CBCS SCHEME

USN | | | | | | | | | | |

21MAT11

First Semester B.E. Degree Examination, June/July 2024
Calculus and Differential Equations

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 of intersection between the curves, $r = a\theta$ and $r = \frac{a}{\theta}$. (06 Marks)

b. With usual notations, prove the following :

(i) $p = r\sin\phi$ (ii) $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$. (07 Marks)

c. Show that the radius of curvature for the curve $r^2 \sec 2\theta = a^2$ is $\frac{a^2}{3r}$. (07 Marks)

OR

2 a. Find the angle between the radius vector and the tangent for the curve $r = ae^{\theta\cot\alpha}$. (06 Marks)

b. For the curve $r^n = a^n \sin n\theta + b^n \cos n\theta$, show that the pedal equation is $p^2\left(a^{2n} + b^{2n}\right) = r^{2n+2}$ (07 Marks)

c. Find the radius of curvature of the curve $x^2y = a\left(x^2 + y^2\right)$ at the point (-2a, 2a). (07 Marks)

Module-2

3 a. Obtain Maclaurin's series expansion of $\log(1+\sin x)$ upto the term containing x^4. (06 Marks)

b. If $z = e^{ax+by} f(ax - by)$, prove that $b\frac{\partial z}{\partial x} + a\frac{\partial z}{\partial y} = 2abz$. (07 Marks)

c. Find the extreme values of the function, $f(x, y) = x^3 + y^3 - 63x - 63y + 12xy$. (07 Marks)

OR

4 a. Evaluate the following : $\lim_{x\to 0}\left(\frac{a^x + b^x + c^x}{3}\right)^{\frac{1}{x}}$. (06 Marks)

b. If $z = e^{ax-by}\sin(ax + by)$ then prove that $b\frac{\partial z}{\partial x} - a\frac{\partial z}{\partial y} = 2abz$. (07 Marks)

c. If $u = x^2 - 2y^2$, $v = 2x^2 - y^2$, find $\frac{\partial(u, v)}{\partial(x, y)}$. (07 Marks)

Module-3

5 a. Solve $(2xy + y - \tan y)dx + (x^2 - x\tan^2 y + \sec^2 y)dy = 0$. (06 Marks)

b. If the air is maintained at 30° C and the temperature of the body cools from 80° C to 60° C in 12 minutes, find the temperature of the body after 24 minutes. (07 Marks)

c. Solve $(px - y)(py + x) = a^2p$ by using the substitution $X = x^2$ and $Y = y^2$. (07 Marks)

OR

6 a. Solve $x^3\frac{dy}{dx} - x^2y = -y^4\cos x$. **(06 Marks)**

b. Find the orthogonal trajectories of the family of curves $r = 4a(\sec\theta + \tan\theta)$, where a is the parameter. **(07 Marks)**

c. Solve $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$. **(07 Marks)**

Module-4

7 a. Solve $\frac{d^2y}{dx^2} - 4y = e^{3x}$. **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 4y = x^2 + 7x + 9$. **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x\tan x$ by the method of variation of parameters. **(07 Marks)**

OR

8 a. Solve $(4D^4 - 4D^3 - 23D^2 + 12D + 36)y = 0$. **(06 Marks)**

b. Solve $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = e^{-x}$. **(07 Marks)**

c. Solve $(2x-1)^2\frac{d^2y}{dx^2} + (2x-1)\frac{dy}{dx} - 2y = 8x^2 - 2x + 3$. **(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 reducing it to the echelon form. **(06 Marks)**

b. Test for consistency and solve the following system of equations,
$x + 3y - 2z = 0$, $2x - y + 4z = 0$, $x - 11y + 14z = 0$ **(07 Marks)**

c. Use the Gauss-Seidel iterative method to solve the system of equations,
$x + 4y + 2z = 15$, $x + 2y + 5z = 20$, $5x + 2y + z = 12$
Carryout four iterations, taking the initial approximation to the solution as (1, 0, 3).
(07 Marks)

OR

10 a. Apply Gauss elimination method to solve the system of equations,
$2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$ **(06 Marks)**

b. Investigate the values λ and μ 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. **(07 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector of the matrix $A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ by taking $[1 \quad 1 \quad 1]^T$ as initial Eigen vector by Rayleigh's power method. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21MAT21

Second Semester B.E. Degree Examination, June/July 2024
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. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dy\,dx\,dz$. **(06 Marks)**

b. Evaluate $\iint_{R} xydxdy$, where R is bounded by x = 2a, the curve $x^2 = 4ay$. **(07 Marks)**

c. Prove that $\beta(m,n) = \frac{\overline{|m}\,\overline{|n}}{\overline{|m+n}}$ **(07 Marks)**

OR

2 a. Evaluate $\int_{0}^{a}\int_{y}^{a}\frac{x}{x^2+y^2}dxdy$ by changing the order of integration. **(06 Marks)**

b. Find the area between the parabolas $y^2 = 4ax$ and $x^2 = 4ay$. **(07 Marks)**

c. Prove that $\int_{0}^{\frac{\pi}{2}}\sqrt{\sin\theta}d\theta \times \int_{0}^{\frac{\pi}{2}}\frac{1}{\sqrt{\sin\theta}}d\theta = \pi$. **(07 Marks)**

