

# CBCS SCHEME

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18MAT11

## First Semester B.E. Degree Examination, Feb./Mar. 2022 Calculus and Linear Algebra

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Show that the curves  $r = ae^{\theta}$  and  $re^{\theta} = b$  cut orthogonally. (06 Marks)
- b. For the curve,  $y = \frac{ax}{a+x}$  show that  $\left(\frac{2\rho}{a}\right)^{2/3} = \left(\frac{x}{y}\right)^2 + \left(\frac{y}{x}\right)^2$  (06 Marks)
- c. Show evolute of the Ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  is  $(xa)^{2/3} + (yb)^{2/3} = (a^2 - b^2)^{2/3}$  (08 Marks)

OR

- 2 a. With usual notations prove that  $\tan \phi = r \frac{d\theta}{dr}$  (06 Marks)
- b. Find the radius of curvature of the curve  $r^2 = a^2 \sec 2\theta$ . (06 Marks)
- c. Find the angle between the curves  $r = a \log \theta$ ,  $r = \frac{a}{\log \theta}$ . (08 Marks)

### Module-2

- 3 a. Obtain Maclaurin's series expansion of  $\log(1 + \cos x)$  upto the term containing  $x^4$ . (06 Marks)
- b. Evaluate  $\lim_{x \rightarrow 0} \left( \frac{a^x + b^x + c^x + d^x}{4} \right)^{1/x}$  (07 Marks)
- c. Find the extreme values of the function  $f(x, y) = x^3 + 3xy^2 - 3x^2 - 3y^2 + 4$ . (07 Marks)

OR

- 4 a. If  $u = x^2 + y^2 + z^2$ ,  $x = e^{2t}$ ,  $y = e^{2t} \cos 3t$ ,  $z = e^{2t} \sin 3t$  then find  $\frac{du}{dt}$ . (06 Marks)
- b. The temperature  $T$  at any point  $(x, y, z)$  in space is  $T = 400xyz^2$ . Find the highest temperature at the surface of the unit sphere  $x^2 + y^2 + z^2 = 1$ . (07 Marks)
- c. If  $u = x^2 + 2y^2$ ,  $v = 2x^2 - y^2$  where  $x = r \cos \theta$ ,  $y = r \sin \theta$  then show that  $\frac{\partial(u,v)}{\partial(r,\theta)} = 6r^3 \sin 2\theta$ . (07 Marks)

### Module-3

- 5 a. Evaluate  $\int_0^a \int_0^{\sqrt{a^2-x^2}} \frac{x}{x^2+y^2} dx dy$  by changing the order of integration. (06 Marks)
- b. Find by double integration, volume of the ellipsoid  $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$  (07 Marks)
- c. With usual notations, show that the relation between Beta function and Gamma function is  $B(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$  (07 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.

OR

- 6 a. Evaluate  $\int_0^4 \int_0^{2\sqrt{z}} \int_0^{\sqrt{4z-x^2}} dy dx dz$  (06 Marks)
- b. Evaluate  $\int_0^\infty \int_0^\infty e^{-(x^2+y^2)} dx dy$  by changing into polar coordinates. (07 Marks)
- c. Prove that  $\int_0^{\pi/2} \sqrt{\sin \theta} d\theta \cdot \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin \theta}} = \pi$  (07 Marks)

Module-4

- 7 a. Solve  $\frac{dy}{dt} + y \tan x = y^3 \sec x$  (06 Marks)
- b. Show that the family curves  $y^2 = 4a(x+a)$  is self orthogonal. (07 Marks)
- c. Solve  $x^2 p^2 + xyp - 6y^2 = 0$  by solving for p. (07 Marks)

OR

- 8 a. Solve  $(x^2 + y^3 + 6x)dx + xy^2 dy = 0$ . (06 Marks)
- b. If the air is maintained at  $30^\circ\text{C}$  and the temperature of the body cools from  $80^\circ\text{C}$  to  $60^\circ\text{C}$  in 12 minutes, find the temperature of the body after 24 minutes. (07 Marks)
- c. Solve  $y^2(y - xp) = x^4 p^2$  using substitution  $X = 1/x$  and  $Y = 1/y$ . (07 Marks)

Module-5

- 9 a. Find the rank of the matrix  $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$  by elementary transformations. (06 Marks)
- b. Apply Gauss Jordan method to solve the system of equations  $2x + y + z = 10$ ,  $3x + 2y + 3z = 18$ ,  $x + 4y + 9z = 16$ . (07 Marks)
- c. Find the largest eigen value and the corresponding eigen vector of the matrix  $A = \begin{bmatrix} 1 & -3 & 2 \\ 4 & 4 & -1 \\ 6 & 3 & 5 \end{bmatrix}$  by Rayleigh's power method. Perform four iterations. Take initial vector as  $[1 \ 0 \ 0]^T$ . (07 Marks)

OR

- 10 a. Investigate the values of  $\lambda$  and  $\mu$  so that the equations  $2x + 3y + 5z = 9$ ,  $7x + 3y - 2z = 8$ ,  $2x + 3y + \lambda z = \mu$  have (i) a unique solution, (ii) infinitely many solutions (iii) no solution. (06 Marks)
- b. Use the Gauss-Seidel iterative method to solve the system of equations  $5x + 2y + z = 12$ ,  $x + 4y + 2z = 15$ ,  $x + 2y + 5z = 20$ . Carryout four iterations, taking the initial approximation to the solution as  $(1, 0, 3)$ . (07 Marks)
- c. Diagonalize the matrix  $A = \begin{bmatrix} 1 & 2 \\ 4 & 3 \end{bmatrix}$ . Hence determine  $A^4$ . (07 Marks)

# CBCS SCHEME

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18PHY12/22

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Engineering Physics

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.

