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06MAT21

Second Semester B.E. Degree Examination, June 2012
Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing at least two from each part.**
2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

- 1 a. Choose your answers for the following : (04 Marks)
- The radius of curvature at a point (r, θ) of $r = ae^{\theta \cot \alpha}$ is
A) $r \operatorname{cosec} \alpha$ B) $\operatorname{cosec} \alpha$ C) $\cot \alpha$ D) none of these
 - The radius of the circle of curvature is
A) 1 B) $\frac{1}{\rho}$ C) ρ D) ρ^2
 - The value of C of the Lagrange's mean value theorem for $f(x) = \tan^{-1}x$ in $[0, 1]$ is
A) 0.125 B) 0.523 C) $\pi/4$ D) $\pi/2$
 - Maclaurin's series expansion of $\sin x$ is
A) $x - \frac{x^3}{3!} + \frac{x^5}{5!} \dots$ B) $1 - \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$
C) $x + \frac{x^3}{3!} + \dots$ D) $1 + x + \frac{x^2}{2} + \dots$
- b. Find the radius of curvature for the curve $y = a \log \sec(x/a)$ at any point (x, y) . (04 Marks)
- c. State and prove Lagrange's mean value theorem. (06 Marks)
- d. Expand $e^{\sin x}$, using Maclaurin's series upto the term containing x^4 . (06 Marks)
- 2 a. Choose your answers for the following : (04 Marks)
- $\lim_{x \rightarrow 0} \sec\left(\frac{\pi}{2x}\right) \log x$ is equal to
A) $\pi/2$ B) $2/\pi$ C) π D) $\pi/3$
 - The basic fundamental indeterminate forms are
A) $\frac{0}{0}$ B) $\frac{\infty}{\infty}$ C) both A and B D) none of these
 - Find the critical point of the function $f(x, y) = \sin x + \sin y + \sin(x + y)$ is
A) (1, 1) B) $(\pi/3, \pi/3)$ C) $(\pi/2, \pi/2)$ D) none of these
 - In a plane triangle ABC, the maximum value of $\operatorname{COSA} \cdot \operatorname{COSB} \cdot \operatorname{COSC}$ is
A) $3/4$ B) $3/8$ C) $1/8$ D) $5/8$
- b. Evaluate $\lim_{x \rightarrow \pi/2} (2x \tan x - \pi \sec x)$. (04 Marks)
- c. Expand $e^{ax} \sin by$ in powers of x and y as far as terms of 3rd degree. (06 Marks)
- d. Show that the maximum value of $xy + a^3 \left(\frac{1}{x} + \frac{1}{y}\right)$ is $3a^2$. (06 Marks)

3 a. Choose your answers for the following :

(04 Marks)

- i) $\int_0^2 \int_0^x (x+y) dx dy$ is equal to
 A) 3 B) 4 C) 5 D) none of these
- ii) The volume of the cylinder with base radius 'a' and height 'h' is
 A) r^2h B) $\frac{2}{3}rh$ C) πr^2h D) none of these
- iii) The value of $\beta(m, n)$ is
 A) $\int_0^{\infty} x^{m-1}(1-x)^{n-1} dx$ B) $\int_0^1 x^{m-1}(1-x)^n dx$
 C) $\int_0^1 x^{m-1}(1-x)^{n-1} dx$ D) none of these
- iv) If n is a positive integer, then $\overline{n+1}$ is equal to
 A) $n\overline{n}$ B) $(n-1)\overline{n-1}$ C) $n\overline{n+1}$ D) n!

b. Calculate by double integration the volume generated by the revolution of the cardioid $r = a(1 - \cos \theta)$ about its axis. (04 Marks)

c. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz dx dy dz$. (06 Marks)

d. Show that $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \times \int_0^{\pi/2} \frac{1}{\sqrt{\sin \theta}} d\theta = \pi$. (06 Marks)

4 a. Choose your answers for the following :

(04 Marks)

- i) \vec{F} is said to be solenoidal, if
 A) $\int_C \vec{F} \cdot d\vec{r} = 0$ B) $\int_C \vec{F} \times d\vec{r} = 0$ C) $\vec{F} \times \vec{r} = 0$ D) none of these
- ii) If $\vec{F} = 3xyi + y^2j$ and C is the curve, in the xy-plane, $y = x^2$ from (0, 0) to (1, 1), then $\int_C \vec{F} \times d\vec{r}$ is :
 A) Constant B) Variable C) zero D) none of these
- iii) Green's theorem in the plane is a special case of
 A) Gauss theorem B) Euler's theorem
 C) Baye's theorem D) Stoke's theorem.
- iv) Stoke's theorem is a relation between
 A) a line integral and a surface integral B) a surface and volume integral
 C) two volume integrals D) a line and volume integral.
- b. If $\vec{F} = 3xyi - y^2j$, evaluate $\int_C \vec{F} \cdot d\vec{r}$ along the curve $y = 2x^2$ in the xy-plane from (0, 0) to (1, 2). (04 Marks)
- c. Evaluate, by Green's theorem, $\int_C (xy + y^2) dx + x^2 dy$, where C is bounded by $y = x$ and $y = x^2$. (06 Marks)
- d. Prove that the cylindrical co-ordinates system is orthogonal. (06 Marks)

PART - B

- 5 a. Choose your answers for the following : (04 Marks)
- i) Solution of the differential equation $(D^2 + a^2)y = 0$ is
 A) $C_1e^{ax} + C_2e^{-ax}$ B) $C_1 \cos ax + C_2 \sin ax$
 C) $(C_1 + C_2x) \cos ax$ D) None of these
- ii) P.I. of the differential equation $(D^2 + 3D + 2)y = e^x$ is
 A) $\frac{1}{6}e^x$ B) $\frac{1}{3}e^x$ C) $\frac{e^x}{2}$ D) e^x
- iii) The roots of the A.E with differential equation $(D^3 + 2D^2 - D - 2)y = 0$ are
 A) (1, 1, -2) B) (-1, 1, -2) C) (1, 1, 2) D) (-1, -1, 2)
- iv) C.F of $(D^2 + 1)y = x^3$ is
 A) $(c_1 + c_2x)e^x$ B) $(c_1x + c_2)e^{-x}$
 C) $(c_1 \cos x + c_2 \sin x)e^x$ D) $(c_1 \cos x + c_2 \sin x)$
- b. Solve $(D^3 + 1)y = e^x$. (04 Marks)
- c. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$. (06 Marks)
- d. Solve by the method of undetermined co-efficients the equation $y'' + 4y = x^2 + e^{-x}$. (06 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- i) The Wronskian of e^x and e^{-x} is
 A) 2 B) -1 C) 0 D) -2
- ii) To transform $(ax + 1)^2 y'' + (ax + 1) y' + y = \phi(x)$ into a L.D.E with constant coefficients, put $t =$
 A) $\log x$ B) $\log(ax + 1)$ C) e^t D) x
- iii) Solve the initial value problem $x'' + 4x' + 29x = 0$ satisfying the conditions $x(0) = 0$, $x'(0) = 15$ is
 A) $e^{-2t}(3 \sin 5t)$ B) $3e^{-2t}$ C) $3 \sin 5t$ D) none of these
- iv) $(C_1 + C_2x)e^x$ is the general solution of
 A) $(D + 1)^2 y = 0$ B) $(D - 1)^2 y = 0$
 C) $(D^2 - 1)y = 0$ D) $(D^2 + 1)y = 0$
- b. Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \log x$. (04 Marks)
- c. Solve $\frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = \frac{e^x}{x}$, by the method of variation of parameter. (06 Marks)
- d. Solve the initial value problem $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 5y + 2 \cosh x = 0$, given $y = 0$, $\frac{dy}{dx} = 1$ at $x = 0$. (06 Marks)
- 7 a. Choose your answers for the following : (04 Marks)
- i) Laplace transform of $te^{-t} \sin t$ is
 A) $\frac{2(s-1)}{(s^2 + s + 1)^2}$ B) $\frac{s+1}{(s^2 - s + 1)^2}$ C) $\frac{s+1}{(s^2 - s + 2)^2}$ D) $\frac{2(s+1)}{(s^2 + 2s + 2)^2}$
- ii) Laplace transform of $\sin 3t$ is
 A) $\frac{s}{s^2 + 9}$ B) $\frac{3}{s^2 + 9}$ C) $\frac{2}{s^2 - 9}$ D) $\frac{1}{s^2 - 9}$
- iii) Laplace transform of $f'(t)$ is
 A) $s f(s) - f(0)$ B) $s f(s) + f(0)$ C) $s f(0) - f'(0)$ D) $s f'(0) - f(0)$
- iv) Laplace transform of t^3 is equal to
 A) $\frac{3!}{s^3}$ B) $\frac{6}{s^2}$ C) $\frac{6}{s^4}$ D) $\frac{5}{s^4}$

