(1) Answer 3 questions from section I and 3 questions from section II.

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

(3) Neat diagrams must be drawn wherever necessary.

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

(5) Your answer will be valued as a whole.

(6) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam data, if necessary.

(7) Assume suitable additional data, if necessary.

SECTION - I

Q.1) (A) Explain the factors which affects battery capacity. **[04]**

(B) At room temperature of 22°C, a filament lamp takes a current of 1.4A at the instant of switching on to a supply of 240V. Calculate its power rating under normal working condition, when its filament attains a steady temperature of 1445°C. Assume RTC for filament material at 22°C as 0.0052/°C. **[06]**

(C) An electric pump lifts 1.2m^2 of water per minute to a height of 15m. If its overall efficiency is 60%, find the input power. If the the pump is used for 4 hrs. a day, find the daily cost of energy at Rs. 2.25 per unit. **[07]**

OR

Q.2) (A) With neat sketch explain construction and working of lead acid cell. **[06]**

(B) With usual notations derive the expression for insulation resistance for single core cable. **[04]**

(C) A DC electric motor drives a train having a mass of 10,000 kg up on incline of 1 in 100, at a steady speed of 60 kmph. The frictional force of the tracks is (10 × 9.81) Netwtons per 1000 kg mass of the train. If the motor operates from a supply of 11kV, find the current drawn by it. Assume overall efficiency of the system as 80%. **[07]**

Q.3) (A) State and explain Thevenin's Theorem. **[04]**

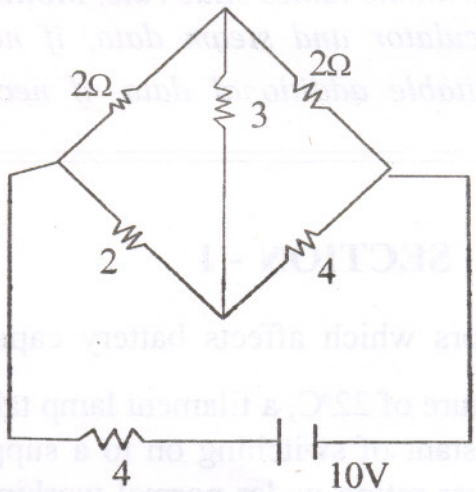

Fig. A

(B) Use Kirchoffs laws to find current flowing in 3Ω resistance. Hence verify your result by Norton's Theorem (Fig. A). **[6+7]**

OR

Q.4) (A) Derive the expressions for converting delta network into equivalent star network. **[05]**

(B)

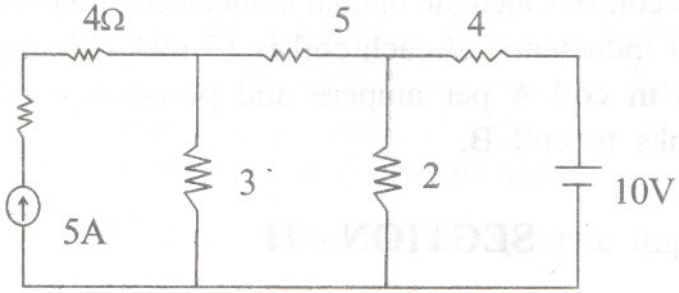

Fig. B

Use superposition theorem to find current in 2Ω resistance (Fig. B). Hence verify your result by Thevenin's theorem. **[6+6]**

Q.5) (A) Explain the concepts of magnetic leakage and fringing. **[04]**

(B) Draw hysterisis loop for a magnetic material and explain following terms :

(1) Magnetic Hysterisis

(2) Residual Flux Density

(3) Coersive Force **[06]**

(C) The mean diameter of steel ring is 40 cm and flux density of 0.9 wb/m^2 is produced by 3500 A/m. If the cross section of the ring is 15 cm^2 and number of turns 440, calculate (1) the exciting current (2) the self inductance. **[06]**

OR

Q.6) (A) Explain the factor's which affects the self inductance of a coil. **[04]**

(B) Define following terms and hence state their units :

(1) Relative Permiability

(2) Permiance

(3) Magnetic Flux Intensity

(4) mmf

(5) Reluctance

(6) Coefficient of Coupling **[06]**

(C) Two identical 750 turn coils A and B lie in parallel planes. A current changing at the rate of 1500 A/s induces an emf of 13.50V in coil B. Calculate mutual inductance of the arrangement. If the self inductance of each coil is 15 mH, calculate the flux produced in coil A per ampere and percentage of this flux which links to coil B. **[06]**

SECTION - II

Q.7) (A) Explain the concept of phase and phase difference. **[04]**

(B) A parallel plate capacitor has two metal plates of area 2.5 m^2 separated by three slabs of different dielectric materials. The relative permitivities of these dielectric materials are 2, 4, 8 and the thicknesses 1, 2 and 3 mm respectively.

Calculate :

(1) The Capacitance of the Capacitor.