2. Physical constants : Velocity of light,  $c = 3 \times 10^8$  m/s

Planck's constant,  $h = 6.625 \times 10^{-34}$  JS

Boltzmann's constant,  $K = 1.38 \times 10^{-23}$  J/K

Avogadro's number,  $N_A = 6.02 \times 10^{26}$  /Kmole

Mass of electron,  $m_e = 9.1 \times 10^{-31}$  kg

Charge of electron,  $e = 1.602 \times 10^{-19}$  C

Relative Permittivity of vacuum,  $\epsilon_0 = 8.854 \times 10^{-12}$  Fa/m

### Module-1

- 1 a. Define simple harmonic motion. Derive the equation for simple harmonic motion using Hooke's law. Mention any five characteristics of simple harmonic motion. (10 Marks)
- b. State the laws of conservation of mass, momentum and energy along with the equations. (06 Marks)
- c. A mass of 5 kg is suspended from the free end of a spring. When set for vertical oscillations, the system executes 100 oscillations in 40 seconds. Calculate the force constant of the spring. (04 Marks)

OR

- 2 a. What are forced vibrations? Obtain an expression for amplitude of a body undergoing forced vibration. (10 Marks)
- b. Distinguish between subsonic and supersonic waves. Mention any two applications of shock waves. (06 Marks)
- c. Calculate the resonance frequency of a spring of force constant 1974 N/m, carrying a mass of 2000 gm. (04 Marks)

### Module-2

- 3 a. State and explain Hooke's law. Define Young's modulus, Bulk modulus, Rigidity modulus and derive the respective equations. (08 Marks)
- b. Derive the relation  $y$ ,  $\eta$  and  $\sigma$ . (08 Marks)
- c. Calculate the torque required to twist a wire of length 1.5 m, radius  $0.0425 \times 10^{-2}$  m, through an angle ( $\pi/45$ ) radian, if the value of rigidity modulus of its material is  $8.3 \times 10^{10}$  N/m<sup>2</sup>. (04 Marks)

OR

- 4 a. Define bending moment. Derive the expression for the bending moment of a beam in terms of moment of inertia. (09 Marks)
- b. Define the terms elasticity and plasticity. Explain the stress-strain curve. (07 Marks)
- c. A rod of cross section of area 1 cm  $\times$  1 cm is rigidly planted into the earth vertically. A string which can withstand a maximum tension of 2 kg is tied to the upper end of the rod and pulled horizontally. If the length of the rod from the ground level is 2 meters, calculate the distance through which its upper end is displaced just before the string snaps. (y for steel =  $2 \times 10^{11}$  N/m<sup>2</sup> and  $g = 9.8$  m/s<sup>2</sup>) (04 Marks)

**Module-3**

- 5 a. Explain the concept of divergence of a vector and its physical significance. State and derive Gauss divergence theorem. (10 Marks)
- b. Obtain an expression for numerical aperture in an optical fiber. (06 Marks)
- c. Find the attenuation in an optical fiber of length 500 m when a light signal of power 100 mW emerges out of the fiber with a power 90 mW. (04 Marks)

**OR**

- 6 a. What is attenuation and attenuation coefficient? Explain different attenuation mechanisms. (08 Marks)
- b. List the four Maxwell's equations for time-varying condition. Derive the wave equation for electromagnetic waves using Maxwell's equations. (08 Marks)
- c. Find the divergence of the vector field  $\vec{A}$  given by  $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$  at a point P(1, 3, 6). (04 Marks)

**Module-4**

- 7 a. State and explain Heisenberg's uncertainty principle. Using this principle, prove that an electron does not exist inside the nucleus. (08 Marks)
- b. Derive the expression for energy density of radiation in terms of Einstein's coefficients. (08 Marks)
- c. A particle of mass  $0.5 \text{ Mev}/c^2$  has kinetic energy 100 eV. Find its de-Broglie wavelength. (04 Marks)

**OR**

- 8 a. Find the expression for Eigen value and Eigen function for a particle in uninfinte potential well. (10 Marks)
- b. What is a laser range finder? Describe how it is made use in defense. (06 Marks)
- c. The average output power of a laser source emitting a laser beam of wavelength  $6328 \text{ \AA}$  is 5 mW. Find the number of photons emitted per second by the laser. (04 Marks)

**Module-5**

- 9 a. Define Fermi factor. Discuss the dependence of Fermi factor on temperature and energy. (08 Marks)
- b. What is internal field? Derive Clausius-Mossotti equation. (08 Marks)
- c. The Hall coefficient of a material is  $-3.68 \times 10^{-5} \text{ m}^3/\text{c}$ . Identify the type of charge carriers and calculate the carrier concentration. (04 Marks)

**OR**

- 10 a. Derive the expression for electrical conductivity of a semiconductor. (08 Marks)
- b. What are the main assumptions of quantum free electron theory and describe how quantum free electron theory has been successful in overcoming the failures of classical free electron theory. (08 Marks)
- c. If a NaCl crystal is subjected to an electric field of 1000 V/m and the resulting polarization is  $4.3 \times 10^{-8} \text{ c/m}^2$ , calculate the dielectric constant of NaCl. (04 Marks)

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18CHE12/22

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Derive an expression for single electrode potential. (07 Marks)
- b. What are concentration cell? A concentration cell was constructed by immersing two copper rods in  $\text{CuSO}_4$  solution of concentration 0.02 M and 0.3 M respectively. Write the cell representation, cell reaction and calculate the emf of the cell at  $25^\circ\text{C}$ . (07 Marks)
- c. Explain the construction and working of Li - ion battery. (06 Marks)