- b. Find L.T of $e^{2t} \cos^2 t$. (04 Marks)
- c. If $f(t)$ is a periodic function of period 'T', then show that $L\{f(t)\} = \frac{1}{1-e^{-Ts}} \int_0^T e^{-st} f(t) dt$. (06 Marks)
- d. Find $L\left\{\frac{e^{-at} - e^{-bt}}{t}\right\}$. (06 Marks)
- 8 a. Choose your answers for the following : (04 Marks)
- i) Inverse Laplace transform of $\frac{1}{s^2 - a^2}$ is
 A) $\frac{\cos at}{a}$ B) $\sin at$ C) $\cosh at$ D) $\frac{\sinh at}{a}$
- ii) Inverse Laplace transform of $\frac{s+2}{s^2 - 4s + 13}$ is
 A) $e^{-2t} \cos 3t + \frac{4}{3} e^{2t} \sin 3t$ B) $e^{2t} \sin 3t + \frac{3}{4} e^{-2t} \cos 3t$
 C) $e^{2t} \sin 3t - \frac{4}{3} e^{-2t} \cos 3t$ D) $e^{2t} \cos 3t + \frac{4}{3} e^{2t} \sin 3t$
- iii) Inverse Laplace transform of $\frac{s}{(s^2 + a^2)^2}$ is
 A) $\frac{1}{2a} t \cos at$ B) $\frac{1}{2a} t \sin at$ C) $t \cos^2 at$ D) $\frac{t}{2} \sin at$
- iv) $L^{-1}\left\{\frac{1}{s^n}\right\}$ is possible only when n is
 A) $n > 1$ B) $n \geq -1$ C) $n = 1, 2, \dots$ D) $n < 1$.
- b. Find the $L^{-1}\left\{\frac{s^2 - 2s + 1}{s^3}\right\}$. (04 Marks)
- c. Find $L^{-1}\left\{\frac{3s + 7}{s^2 - 2s - 3}\right\}$. (06 Marks)
- d. Applying L.T method, solve $x'' - 2x' + x = e^{2t}$ given that $x(0) = 0$ and $x'(0) = -1$. (06 Marks)

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06CHE12/22

First/Second Semester B.E. Degree Examination, June 2012

Engineering Chemistry

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, choosing at least two from each part.**
2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART - A

- 1 a. Choose the correct answers for the following : (04 Marks)**
- Which one of the following is not a primary fuel?
 A) coal B) crude oil C) natural gas D) kerosene
 - The method used for obtaining synthetic petrol is
 A) catalytic cracking B) bergius process
 C) refining D) none of these
 - The knocking tendency of hydrocarbon decreases in the following order
 A) straight chain > cyclo alkanes > aromatic > branched chain
 B) straight chain > branched chain > cyclo alkanes > aromatic
 C) aromatic > cyclo alkanes > branched chain > straight chain
 D) cyclo alkane > aromatic > branched chain > straight chain
 - In photo voltaic cell solar energy is utilized to transform
 A) solar energy into light and heat energy
 B) solar energy into electrical energy
 C) solar energy into electrical and chemical energy
 D) none of these
- b. Describe the experimental method of determining calorific value of a solid fuel using bomb calorimeter. (06 Marks)**
- c. Calculate the gross and net calorific values of coke sample using the following data :
 Mass of coke = 0.85×10^{-3} kg, mass of water = 2.0 kg, water equivalent of calorimeter = 0.6 kg, sp.heat of water = $4.187 \text{ kJkg}^{-1}\text{K}^{-1}$, percentage of hydrogen in fuel sample = 5%, increase in temperature = 3.5 K, latent heat = 2457 kJkg^{-1} . (04 Marks)**
- d. Explain the process of doping of silicon. Give two applications of photovoltaic cells. (06 Marks)**
- 2 a. Choose the correct answers for the following : (04 Marks)**
- Daniel cell is a combination of standard electrodes of
 A) Cu and Ag B) Zn and Cd C) Zn and Cu D) Cu and Cd
 - The concentration cell stops working when
 A) $M_1 > M_2$ B) $M_2 > M_1$ C) $M_2 = M_1$ D) None of these
 - Calomel is the commercial name of
 A) mercuric chloride B) mercurous chloride
 C) mercuric sulphate D) mercurous sulphate
 - The potential of the calomel electrode varies with the concentration of
 A) mercuric chloride B) mercurous sulphate
 C) mercurous chloride D) potassium chloride

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 2 b. What are reference electrodes? Explain the construction of Ag/AgCl electrode. Give half-cell reactions. (05 Marks)
- c. An electrochemical cell consists of iron electrode dipped in 0.01M FeSO₄ solution and copper electrode dipped in 0.1M CuSO₄ solution. Write the cell representation, cell reaction and calculate emf of the cell at 298 K. Given standard reduction potentials of iron and copper electrodes are -0.44 V and 0.34 V respectively. (05 Marks)
- d. Define single electrode potential. Explain the determination of potential of Zn-electrode dipped in 0.5M ZnSO₄, using standard hydrogen electrode. (06 Marks)
- 3 a. Choose the correct answers for the following : (04 Marks)
- Which of the following is not a rechargeable battery?
A) lead acid B) Ni-metal hydride C) Ni-Cd D) Zn-MnO₂
 - Which of the following is a reserve battery?
A) Zn-air B) Ni-metal hydride C) Zn-Ag₂O D) Li-MnO₂
 - In hydrogen-oxygen fuel cell which of the following electrolyte is used?
A) H₂SO₄ B) NH₄OH C) KOH D) CH₃COOH
 - The concentration of sulphuric acid to be maintained in lead-acid battery is
A) 10 M B) 5 M C) 15 M D) 2 M
- b. What are primary, secondary and reserve batteries? Explain the construction and working of Zinc-air battery. (08 Marks)
- c. Explain the construction and working of methanol-oxygen fuel cell. (05 Marks)
- d. Give the advantages of fuel cells over batteries. (03 Marks)
- 4 a. Choose the correct answers for the following : (04 Marks)
- Water-line corrosion can be explained on the basis of
A) stress corrosion B) differential aeration corrosion
C) centralized corrosion D) all of these
 - Differential metal corrosion is
A) galvanic corrosion B) differential aeration corrosion
C) stress corrosion D) pitting corrosion
 - Which of the following metal is used as _____ anode protection to iron?
A) Zn B) Cu C) Ni D) none of these
 - Which of the following acts as oxygen scavenger in cathodic inhibition?
A) Na₂SO₃ B) Na₂SO₄ C) ZnSO₄ D) NiSO₄
- b. Explain differential metal corrosion, with a suitable example. (06 Marks)
- c. Discuss the effect of the following on the rate of corrosion :
i) Anodic and cathodic areas ii) Corrosion product iii) Temperature (06 Marks)
- d. Write a note on anodic protection. (04 Marks)

PART - B

- 5 a. Choose the correct answers for the following : (04 Marks)
- For an electrolyte mixture containing Cu²⁺, Zn²⁺ and Cd²⁺ the order of electro deposition is
A) Cu, Cd, Zn B) Cu, Zn, Cd C) Zn, Cd, Cu D) Cd, Cu, Zn
 - When the object to be plated is irregular, the process employed is
A) electroplating B) electroless plating
C) electrophoretting D) electropolishing
 - Addition of buffer to the plating bath is to
A) increase the pH of the bath B) decrease the pH of the bath
C) control the pH of the bath D) none of these

- 5 a. iv) In electroplating of chromium, inert anode is used in place of chromium because
 A) wide difference between anode and cathode efficiencies
 B) imbalance of the bath composition with respect to Cr(III) and Cr(VI)
 C) to avoid poor quality deposition
 D) all of these
- b. Explain the decomposition potential and over-voltage. (04 Marks)
- c. Explain the role of the following factors on the nature of electro deposit :
 i) Current density
 ii) Throwing power (06 Marks)
- d. Explain the electroless plating of copper. (06 Marks)
- 6 a. Choose the correct answers for the following : (04 Marks)
- i) Para Azoxy Anisole is an example for
 A) nematic B) smectic C) chiral nematic D) cholesteric
- ii) Which of the following is a lyotropic liquid crystal?
 A) para azoxy anisole B) para azoxy phenetole
 C) cholesteryl benzoate D) soap-water mixture
- iii) Which of the following is a reference electrode?
 A) glass electrode B) calomel electrode
 C) platinum electrode D) none of these
- iv) Calorimetry involves the measurement of absorbance using monochromatic light in the
 A) visible range B) IR range C) UV range D) all of these
- b. Explain with suitable examples the liquid crystalline behaviour in homologues of PAA. (04 Marks)
- c. Explain the molecular ordering in the following liquid crystal phases :
 i) Nematic phase
 ii) Chiral nematic phase (06 Marks)
- d. State Lambert's law and Beer's law. Explain the colorimetric estimation of copper using NH_3 as the complexing agent. (06 Marks)
- 7 a. Choose the correct answers for the following : (04 Marks)
- i) The emulsion polymerization of chloroprene gives
 A) butyl rubber B) epoxy resin C) neoprene rubber D) styrene
- ii) The polymer having highest T_g is
 A) polypropylene B) polyethylene C) pvc D) polystyrene
- iii) The monomer ethylene is
 A) monofunctional B) bifunctional C) trifunctional D) poly functional
- iv) Which of the following polymer is used as substitute for glass?
 A) teflon B) polyurethane C) PMMA D) PVC
- b. Explain the free radical mechanism of addition polymerization taking ethylene as an example. (04 Marks)
- c. Give the synthesis and applications of the following :
 i) PMMA
 ii) Butyl rubber
 iii) Teflon (09 Marks)
- d. Give the structure and applications of conducting polyaniline. (03 Marks)