Module-2

3 a. Find the directional derivative of $Q = xy^3 + yz^2$ at the point (2, -1, 1) in the direction of $i + 2j + 2k$. **(06 Marks)**

b. Find divF and curlF, where $F = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. Show that $\vec{F} = \frac{x\hat{i} + y\hat{j}}{x^2 + y^2}$ is both solenoidal and irrotational. **(07 Marks)**

OR

4 a. Find the work done in moving a particle in the force field $\vec{F} = 3x^2\hat{i} + (2xz - y)\hat{j} + z\hat{k}$ along the straight line joining (0, 0, 0) to (2, 1, 3). **(06 Marks)**

b. Apply Green's theorem to evaluate $\int_{C}(3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region bounded by x = 0, y = 0 and x + y = 1 **(07 Marks)**

c. Using stoke's theorem evaluate $\int_{C}\vec{F}.d\vec{r}$, where $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\hat{j}$ and C is the boundary of the rectangle $x = \pm a$, y = 0, y = b. **(07 Marks)**

Module-3

5 a. Form the partial differential equation by the elimination of arbitrary functions from, $z = f(x + ay) + g(x - ay)$. **(06 Marks)**

b. Derive the one dimensional heat equation. **(07 Marks)**

c. Solve $(mz - ny)\frac{\partial z}{\partial x} + (nx - lz)\frac{\partial z}{\partial y} = ly - mx$. **(07 Marks)**

OR

6 a. 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, when y is an odd multiple of $\frac{\pi}{2}$. **(06 Marks)**

b. Form the partial differential equations from $f(x + y + z,\ x^2 + y^2 + z^2) = 0$. **(07 Marks)**

c. Solve $\frac{\partial^3 z}{\partial x^2 \partial y} + 18xy^2 + \sin(2x - y) = 0$. **(07 Marks)**

Module-4

7 a. Find a real root of the equation $x \log_{10} x = 1.2$ by regula-falsi method, correct to four decimal places. **(06 Marks)**

b. Find the cubic polynomial which takes the following values by using Newton's Forward interpolation.

x	0	1	2	3
f(x)	1	2	1	10

and hence evaluate f(4). **(07 Marks)**

c. Evaluate $\int_0^6 \frac{dx}{1+x^2}$, by using (i) Simpson's rule (ii) Simpson's $\left(\frac{3}{8}\right)^{th}$ rule. **(07 Marks)**

OR

8 a. Using Newton's-Raphson method find real root of the equation, $3x - \cos x - 1 = 0$ near x = 0.5, correct to 3 decimal places. **(06 Marks)**

b. Using Newton's divided difference formula for the following data :

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

Evaluate f(9). **(07 Marks)**

c. From the following table, estimate the number of students who obtained marks between 40 and 45.

Marks :	30 – 40	40 – 50	50 – 60	60 – 70	70 – 80
No. of students :	31	42	51	35	31

(07 Marks)

Module-5

9 a. Using Taylor's series method, solve $\frac{dy}{dx} = 2y + 3e^x$, find y(0.2) with y(0) = 0 upto 4^{th} order derivative with expansion. **(06 Marks)**

b. Use Runge-Kutta method to find an approximate value of y when x = 0.2 given that $\frac{dy}{dx} = x + y^2$ with y(0) = 1 and taking h = 0.2. **(07 Marks)**

c. Apply Milne's Predictor-corrector method, find y at x = 0.8 given $\frac{dy}{dx} = x - y^2$ with y(0) = 0, h(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762 and h = 0.2. **(07 Marks)**

OR

10 a. Using Taylor's series method, find the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, y(0) = 1, upto 4th order derivative in the expansion. **(06 Marks)**

b. Apply modified Euler's method, find y(0.2) and h = 0.2 given $\frac{dy}{dx} = x + \sqrt{|y|}$, with y(0) = 1. Carry out two iterations. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.04 and y(0.3) = 2.09. Find y(0.4) by using Milne's predictor-corrector method. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21CHE12/22

First/Second Semester B.E. Degree Examination, June/July 2024
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. Define Single Electrode Potential. Derive Nernst's equation for single electrode potential. **(07 Marks)**

b. What are ion selective electrodes? Explain construction and working of glass electrode. **(07 Marks)**

c. Write brief note on recycling of Lithium ion batteries by direct recycling method. **(06 Marks)**

OR

2 a. Distinguish between primary, secondary and reserve batteries. **(06 Marks)**

b. Describe the construction and working principle of calomel electrode. **(07 Marks)**

c. For the cell, $Fe \mid Fe^{+2}(0.01) \parallel Ag^{+}(0.1) \mid Ag$
Write the cell reaction and calculate the emf of the cell at 298 K. If standard electrode potential of Fe and Ag electrodes are – 0.44 V and +0.8 V respectively. **(07 Marks)**

Module-2

3 a. Explain the following factors which affecting the rate of corrosion:
i) Ratio of anodic and cathodic areas
ii) Nature of the corrosion product **(07 Marks)**

b. Explain the following :
i) Differential Metal Corrosion
ii) Waterline corrosion **(06 Marks)**

c. What is Electroplating? Explain the electroplating of chromium. **(07 Marks)**