OR

- 2 a. With a neat sketch explain the construction and working of calomel electrode. Write its advantages and application. (07 Marks)
- b. Explain the construction and working of Ni-MH battery. Write any two applications. (07 Marks)
- c. What are ion selective electrodes? Explain the construction and working of glass electrode. (06 Marks)

### Module-2

- 3 a. What is corrosion? Explain electrochemical theory of corrosion. (07 Marks)
- b. Explain Bimetallic and Pitting corrosion. (07 Marks)
- c. What is Electroless plating? Explain Electroless plating of Nickel. (06 Marks)

OR

- 4 a. Explain Polarization and Decomposition potential. (07 Marks)
- b. What is electroplating? Explain electroplating of Hard and Decorative Chromium. (07 Marks)
- c. What is Galvanization? Explain galvanization process of Zn. (06 Marks)

### Module-3

- 5 a. Define calorific value. Explain the determination of calorific value of a solid fuel by Bomb calorimeter. (07 Marks)
- b. On burning 0.87 g of coal sample in a bomb calorimeter the temperature of water rise to  $4.8^\circ\text{C}$ . The mass of water in the calorimeter and water equivalent of calorimeter is 3800 g and 430 g and % of  $\text{H}_2$  in the coal sample is 4.7, calculate GCV and NCV. (Given: Specific heat of water  $4.18 \text{ kJ/kg}^\circ\text{C}$ , latent heat of steam  $2454 \text{ kJ/kg}$ ). (07 Marks)
- c. What is PV cell? Explain the construction and working of PV cell. (06 Marks)

OR

- 6 a. What are fuel cells? Explain the construction and working of  $\text{MeOH/O}_2$  fuel cell. (07 Marks)
- b. What is meant by knocking? Explain the mechanism of knocking and write its ill effects. (07 Marks)
- c. Write a note on Bio-Diesel. (06 Marks)

**Module-4**

- 7 a. What are the sources of ozone depletion? What are its effects, how it is controlled?(07 Marks)  
b. Mention the sources of solid waste and explain any two methods of disposal solid waste. (07 Marks)  
c. What is boiler feed water? Explain the mechanism of formation of sales and sludges. What are its disadvantages? (06 Marks)

**OR**

- 8 a. Define COD? Explain the experimental determination of COD. (07 Marks)  
b. In a COD test 28.9 cm<sup>3</sup> and 13.3 cm<sup>3</sup> of 0.05N FAS solution was required for blank and sample titration respectively. The volume of the test sample used was 25 cm<sup>3</sup>. Calculate the COD sample. (07 Marks)  
c. Explain the sewage treatment by activated sludge process. (06 Marks)

**Module-5**

- 9 a. Explain the theory and instrumentation of Potentiometry. (07 Marks)  
b. Explain the theory and instrumentation of Conductometry and plot graph for Strong acid vs Strong base → Weak acid vs Strong base. (07 Marks)  
c. Explain the synthesis of nano materials by sol-gel process. (06 Marks)

**OR**

- 10 a. Write the synthesis of nano materials by chemical vapour deposition technique. (07 Marks)  
b. Write a note on CNT and Fullerenes. (07 Marks)  
c. Explain the theory and instrumentation of calorimetry by taking Cu as an example.(06 Marks)

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# CBGS SCHEME

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18ELE13/23

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. State and explain Kirchhoff's laws and ohm's law. (06 Marks)  
b. Find :  
i) Voltage drop across  $4\ \Omega$   
ii) Supply voltage for the networks shown in Fig.Q1(b).

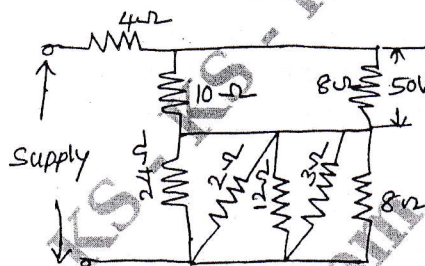


Fig.Q1(b)

- c. Define the following : (08 Marks)  
i) Average value of alternating current ii) Form factor iii) Peak factor. (06 Marks)

OR

- 2 a. Two resistance  $20\ \Omega$  and  $40\ \Omega$  are connected in parallel. A resistance of  $10\ \Omega$  is connected in series with the combination. A voltage of  $200\text{V}$  is applied across the circuit. Find the current in each resistance and voltage across  $10\ \Omega$ . Find also the power consumed in all the resistors. (08 Marks)  
b. Derive the expression for RMS value average current of a sinusoidally varying quantity. (08 Marks)  
c. Two alternating currents in a parallel circuit are represented by  $i_1 = 5\sin \omega t$  and  $i_2 = 10 \sin(\omega t + 60^\circ)$ . Find the resultant current. (04 Marks)

### Module-2

- 3 a. Show that a pure inductance does not consume any power draw the waveforms of voltage, current, power when an alternating voltage is applied to pure inductance. (08 Marks)  
b. A coil of resistance  $10\ \Omega$  and inductance  $0.1\text{H}$  is connected in series with a  $150\ \mu\text{F}$  capacitor across a  $200\text{V}$ ,  $50\text{Hz}$  supply. Calculate :  
i) Inductive reactance  
ii) Capacitive reactance  
iii) Impedance  
iv) Current  
v) Power factor  
vi) Voltage across coil  
vii) Voltage across capacitor. (08 Marks)  
c. An inductive coil takes a current of  $33.24\text{A}$  from  $230\text{V}$ ,  $50\text{Hz}$  supply, if the resistance of coil is  $6\ \Omega$ . Calculate inductance of the coil and power taken by the coil. (04 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.