- 8 a. Choose the correct answers for the following : (04 Marks)
- i) Temporary hardness of water is caused due to the presence of
A) $MgCl_2$ B) $Ca(HCO_3)_2$ C) $CaCO_3$ D) all of these
 - ii) The secondary treatment of sewage involves
A) biological treatment B) physical treatment
C) chemical treatment D) all of these
 - iii) The method used for desalination of water is
A) lime-soda process B) permutit process
C) flash evaporation D) ion-exchange process
 - iv) Which of the following method is used for the estimation of chloride content in water
A) Winkler's method B) argentometric method
C) PDA method D) SPADNS method
- b. 100 ml of water sample required 4 ml of N/50 H_2SO_4 for neutralization to phenolphthalein end point. Another 15 ml of the same acid was needed for further titration to methyl orange end point. Determine the type and amount of alkalinity. (04 Marks)
- c. Explain Winkler method of determining dissolved oxygen. Give the reaction involved. (06 Marks)
- d. What is potable water? Give the characteristics of potable water. Explain desalination of water by reverse osmosis process. (06 Marks)

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06PHY12/22

First/Second Semester B.E. Degree Examination, June 2012
Engineering Physics

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, choosing at least two from each part.
 2. Answer all objective type questions only in OMR sheet page 5 of the answer booklet.
 3. Answer to objective type questions on sheets other than OMR will not be valued.
 4. Physical constants : $h = 6.62 \times 10^{-34} \text{ J-s}$, $m_e = 9.1 \times 10^{-31} \text{ kg}$, $C = 3 \times 10^8 \text{ m/s}$.

PART – A

- 1 a.** Choose your answers for the following : (04 Marks)
- i) If the de Broglie wave is represented by a wave group, then
 A) group velocity is equal to velocity of light
 B) group velocity is equal to phase velocity
 C) group velocity is equal to particle velocity
 D) phase velocity is greater than velocity of light.
- ii) The Davisson – Germer experiment provides direct verification of
 A) particle nature of the waves B) x-ray diffraction through crystals
 C) de Broglie's hypothesis D) quantum nature of light
- iii) In Black-body radiation spectra
 A) λ_m shifts towards lower wave length side as temperature increases
 B) λ_m shifts towards lower wave length side as temperature decreases
 C) the total area covered by the curve remains same at all temperature
 D) the total energy radiated per second per unit area is equal to cubic power of temperature.
- iv) If the energy of an electron is comparable to its rest mass energy, then which of the following energy equation holds good.
 A) $E = \sqrt{m_0^2 c^4 + p^2 c^2}$ B) $E = \frac{p^2}{2m}$
 C) $E = pc$ D) $E = \sqrt{m_0 c^2 + p^2 c^2}$
- b. Assuming that de Broglie's wave associated with a particle is represented by a wave group, find a relationship between group velocity and particle velocity. (05 Marks)
- c. Using the concept of group velocity derive an expression for de Broglie wavelength. (06 Marks)
- d. Compare the de Broglie wave length associated with
 i) 10g bullet travelling at 500 m/s and
 ii) An electron with kinetic energy of 100 MeV. (05 Marks)
- 2 a.** Choose your answers for the following : (04 Marks)
- i) According to uncertainty principle, an electron with 1 MeV K.E.
 A) Cannot be accommodated within the nucleus
 B) Can be accommodated with in the nucleus
 C) Cannot be a part neither of atom nor nucleus
 D) Non of the these
- ii) The wave function ψ is said to be normalized if
 A) $\int_{-\infty}^{+\infty} |\psi|^2 dv$ B) $\int_{-\infty}^{+\infty} |\psi|^2 dv = 0$ C) $\int_{-\infty}^{+\infty} |\psi|^2 dv = \infty$ D) None of these

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
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- iii) For a physical system, the Schrodinger's wave equation is Time-independent
 A) When potential energy of the system does not depend on time
 B) When potential energy of the system depends on time
 C) When potential energy of the system depends both on time and position
 D) When the total energy of the system is not steady.
- iv) For a particle trapped in an infinite potential well, the possible energy Eigen values
 A) Vary continuously
 B) Are discrete energy states including zero energy state
 C) Are discrete energy states excluding zero energy state
 D) Non of these.
- b. Explain physical significance of wave function. (05 Marks)
- c. Find the energy eigen values of a particle trapped in a one dimensional potential well of infinite height. (07 Marks)
- d. Compute the first two permitted energy states of an electron trapped in a box of 1 \AA unit wide. (04 Marks)
- 3 a. Choose your answers for the following : (04 Marks)
- i) Relaxation time
 A) is the time taken for the drift velocity to decay to $1/e$ of its initial value when electric field is switched off.
 B) is the time taken for drift velocity to increase by a factor 'e' of initial value when the field is switched on
 C) is the time duration between two successive collisions
 D) is the time taken for the drift velocity to decay to zero of its initial value when electric field is switched off.
- ii) The collision time and root mean square velocity of the electron at room temperature are $2.5 \times 10^{-14}\text{ s}$ and $1 \times 10^5\text{ m/s}$ respectively. The classical value of mean free path of the electron is
 A) $2.5 \times 10^{-19}\text{ m}$ B) 0.25 nm C) 25 \AA units D) 2.5 nm
- iii) Free electron Fermi gas
 A) is a gas of free electrons moving zig-zag in a lattice
 B) is a gas of interacting electrons moving opposite to applied electric field in a lattice
 C) is a gas of free electrons escaping the metal surface
 D) is a gas of free and non interacting electrons subject to Pouli's exclusive principle
- iv) Fermi energy level is that energy level at which
 A) the probability occupation is full B) the probability occupation is half
 C) the probability occupation is zero D) None of these
- b. Discuss the breakdown of classical free electron theory with specific reference to mean free path of electrons and molar specific heat of metals. (04 Marks)
- c. Define density of energy states in metals and derive an expression for the density of energy states. (08 Marks)
- d. Calculate the mobility of free electrons in silver at room temperature, given that, silver has electron density $5.89 \times 10^{28}/\text{m}^3$ and resistivity of $1.61 \times 10^{-8}\ \Omega\text{m}$. (04 Marks)
- 4 a. Choose your answers for the following : (04 Marks)
- i) The electronic polarizability α_e of a gas atom is
 A) $4\pi\epsilon_0$ B) $4\pi\epsilon_0 R$ C) $4\pi\epsilon_0 R^2$ D) $4\pi\epsilon_0 R^3$
- ii) The dipole moment per unit volume of a solid is the sum of all the individual dipole moments and is called
 A) Polarization of the solid B) Permittivity of the solid
 C) Electrostatic moment D) None of these
- iii) In a ferroelectric material, as the applied electric field is gradually reduced to zero, the polarization still left is known as :
 A) Coercive polarization B) Remanent polarization
 C) Zero polarization D) Positive polarization

- iv) The magnetic material in which permanent magnetic dipoles due to electron spin are already aligned in the absence of magnetic field
 A) Paramagnetic materials B) Ferromagnetic materials
 C) Ferrimagnetic materials D) Diamagnetic materials
- b. Explain the term 'internal field'. Derive an expression for internal field in the case of one dimensional array of atoms in dielectric solids. (07 Marks)
- c. What are hard and soft magnetic materials? Give their characteristic properties? (06 Marks)
- d. The electronic polarizability of Helium is $0.18 \times 10^{-40} \text{ F.m}^2$. Calculate the radius of the electron orbit ($\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$). (03 Marks)

PART - B

- 5 a. Choose your answers for the following : (04 Marks)
- i) If E_u and E_l are energies of upper and lower energy levels of an atom, then, stimulated emission is
 A) a process of emission of a photon of energy $h\gamma = E_u - E_l$
 B) a process of emission of a photon of energy $h\gamma = E_u - E_l$ in addition to incident photon
 C) a process of absorption of a photon of energy $h\gamma = E_u - E_l$ resulting in excitation
 D) is a process of natural decay
- ii) At radiative thermal equilibrium
 A) upward radiative flux is absent
 B) downwards radiative flux is absent
 C) upward radiative flux is not equal to downward radiative flux
 D) upward radiative flux is equal to downward radiative flux
- iii) If N_u and N_l are population densities of upper and lower energy states respectively; then population inversion is the condition such that
 A) $N_u = N_l$ B) $N_u < N_l$ C) $N_u > N_l$ D) $\frac{N_u}{N_l} = e^{(E_u - E_l)/KT}$
- iv) The principle of construction of hologram is due to
 A) Diffraction phenomenon B) Scattering phenomenon
 C) Polarization phenomenon D) Interference phenomenon
- b. Derive an expression for spectral energy density at thermal equilibrium in terms of Einstein's coefficients. (08 Marks)
- c. With the help of a neat energy level diagram, describe the construction and working of He - Ne laser. (08 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- i) The propagation mechanism in optical fibers is based on the principle of
 A) Scattering of light at the boundary between core and cladding
 B) Total internal reflection of light at the boundary between core and cladding
 C) Dispersion of light in the media of the core
 D) None of these
- ii) The transmission attenuation in optical fibers is expressed in
 A) $\text{dB loss} = \log_{10} \left(\frac{P_{\text{out}}}{P_{\text{in}}} \right)$ B) $\text{dB loss} = -\log_{10} \left(\frac{P_{\text{out}}}{P_{\text{in}}} \right)$
 C) $\text{dB loss} = -10 \log_{10} \left(\frac{P_{\text{out}}}{P_{\text{in}}} \right)$ D) $\text{dB loss} = 10 \log_{10} \left(\frac{P_{\text{out}}}{P_{\text{in}}} \right)$
- iii) The temperature at which a conductor becomes a super conductor is called
 A) Super conducting temperature B) Curi temperature
 C) Onne's temperature D) Critical temperature

