CBCS SCHEME

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18MAT11

First Semester B.E. Degree Examination, July/August 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. With usual notations prove that $\frac{1}{p^2}=\frac{1}{r^2}+\frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$. **(07 Marks)**

b. Find the angle of intersection of the curves $r = \sin\theta + \cos\theta$ and $r = 2\sin\theta$. **(06 Marks)**

c. Find the radius of curvature at any point on the curve $y^2=\frac{a^2(a-x)}{x}$. Where the curve meets x-axis. **(07 Marks)**

OR

2 a. Show that the pair of curves $r^n = a^n \cos n\theta$ and $r^n = b^n \sin n\theta$ intersect orthogonally. **(06 Marks)**

b. Find the pedal equation of the curve $r^m \cos m\theta = a^m$. **(06 Marks)**

c. Show that the evolute of the parabola $y^2 = 4ax$ is $27ay^2 = 4(x-2a)^3$. **(08 Marks)**

Module-2

3 a. Find the Maclaurin's series of Log (secx) upto the terms containing x^4. **(07 Marks)**

b. Evaluate $\lim_{x\to 0}\left[\frac{a^x+b^x+c^x+d^x}{4}\right]^{1/x}$. **(06 Marks)**

c. Find the extreme values of $f(x, y) = x^4 + y^4 - 2x^2 + 4xy - 2y^2$. **(07 Marks)**

OR

4 a. If $u = f(r, s, t)$ where $r=\frac{x}{y}$, $s=\frac{y}{z}$, $t=\frac{z}{x}$ prove that $x.\frac{\partial u}{\partial x}+y.\frac{\partial u}{\partial y}+z.\frac{\partial u}{\partial z}=0$. **(07 Marks)**

b. If x, y, z are the angles of a triangle, find the maximum values of cosxcosycosz. **(07 Marks)**

c. If $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$, $w = x + y + z$ find $J\left(\frac{uvw}{xyz}\right)$. **(06 Marks)**

Module-3

5 a. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)\,dxdydz$. **(07 Marks)**

b. Evaluate $\int_{0}^{4a}\int_{\frac{x^2}{4a}}^{2\sqrt{ax}} dydx$ by changing the order of integration. **(06 Marks)**

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

OR

6 a. Evaluate $\iint_R xydxdy$ over the positive quadrant of the circle $x^2 + y^2 = 4$. **(07 Marks)**

b. Find the volume of the region bounded by $z = x^2 + y^2$, $z = 0$, $x = -a$, $x = a$ and $y = -a$, $y = a$. **(06 Marks)**

c. Show that $\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \times \int_0^{\pi/2} \sqrt{\sin\theta}\, d\theta = \pi$. **(07 Marks)**

Module-4

7 a. Solve $(5x^4 + 3x^2y^2 - 2xy^3)dx + (2x^3y - 3x^2y^2 - 5y^4)\, dy = 0$. **(06 Marks)**

b. Solve $\frac{dy}{dx} + y\tan x = y^2 \sec x$. **(07 Marks)**

c. A body in air at 80°C cools down to 60°C in 20 minutes, the temperature of the air being 40°C what will be the temperature of the body after 40 min. **(07 Marks)**

OR

8 a. Solve $(5x^3 + 12x^2 + 6y^2)dx + 6xydy = 0$. **(07 Marks)**

b. Solve $xp^2 - yp + a = 0$. Also find its singular solution. **(06 Marks)**

c. Find the orthogonal trajectories of the family of curves $r = a(1-\cos\theta)$. **(07 Marks)**

Module-5

9 a. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 0 \\ 2 & 4 & 3 & 2 \\ 3 & 2 & 1 & 3 \\ 6 & 8 & 7 & 5 \end{bmatrix}$ using elementary row transformations. **(06 Marks)**

b. Find the largest eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ with initial vector $[1 \quad 0 \quad 0]^1$. Carry out 6 iterations. **(07 Marks)**

c. Solve the following system of equations by Gauss elimination method.
$2x - 3y + z = 9$, $x + y + z = 6$, $x - y + z = 2$. **(07 Marks)**

OR

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

b. Reduce the matrix $A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ into diagonal form. **(07 Marks)**

c. Solve the following system of equations by Gauss-Seidal method:
$20x + 2y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$ carry out 5 iterations. **(07 Marks)**