OR

4 a. What is meant by metal finishing? Mention (any five) technological importance of metal finishing. **(06 Marks)**

b. A thick steel sheet of Area 800 cm^2 is exposed to air near the ocean. After a year period it was found to experience a weight loss of 7.6 kg due to corrosion. If the density of the brass is 7.9 g/cm^3. Calculate the corrosion penetrating rate in mpy and mm/y (given k = 534 in mpy and 87.6 in mm/y). **(07 Marks)**

c. What is electroless plating? Explain the electroless plating of copper. **(07 Marks)**

Module-3

5 a. What are polymer composites? Explain the synthesis and application of Kevlar fibre. **(07 Marks)**

b. What are conducting polymers? Explain the various factors influencing the conduction in organic polymers. **(07 Marks)**

c. Explain any two size dependent properties of nanomaterials. **(06 Marks)**

OR

6 a. What are nanomaterials? Explain the synthesis of nanomaterial by sol-gel process. **(07 Marks)**

b. What are biodegradable polymers? Explain the properties and application of polylactic acid. **(07 Marks)**

c. Write a note on Carbon nanotubes properties and its application. **(06 Marks)**

Module-4

7 a. Explain briefly any 6 basic principles of green chemistry. **(06 Marks)**

b. Explain the synthesis of Adipic acid by conventional route from Benzene and Green route from glucose. **(07 Marks)**

c. Describe the hydrogen production by photo catalytic water splitting method. **(07 Marks)**

OR

8 a. Explain the construction and working of methanol-oxygen fuel cell. **(06 Marks)**

b. Explain the synthesis of paracetamol by conventional and green route from phenol. **(07 Marks)**

c. Describe the hydrogen production by photo electrocatalytic method. **(07 Marks)**

Module-5

9 a. Explain the theory, instrumentation and applications of calorimetry. **(07 Marks)**

b. Write the principles and requirements of titrimetric analysis. **(07 Marks)**

c. In COD test 25.5 cm^3 and 12.5 cm^3 of 0.05 N FAS solution are required for blank and sample titration respectively. The volume of the test sample used is 26 cm^3. Calculate the COD of the sample. **(06 Marks)**

OR

10 a. Explain the theory, instrumentation and applications of Flame Photometry. **(07 Marks)**

b. Define the following units of standard solution:
i) Molarity ii) Normality iii) PPM **(06 Marks)**

c. Explain the determination of hardness of water by EDTA method. **(07 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21PHY12/22

First/Second Semester B.E. Degree Examination, June/July 2024
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 speed of light $C = 3 \times 10^8$ m/s, Plancks constant $h = 6.625 \times 10^{-34}$ J/S, Boltzmann constant $K = 1.38 \times 10^{-23}$ J/K, Acceleration due to gravity $= 9.8 m/s^2$, Mass of electron $= 9.1 \times 10^{-31}$ kg, Charge on electron $= 1.6 \times 10^{-19}$ C, Permittivity of free space $= 8.854 \times 10^{-12}$ F/m.

Module-1

1 a. Define simple harmonic motion and give two examples applying Hookes law arrive at an equation for the effective spring constant of series and parallel combination of springs. **(09 Marks)**

b. Define Mach number and explain subsonic, supersonic, and transonic waves. **(07 Marks)**

c. The distance between the pressure sensors in a shock tube is 170mm. The time taken by the shock wave this distance is 0.5ms. If the velocity of the sound under same condition is 340m/s, find the mach number of the shock waves. **(04 Marks)**

OR

2 a. With neat diagram, explain construction and working of Reddys tube. Mention any two applications of shock waves. **(09 Marks)**

b. What are damped oscillations? Discuss the theory of damped oscillations. **(07 Marks)**

c. A mass of 0.5kg causes an extension 0.03m in a spring and the system is set for oscillations. Find the force constant of the spring. Also find the angular frequency and period of oscillations. **(04 Marks)**

Module-2

3 a. Discuss the spectral distribution of energy in the black body radiation spectrum and hence explain Wein's displacement law and Stefan's law of radiation. **(08 Marks)**

b. Show that electron is extra nuclear particle in an atom by applying Heisenbergs uncertainity principle. **(07 Marks)**

c. An electron is bound in an one dimensional potential box of 1 Å and infinite wall height. Find the energy of electron in the ground state and first three excited state. **(05 Marks)**

OR

4 a. Set up time independent Schrodingers wave equation in one dimension. **(08 Marks)**

b. State and explain de-Broglies hypothesis of matter waves. Explain the properties of wave function. **(07 Marks)**

c. The position and momentum of an electron with energy 0.5kev are determined. What is minimum percentage uncertainity in its momentum if the uncertainity in the measurement of its position is 0.5 Å ? **(05 Marks)**

Module-3

5 a. Obtain the expression for energy density of radiation in terms of Einsteins A and B coefficients. Mention the conditions for laser action. **(09 Marks)**

b. Define modes of propagation, with neat diagram explain the types of optical fiber. **(07 Marks)**

c. Compare the acceptance angle of an optical fiber placed in air and water. Given the R.I of core and cladding of optical fiber are 1.5 and 1.45 respectively. The R.I. of water is 1.33. **(04 Marks)**