- iv) Type-1 super conducting material when placed in a magnetic field will
 A) Attract the magnetic field towards its centre
 B) Repel all the magnetic lines of force passing through it
 C) Attract the magnetic field but transfer it into a concentrated zone
 D) Not influence the magnetic field
- b. Explain Meissner effect. (05 Marks)
- c. Describe different types of optical fibers with neat diagrams. (06 Marks)
- d. An optical fiber has cladding of refractive index 1.5 and numerical aperture 0.39, find the refractive index of the core and acceptance angle, confinement angle, and critical angle for the boundary between core and cladding. (05 Marks)
- 7 a. Choose your answers for the following : (04 Marks)
- i) Which of the following crystal structure is having the least coordination number?
 A) Simple cubic B) Body centred cubic
 C) Face centered cubic D) Diamond structure
- ii) In TRIGONAL crystal systems the axial lengths and inter axial angles respectively are
 A) $a = b = c$ and $\alpha = \beta = \gamma = 90^\circ$ B) $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma$
 C) $a = b \neq c$ and $\alpha = \beta = 90^\circ, \gamma = 120^\circ$ D) $a = b = c$ and $\alpha = \beta = \gamma < 120^\circ \neq 90^\circ$
- iii) If (hkl) are the miller indices of a plane,
 A) then, h, k, l are intercepts on \bar{a}, \bar{b} and \bar{c} axes respectively
 B) then the plane cuts the axes into h, k and l equal segments respectively
 C) then, h, k, l represents three non collinear points on the plane
 D) then, they refer to planes which in crystal are equivalent even though their miller indices differ.
- iv) If 'a' is lattice constant, Δv , volume of each atom and 'n' is number of atoms per unit cell, then the atomic packing factor is
 A) $\frac{n\Delta v}{a^3}$ B) $\frac{na^3}{\Delta v}$ C) $\frac{a^3}{n\Delta v}$ D) $n \cdot \Delta v \cdot a^3$
- b. What do you understand by coordination number and atomic packing factor in crystals? Show that the packing factor for bcc and fcc structures are $\sqrt{3} \frac{\pi}{8}$ and $\sqrt{2} \frac{\pi}{6}$ respectively. (08 Marks)
- c. Deduce Bragg's law for x-ray diffraction in crystals. (04 Marks)
- d. Copper has fcc structure and the atomic radius is 0.1278 nm. Calculate the inter planar spacing for (111) and (321) planes. (04 Marks)
- 8 a. Choose your answers for the following : (04 Marks)
- i) The graphite structure is composed of layers of arranged carbon atoms
 A) Octogonally B) Pentogonally C) Hexogonally D) Septogonally
- ii) In considering the scaling of electromagnetic systems, it is convenient to assume that, electrostatic field strengths
 A) are independent of scale B) are dependent on scale
 C) are weak D) are strong
- iii) In which of the following media the ultrasonic velocity is fastest
 A) Sea water B) Ordinary water C) Distilled water D) Alcohol
- iv) Ultrasonic waves are
 A) Radio waves with frequency of the order of 10^{10} Hz
 B) Transverse waves with frequency of the order of 20000 Hz
 C) Longitudinal waves with frequency of the order of 2000 Hz
 D) Sound waves with frequency more than 20000 Hz.
- b. What is scaling of classical mechanical systems? What are the basic assumptions made in scaling? Give the magnitudes and scaling of four physical parameters. (08 Marks)
- c. Describe a method of measuring velocity of ultrasonic waves in liquids. (08 Marks)

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06CIV13/23

First/Second Semester B.E. Degree Examination, June 2012
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions, choosing at least two from each part.
 2. Answer all objective type questions only OMR sheet, page 5, of the answer booklet.
 3. Answers for objective type questions on sheets other than OMR will not be valued.
 4. Missing data if any may be suitably assumed.

PART – A

- 1 a. Choose your answers for the following : (04 Marks)
- Temporary dams are called as
 A) Earth dam B) Gravity dam C) Cofferdam D) Diversion dam.
 - Boundary between carriage way and foot paths are
 A) Traffic separators B) Kerbs C) Shoulders D) Fencing
 - Bascule bridge is a
 A) Deck bridge B) Through bridge
 C) Semi-through bridge D) None of these
 - Geo-technical engineering is also called as
 A) Structural engineering B) Irrigation engineering
 C) Soil mechanics D) Hydraulics
- b. Explain impact of infrastructural facilities on socio – economic development of a country. (06 Marks)
- c. Explain briefly with neat sketches, gravity dam and earth dam. (06 Marks)
- d. Draw simple sketch of any two types of bridges. (04 Marks)
- 2 a. Choose your answers for the following : (04 Marks)
- An object which has only mass, but no size is called
 A) Continuum B) Point force C) Particle D) Rigid body
 - Moment of a force about a point is a measure of its
 A) Rotational effect B) Translational effect
 C) Irrotational effect D) None of these.
 - A body which does not undergo any deformation on application of force is
 A) Deformable body B) Rigid body C) Elastic body D) Plastic body
 - Two equal and opposite, parallel and non-collinear forces constitute a
 A) Point force B) Couple C) Both A and B D) None of these.
- b. Write any two Newton's laws of motion. What are the characteristics of a couple? (05 Marks)
- c. State and explain the principle of transmissibility of a force. (03 Marks)
- d. A system of forces is acting on a rigid body as shown in Fig. Q2(d), reduce this system to
 i) a single force
 ii) a single force and a couple at A
 iii) a single force and a couple at B. (08 Marks)

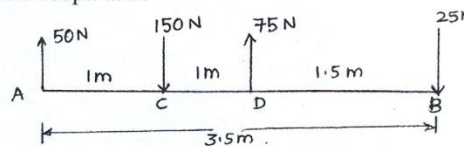


Fig. Q2(d)
1 of 4

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

- 3 a. Choose your answers for the following : (04 Marks)
- i) Lines of action of all forces pass through a single point and all forces lie in the same plane. Such forces are called

A) Coplanar concurrent forces	B) Coplanar non concurrent forces
C) Non coplanar concurrent forces	D) Collinear forces.
 - ii) The method to resolve a single force in two mutual perpendicular directions is called

A) Composition of forces	B) Resolution of forces
C) Moment	D) All of the above
 - iii) Resultant of two forces shown in Fig. Q3(a) is

A) 1000 kN	B) 1400 kN	C) 1100 kN	D) 1200 kN
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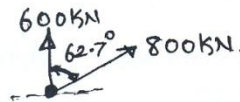


Fig. Q3(a)

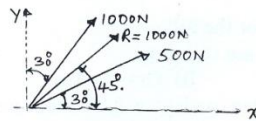


Fig. 3(b)

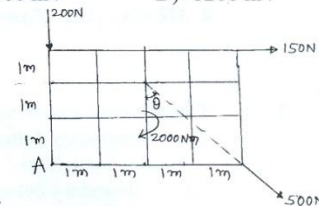


Fig. Q3(c)

- iv) Two forces of equal magnitude P act at angle ' θ ' to each other. What will be their resultant?

A) $P \cos \theta/2$	B) $2P \cos \theta$	C) $2P \cos \theta/2$	D) $P \cos \theta$.
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- b. Two forces acting on a body are 500 N and 1000 N as shown in Fig. Q3(b). Determine the third force F such that the resultant of all three forces is 1000 N directed at 45° to the x -axis. (06 Marks)
- c. Find the equilibrant with respect to A as origin for the system of forces shown in Fig. Q3(c). (10 Marks)

- 4 a. Choose your answers for the following : (04 Marks)
- i) Point where the whole weight of body acts at

A) Centroid	B) Centre of gravity
C) Axis of reference	D) Second moment of area
 - ii) The distance of centroid of quarter circle from its diameters are

A) $\frac{4r}{3\pi}$	B) r	C) $\frac{\pi^4}{4}$	D) $\frac{3r}{4\pi}$
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 - iii) Height of centroid of a triangle of height ' h ' from its base is

A) $\frac{h}{2}$	B) $\frac{2}{3}h$	C) $\frac{h}{3}$	D) $\frac{3h}{4}$
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 - iv) The centroid of a plane lamina will not be at its geometrical centre if it is a

A) Circle	B) Right angled triangle
C) Rectangle	D) Equilateral triangle
 - b. Locate the centroid of a semicircle by the method of integration. (06 Marks)
 - c. Locate the centroid of the shaded area shown in Fig. Q4(c). (10 Marks)

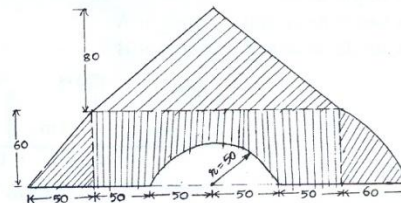


Fig. Q4(c)