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18MAT21

Second Semester B.E. Degree Examination, July/August 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 directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1, -2, -1) in the direction of the vector $2i - j - 2k$. **(06 Marks)**

b. Find $\text{div}\,\vec{F}$ and $\text{curl}\,\vec{F}$ where $\vec{F} = \text{Grad}(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**

c. If $\vec{F} = 3x^2i + (2xz - y)j + zk$ find the work done in moving a particle along the curve, $x^2 = 4y$, $3x^3 = 8z$ from $x = 0$ to $x = 2$. **(07 Marks)**

OR

2 a. Find the values of a, b, c such that $\vec{F} = (axy + bz^3)i + (3x^2 - cz)j + (3xz^2 - y)k$ is a conservative force field. Hence find the scalar potential ϕ such that $\vec{F} = \nabla\phi$. **(06 Marks)**

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

c. Using Gauss divergence theorem evaluate $\iint_S \vec{F}.\hat{n}\,ds$ over the rectangular parallelopiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$ given that $\vec{F} = (x^2 - yz)i + (y^2 - zx)j + (z^2 - xy)k$. **(07 Marks)**

Module-2

3 a. Solve $(D-2)^2 y = 8(e^{2x} + \sin 2x)$. **(06 Marks)**

b. Solve $(D^2 + a^2)y = \sec ax$ by the method of variation of parameters. **(07 Marks)**

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

OR

4 a. Solve $(4D^4 - 8D^3 - 7D^2 + 11D + 6)y = 0$. **(06 Marks)**

b. Solve $(D^2 + 4)y = x^2 + e^{-x}$. **(07 Marks)**

c. Solve $(x+1)^2\frac{d^2y}{dx^2} + (x+1)\frac{dy}{dx} + y = 2\sin(\log(x+1))$. **(07 Marks)**

Module-3

5 a. Form the partial differential equation by eliminating the arbitrary function from $\phi(x+y+z, x^2+y^2-z^2)=0$. **(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 when y is an odd multiple of $\frac{\pi}{2}$. **(07 Marks)**

c. Derive one dimensional heat equation, $\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

OR

6 a. Form the partial differential equation by eliminating the arbitrary function from the equation, $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} + z = 0$ given that $x = 0,\ z = e^y,\ \frac{\partial z}{\partial x} = 1$. **(07 Marks)**

c. Find all the possible solutions of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$ using the method of separation of variables. **(07 Marks)**

Module-4

7 a. Test for convergence of the series,
$\sum_{n=1}^{\infty} \frac{3.6.9.....3n}{4.7.10.....(3n-1)} \cdot \frac{5^n}{(3n+2)}$. **(06 Marks)**

b. With usual notation prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(07 Marks)**

c. Express $2x^3 - x^2 - 3x + 2$ in terms of Legendre's polynomial. **(07 Marks)**

OR

8 a. Discuss the convergence of the series,
$\left(\frac{3}{4}\right)x + \left(\frac{4}{5}\right)^2 x^2 + \left(\frac{5}{6}\right)^3 x^3 + ...$ **(06 Marks)**

b. If α and β are two roots of $J_n(x) = 0$ then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

c. Express $x^4 + 3x^3 - x^2 + 5x - 2$ in terms of Legendre's polynomial. **(07 Marks)**

Module-5

9 a. Using Newton's forward difference formula find f(3) given that,

x	0	2	4	6	8	10
f(x)	0	4	56	204	496	980

(06 Marks)

b. Using Regula-Falsi method find the root of the equation, $xe^x = \cos x$ that lies between 0.4 and 0.6. Carryout 4 iterations. **(07 Marks)**

c. Use Weddle's rule to evaluate $\int_0^{\pi/2} \sqrt{\cos\theta}\, d\theta$ on dividing the interval $\left[0, \frac{\pi}{2}\right]$ into 6 equal parts. **(07 Marks)**

OR

10 a. Use Newton Raphson method to find a real root of the equation $x \sin x + \cos x = 0$ near $x = \pi$. Carryout iterations upto 4 decimal places of accuracy. **(06 Marks)**

b. If $y(0) = -12$, $y(1) = 0$, $y(3) = 6$, $y(4) = 12$ find Lagrange's interpolating polynomial and estimate y at x = 2. **(07 Marks)**

c. Using Simpson's $\frac{1}{3}^{rd}$ rule evaluate $\int_0^1 \frac{dx}{1+x^2}$ by taking $h = \frac{1}{6}$. **(07 Marks)**

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18CHE12/22

First/Second Semester B.E. Degree Examination, July/August 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. Define single electrode potential. Derive Nernst equation for single electrode potential. **(07 Marks)**

b. What are batteries? Explain the construction and working of Nickel – Metal hydride battery. Mention its applications. **(07 Marks)**

c. A galvanic cell consists of a rod of copper immersed in 10.0M solution of $CuSO_4$ and a rod of iron immersed in 0.1M solution of $FeSO_4$. Write the cell representation, cell reaction and calculate the emf of the cell. Given, $E^0_{Fe^{2+}/Fe} = -0.44V$ and $E^0_{Cu^{2+}/Cu} = 0.34V$. **(06 Marks)**