OR

- 4 a. In a three phase star connection, show that  $V_L = \sqrt{3}V_{ph}$ , also draw vector diagram of line voltage and phase voltage. (07 Marks)
- b. What are the advantages and three phase system over a single phase system? (07 Marks)
- c. A delta connected load consist of a resistance of  $10\Omega$  and capacitance of  $100\mu F$  in each phase. A supply of 410V at 50Hz a applied to the load. Find line current, power consumed by the load and power factor. (06 Marks)

Module-3

- 5 a. Derive the EMF equation of a transformer. (06 Marks)
- b. A single phase transformer working at 0.8 power factor has an efficiency at 94% at both  $\frac{3}{4}$  full load and pull load of 600KW. Find the efficiency at  $\frac{1}{2}$  full load unity power factor. (08 Marks)
- c. Primary winding of a transformer is connected to a 240V, 50Hz. The secondary winding has 1500 turns and the maximum value of core flux is 0.00207 wb. Find secondary induced emf, number of turns in primary and cross sectional area of core. If max value of flux density is 0.465 Tesla. (06 Marks)

OR

- 6 a. Explain plate Earthing. (06 Marks)
- b. With circuit diagram and switching table, explain two-way control of lamp. (08 Marks)
- c. What are the precaution to be taken against electric shock? (06 Marks)

Module-4

- 7 a. Draw a neat sketch of DC machine and name the parts and briefly explain the function of each. (10 Marks)
- b. A 4-pole, 220V, Lap connected DC shunt motor has 36 slots, each slot containing 16 conductors, it draws a current of 40A from the supply. The field resistance and armature resistance are  $110\Omega$  and  $0.1\Omega$  respectively. The motor develops an output power of 6KW. Flux per pole is 40MWb. Calculate : i) speed ii) torque developed by the armature iii) shaft torque. (10 Marks)

OR

- 8 a. EMF generated in the armature of a shunt generator is 625V. When delivering its full current of 400A to an external circuit. The field current is 6A and armature resistance is  $0.06\Omega$ . What is the terminal voltage? (06 Marks)
- b. Sketch the various characteristic of DC motor (shunt). (08 Marks)
- c. What is the significance of back EMF in a DC motor? (06 Marks)

Module-5

- 9 a. Derive the EMF equation of an alternator. (06 Marks)
- b. 4-pole, 1500rpm, star connected alternator has 9 slot/pole, and 8 conductor per slot. Find the flux per pole to give a terminal voltage of 3300V. Take the winding factor as unity. (07 Marks)
- c. A 6 pole, star connected alternator has a 90 slot and 8 conductor per slot, and rotates at 1000rpm. The flux per pole is 50 mwb. Find the induced emf across its lines. Take the winding factor of 0.97. (07 Marks)

OR

- 10 a. Mention the advantages and disadvantages of a squirrel cage and slip ring induction motors. (07 Marks)
- b. Why starter is required for a three phase induction motor? (07 Marks)
- c. A 6 pole induction motor is supplied by a 10 pole alternator. Which is driven at 600rpm. If the motor is running at 970rpm, find the slip. (06 Marks)



# CBCS SCHEME

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18CPS13/23

First/Second Semester B.E. Degree Examination, Feb./Mar. 2022

## C Programming for Problem Solving

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

- 1 a. Write an algorithm and draw flow chart, which reads 3 sides of a triangle and prints whether it is equilateral, isosceles and scalene. (08 Marks)
- b. Write basic structure of C program and explain its different sections. Also, give an example. (08 Marks)
- c. Identify the following variable names. State whether variable is valid or invalid. If invalid give reasons i) INT ii) for iii) larea iv) STATIC. (04 Marks)

OR

- 2 a. List and mention function of any five flow chart symbols. (05 Marks)
- b. Define C-token. List and explain different C-tokens. (10 Marks)
- c. Write a C program to swap contents of two variables. Print contents of variable before swap and after swap. (05 Marks)

### Module-2

- 3 a. Distinguish between the following functions:  
i) scanf() and gets()  
ii) scanf() and printf()  
iii) putchar() and printf() (06 Marks)
- b. Write a C program to generate and print first 'N' Fibonacci numbers using looping constructs. (08 Marks)
- c. Write the syntax of Nested if..else statement and explain its working. (06 Marks)

OR

- 4 a. Write a C program to print the string "PROGRAM" in following pattern using formatted output statement

```
          P
         P R
        P R O
       P R O G
      P R O G R
     P R O G R A
    P R O G R A M
```

(08 Marks)

- b. Distinguish between the following:  
i) while loop and do..while loop (06 Marks)
- ii) break and continue. (06 Marks)
- c. Write the syntax of else..if ladder and explain its working. (06 Marks)

**Module-3**

- 5 a. Define an array. Write the syntax of declaration and initialization of – one-dimensional array and two-dimensional array with example for each. (10 Marks)
- b. Write a C program to search a key element in the given sorted array of integer numbers using binary search technique. (06 Marks)
- c. Write a C program to copy one string to another without using strcpy(). (04 Marks)

OR

- 6 a. Write a C program to read a square matrix A ( $m \times n$ ) and find the trace of the matrix. (08 Marks)
- b. List advantages and disadvantages of array. (06 Marks)
- c. Write the syntax and give one example for built-in string functions listed below:  
i) strcmp() ii) strcpy() iii) strrev() iv) strcat() v) strcat() vi) strlen() (06 Marks)