PART – B

- 5 a. Choose your answers for the following : (04 Marks)
- Relation between action and reaction force is
 - They are equal in magnitude and opposite in direction
 - They have common line of action
 - Act perpendicular to the line of contact
 - All the above
 - The non-applied forces are
 - Self weight
 - Reaction
 - Both A and B
 - None of these
 - A force which nullifies the effect of forces is called
 - Equilibrium
 - Equilibrant
 - Resultant
 - None of these
 - A system that possesses a resultant
 - Will be in equilibrium
 - Will be under rest
 - Not be in equilibrium
 - None of these
- b. State Lami's theorem. (02 Marks)
- c. A sphere of weight 5 kN is supported by the Pulley 'P' and 2 kN weight passing over a smooth pulley as shown in Fig. Q5(c). If $\alpha = 30^\circ$, calculate the value of P and θ . (06 Marks)

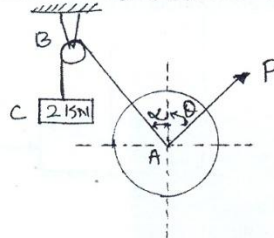


Fig. Q5(c)

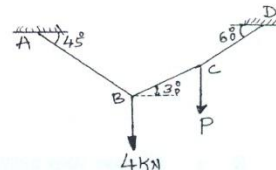


Fig. Q5(d)

- d. A string is subjected to the forces 4 kN and P as shown in Fig. Q5(d). Determine the magnitudes of P and tension forces induced in various portions of the string. (08 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- A beam which has one end fixed and other end simply supported is called
 - Fixed beam
 - Simply supported beam
 - Propped cantilever beam
 - Cantilever beam
 - If the intensity of load increases linearly along the length of beam, it is
 - Uniformly distributed load
 - Uniformly varying load
 - Moment
 - General loading
 - A statically indeterminate beam is a
 - Cantilever beam
 - Simply supported beam
 - Double over hanging beam
 - Continuous beam
 - A support, where two reaction components exist which are mutually perpendicular, is
 - Simple support
 - Roller support
 - Hinge support
 - Fixed support.
- b. Find the support reaction for the cantilever beam loaded as shown in Fig. Q6(b). (08 Marks)

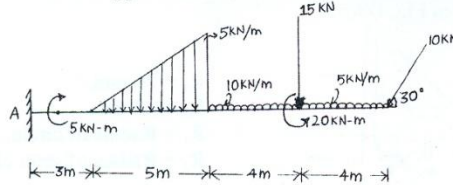


Fig. Q6(b)

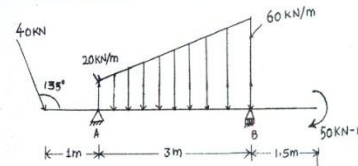
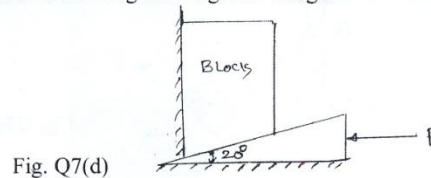


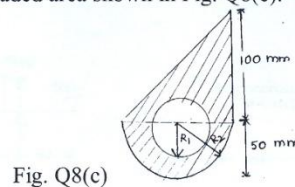
Fig. Q6(c)

- c. Determine the reaction at the supports A and B for a beam loaded as shown in Fig. Q6(c). (08 Marks)

- 7 a. Choose your answers for the following : (04 Marks)
- Friction acting on a body which is just on the point or verge of sliding is called
 - Limiting friction
 - Sliding friction
 - Co-efficient of friction
 - Cone friction
 - Friction acting on a body when the contact surfaces are completely separated by lubricant is called.
 - Non viscous friction
 - Film friction
 - Viscous friction
 - Dry friction
 - Friction force always acts
 - Opposite to the motion of the body
 - Along the motion of the body
 - Perpendicular to the motion
 - None of these
 - The coefficient of friction is equal to
 - The tangent of cone of friction
 - The tangent of angle of friction
 - The tangent of angle of repose
 - The ratio of resultant to normal.
- b. State the laws of friction (04 Marks)
- c. Define : i) Angle of friction ii) Co-efficient of striction. (02 Marks)
- d. A block weighting 10 kN is to be raised by means of 20° wedge as shown in Fig. Q7(d). Find the horizontal force P, which will just raise the block. Assume co-efficient of friction for all surfaces of contact is 0.3. Neglect weight of wedge. (10 Marks)



- 8 a. Choose your answers for the following : (04 Marks)
- Area moment of inertia is
 - First moment of area
 - Second moment of area
 - Radius of gyration
 - Area of cross section
 - Radius of Gyration is given by
 - $K = \sqrt{\frac{I}{A}}$
 - $K = \sqrt{\frac{A}{I}}$
 - $K = \sqrt{\frac{I}{Y}}$
 - $K = I \times A$
 - Moment of inertia of a triangle about its base is
 - $\frac{bh^3}{36}$
 - $\frac{bh^3}{12}$
 - $\frac{hb^3}{48}$
 - $\frac{hb^3}{36}$
 - Algebraic sum of first moment of elemental areas of plane figures about centroidal axis is always
 - Unity
 - Zero
 - Total area of elements
 - Moment of inertia.
- b. State and prove perpendicular axis theorem. (04 Marks)
- c. Determine the second moment of area and radius of gyration about the horizontal centroidal axis for the shaded area shown in Fig. Q8(c). (12 Marks)



$R_1 = 20 \text{ mm}$,
 $R_2 = 50 \text{ mm}$,
 $R_1 = \text{Radius of circle}$,
 $R_2 = \text{Radius of semi circle}$

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06EME14/24

First/Second Semester B.E. Degree Examination, June 2012

Elements of Mechanical Engineering

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions choosing at least two from each part.
 2. Answer all objective type questions only on OMR sheet page 5 of the Answer Booklet.
 3. Answer to objective type questions on sheets other than OMR will not be valued.
 4. Use of steam tables is NOT permitted.
 5. Any missing data may be suitably assumed.

PART – A

- 1 a. Choose your answers for the following : (04 Marks)
- i) Fossil fuels are
 A) solid fuel B) liquid fuel C) gaseous fuel D) all of these.
- ii) The water tubes in Babcock-Wilcox boiler are inclined to
 A) Improve radiation heat transfer B) Improve convective heat transfer
 C) Accommodate the furnace D) Promote natural convection of water
- iii) With increase in pressure, the enthalpy of dry saturated steam
 A) increases B) decreases
 C) remains same D) first increases and then decreases
- iv) The specific volume of water, when heated at 0°C
 A) first increases and then decreases B) first decreases and then increases
 C) increases steadily D) decreases steadily.
- b. List any four sources of energy, with suitable examples. (04 Marks)
- c. Describe with a neat sketch, the working of a Babcock-Wilcox boiler. Indicate clearly the direction of flow of flue gases. (08 Marks)
- d. Find the enthalpy of 1.0 kg of steam at 20 bar when
 i) it is wet with dryness fraction of 0.9
 ii) it is super heated with its temperature of 350°C.
 [Take specific heat of super heated steam as 2.3 kJ/kgK and properties of steam at 20 bar as $t_{sat} = 212.4^{\circ}\text{C}$, $h_f = 908.6 \text{ kJ/kg}$, $h_{fg} = 1888.6 \text{ kJ/kg}$] (04 Marks)
- 2 a. Choose your answers for the following : (04 Marks)
- i) turbine is an example of impulse turbine.
 A) De-Laval B) Kaplan C) Francis D) Lawn sprinkler
- ii) A gas turbine as compared to a diesel engine takes longer time to accelerate to full speed because
 A) gas turbine has lesser maximum pressure
 B) diesel engine has larger number of bearings
 C) gas turbine has larger rotating mass
 D) gas turbine needs no water cooling.
- iii) Kaplan turbine is efficient and preferred when
 A) low head and low discharge is available
 B) low head and high discharge is available
 C) high head and low discharge is available
 D) high head and high discharge is available.
- iv) Cooling water is not needed in
 A) gas turbine plant B) diesel engine plant
 C) steam turbine plant D) nuclear plant

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 2 b. With neat sketches, explain compounding of an impulse turbine. (06 Marks)
 c. With a neat sketch, explain the construction and working of a closed cycle gas turbine plant. (06 Marks)
 d. Classify water turbines. (04 Marks)
- 3 a. Choose your answers for the following : (04 Marks)
- The overall efficiency of an I.C. engine is

A) mechanical efficiency	B) brake thermal efficiency
C) indicated thermal efficiency	D) none of these
 - The air fuel ratio in a petrol engine is governed by

A) injector	B) governor
C) carburetor	D) fly wheel
 - The ratio of speed of the camshaft to speed of the crank shaft in a four stroke cycle engine is

A) 1 : 2	B) 2 : 1
C) 1 : 1	D) none of these
 - For the same speed and power, the size of the flywheel of a four stroke petrol engine is

A) same as that of 2-stroke petrol engine
B) larger than that of 2-stroke petrol engine
C) smaller than that of 2-stroke petrol engine
D) all of these.
- b. Explain with a neat sketch, working of a two stroke petrol engine. (06 Marks)
 c. A single cylinder two stroke petrol engine develops 7.5 kW at 2500 rpm. The mean effective pressure on the piston is 8 bar and mechanical efficiency is 80%. Calculate the diameter and stroke of the cylinder if stroke to bore ratio is 1.5. Also calculate the fuel consumption rate, if brake thermal efficiency is 28%. The calorific value of the fuel is 43900 kJ/kg. (10 Marks)
- 4 a. Choose your answers for the following : (04 Marks)
- An ideal refrigerant should have