OR

2 a. What are reference electrodes? Describe the construction and working of calomel electrode. Mention its advantages. **(07 Marks)**

b. Explain primary, secondary and reserve batteries with an example. **(07 Marks)**

c. Define electrolyte concentration cell. Give an example. The emf of the cell $Ag(s)|Ag^+(0.01M)||Ag^+(xM)|Ag(s)$ is 0.0591V at 298K. Find the value of x. **(06 Marks)**

Module-2

3 a. Define metallic corrosion. Discuss the electrochemical theory of corrosion taking iron as an example. **(07 Marks)**

b. What is galvanizing? Explain the galvanizing of iron. **(07 Marks)**

c. What is electroplating? Explain the electroplating of hard chromium with reactions. **(06 Marks)**

OR

4 a. What is cathodic protection? Explain the impressed current and sacrificial anode methods of corrosion control. **(07 Marks)**

b. Define electroless plating. Discuss the electroless plating of copper with relevant reactions. **(07 Marks)**

c. What is metal finishing? Mention any FIVE technological importance of metal finishing. **(06 Marks)**

Module-3

5 a. Explain the experimental determination of calorific value of a solid fuel using Bomb calorimeter. **(07 Marks)**

b. What is biodiesel? How is it produced? Mention its advantages. **(07 Marks)**

c. What is knocking in IC engines? Explain the mechanism of knocking in petrol engine. **(06 Marks)**

OR

6 a. What are PV cells? Explain the construction and working of PV cell with neat diagram. **(07 Marks)**

b. Describe the construction and working of MeOH – O_2 fuel cell. Mention its applications. **(07 Marks)**

c. On burring 0.78g of a fuel in a bomb calorimeter, the temperature of 2600g of water was increased by 2.8K water equivalent of calorimeter is 400g. If the fuel contains 5% hydrogen, calculate its GCV and NCV. Given, specific heat of water = 4.187kJkg^{-1} K^{-1} and Latent heat of steam = 2454 kJ/kg. **(06 Marks)**

Module-4

7 a. Mention the sources, effects and discuss the control of oxides of sulphur pollution. **(07 Marks)**

b. What is boiler feed water? Explain the scale and sludge formation in boilers. Mention their ill effects. **(07 Marks)**

c. Define BOD and COD. In a COD test, 28.2cm^3 and 12.5cm^3 of 0.05N FAS solution is consumed for blank titration and sample titration respectively. The volume of waste water used is 25cm^3. Calculate the COD of the sample. **(06 Marks)**

OR

8 a. Mention the sources of solid wastes. Explain the scientific land filling method and composting method of solid waste disposal. **(07 Marks)**

b. What are the sources, ill effects and control of lead pollution? **(07 Marks)**

c. What is desalination of sea water? Describe the desalination of water by reverse osmosis process. **(06 Marks)**

Module-5

9 a. Write the principle and explain the instrumentation and any one application of conductometry. **(07 Marks)**

b. What are nano – materials? Explain the synthesis of nano-materials by chemical vapour deposition. **(07 Marks)**

c. Explain the theory and instrumentation of potentiometry. **(06 Marks)**

OR

10 a. Write a note on fullerenes sand carbon nanotubes. **(07 Marks)**

b. Discuss the synthesis of nanomaterials by sol-gel process. **(07 Marks)**

c. Discuss the theory and application of colorimetry in the estimation of concentration of copper in the given solution. **(06 Marks)**

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18PHY12/22

First/Second Semester B.E. Degree Examination, July/August 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 : $c = 3 \times 10^8$ m/s, $h = 6.625 \times 10^{-34}$ JS, $K = 1.38 \times 10^{-23}$ J/K, $N_A = 6.02 \times 10^{26}$/kmole, $m_e = 9.1 \times 10^{-31}$ kg, $e = 1.6 \times 10^{-19}$ C.***

Module-1

1 a. What are shock waves? Mention the characteristics of shock waves. **(06 Marks)**

b. Discuss theory of forced vibrations and hence obtain the expression for amplitude. **(10 Marks)**

c. A free particle is executing S.H.M in a straight line with a period of 25 sec, 5 sec after it has crossed the equilibrium point, the velocity is found to be 0.7 m/s. Find the displacement at the end of 10 sec, and also the amplitude of oscillation. **(04 Marks)**