OR

6 a. Derive an expression for numerical aperture of an optical fiber. **(08 Marks)**

b. With neat diagrams explain construction and working of CO_2 laser. **(08 Marks)**

c. The ratio of population of two energy levels is 1.059×10^{-30}. Find the wavelength of light emitted for the transition between these states at 330K. **(04 Marks)**

Module-4

7 a. What is Fermi function? Explain the variation of Fermi function with energy at OK and T > OK. **(08 Marks)**

b. Obtain an expression for electrical conductivity for an intrinsic semiconductor. **(07 Marks)**

c. Find the polarization produced in a crystal by an electric field of strength 500V/mm if it has dielectric constant of 6. **(05 Marks)**

OR

8 a. What is Hall effect? Obtain an expression for Hall coefficient. **(08 Marks)**

b. What is polarization? Derive Clausius-Mossotti equation. **(07 Marks)**

c. The resistivity of intrinsic Ge is 0.47Ωm. If mobilities of electron and hole are respectively $0.38 m^2/vs$ and $0.18 m^2/vs$, calculate intrinsic carrier density. **(05 Marks)**

Module-5

9 a. With neat diagrams explain principle, construction and working of atomic force microscopy. **(10 Marks)**

b. Define nano material and explain. What are nano composites? **(05 Marks)**

c. X-rays are diffracted in the first order from a crystal with inter planar spacing 2.8×10^{-10}m at a glancing angle of 60°. Calculate the wavelength of X-ray. **(05 Marks)**

OR

10 a. With neat diagram describe the principle construction and working of scanning electron microscope. **(10 Marks)**

b. Explain the principle of X-ray photo electron spectroscopy. **(05 Marks)**

c. Determine the crystallite size if the wavelength of X-rays used is 10nm, the peak width is 0.5° and peak position is 25° for a cubic crystal (Given K = 0.94). **(05 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ELE13/23

First/Second Semester B.E. Degree Examination, June/July 2024
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 Ohms Law and mention its limitations. **(05 Marks)**

b. Find the currents in the various branches of the given network shown in Fig.Q1(b).

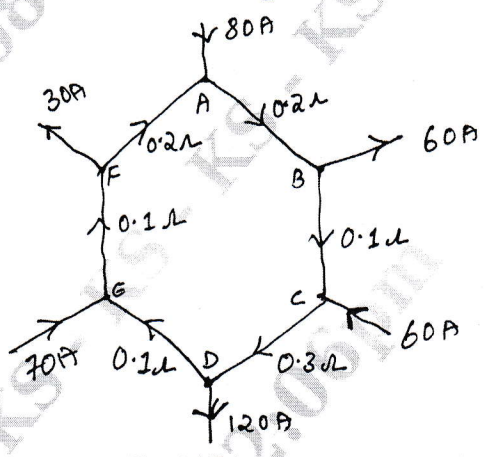

Fig.Q1(b) **(07 Marks)**

c. State and derive the condition to draw maximum power from the load using maximum power transfer theorem. **(08 Marks)**

OR

2 a. Define RMS value and average value of an alternating quantity and derive the expression for the same. **(10 Marks)**

b. List the advantages of sinusoidal waveform. **(05 Marks)**

c. Show that, the power consumed in a pure capacitance is zero. **(05 Marks)**

Module-2

3 a. Derive an expression for the power consumed in a series RL – AC circuit and draw voltage current and power waveform. **(08 Marks)**

b. A circuit show in Fig.Q3(b) consists of a resistance of 10Ω, an inductance of 16mH and a capacitance of 150μF connected in series. A supply of 100V, 50Hz is given to the circuit. Find the current, p.f and power consumed by the circuit.

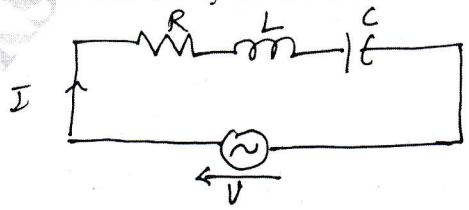

Fig.Q3(b) **(06 Marks)**

c. Draw the power triangle and define active power, reactive power and apparent power. **(06 Marks)**

OR

4 a. Derive the relationship between line and phase values of current in a three phase balanced star connected system. **(06 Marks)**

b. A three phase load of three equal impedances connected in delta across a balanced 400V supply takes a line current of 10A, a power factor of 0.7 lagging. Calculate :
i) The phase current
ii) The total power
iii) Total reactive KVA. **(06 Marks)**

c. Show that two wattmeters are sufficient to measure 3 phase power and power factor of the circuit in a 3 phase balanced circuit. **(08 Marks)**

Module-3

5 a. Explain the construction of a DC generator with a neat sketch. **(08 Marks)**

b. Derive an equation for the torque developed in the armature of a DC motor. **(06 Marks)**

c. A 4-pole, 1500rpm DC generator has a lap wound armature having 24 slots with 10 conductors per slot. If the flux per pole s 0.04wb, calculate the emf generated in the armature. What would be the generated emf. If the winding is wave connoted? **(06 Marks)**

OR

6 a. Derive the EMF equation of a transformer. **(06 Marks)**

b. Explain different losses occurring in a transformer. **(06 Marks)**

c. A transformer is rated at 100KVA, at full load its copper loss is 1200W and the iron loss is 960W calculate:
i) The efficiency of full load, u.p.f
ii) The efficiency of at half load 0.8pf
iii) The load KVA at which maximum efficiency occurs
iv) Maximum efficiency at 0.85 pf. **(08 Marks)**