A) low freezing point	B) low boiling point
C) high latent heat of vapourization	D) all of these.
 - In vapour-absorption refrigeration system is/are used to pressurize the refrigerant

A) a pump and generator	B) a compressor
C) both of (A) and (B)	D) none of these.
 - Refrigeration is a process of heat extraction from

A) a hot body and delivered to a cold body with the help of external work
B) a cold body and delivered to a hot body without the help of external work
C) a cold body and delivered to a hot body with the help of external work
D) a hot body and delivered to a cold body without the help of external work.
 - Air conditioning is a process of

A) control of temperature	B) control of humidity
C) control of cleanliness and air motion	D) all of these.
- b. Define : i) COP of refrigeration, ii) Ton of refrigeration. (04 Marks)
 c. Draw a neat sketch of vapour compressor refrigeration system. Indicate the state of the refrigerant at all salient points and direction of flow of refrigerant. (06 Marks)
 d. Describe room air conditioner with a simple sketch. (06 Marks)

PART – B

- 5 a. Choose your answers for the following : (04 Marks)
- Which of the following parts is not present in lathe
A) spindle B) knee
C) bed D) slide
 - Which of the following operations can be carried out on lathe
A) knurling B) facing
C) thread cutting D) all of these
 - is the operation of enlarging a hole by a single point cutting tool.
A) reaming B) counter sinking
C) boring D) all of these
 - Drilling machine can be specified based on
A) max.dia. of drill B) spindle travel
C) power of the motor D) all of these
- b. With a neat sketch, explain taper turning on lathe by swiveling of compound slide. (06 Marks)
- c. Classify drilling machines. (04 Marks)
- d. With neat sketches, explain : i) counter sinking, ii) counter boring, iii) reaming. (06 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- is a machine tool that removes metal as the work is fed against a rotating multipoint cutter.
A) lathe B) drilling machine
C) shaping machining D) milling machine.
 - In a horizontal milling machine, the rotating spindle is called as
A) cutter B) yoke
C) arbor D) over-arm
 - Which of the following are natural abrasives
A) sand stone B) corundum
C) diamonds D) all of these
 - grinding produces flat surface.
A) cylindrical B) surface
C) form D) none of these
- b. Distinguish between up milling and down milling. (04 Marks)
- c. With a neat sketch, explain the working of vertical milling machine. (08 Marks)
- d. List the applications and advantages of centreless grinding. (04 Marks)
- 7 a. Choose your answers for the following : (04 Marks)
- Spot welding is an example of
A) gas welding B) resistance welding
C) TIG welding D) arc welding
 - Which of the following can act as a lubricant?
A) oil B) grease C) graphite D) all of these
 - is the property which enables oil to spread over and adhere to the surface of bearing.
A) oiliness B) flash point C) specific gravity D) density
 - Which of the following is demerit of ball bearing
A) less friction B) requires less lubrication
C) compact D) none of these

- 7 b. Distinguish between soldering, brazing and welding. (06 Marks)
c. List the basic requirements of a good lubricant. (04 Marks)
d. Describe with a neat sketch, working of a bushed bearing. (06 Marks)
- 8 a. Choose your answers for the following : (04 Marks)
- i) Belt drives are preferred when the distance between the shaft centers is
A) very small B) large
C) any distance D) none of these
 - ii) gears connect two non-parallel, non-intersecting shafts which are usually at right angles.
A) spur B) bevel
C) worm D) none of these
 - iii) In a clock mechanism Gear train is used to connect minute hand and hour hand.
A) simple B) compound
C) epicyclic D) none of these
 - iv) Number of teeth on a wheel per unit of its pitch diameter is called
A) addendum B) dedendum
C) diametral pitch D) circular pitch
- b. Derive an expression for the length of the belt in a crossed flat belt drive. (06 Marks)
c. Name different gear drives and mention their applications. (04 Marks)
d. With neat sketches, explain : i) simple gear train, ii) compound gear train. (06 Marks)

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06ELN15/25

First/Second Semester B.E. Degree Examination, June 2012
Basic Electronics

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer FIVE full questions choosing at least TWO from each part.
2. Answer all objective type questions only on OMR sheet page 5 of the Answer Booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART – A

- 1 a. Choose your answers for the following : (04 Marks)
- In full wave rectification, if the input frequency is 50 Hz, then output frequency is,

A) 50 Hz	B) 100 Hz
C) 150 Hz	D) None of these
 - The diodes which are designed with adequate power dissipation capabilities to operate in the break down region may be employed as _____ devices.

A) Variable voltage	B) Constant current
C) Constant voltage	D) Variable current
 - If the pn-junction is heavily doped, breakdown voltage will _____.

A) Decrease	B) Increase
C) Constant	D) None of these
 - If the reverse voltage across the diode increases, the width of the depletion layer

A) Decreases	B) Remains constant
C) Increases	D) None of these
- b. Draw the VI-characteristics of a diode and explain with reference to the diode current equation. (08 Marks)
- c. A full wave rectifier circuit uses a capacitor filter of 1000 μ F and provides a dc load current of 500 mA at 2% ripple. Calculate dc output voltage, peak rectified voltage, rms ripple voltage on the capacitor and % regulation. (08 Marks)
- 2 a. Choose your answers for the following : (04 Marks)
- In the saturation region, the base to collector junction is _____.

A) Reverse biased	B) Forward biased
C) Not biased	D) None of these
 - The input resistance of a CE-mode transistor is much _____ than its output resistance.

A) More	B) Less
C) Larger	D) None of these
 - Common collector arrangement is generally used for _____.

A) Impedance matching	B) Voltage amplification
C) Current amplifier	D) None of these
 - The collector current in a transistor is 5 mA. If $\beta = 140$ and the base current is 35 μ A, then the leakage current I_{CBO} is,

A) 10 μ A	B) 0.714 μ A
C) 0.78 μ A	D) 20 μ A
- b. For a silicon transistor $\alpha = 0.995$, emitter current is 10 mA and leakage current I_{CO} is 0.5 μ A. Find I_C , I_B , β and I_{CEO} . (06 Marks)
- c. Draw the input and output characteristics of a transistor in CB – configuration, clearly indicate the various regions and explain it. (10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

- 3 a. Choose your answers for the following : (04 Marks)
- The process of making operating point independent of temperature changes or variations in transistor parameters is known as
 - Biasing
 - Stabilization
 - Thermal runaway
 - None of these
 - The intersection of the dc load line with given base current curve is the
 - h-point
 - D-point
 - Q-point
 - None of these
 - Lower stability factors imply lower variation in the _____ current.
 - Collector
 - Base
 - Emitter
 - Both base and emitter.
 - To forward bias the base to emitter junction, the minimum V_{BE} required is _____ for Si transistor.
 - 4V
 - 0.7V
 - 0.007V
 - None of these
- b. Define stability factor. Discuss the factors that cause instability of biasing circuits. (08 Marks)
- c. For the circuit shown in Fig. Q3 (c), determine I_C , V_E , V_C and V_{CE} . (08 Marks)

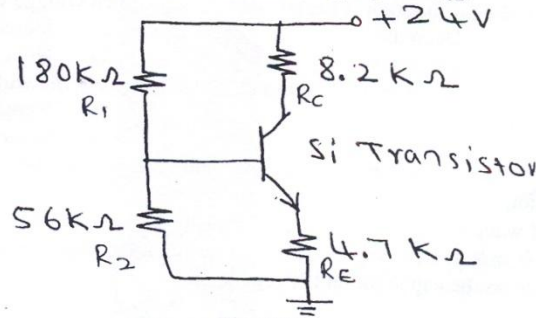


Fig. Q3 (c)

- 4 a. Choose your answers for the following : (04 Marks)
- FET is a _____ controlled device
 - Voltage
 - Current
 - Pulse
 - Power
 - The unit of transconductance g_m of an FET is _____
 - volts/ampere
 - volts
 - ampere/volts
 - None of these
 - Latching current in SCR is _____ holding current.
 - less than
 - more than
 - equal to
 - none of these
 - JFET has _____ input impedance.
 - high
 - low
 - very low
 - none of these
- b. Draw the two transistor equivalent of an SCR and explain working of SCR. (08 Marks)
- c. Draw the VI-characteristic and equivalent circuit of UJT. Explain how UJT can be used as a relaxation oscillator. (08 Marks)

PART - B

- 5 a. Choose your answers for the following : (04 Marks)
- The magnitude voltage gain at half power frequencies of an RC-coupled amplifier is _____ times maximum voltage gain

A) 0.707	B) 7.07
C) 10	D) 17.06
 - With negative feedback, output impedance of an voltage series feedback

A) Remains constant	B) Decreases
C) Increases	D) None of these
 - Without bypass capacitor across R_E , the voltage gain

A) decreases	B) increases
C) constant	D) none of these
 - The magnitude of product of open loop gain (A) and feedback factor (β) is less than one, then the output voltage _____ with frequency.