**Module-4**

- 7 a. List and explain two techniques for passing parameters from one function to another by taking an example of C program. (10 Marks)
- b. Differentiate between recursion and iteration. (06 Marks)
- c. Write a C program to find factorial of a given number using recursion. (04 Marks)

OR

- 8 a. Write a C program to compute  $nCr$  for the given values of n and r using recursion. (10 Marks)
- b. Distinguish between built-in functions and user defined functions. (04 Marks)
- c. List any six benefits of functions. (06 Marks)

**Module-5**

- 9 a. Write a note on the following by giving segment of C program:  
i) Array of structure  
ii) Structure within a structure. (08 Marks)
- b. Define pointer. Mention any two differences between a pointer variable and a normal variable. (04 Marks)
- c. What is pre-processor directives? Mention significance of following C-pre-processors:  
i) #ifdef ii) #pragma iii) #include iv) #undef v) #define vi) #error (08 Marks)

OR

- 10 a. Create a structure student having members name and USN. Write a C program which reads details of 5 students and print the same. (10 Marks)
- b. Define macro. Using macros, write a C program to find area of circle. (06 Marks)
- c. Define pointer. Write the syntax and give an example of declaring and assigning a value to pointer. (04 Marks)

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# CBCS SCHEME

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18ELN14/24

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Basic Electronics

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Explain the operation of PN junction diode under forward and reverse bias conditions. (06 Marks)
- b. A full wave bridge rectifier with an input of 100V (rms) feeds a load of  $1\text{K}\Omega$ ,  $V_T = 0.7\text{V}$ .
- If the diodes employed are silicon, what is the DC voltage across the load?
  - Determine the PIV rating of each diode
  - Determine the maximum current that each diode conducts and the diode power rating. (06 Marks)
- c. Write a short note on :
- Light emitting diode
  - Photodiode
  - Photo coupler. (08 Marks)

OR

- 2 a. What is Zener diode? With a neat circuit diagram, explain the operation of a voltage regulator. (08 Marks)
- b. A silicon diode has  $I_S = 10\text{nA}$  at  $25^\circ\text{C}$ . Calculate  $I_D$  for a forward bias of  $0.6\text{V}$ . (04 Marks)
- c. Define rectifier. Sketch a half wave rectifier with waveforms derive the following :
- Average voltage
  - Average current
  - Efficiency
  - Ripple factor. (08 Marks)

### Module-2

- 3 a. Explain the construction and operation of N-channel JFET (06 Marks)
- b. With a neat diagram, explain the operation of CMOS inverter. (08 Marks)
- c. With a neat diagram, explain the VI characteristics of SCR. (06 Marks)

OR

- 4 a. Explain the characteristics of n-channel JFET. (06 Marks)
- b. With a neat diagram, explain the characteristics of a enhancement type MOSFET (N-channel). (08 Marks)
- c. With neat diagram, explain the two transistor model of an SCR. (06 Marks)

### Module-3

- 5 a. For an op-amp :
- List the characteristics of an ideal op-amp
  - Draw the three input summing circuit (inverting amplifier) and derive the expression for its output voltage. (08 Marks)
- b. Define the terms with respect to op-amp
- Slew rate
  - CMRR
  - Common mode gain  $A_{cm}$  or  $A_c$  of op-amp. (06 Marks)
- c. Design an adder circuit using an op-amp to obtain the output voltage of  $-(2V_1 + 3V_2 + 5V_3)$ . (06 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.

OR

- 6 a. Draw the circuit of non-inverting op-amp. Derive the expression for its voltage gain. (08 Marks)
- b. With a neat circuit diagrams, explain how an op-amp can be used as a :  
i) differentiator ii) an integrator. (06 Marks)
- c. Find the output  $V_0$  for the following op-amp circuit.

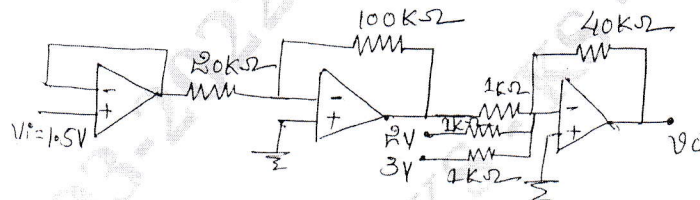


Fig.Q6(c)

(06 Marks)

**Module-4**

- 7 a. What is an amplifier? Explain the operation of transistor amplifier circuit. (08 Marks)
- b. Define feedback amplifier? With a necessary diagram and equation explain different types of feedback. (12 Marks)

OR

- 8 a. Briefly explain how a transistor is used as an electronic switch. (06 Marks)
- b. Explain how 555 timer can be used as an oscillator. (06 Marks)
- c. Define an oscillator? Derive the equation for Wein bridge oscillator. (08 Marks)

**Module-5**

- 9 a. Convert the following :  
i)  $(725.25)_{10} = (?)_2 = (?)_{16}$   
ii)  $(111100111110001)_2 = (?)_{10} = (?)_{16}$ . (08 Marks)
- b. Simplify the following :  
i)  $AB + \bar{A}C + A\bar{B}C(AB + C)$   
ii)  $(A + \bar{B})(CD + E)$ . (06 Marks)
- c. Realize a full adder using 2-half adders. (06 Marks)

OR

- 10 a. What is multiplex? Explain the working of 4 : 1MUX. (06 Marks)
- b. With the help of a logic diagram and truth table, explain the working of a clocked SR flip-flop. (06 Marks)
- c. What is a shift register? Explain the working a 4-bit SISO shift register. (08 Marks)

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18CIV14/24

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Elements of Civil Engineering and Mechanics

Time: 3 hrs.