Module-4

7 a. Explain the concept of rotating magnetic field in case of a 3-phase induction motor. **(08 Marks)**

b. Distinguish between wound rotor (slip ring) and squirrel large rotor of induction motor. **(06 Marks)**

c. Define slip of an induction motor and derive the relation between the supply frequency and rotor current frequency. **(06 Marks)**

OR

8 a. Derive the emf equation of alternator (Three phase synchronous generator). **(08 Marks)**

b. Explain the construction of two types of alternator with a neat diagram. **(06 Marks)**

c. A 3-phase 50Hz, 16-pole alternator with star connected winding has 144 slots with 10 conductors/slot. The flux/pole is 24.8mwb and the coils are full pitched. Find :
i) The speed ii) Line EMF. Assume the distribution factor $k_d = 0.96$. **(06 Marks)**

Module-5

9 a. Explain the concept of power transmission and power distribution with a neat diagram of power system. **(08 Marks)**

b. Explain tariff and list out the types of tariffs. **(06 Marks)**

c. What are the desirable characteristics of a tariff and explain two-part tariff. **(06 Marks)**

OR

10 a. Explain the necessity of earthing and also explain pipe earthing with a neat diagram. **(08 Marks)**

b. Explain the working RCCB with a neat diagram. **(06 Marks)**

c. Write about precautions against electric shock. **(06 Marks**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21ELN14/24

First/Second Semester B.E. Degree Examination, June/July 2024
Basic Electronics and Communication Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Describe various electronic units of a d.c. power supply with a neat block diagram. **(07 Marks)**

b. Derive an expression for overall gain of an amplifier with negative feedback. **(07 Marks)**

c. Illustrate single-stage astable multivibrator using operational amplifier and explain the threshold voltages. **(06 Marks)**

OR

2 a. With neat block diagram and waveforms, explain the working of bridge rectifier. **(08 Marks)**

b. Explain the working of op-amp comparators and summing amplifiers with input and output waveforms. **(08 Marks)**

c. A 5 V zener diode has a maximum rated power dissipation of 500 mW. If the diode is to be used in a simple regulator circuit to supply a regulated 5 V to a load having resistance of 400 Ω ; determine a suitable value of series resistor for operation in conjunction with a supply of 9 V. **(04 Marks)**

Module-2

3 a. With the help of truth table and logic expressions, explain full adder using basic gates. **(08 Marks)**

b. Discuss the design of a 3-bit asynchronous up-counter. **(07 Marks)**

c. Write a note on different data types mentioning the bit size and range of values supported. **(05 Marks)**

OR

4 a. Design a 3-to-8 Decoder and show its implementation using basic gates. **(07 Marks)**

b. With the help of timing diagram, explain how D-type bistable circuit works. **(06 Marks)**

c. With a neat block diagram, show how typical input and output blocks are connected to a microcontroller unit. **(07 Marks)**

Module-3

5 a. Differentiate : Embedded systems versus General computing systems. Also provide major application areas of Embedded Systems. **(08 Marks)**

b. Discuss arrangement of an instrumentation system and a control system. **(06 Marks)**

c. Illustrate topology for USB device connection. Also, classify four different data transfers supported by USB. **(06 Marks)**

OR

6 a. Explain the principle of operation, working and applications of stepper motor. **(08 Marks)**

b. With relevant diagrams, explain the operation of Relay. **(06 Marks)**

c. Write a note on classification of Embedded systems. **(06 Marks)**

Module-4

7 a. Draw a block schematic diagram of the most general form of basic communication system and explain. **(08 Marks)**

b. Explain different types of radio wave propagation with a neat diagram. **(06 Marks)**

c. Differentiate : (i) Amplitude modulation versus Frequency modulation.
(ii) Analog modulation versus Digital modulation. **(06 Marks)**

OR

8 a. Explain PAM, PWM, PPM and PCM with the help of waveforms. **(08 Marks)**

b. Discuss Forward Error Correction (FEC) technique. With neat diagram and example. **(07 Marks)**

c. Define an antenna and discuss various types of antennas. **(05 Marks)**

Module-5

9 a. Draw the schematic diagram of cellular telephone system and define its basic components. **(06 Marks)**

b. Draw the block diagram, showing the basic elements of a satellite communication system and briefly explain. **(08 Marks)**

c. With the help of block diagram, explain generalized configuration of a fiber-optic communication system. **(06 Marks)**

OR

10 a. With a neat block diagram, explain GSM system architecture. **(08 Marks)**

b. With the help of architecture figure, explain the evolution from GSM to LTE. **(08 Marks)**

c. What is Bluetooth? Explain Bluetooth architecture. **(04 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21PSP13/23

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2024
Problem Solving Through Programming

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. What is a Computer? Explain various types of computers. **(10 Marks)**

b. Explain basic structure of C program along with a program to find area of a circle. **(10 Marks)**

OR

2 a. With a neat diagram, explain architecture of computer. **(10 Marks)**

b. What is a token? List all types of tokens used in C programming language with an example for each. And also explain how to use below listed six operators with an example for each
i) ! ii) size of iii) + + iv) , v) ∧ vi) >> = **(10 Marks)**