A) Remains constant	B) Decreases
C) Variable	D) None of these
- b. A crystal has $L = 0.33$ H, $C = 0.06$ pF, $R = 5$ K Ω and $C_m = 1$ PF. Find
- Series resonant frequency
 - Parallel resonant frequency (06 Marks)
- c. Draw the frequency response of an RC-coupled amplifier and explain it. Mention its advantages and disadvantages (10 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- If the different input signal is applied to the two inputs of op-amp, then mode is

A) Common	B) Mixed
C) Difference	D) None.
 - If a sinusoidal voltage is applied to vertical deflection plates only, then we get _____ on the screen of the CRO.

A) Vertical line	B) Horizontal line
C) Both lines	D) None
 - The unit of PSRR is _____

A) Volts	B) Amperes
C) μ V/V	D) None
 - Maximum rate of change of output voltage with time is called _____

A) CMRR	B) Slew rate
C) Over rate	D) None
- b. Define the following terms with respect to op-amp:
- CMRR
 - Input offset voltage
 - Input offset current
 - Input bias current (08 Marks)
- c. Draw the three input non-inverting summer circuit using an op-amp and derive an expression for output voltage. (08 Marks)

- 7 a. Choose your answers for the following : (04 Marks)
- i) $(ABC.D)_{16} = (\quad)_{10}$
 A) 2748.8125 B) 2741.81
 C) 2640.2 D) 3641.25
- ii) $(934)_{10} = (\quad)_8$
 A) 1600 B) 1646
 C) 1641 D) 1644
- iii) $(11001.110)_2 = (\quad)_{10}$
 A) 24.75 B) 20.75
 C) 40.26 D) 25.75
- iv) 2's complement of $(10011)_2$ is _____
 A) 01101 B) 01110
 C) 01111 D) 11111
- b. Draw the block diagram of a superhetrodyne receiver and explain the functions of each block. (08 Marks)
- c. The total power content of an AM wave is 2.64 kW at a modulation factor of 80%. Determine the power content of,
 i) Carrier ii) Each side band (04 Marks)
- d. Subtract using 2's complement of [78-65]. (04 Marks)
- 8 a. Choose your answers for the following : (04 Marks)
- i) The NAND-gate is AND-gate followed by _____
 A) OR gate B) EX-OR gate
 C) EX-NOR gate D) NOT gate
- ii) $A+(B+C) = (A+B)+C$ is _____ law.
 A) Associative B) Commutative
 C) Distributive D) None
- iii) $A + \overline{AB} = \underline{\hspace{2cm}}$
 A) $A + A$ B) \overline{A}
 C) $A + B$ D) None
- iv) The output is high, when both inputs are not equal, such a gate is called _____
 A) EX - OR gate B) NOT gate
 C) EX - NOR gate D) None
- b. Design a full adder circuit and realize, using two half adders. (08 Marks)
- c. Simplify the following Boolean expressions and implement using only NAND-gates:
 i) $y = \overline{ABC} + \overline{A}BC + \overline{A}\overline{B} + A\overline{C}$
 ii) $y = A(\overline{ABC} + \overline{A}BC)$ (08 Marks)

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06ELE15/25

First/Second Semester B.E. Degree Examination, June 2012
Basic Electrical Engineering

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, choosing at least two from each part.**
2. Answer all objective type questions only on OMR sheet page 5 of the answer booklet.
3. Answer to objective type questions on sheets other than OMR will not be valued.

PART - A

- 1 a. Choose your answers for the following : (04 Marks)
- Ohm's law does not hold good for non-metallic conductors such as ____
 A) Copper B) Aluminium
 C) Silver D) Silicon carbide
 - The direction of magnetic field produced by a linear current is given by ____
 A) Flemings left hand rule B) Right hand thumb rule
 C) Amper's law D) Lenz's law
 - For ideal voltage source, the value of internal resistance is
 A) 1 B) ∞
 C) zero D) None of these
 - Equivalent inductance of series aiding of two coil connection is
 A) $L_{eq} = L_1 + L_2 - 2M$ B) $L_{eq} = L_1 + L_2 + 2M$
 C) $L_{eq} = L_1 + 2L_2 + M$ D) $L_{eq} = 2L_1 + L_2 - M$
- b. A resistance R is connected in series with a parallel circuit comprising two resistances of $12\ \Omega$ and $8\ \Omega$. The total power dissipated in the circuit is 700 watts when the applied voltage is 200V. Calculate the value of R. (06 Marks)
- c. State and explain Faraday's law of electromagnetic induction and state Lenz's law also. (05 Marks)
- d. Two coupled coils of self inductances 0.8 H and 0.20 H, have a co-efficient of coupling 0.9. Find the mutual inductance and turns ratio. (05 Marks)
- 2 a. Choose your answers for the following : (04 Marks)
- The sinusoidal currents are given by $i_1 = 10 \sin(\omega t + \pi/3)$, $i_2 = 15 \sin(\omega t - \pi/4)$. The phase difference between them in degrees is
 A) 15° B) 105° C) 60° D) 45°
 - The peak factor is given by $K_p =$ ____
 A) 1.414 B) 1.11 C) 0.707 D) 0.635
 - When the frequency of the applied voltage in R.L series circuit is increased the inductive reactance ____
 A) decreases B) becomes zero C) increases D) remains same
 - The power factor of R.L.C. series circuit, when $X_L > X_C$
 A) lagging B) leading C) unity D) zero
- b. Derive equations for the rms value and average value of a sinusoidally varying current. (06 Marks)
- c. Derive an equation for the power consumed by a R-C series circuit. Draw the waveforms of voltage, current and power. (05 Marks)
- d. A circuit consists of a resistance of $20\ \Omega$ and an inductance of 0.05 H connected in series. A supply of 230V, 50Hz is applied to the circuit. Find the current, power factor and power consumed by the circuit. (05 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
 2. Any revealing of identification, appeal to evaluator and/or equations written eg. $42+8=50$, will be treated as malpractice.

- 3 a. Choose your answers for the following : (04 Marks)
- The algebraic sum of instantaneous phase currents on a three phase balanced system is
 - one
 - zero
 - infinity
 - none of these
 - In star connected system, the relation between the line voltage and phase voltage is
 - $E_l = E_{ph}$
 - $E_{ph} = \sqrt{3} E_l$
 - $E_l = \sqrt{3} E_{ph}$
 - $E_l = 3 E_{ph}$
 - In the two-wattmeter method of measuring 3-phase power, one of the wattmeter reads zero, when the load angle power factor angle is
 - 60°
 - 0°
 - 90°
 - 30°
 - The expression of 3.ϕ power equation in terms of phase values
 - $3 V_{ph} I_{ph} \sin \phi$
 - $\sqrt{3} V_{ph} I_{ph} \cos \phi$
 - $3 V_{ph} I_{ph} \cos \phi$
 - $\sqrt{3} V_{ph} I_{ph} \sin \phi$
- b. With relevant vector diagram, show that two wattmeters are sufficient to measure three-phase power. (08 Marks)
- c. Three equal impedances, each having a resistance of 8Ω and inductive reactance of 6Ω are connected in i) Star ; ii) Delta, across a 3-phase, 440V supply
Find :
- Phase current
 - Line current
 - Total power consumed by the circuit in both cases. (08 Marks)
- 4 a. Choose your answers for the following : (04 Marks)
- The number of revolution of the disc in energy meter is directly proportional to the consumed _____.
 - power
 - energy
 - voltage
 - current
 - Integrating meters are used for the measurement of _____.
 - current
 - voltage
 - power
 - energy
 - In a dynamometer wattmeter, the moving coil is _____.
 - potential coil
 - current coil
 - current or potential coil
 - none of these
 - A good earthing should provide _____ resistance in earthing path
 - medium
 - high
 - low
 - none of these
- b. Explain with a neat diagram the working of dynamometer type wattmeter. (08 Marks)
- c. With a neat diagram explain plate earthing. (04 Marks)
- d. Define the following terms with reference to fuses :
- Rated current
 - Fusing current
 - Fusing factor. (04 Marks)

PART – B

- 5 a. Choose your answers for the following : (04 Marks)
- i) The commutator converts in the dc machine _____
 A) ac to ac B) dc to ac
 C) ac to dc D) dc to dc
 - ii) The direction of the force in Dc motor is given by
 A) Fleming's left hand rule B) Fleming's right hand rule
 C) Lenz's law D) Cork screw rule
 - iii) Electrical equivalent of the mechanical power developed by the armature is equal to
 A) $V_a I_a$ B) $E_b I_a$
 C) $I_a^2 R_a$ D) none of these
 - iv) For DC series motor, torque is proportional to
 A) I_a^2 B) I_a
 C) V^2 D) none of these
- b. With a neat sketch, explain the construction of the DC machine showing the various parts. (06 Marks)
- c. Give the classification of DC motor, sketch the various characteristics of shunt and series motor and mention their applications. (06 Marks)
- d. A 4 pole, 500V shunt motor has 720 conductors wave connected on its armature, the full load armature current is 60A and the flux per pole is 0.03 wb. The armature resistance is 0.2Ω and the contact drop is 1V per brush. Calculate the full load speed. (04 Marks)
- 6 a. Choose your answers for the following : (04 Marks)
- i) The core of the transformer is laminated to reduce
 A) friction loss B) copper loss
 C) hysteresis loss D) eddy current loss
 - ii) The iron losses depend on the maximum value of the
 A) input voltage B) input current
 C) flux density D) frequency
 - iii) If copper loss of a transformer at 1/2 full load is 200 watts then its full load copper loss would be
 A) 200 W B) 400 W
 C) 1600 W D) 800 W
 - iv) The copper losses in the transformer vary as the square of the
 A) voltage B) power
 C) flux density D) current
- b. Derive an expression for the electromotive force induced in the secondary winding of a transformer. (05 Marks)
- c. Define the efficiency of a transformer and derive the condition for which the efficiency of a transformer is maximum. (05 Marks)
- d. A 600 KVA transformer has an efficiency of 92% at full load unity p.f. and half load, 0.9 p.f. Determine its efficiency at 75% of full load and 0.9 p.f. (06 Marks)