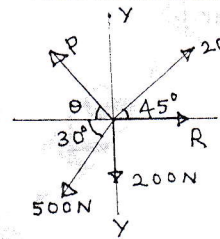
Max. Marks: 100

*Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Assume any missing data suitably.*

### Module-1

- 1 a. Briefly tell about any two fields of Civil Engineering. (04 Marks)  
 b. List the role of Civil Engineering in the infrastructural development of a country. (06 Marks)  
 c. Four coplanar forces are acting at the point are shown in Fig.Q.1(c). One of the forces is unknown and its magnitude is P. The resultant has a magnitude of 500N and is acting along X – axis. What is the unknown force P and its inclination with X – axis. (10 Marks)

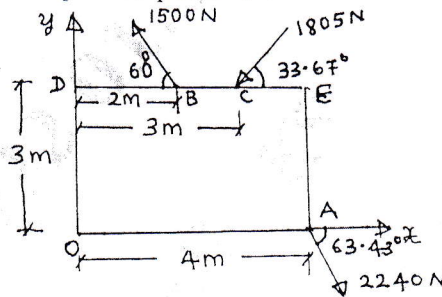
Fig.Q.1(c)



OR

- 2 a. State and explain parallelogram law of forces. (04 Marks)  
 b. State and prove Varignon's theorem of moments. (06 Marks)  
 c. Fig.Q.2(c) shows coplanar system of forces acting on a flat plate. Determine:  
 i) The resultant (10 Marks)  
 ii) X and Y intercepts with respect to point 'O'.

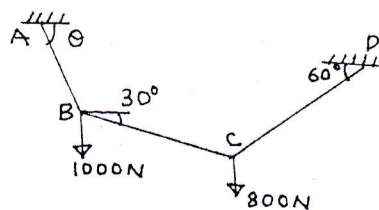
Fig.Q.2(c)



### Module-2

- 3 a. Explain free body diagram with sketches. (04 Marks)  
 b. State and prove Lami's theorem. (06 Marks)  
 c. Compute the unknown angle and tension in the strings AB, BC and CD as shown in Fig.Q.3(c). (10 Marks)

Fig.Q.3(c)



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.

OR

- 4 a. Prove that angle of friction is equal to angle to repose. (06 Marks)
- b. Define:
- Limiting friction (04 Marks)
  - Cone of friction.
- c. Two blocks A and B of masses 30kg and 40kg respectively are connected by means of a bar placed on a inclined plane as shown in Fig.Q.4(c). If  $\mu = 0.25$ , find the value of  $\theta$  required for the motion of block to impend. (10 Marks)

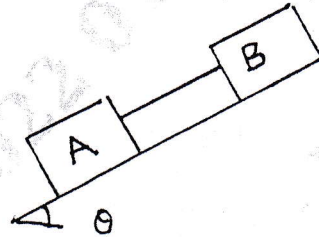


Fig.Q.4(c)

Module-3

- 5 a. Explain the different types of loading with sketches. (06 Marks)
- b. Briefly explain determinate and indeterminate beams. (04 Marks)
- c. A beam AB 1.7m long is loaded as shown in Fig.Q.5(c). Find the reactions at A and B. (10 Marks)

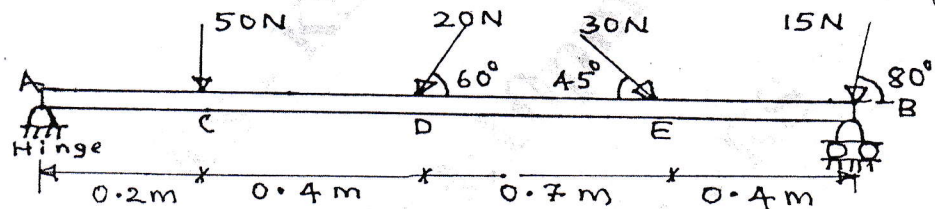


Fig.Q.5(c)

OR

- 6 a. What are the steps to be followed in the analysis of statically determinate trusses by the method of joints? (06 Marks)
- b. Analyze the truss shown in Fig.Q.6(b) by the method of joints. Tabulate the results and indicate the nature of forces in the truss. (14 Marks)

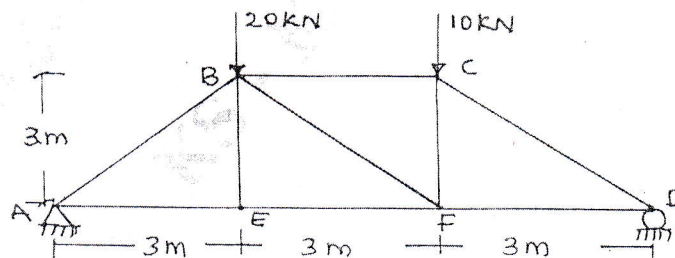


Fig.Q.6(b)

**Module-4**

- 7 a. State and prove parallel axis theorem.  
b. Find the centroid for the Fig.Q.7(b) shown below:

(08 Marks)

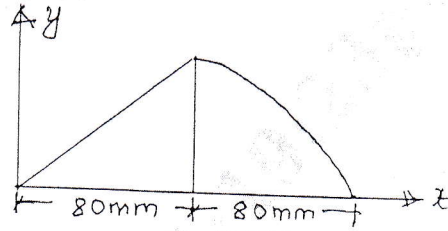


Fig.Q.7(b)

(12 Marks)

**OR**

- 8 a. Find the centroid of a triangle of base 'b' and height 'h' from first principle.  
b. Determine the moment of inertia of Fig.Q.8(b) about centroidal X axis and Y axis.