(2) The potential gradient in each dielectric due to a p.d. of 10 kV between the metal plates. **[07]**

(C) Three voltages represented by :

$e_1 = 30 \sin wt$

$e_2 = 30 \sin (wt + \pi/4)$

$e_3 = 40 \cos (wt + \pi/6)$

act together in a circuit. Find an expresion for the resultant voltage. Represent them by appropriate vectors. **[06]**

OR

Q.8) (A) Explain rectangular and polar representation of alternating quantities. **[04]**

(B) A parallel plate air capacitor is charged to 100V. Its plate separation is 2 mm and the area of each of its plate is 120 cm^2 calculate the increase or decrease of stored energy when plate separation is reduced to 1mm. (a) At constant voltage (b) At constant charge. **[06]**

(C) A 50 Hz sinusoidal voltage has rms value 200V. Its value at t = 0 is $\left(\sqrt{2} \times 200\right)$V positive. When applied to a circuit, current drawn by the circuit is 5A and lags behind the voltage by one-sixth of a cycle. Write the expressions for the instantaneous values of voltage and current. Sketch their waveforms and find their values at t = 0.0125 sec. **[07]**

Q.9) (A) Derive the expresion for dynamic impedance of parallel resonant circuit. **[04]**

(B) A choke coil and pure resistance are connected in series across 203V, 50 Hz, AC supply.

If the voltage drop across coil is 190V and across resistance is 80V while current drawn by the circuit is 5A. Calculate

(1) Internal Resistance of Coil

(2) Inductance of Coil

(3) Resistance

(4) Power factor of the circuit

(5) Power consumed by the circuit **[07]**

(C) A 20Ω resistor is connected in series with an inductor, a capacitor and an ammeter across a 25V variable frequency supply. When the frequency is 400 Hz, the current is at its maximum value of 0.5A and the p.d. across the capacitor is 150V. Calculate :

(1) The capacitance of the capacitor.

(2) The resistance and inductance of the inductor. **[06]**

OR

Q.10) (A) Compare series resonance with parallel resonance. **[04]**

(B) Two circuits A and B are connected in parallel to a 115V, 50Hz supply. The total current taken by the combinations is 10A at unity p.f. Circuit A consists of a 10Ω resistance and 200×10^{-6}F capacitor connected in series. Circuit B consists of a resistance and an inductance in series. Find

(1) Current

(2) p.f.

(3) Impedance

(4) Resistance

(5) Inductive reactance for Cireuit B **[07]**

(C) Two impedances (8 + j6) and (3 – j4) are connected in parallel. If total current drawn by the combination is 25A, find the current and power taken by each impedance. **[06]**

Q.11) (A) With usual notations show that power consumed by three phase delta connected load is three times power consumed by star connected load. **[04]**

(B) Show that for both star as well as delta connected 3-phase load.

$P = \sqrt{3}\ V_L\ I_L \cos\phi$

$Q = \sqrt{3}\ V_L\ I_L \sin\phi$ **[04]**

(C) The iron loss of 80 kVA 1,000/200V, single phase transformer is 500w. Copper loss, when primary carries 50A is 400W. Find

(1) Area of cross section of limb of working flux density is 1T and there are 10,000 turns on primary.

(2) Primary and secondary full load current.

(3) Efficiency at full load and 0.8 lagging p.f.

(4) Efficiency at 75% of full load and unity p.f. **[08]**

OR

Q.12) (A) Explain how the current drawn by the primary increases when the load on the secondary of the transformer increases. **[04]**

(B) Compare shell type and core type transformer. **[04]**

(C) Three identical choke coils are connected as a delta load to a three phase supply. The line current drawn from the supply is 15A and total power consumed is 7.5 kW. The kVA input to the load is 10 KVA.

Find out :

(1) Line and Phase Voltage

(2) Impedance / Phase

(3) Reactance / Phase

(4) Resistance / Phase

(5) Power Factor

(6) Phase Current

(7) Inductance per phase if frequency 50 Hz **[08]**

Total No. of Questions : 12] [Total No. of Printed Pages : 6

[3461]-5

F. E. (2003 Course) Examination - 2008

BASIC CIVIL ENGINEERING

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

Instructions :

(1) Solve either 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** 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, electronic pocket calculator is allowed.

SECTION - I

Q.1) (A) Explain role of Civil Engineer in Mechanical Engineering. **[04]**

(B) Explain any two applications of following branches of Civil Engineering : **[2x3=06]**

(1) Surveying

(2) Fluid Mechanics

(3) Environmental Engineering

(C) Write short notes on following : **[3+3=06]**

(1) Infrastructure Development

(2) Earthquake Engineering

OR

Q.2) (A) Explain importance of 'Quantity Surveying'. **[04]**

(B) Explain in brief role of Civil Engineer in Construction of : **[3+3=06]**

(1) Power House

(2) Transmission Tower

(C) Briefly explain any two applications of : **[3+3=06]**

(1) Foundation Engineering

(2) Infrastructure Development

Q.3) (A) What is Local Attraction ? State whether stations A and B are free from local attraction or affected by local attraction, if FB of line AB is 58° 20′ and BB of line AB is 238°40′.