- 7 a. Choose your answers for the following : (04 Marks)
- A 6 pole, 1000 rpm alternator generates emf at a frequency of
 A) 60 Hz B) 40 Hz
 C) 25 Hz D) 50 Hz
 - A smooth cylindrical type rotor is used for alternator having
 A) low speed B) low and medium speed
 C) high speed D) none of these
 - For full pitch coil, the pitch factor K_p is
 A) less than 1 B) 1
 C) greater than 1 D) none of these
 - The number of cycles generated in a 8-pole alternator in one revolution is
 A) 4 B) 2
 C) 8 D) 16
- b. Obtain expression for emf of an alternator and explain the significance of winding factor. (06 Marks)
- c. How are alternators classified? With neat figures, give the constructional difference between them. (05 Marks)
- d. A 6 pole, three phase star connected alternator has an armature with 90 slots and 8 conductors per slot and rotates at 1000 rpm. The flux per pole is 0.05 wb. Calculate the emf generated, if the winding factor is 0.97 and pitch factor is unity. (05 Marks)

- 8 a. Choose your answers for the following : (04 Marks)
- In three-phase IM a rotating magnetic field of constant magnitude
 A) $\frac{\sqrt{3}}{2} \phi_m$ B) $1.5 \phi_m$
 C) $-\frac{\sqrt{3}}{2} \phi_m$ D) $-1.5 \phi_m$
 - A 4 pole, 50Hz induction motor runs with a slip of 4%. What is the speed of motor?
 A) 1500 rpm B) 1400 rpm
 C) 1440 rpm D) 1000 rpm
 - An induction motor under full load has a slip of about
 A) 0.03 B) 0.3
 C) 0.1 D) zero
 - The frequency of rotor induced current is given by
 A) $f' = f/s$ B) $f' = sf$
 C) $f' = \sqrt{sf}$ D) $f' = (1 - s) f$
- b. Explain the concept of rotating magnetic field in an 3ϕ induction motor. (06 Marks)
- c. Define a slip. Derive expression for the slip and frequency of rotor current. (05 Marks)
- d. A 3-phase induction motor has 6 poles and runs at 960 rpm on full load. It is supplied from an alternator having 4 poles and running at 1500 rpm. Calculate the full load slip and the frequency of the rotor currents of the induction motor. (05 Marks)

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Question Paper Version : A

First/Second Semester B.E Degree Examination, June 2012

Environmental Studies

(COMMON TO ALL BRANCHES)

Time: 2 hrs.]

[Max. Marks: 50

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the fifty questions, each question carries **ONE mark**.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

1. Which of the following is a biotic component of an ecosystem?
a) Fungi b) Solar light c) Temperature d) Humidity
2. In an ecosystem, the flow of energy is
a) Bidirectional b) Cyclic c) Unidirectional d) Multidirectional
3. The first International Earth Summit was held at
a) Johannesburg b) Rio-de Janerio c) Kyoto d) Stockholm
4. ISO 14000 standards deal with
a) pollution management b) environmental management
c) risk management d) None of these.
5. The major atmospheric gas layer in stratosphere is
a) Hydrogen b) Carbon dioxide c) Ozone d) Helium.
6. Which of the following is not the environmental effect of industrialization, in general?
a) Solid waste b) Water pollution c) Economic growth d) Air pollution.
7. EIA can be expanded as
a) Environment and Industrial Act b) Environment and Impact Activities
c) Environmentally Important Activity d) Environmental Impact Assessment.
8. The impact of construction of dams is
a) submerged forests b) loss of wild life habitat
c) damages down stream ecosystem d) All of these.

9. Among the fresh water available on the Earth, the percentage of surface water is about
a) 50 % b) 10 % c) 5 % d) less than 1%.
10. Major sources of fluoride is
a) Ground water b) Toothpaste c) River water d) Food products
11. Bluebaby syndrome (methaemoglobinemia) is caused by the contamination of water due to
a) Phosphates b) Sulphur c) Nitrates d) Arsenic
12. The most important fuel used by nuclear power plant is
a) U-235 b) U-248 c) U-238 d) U-245
13. Bacteriological pollution of water is due to the presence of
a) silt and grit b) parasitic worms
c) suspended particals d) floating materials.
14. Lead poisoning may cause
a) reduction in haemoglobin b) kidney damage
c) mental retardation d) all of these.
15. Air pollution from automobiles can be controlled by fitting
a) electrostatic precipitator b) wet scrubber
c) catalytic converter d) all of these.
16. Which of the following are non-biodegradable?
a) Plastics b) Domestic sewage c) Detergents d) Both a and c
17. Which of the following is a secondary air pollutant?
a) Carbon monoxide b) Sulphur dioxide c) Ozone d) Carbon dioxide.
18. In which year, the Hon'ble Supreme Court of India made environmental education compulsory subject at all the levels of education?
a) 2000 b) 2001 c) 2002 d) 2003
19. Environmental protection is a fundamental duty of the citizen of India under the article
a) 51-A(8) b) 48-A c) 47 d) 21
20. Ozone layer is present in
a) Stratosphere b) Mesosphere c) Thermosphere d) Troposphere
21. Chernobyl nuclear disaster occurred in the year
a) 1984 b) 1952 c) 1986 d) 1987
22. Which of the following is not a renewable source of energy?
a) Wind energy b) Tidal wave energy c) Solar energy d) Fossil fuels.
23. Electromagnetic radiation can cause
a) Plague b) Malaria c) Cancer d) Dengue fever.
24. Nuclear power plant in Karnataka is located at
a) Bhardravathi b) Sandur c) Raichur d) Kaiga
25. Which place in India, the tidal energy has been experimented?
a) Goa b) Karnataka c) Kerala d) Tamil Nadu

26. In hydro power plants, power is generated by
 a) Hot springs b) Wind c) Water d) Solar energy
27. Environmental pollution is due to
 a) rapid urbanization b) deforestation c) afforestation d) both a and b
28. Definition of noise is
 a) Loud sound b) Unwanted sound c) constant sound d) Sound of high frequency
29. Sound, beyond which of the following level, can be regarded as a pollutant?
 a) 40 dB b) 80 dB c) 120 dB d) 150 dB
30. 'Minamata disease' is caused by
 a) Lead b) Arsenic c) Mercury d) Cadmium.
31. An alternative eco-friendly fuel for automobiles is
 a) Petrol b) Diesel c) CNG d) Kerosene
32. Population explosion will cause
 a) Bio-diversity b) Stress on ecosystem
 c) More employment d) None of these.
33. Which of the following is not a solution for global warming?
 a) Reducing fossil fuel consumption b) Planting more trees
 c) Deforestation d) None of these.
34. The first of the major environmental protection act to be promulgated in India was
 a) Air act b) Water act c) Environmental act d) Noise pollution act
35. Population explosion will cause
 a) Socio-economic problems b) Energy crises
 c) Food scarcity d) All of these.
36. Global warming could affect
 a) Climate b) Increase in sea level
 c) Melting of glaciers d) All of these.
37. Acid rain can be controlled by
 a) Reducing SO₂ and NO₂ emission b) Reducing oxygen emissions
 c) Increasing number of lakes d) Increasing the forest cover
38. The pH value of the acid rain water is
 a) 5.7 b) 7.0 c) 8.5 d) 7.5
39. Major compound responsible for the destruction of stratospheric ozone layer is
 a) Oxygen b) CFC c) Carbon dioxide d) Methane
40. Domesticated animals are used for
 a) Dairy products b) Production of fiber c) Production of meat d) All of these.
41. World ozone day is being celebrated on
 a) September 5th b) October 5th c) September 16th d) September 11th
42. Bhopal gas tragedy was due to the leakage of
 a) Methyl isocyanate (MIC) b) Sulphur dioxide
 c) Mustard gas d) Methane

43. The forest (conservation) Act was enacted in the year
a) 1986 b) 1974 c) 1980 d) 1972
44. The leader of Chipko movement is
a) Medha Patkar b) Sunderlal Bahuguna c) Vandana Shiva d) Suresh Heblkar
45. An international conference on environmental education was held in December 1982 at
a) Kyoto b) Vienna c) New Delhi d) London
46. The world environmental day is celebrated on
a) June 5th b) November 5th c) April 5th d) December 5th
47. India has the world's largest share of
a) Manganese b) Copper c) Mica d) Diamond
48. The hydrological cycle is related to
a) Water cycle and balance b) Water and electricity
c) Hydropower d) Water characterization
49. An important NGO involved in global environmental protection is
a) UNICEF b) Green peace c) WHO d) CPCB
50. About 3/4th of the country's coal deposits are found in
a) Karnataka b) Tamil Nadu c) Kashmir d) Bihar & Orissa