(12 Marks)

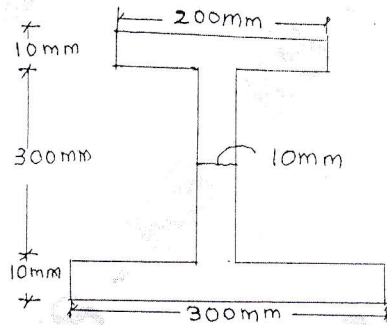


Fig.Q.8(b)

**Module-5**

- 9 a. Define:  
i) Trajectory  
ii) Time of flight  
iii) Superelevation  
iv) Curve linear motion  
v) Rectilinear motion.  
b. A tower in 90m in height. A particle is dropped from the top of tower and at the same time another particle is projected upward from the foot of tower. Both the particle meet at a height of 30m with respect foot of the tower. Find the velocity with which second particle is projected upward.

(10 Marks)

(10 Marks)

**OR**

- 10 a. State and explain D'Alembert's principle.  
b. Two weights 800N and 200N are connected by thread and they move along a rough horizontal plane under the action of force of 400N applied to the 800N weight as shown in Fig.Q.10(b). Using D'Alembert's principle, find the acceleration of weights and tension in thread. Take coefficient of friction = 0.3.

(12 Marks)

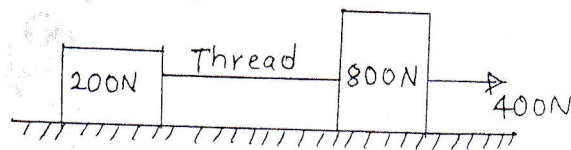


Fig.Q:10(b)

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# CBCS SCHEME

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18ME15/25

## First/Second Semester B.E. Degree Examination, Feb./Mar. 2022 Elements of Mechanical Engineering

Time: 3 hrs.

Max. Marks: 100

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.  
2. Assume missing data, if any.  
3. Use of steam table is permitted.*

### Module-1

- 1 a. Explain in brief three primary processes of solar energy conversion into other forms of energy. (10 Marks)  
b. Write a note on global warming and ozone depletion. (10 Marks)

OR

- 2 a. State and explain zeroth law, first law and second law of thermodynamics. (10 Marks)  
b. Find the specific volume and enthalpy of 1 kg of steam at 0.8 MPa when:  
(i) The steam is 10% wet.  
(ii) The steam is heated to a temperature of 300°C.  
Assume  $C_{ps}$  value as 2.25 kJ/kg. (10 Marks)

### Module-2

- 3 a. What are the advantages and disadvantages of water tube boiler over fire tube boiler? (06 Marks)  
b. List the boiler mountings such as mountings for safety and operations. (04 Marks)  
c. With a neat sketch, explain the working of Pelton wheel. (10 Marks)

OR

- 4 a. Explain with neat sketch the working of centrifugal pump. (10 Marks)  
b. Classify turbines. Explain the working of FRANCIS turbine. (10 Marks)

### Module-3

- 5 a. With the help of theoretical P-V diagram, explain OTTO four stroke cycle engine. (10 Marks)  
b. The following observations were obtained during a trial on a 4-stroke diesel engine:  
Cylinder dia = 250 mm  
Stroke of the piston = 400 mm  
Crankshaft speed = 250 rpm  
Brake load = 687 N  
Brake drum dia = 2m  
Diesel oil consumption = 0.1 m<sup>3</sup>/min  
Specific gravity of diesel = 0.78  
Calorific value of diesel = 43900 kJ/kg  
Find: (i) BP (ii) IP (iii) FP (iv)  $\eta_{mech}$  (v)  $\eta_{B,T}$  (10 Marks)

OR

- 6 a. Give the list of refrigerants with their applications. (05 Marks)  
b. Define the following:  
(i) Refrigerating effect (ii) Ton of refrigeration (iii) COP  
(iv) Relative COP (v) Ice making capacity (05 Marks)  
c. Explain with neat sketch the working principle of vapour absorption refrigeration. (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.



**Module-4**

- 7 a. What is composite material? State advantages and applications of composite materials. (06 Marks)  
b. Write short notes on: (i) Shape memory materials (ii) Optical fibre glass (04 Marks)  
c. Derive an expression for the length of belt in crossed belt drive. (10 Marks)

OR

- 8 a. Classify metal joining processes. Explain different types of flames used in oxy-acetylene welding. (10 Marks)  
b. A simple gear train consists of four gears having 30, 40, 50, 60 teeth respectively. Determine the speed and direction of the last gear if the first gear makes 600 rpm in clockwise direction. (10 Marks)

**Module-5**

- 9 a. How do you specify a lathe? (04 Marks)  
b. Explain with a neat sketch taper turning by compound slide swiveling method. (10 Marks)  
c. Explain the following operations on milling machine with suitable sketches:  
(i) Plain milling (ii) Straddle milling (iii) Gang milling (06 Marks)

OR

- 10 a. Define robot. List the industrial applications of robot. (05 Marks)  
b. Explain the components of CNC with a block diagram. (10 Marks)  
c. Differentiate between open loop and closed loop systems. (05 Marks)

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# CBCS SCHEME

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18MAT21

## Second Semester B.E. Degree Examination, Feb./Mar.2022 Advanced Calculus and Numerical Methods

Time: 3 hrs.