Module-2

3 a. List all branching statements used in C programming language. Explain any three two-way selection statements with an example for each. Also write their syntax and flowchart. **(10 Marks)**

b. Develop an algorithm, flowchart and also write C program for
i) To swap values of two variables without using third variable.
ii) To compute simple interest. **(10 Marks)**

OR

4 a. With syntax, flowchart explain switch statement? Write a C program to simulate simple calculator. **(10 Marks)**

b. Explain formatted output function used in C with its control string specifications:
i) Write printf statement to display "VTU\' Belagavi"
ii) Write printf statement to display +0.45.234 using appropriate control string.
iii) Write printf statement to display Oxabba using appropriate control string. **(10 Marks)**

Module-3

5 a. Define an array. Explain the declaration and initialization of single dimensional array with examples. **(10 Marks)**

b. Explain any five string manipulation functions available in string.h with an example for each. **(10 Marks)**

OR

6 a. What is Two-dimensional array? Explain its declaration and initialization with example. **(10 Marks)**

b. What is a string? Give its declaration with examples. Explain unformatted string input and output function with an example for each. **(10 Marks)**

Module-4

7 a. Explain elements of function definition, with an example. **(10 Marks)**

b. What is user defined function and library function? What is call-by-value method? Implement a C program to add two numbers using call-by-value-method. **(10 Marks)**

OR

8 a. What is function? Explain classification of user defined function based on parameter passing and return value with an example for each. **(10 Marks)**

b. Highlight the differences between call-by-value and call-by-reference methods. Implement a C program to generate Fibonacci series of N numbers using recursion. **(10 Marks)**

Module-5

9 a. What are storage classes in C programming? Explain their lifetime, scope, initial value and storage space. Also explain use of auto and register storage classes. **(10 Marks)**

b. Implement structure to read, write, compute average marks of n students. Display the names of students whose average is below 50 and above 50 marks. **(10 Marks)**

OR

10 a. What are preprocessor directives? Explain various types of preprocessor directives with example for each. **(10 Marks)**

b. What is pointer? Develop a program using pointers to compute the sum, mean and standard deviation of all elements stored in an array of N real number. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21EME15/25

First/Second Semester B.E. Degree Examination, June/July 2024
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. Use of Steam table is permitted.

Module-1

1 a. Discuss the emerging trends and technologies in Energy, Manufacturing, Aerospace, Automotive and Marine Sectors and their contribution to the GDP. **(10 Marks)**

b. Define the following terms:
i) Sensible heat ii) Latent heat of evaporation iii) Amount of superheat
iv) Degree of superheat v) Dryness fraction **(10 Marks)**

OR

2 a. Find the enthalpy of 1 kg of steam at 12 bar, when :
i) Steam is dry saturated ii) Steam is 22% wet iii) Superheated to 250°C
Assume specific heat of superheated steam as 2.25 kJ/kg °K (From steam tables, at 12 bar, $t_s = 188°C$, $h_f = 798.43$ kJ/kg , $h_{fg} = 1984.3$ kJ/kg) **(10 Marks)**

b. With a neat sketch explain the construction and working of a Nuclear Power Plant. **(10 Marks)**

Module-2

3 a. What is Kaplan turbine? With a neat sketch explain the construction and working of a Kaplan turbine. **(10 Marks)**

b. How are composites classified? Explain each one of them briefly. **(10 Marks)**

OR

4 a. Write short notes on :
i) Shape memory alloys ii) Piezoelectric materials **(10 Marks)**

b. With the help of a neat sketch explain the principle and process of electric arc welding. **(10 Marks)**

Module-3

5 a. Draw a schematic diagram of an IC engine and mention the functions of various parts. **(10 Marks)**

b. Write short notes on :
i) Electric vehicles ii) Hybrid vehicles **(10 Marks)**

OR

6 a. Differentiate between refrigeration and air conditioning. Briefly discuss the desirable properties of a good refrigerant. **(10 Marks)**

b. With a neat sketch explain the construction and working of a vapour compression refrigeration system. **(10 Marks)**

Module-4

7 a. Differentiate between the following :
   i) Spur gear and Bevel gear
   ii) Helical gear and Herringbone gear **(10 Marks)**

b. Derive velocity ratio for a compound gear train. **(05 Marks)**

c. A simple gear train consists of four gear wheels having 30, 40, 50 and 60 teeth respectively. Determine the speed and direction of the last gear, if the first gear makes 600 rpm in clockwise direction. **(05 Marks)**

OR

8 a. How are robots classified based on their physical configuration? Explain any two of them with neat functional sketches. **(10 Marks)**

b. The sum of diameters of two pulleys is 1000 mm and the pulleys are connected by a belt. If the pulleys rotate at 600 rpm and 1800 rpm, determine the diameter of each pulley. **(05 Marks)**

c. Differentiate between linear and oscillatory motion. Give one example for each. **(05 Marks)**

Module-5

9 a. Discuss the following Lathe operations with neat sketches:
   i) Facing
   ii) Knurling **(10 Marks)**

b. Briefly explain open loop and closed loop control systems with simple block diagrams. **(10 Marks)**