Also state the reasons. **[1+3=04]**

(B) Convert the following : **[03]**

(1) 1 cm = 5 km

(2) 1 : 200000

(C) Define Ranging and state two methods of ranging (do not explain). **[1+1=02]**

(D) Define the following. Draw their explanatory sketches : **[2x4=08]**

(1) Whole Circle Bearing (W.C.B.)

(2) Reduced Bearing (R.B.)

(3) Swing Offset

(4) Oblique Offset

OR

Q.4) (A) Explain in brief (with sketches) line ranger and its use. **[05]**

(B) Define three types of Survey Line and draw their sketch. **[3+1=04]**

(C) Find corrected Fore Bearings and Back Bearings of closed traverse using following readings. Draw neat sketch of the travese : **[08]**

Line	FB	BB
PQ	46° 10′	226° 10′
QR	119° 20′	298° 40′
RS	169° 30′	351° 10′
SP	280° 20′	99° 20′

Q.5) (A) Briefly explain how line of sight is made truly horizontal in case of Dumpy Level. **[03]**

(B) Explain the following with neat sketch : **[1+3=04]**

(1) Contour

(2) Contour Interval

(3) Horizontal Equivalent

(C) State any two uses of laser in construction or surveying. **[02]**

(D) Following readings were observed with a dumpy level. **[08]**

2.225, 1.605, 0.990, 2.090, 2.865, 1.265, 0.605 and 1.985

The instrument was shifted after third and sixth reading. The first reading was taken on a Bench Mark of value 532.385 m. Enter all the readings in tabular form and calculate RLS of all points by RISE and FALL method.

(Tabular form without 'Remarks' will be given less credit)

OR

Q.6) (A) Define Bench Mark and state types of Bench Mark. **[1+2=03]**

(B) State two uses of each of the following : **[03]**

(1) Digital Theodolite

(2) G.I.S.

(3) G.P.S.

(C) Briefly explain with the help of sketches three characteristics of contour lines. [03]
(No marks for contour without RL value in sketch)

(D) The following series of back sight and fore sight were taken successively in a Fly Leveling. The first reading was taken on point whose RL is 300 m.

Find RLs of all the points using HI method. Apply Check.

1.315, 1.415, 2.340, 1.975, 2.150, 0.734, 0.322, 2.570. [08]

SECTION - II

Q.7) (A) Write a note on types of Shallow Foundations. Draw neat plan and elevation of any one type of shallow foundation with neat labelling. [3+2=05]

(B) State four important requirements (qualities) of brick wall and draw front view of brick wall showing joints properly. [2+1=03]

(C) Write a note on 'Uses' and 'Types' of Sand as a construction material. [04]

(D) Why are framed structures preferred over the load bearing ones in urban areas ? (State minimum four points with reasons) [04]

OR

Q.8) (A) Differentiate between the following (3 differences each) : [09]

(1) P.C.C. – R.C.C.

(2) Uniform (foundation) Settlement – Differential Settlement

(3) Dead Loads – Live Loads

(B) Write notes on : [07]

(1) Prestressed Concrete and Applications

(2) Types and uses of Steel in Construction

Q.9) (A) What are the basic factors considered while comparing and selecting sites for residential building ? (State any eight factors) **[04]**

(B) State eight planning principles used for buildings. Explain any one with sketches. **[2+3=05]**

(C) Explain the necessity of following clearly : **[08]**

(1) F.S.I.

(2) Setback Distance

(3) Land Acquisition Act, 1894

(4) Environment Protection Act, 1986

OR

Q.10) (A) Why are Building Byelwas necessary ? Explain clearly with examples. **[04]**

(B) Define Carpet Area, Built up Area and F.S.I. **[03]**

(C) State various provisions for lighting and ventilation for building/ rooms. **[03]**

(D) State the objectives of Land Acquisition Act, 1894 and Environment Protection Act, 1986. **[03]**

(E) Write a note on 'Roominess' as planning principle. (Sketches must be drawn) **[04]**

Q.11) (A) Write notes on : **[12]**

(1) Biotic and Abiotic Factors of Environment

(2) Sources of Air Pollution

(3) Effects of Water Pollution

(4) Methods of Reducing Land Pollution

(B) State the meaning of Non-conventional Energy Sources. What are the types of these sources and their limitations ? **[1+4=05]**

OR

Q.12) (A) State the sources and ill-effects of Noise Pollutions. **[04]**

(B) Enlist the methods of reducing and controlling Air Pollution. **[04]**

(C) How indiscriminate use of conventional energy sources is harmful to nature ? Explain clearly with examples. **[04]**

(D) Briefly explain following terms (their meaning/definitions and relevance) : **[05]**

(1) PM_{10}

(2) Sewage

(3) Catalytic Converter

(4) B.O.D.

(5) Green House Gases