Max. Marks: 100

*Note: Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

1. a. Find the angle between the surfaces  $x^2 + y^2 + z^2 = 9$  and  $z = x^2 + y^2 - 3$  at the point  $(2, -1, 2)$ . (06 Marks)
- b. Find the divergence and curl of the vector  $\vec{F}$  if  $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$ . (07 Marks)
- c. Show that  $\vec{F} = (y+z)\vec{i} + (z+x)\vec{j} + (x+y)\vec{k}$  is irrotational and also find a scalar function  $\phi$  such that  $\vec{F} = \nabla\phi$ . (07 Marks)

OR

2. a. Verify Green's theorem for  $\int_C (xy + y^2)dx + x^2dy$ , where C is the bounded by  $y = x$  and  $y = x^2$ . (06 Marks)
- b. Using Stoke's theorem, evaluate  $\int_C xydx + xy^2dy$ , where C is the square in the x-y plane with vertices  $(1, 0)(-1, 0)(0, 1)(0, -1)$ . (07 Marks)
- c. Using Gauss divergence theorem, evaluate  $\iint_C \vec{F} \cdot \vec{n} ds$  over the entire surface of the region above xy-plane bounded by the cone  $z^2 = x^2 + y^2$  and the plane  $z = 4$ , where  $\vec{F} = 4xz\vec{i} + xyz^2\vec{j} + 3zk\vec{k}$ . (07 Marks)

### Module-2

3. a. Solve  $(D^2 - 4D + 13)y = \cos 2x$ , where  $D = \frac{d}{dx}$ . (06 Marks)
- b. Solve  $(D^2 - 2D + 1)y = \frac{e^x}{x}$ , by the method of variation of parameter, where  $D = \frac{d}{dx}$ . (07 Marks)
- c. Solve  $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10\left(x + \frac{1}{x}\right)$ . (07 Marks)

OR

4. a. Solve  $(D-2)^2 y = 8(e^{2x} + \sin 2x)$ , where  $D = \frac{d}{dx}$ . (06 Marks)
- b. Solve  $(1+x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = \sin 2[\log(1+x)]$ . (07 Marks)

- c. The differential equation of the displacement  $x(t)$  of a spring fixed at the upper end and a weight at its lower end is given by  $10 \frac{d^2x}{dt^2} + \frac{dx}{dt} + 200x = 0$ . The weight is pulled down 0.25 cm, below the equilibrium position and then released. Find the expression for the displacement of the weight from its equilibrium position at any time  $t$  during its first upward motion. (07 Marks)

**Module-3**

- 5 a. Form the partial differential equation by eliminating the arbitrary constants form,  $(x-a)^2 + (y-b)^2 + z^2 = C^2$ . (06 Marks)
- b. Solve  $\frac{\partial^2 z}{\partial x \partial y} = \sin x \sin y$  for which  $\frac{\partial z}{\partial y} = -2 \sin y$  when  $x = 0$  and  $z = 0$  if  $y$  is an odd multiple of  $\frac{\pi}{2}$ . (07 Marks)
- c. Derive one-dimensional heat equation in the standard form. (07 Marks)

**OR**

- 6 a. Form the partial differential equation by eliminating the arbitrary function from  $z = f(x+ct) + g(x-ct)$ . (06 Marks)
- b. Solve  $(y-z)p + (z-x)q = (x-y)$ . (07 Marks)
- c. Solve one dimensional wave equation, using the method of separation of variables. (07 Marks)

**Module-4**

- 7 a. Test for the convergence or divergence of the series  $\sum_{n=1}^{\infty} \frac{n!}{(n^n)^2}$ . (06 Marks)
- b. Solve Bessel's differential equation leading to  $J_n(x)$ . (07 Marks)
- c. Express  $x^4 - 2x^3 + 3x^2 - 4x + 5$  in terms of Legendre polynomial. (07 Marks)

**OR**

- 8 a. Discuss the nature of the series,  $\frac{1}{2} + \left(\frac{2}{3}\right)x + \left(\frac{3}{4}\right)^2 x^2 + \left(\frac{4}{5}\right)^3 x^3 + \dots$ . (06 Marks)
- b. With usual notation, show that
- (i)  $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}} \sin x$
- (ii)  $J_{-1/2}(x) = \sqrt{\frac{2}{\pi x}} \cos x$  (07 Marks)
- c. Use Rodrigues formula to show that  $P_4(\cos\theta) = \frac{1}{64} [35 \cos 4\theta + 20 \cos 2\theta + 9]$ . (07 Marks)

**Module-5**

- 9 a. Find a real root of the equation  $\cos x - 3x + 1 = 0$ , correct to 3 decimal places using regula falsi method. (06 Marks)
- b. Use an appropriate interpolation formula to compute  $f(42)$  using the following data:

x	40	50	60	70	80	90
f(x)	184	204	226	250	276	304

(07 Marks)

- c. Evaluate  $\int_4^{5.2} \log x dx$  by using Weddle's rule, divided into six equal parts. (07 Marks)

OR

- 10 a. Find a real root of the equation,  $x \sin x + \cos x = 0$  near  $x = \pi$ , correct to four decimal places. Using Newton-Raphson method. (06 Marks)
- b. Find  $f(9)$  from the data by Newton's divided difference formula. (07 Marks)

x	5	7	11	13	17
f(x)	150	392	1452	2366	5202

- c. By using Simpson's  $\frac{1}{3}$  rule  $\int_0^1 \frac{dx}{1+x^2}$  dividing interval (0,1) into six equal parts and hence find approximate value of  $\pi$ . (07 Marks)

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- c. Evaluate  $\int_4^{5.2} \log x dx$  by using Weddle's rule, divided into six equal parts. (07 Marks)

OR

- 10 a. Find a real root of the equation,  $x \sin x + \cos x = 0$  near  $x = \pi$ , correct to four decimal places. Using Newton-Raphson method. (06 Marks)
- b. Find  $f(9)$  from the data by Newton's divided difference formula. (07 Marks)

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f(x)	150	392	1452	2366	5202

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