OR

10 a. With a neat sketch explain the construction and working of a vertical milling machine. **(10 Marks)**

b. Write short notes on :
   i) CNC machining center
   ii) CNC turning center. **(10 Marks)**

* * * * *

CBCS SCHEME

USN | | | | | | | | | | |

21CIV14/24

First/Second Semester B.E. Degree Examination, June/July 2024
Elements of Civil Engineering and Mechanics

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Discuss the role of a civil engineer in the development of a nation. **(08 Marks)**

b. Explain the importance of the following fields of civil engineering:
i) Structural engineering
ii) Environmental engineering
iii) Transportation engineering. **(12 Marks)**

OR

2 a. "Civil engineering is one of the basic needs of the society and nation". Justify the statement. **(08 Marks)**

b. Highlight the significance of the following streams of civil engineering:
i) Water resources and irrigation engineering
ii) Building materials
iii) Geotechnical engineering. **(12 Marks)**

Module-2

3 a. Explain with examples:
i) Resolution and composition of forces
ii) Moment and couple. **(06 Marks)**

b. Compute the magnitude and direction of the unknown force, if the resultant force of 72kN acts along the positive direction of Y axis as shown in Fig.Q.3(b). **(06 Marks)**

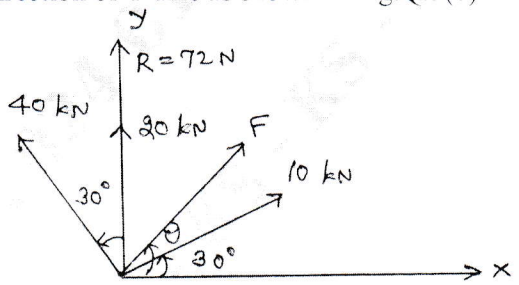

Fig.Q.3(b)

c. Calculate the force P required to cause impending motion in the system shown in Fig.Q.3(c). Assume smooth pulley and coefficient of friction for all contact surfaces as 0.20.

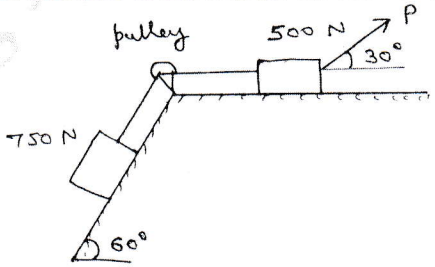

Fig.Q.3(c) **(08 Marks)**

OR

4 a. Explain with sketches:
i) Principle of transmissibility of a force
ii) Varignon's theorem of moments. **(06 Marks)**

b. Determine the magnitude, direction and the X-intercept of the resultant of the force system shown in Fig.Q.4(b) with respect to point A. **(06 Marks)**

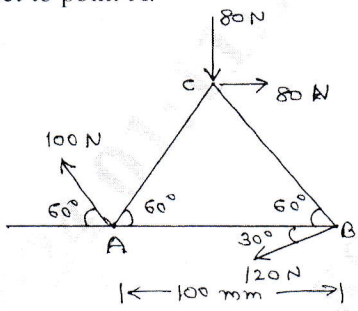

Fig.Q.4(b)

c. Define angle of limiting friction. Compute the value of θ required to move the 900N block down the plane as shown in Fig.Q.4(c). Take the coefficient of friction for all contact surfaces as 1/3. **(08 Marks)**

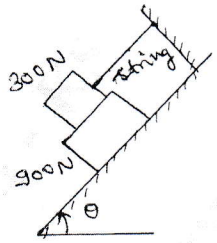

Fig.Q.4(c)

Module-3

5 a. State and prove "Parallel axis theorem". **(06 Marks)**

b. Derive the expression for locating the centroid of a semi-circular lamina from first principles. **(06 Marks)**

c. Determine the moment of inertia of the shaded area shown in Fig.Q.5(c) with respect to
i) Horizontal centroidal axis
ii) The base BC.
All dimensions given are in mms.

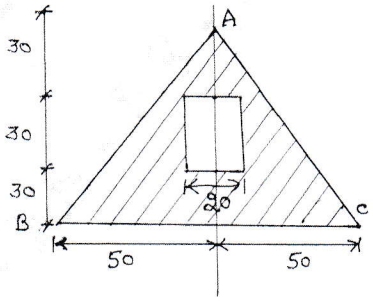

Fig.Q.5(c) **(08 Marks)**

OR

6 a. Define the following terms and give the relevant expressions:
i) Polar moment of inertia
ii) Radius of gyration
iii) Section modulus. **(06 Marks)**

b. Deduce the expression for the moment of inertia of a triangular lamina about its base. Hence, obtain the expression about the horizontal centroidal axis. **(06 Marks)**

c. Determine the centroid of the shaded area with reference to the axes shown in Fig.Q.6(c). All the dimensions are in mms.

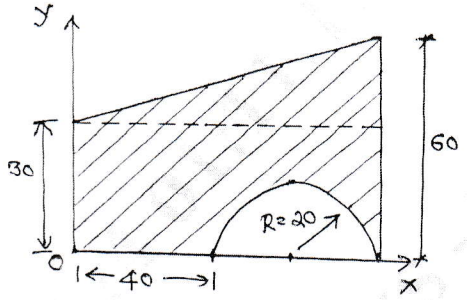

Fig.Q.6(c)

(08 Marks)

Module-4

7 a. Compute the support reactions of the beam shown in Fig.Q.7(a). **(10 Marks)**

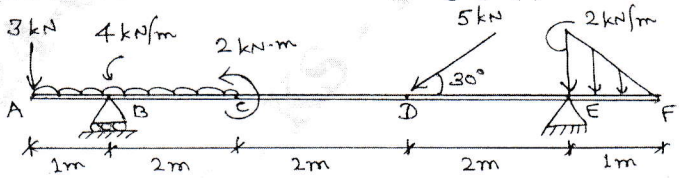

Fig.Q.7(a)

b. Determine the forces in the members of the truss shown in Fig.Q.7(b) by method of joints. Tabulate the results. **(10 Marks)**

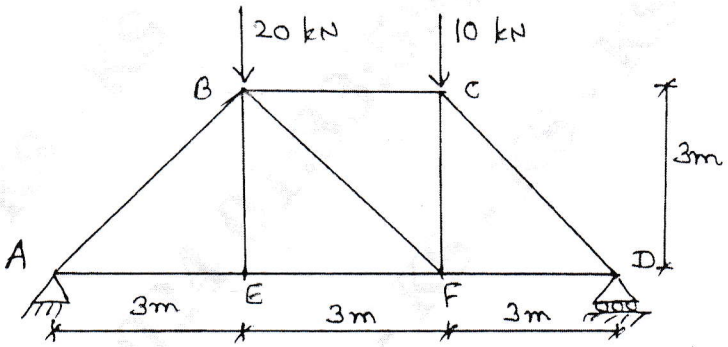

Fig.Q.7(b)

OR

8 a. Distinguish between hinged support and fixed support with sketches. **(04 Marks)**

b. Compute the support reactions in the beam shown in Fig.Q.8(b). **(06 Marks)**

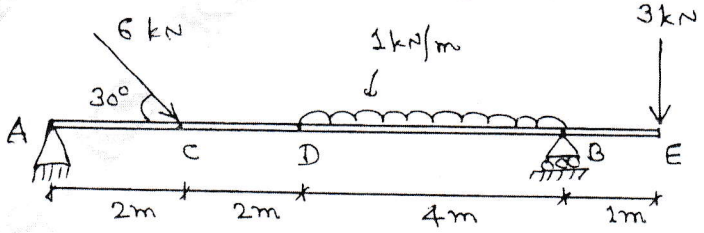

Fig.Q.8(b)

c. Determine the forces in the members GC, BC, DF, CD and EF of the truss shown in Fig.Q.8(c) by method of sections. **(10 Marks)**

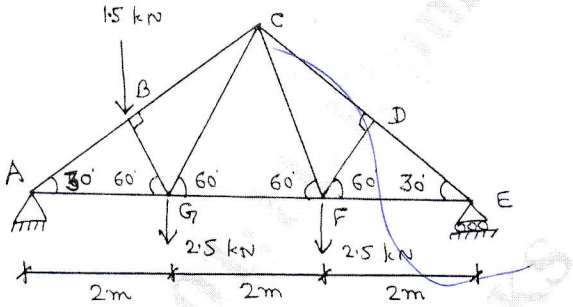

Fig.Q.8(c)

Module-5

9 a. With sketches, explain:
   i) Range and trajectory of a projectile.
   ii) Super elevation and its advantages. **(06 Marks)**

b. A motorist is travelling at 80kmph, when he observes a traffic light 200m ahead of him turns red. The traffic light is timed to stay red for 10 seconds. If the motorist wishes to pass the light without stopping, just as it turns green, determine:
   i) The required deceleration of the motor
   ii) The speed of the motor as it passes the light. **(06 Marks)**

c. Two weights 800N and 200N are connected by a string and they move along a rough horizontal plane under the action of a force of 400N applied as shown in Fig.Q.9(c). Taking the friction coefficient between the weights and the plane as 0.30, determine the acceleration of the weights and tension in the string by D'Alembert's principle. **(08 Marks)**

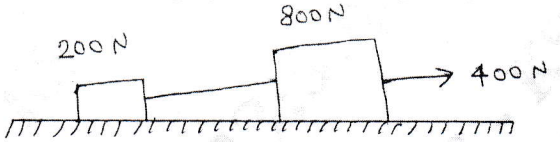

Fig.Q.9(c)

OR

10 a. Distinguish between :
   i) Instantaneous velocity and average velocity.
   ii) Constant acceleration and variable acceleration.
   iii) Rectilinear motion and curvilinear motion. **(06 Marks)**

b. The horizontal component of velocity of a projectile is twice the vertical component. Compute the range on the horizontal plane, if the projectile passes through a point 18m horizontally and 3m vertically above the point of projection. **(06 Marks)**

c. Two bodies weighing 300N and 450N are hung to the ends of a rope passing over a smooth pulley as shown in Fig.Q.10(c). Calculate the tension in the string and acceleration of the system by D'Alembert's principle. **(08 Marks)**

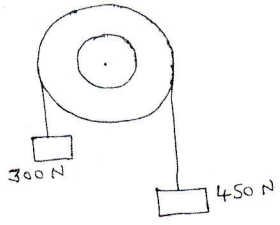

Fig.Q.10(c)

* * * * *