OR

2 a. Derive the expression for equivalent force constant for 2 springs in series. What is an expression for period of its oscillation? **(06 Marks)**

b. Explain the construction and working of Reddy tube with a neat diagram. Mention any four applications of shock waves. **(10 Marks)**

c. A 20 gm oscillator with natural angular frequency 10 rad/sec is vibrating in damping medium. The damping force is proportional to the velocity of the vibrator. If the damping coefficient is 0.17, how does the oscillation decay? **(04 Marks)**

Module-2

3 a. State and explain Hooke's law with the help of stress-strain diagram. Define elastic limit. **(06 Marks)**

b. Define bending moment. Derive an expression for Young's modulus of single cantilever beam. **(09 Marks)**

c. An increment in length by 1 mm was observed in a gold wire of diameter 0.3 mm, when it was subjected to a longitudinal force of 2 Newtons and a twist of 0.1 radian was observed in the same wire when its one end was subjected to a torque of 7.9×10^{-7} Nm, while its other end was fixed. Calculate the value of Poisson's ratio of gold. **(05 Marks)**

OR

4 a. Derive the relation between K, Y and σ where the symbols have their usual meaning. **(07 Marks)**

b. Derive the expression for couple per unit twist of a solid cylinder. **(10 Marks)**

c. Calculate the Poisson's ratio for silver given Young's modulus is 7.25×10^{10} N/m^2 and bulk modulus is 11×10^{10} N/m^2. **(03 Marks)**

Module-3

5 a. Describe the concept of divergence. What is the physical significance? Derive Gauss divergence theorem. **(09 Marks)**

b. With neat diagrams, explain different types of optical fibers. **(07 Marks)**

c. Find the divergence of the vector field $\vec{A}$ given $\vec{A} = 6x^2\hat{a}_x + 3xy^2\hat{a}_y + xyz^3\hat{a}_z$ at a point P(1, 3, 6) **(04 Marks)**

OR

6 a. What is displacement current? Derive an expression for displacement current. **(06 Marks)**

b. Explain the terms:
(i) Total internal reflection
(ii) Acceptance angle
(iii) Numerical aperture.
Obtain an expression for numerical aperture. **(09 Marks)**

c. The attenuation in an optical fiber is 3.6 dB/km. What fraction of its initial intensity remains after (i) 1 km (ii) 2 km (iii) 3 km? **(05 Marks)**

Module-4

7 a. Setup one dimensional time independent Schrodinger wave equation. **(08 Marks)**

b. Derive an expression for energy density using Eeinstein's coefficients. **(08 Marks)**

c. A spectral line of wavelength 5461 $\mathring{A}$ has a width of 10^{-4} $\mathring{A}$. Evaluate the minimum time spent by the electrons in the upper energy state. **(04 Marks)**

OR

8 a. With a proper energy level diagram, explain the construction and working of semiconductor laser. Write a short note on laser range finder. **(10 Marks)**

b. Explain the four properties of wave function. **(06 Marks)**

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

Module-5

9 a. Give the assumptions of quantum free electron theory and hence obtain an expression for the Fermi energy of 0 K. **(10 Marks)**

b. What are dielectrics? Derive Clausius-Mossotti equation. **(06 Marks)**

c. The conductivity and Hall coefficient of an n-type semiconductor are 112/Ωm and 1.25×10^{-3} m^3/c respectively. Calculate the charge carrier concentration and electron mobility. **(04 Marks)**

OR

10 a. Describe Fermi level in intrinsic semiconductor and hence obtain an expression for Fermi energy interms of energy gap of intrinsic semiconductor. **(08 Marks)**

b. What is Hall effect? Obtain an expression for charge density and Hall voltage interms of Hall coefficient. **(08 Marks)**

c. An elemental solid dielectric material has polarizability 7×10^{-40} Fm^2. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material if the material has 3×10^{28} atoms/m^3. **(04 Marks)**

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CBCS SCHEME

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18CPS13/23

First/Second Semester B.E. Degree Examination, July/August 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 basic structure of 'C' program and explain its different sections. **(08 Marks)**

b. Describe the various types of computers. **(06 Marks)**

c. Define a token. Explain the different tokens available in C language. **(06 Marks)**

OR

2 a. Define a variable. Explain the rules for constructing variables in 'C' language? Give example for valid and invalid variables. **(08 Marks)**

b. What is a data type? Explain all the basic data types available in C language with example. **(08 Marks)**

c. List all the operators used in C language and evaluate following expressions:

(i) $x = a - b/3 - c * 2 - 1$ when $a = 9, b = 12, c = 3$

(ii) $10! = 10 \mid\mid 5 < 4 \;\&\&\; 8$ **(04 Marks)**

Module-2

3 a. What are formatted and unformatted I/O functions? Explain them with syntax. **(08 Marks)**

b. Write a 'C' program to find area and circumference of a circle. **(06 Marks)**

c. What is looping? Explain for ( ) loop with syntax and example. **(06 Marks)**

OR

4 a. What is branching? List and explain all the branching statements with syntax. **(10 Marks)**

b. Write a C program to compute roots of a quadratic equations for non-zero coefficients of a, b and c. **(06 Marks)**

c. Bring out differences between while ( ) loop and do... while ( ) loop. **(04 Marks)**

Module-3

5 a. What is an array? Explain how 1D and 2D arrays are declared and initialized? **(08 Marks)**

b. Write a program to sort a given array of integers in ascending order using Bubble sort technique. **(08 Marks)**

c. Explain the declaration and initialization of string variables. **(04 Marks)**

OR

6 a. Define a string. List all the string manipulation functions. Explain any 4 with examples. **(10 Marks)**

b. Write C programs for,

(i) Linear search.

(ii) Binary search.

(Consider Integer data as input) **(10 Marks)**

Module-4

7 a. What are user defined functions? List and explain all the categories of user defined functions based on return type and parameters. **(10 Marks)**
b. Write a program to find factorial of a number using function. **(05 Marks)**
c. Write a program to find GCD and LCM of two integer numbers using functions. **(05 Marks)**

OR

8 a. Explain Pass by value and pass by reference with syntax and examples for each. **(10 Marks)**
b. What is recursion? What are the elements for recursion? Explain. **(05 Marks)**
c. Write a C recursive program to compute the Fibonacci series upto n terms. **(05 Marks)**

Module-5

9 a. Define a structure. Explain the syntax of structure declaration in C with example. **(06 Marks)**
b. List and explain types of structures with their syntax. **(06 Marks)**
c. Write a C program to implement structures to read, write and compute average marks and the students scoring above and below average marks for class of N students. **(08 Marks)**

OR

10 a. What is a Pointer? Show how pointer variables are declared and initialized? List advantages and disadvantages of pointers. **(08 Marks)**
b. What is preprocessor directive? Explain any two preprocessor directives in C. **(06 Marks)**
c. Write a C program to swap contents of two variables using pointer technique. **(06 Marks)**

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CBCS SCHEME

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18ELE13/23

First/Second Semester B.E. Degree Examination, July/August 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 Kirchoff's laws. **(06 Marks)**

b. A 10Ω resistance is connected in series with a parallel combination of 15Ω and 20Ω resistors. The circuit is applied with V volts. The power taken by the circuits is 150 watts. Solve for the total current through the circuit and power consumed in all resistors. **(06 Marks)**

c. Derive the Rms and average values of a sinusoidal AC waveform and hence obtain the values of form factor and peak factor. **(08 Marks)**

OR

2 a. State and explain OHM's law and list out its limitations. **(05 Marks)**

b. An alternating current i is given by i = 100sin 314t. Find i) The amplitude ii) Frequency iii) Time period iv) Rms value v) Average value vi) Form factor vii) Peak factor. **(07 Marks)**

c. In Fig Q2(c), find the voltage across 4Ω resistor and the supply voltage V.

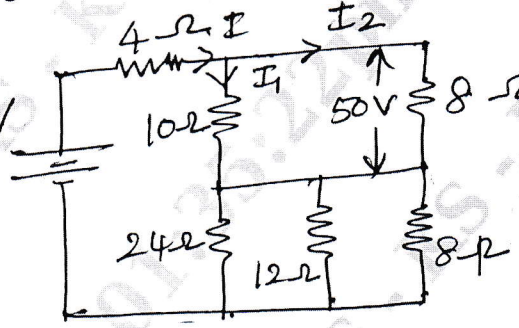

Fig Q2(c) **(08 Marks)**

Module-2

3 a. Show that power consumed in a pure capacitor is zero when a sinusoidal voltage is applied across it. Draw the voltage, current and power wave forms. **(06 Marks)**

b. A series R – L – C circuit with 100Ω, 25μF and 0.15H is connected across 220V, 50Hz supply. Calculate i) Impedance ii) Current iii) Power consumed iv) power factor of the circuit. **(08 Marks)**

c. Obtain the relationship between the line and phase quantities in a three phase balanced star connected system. Also derive the power equation. **(06 Marks)**

OR

4 a. Derive the equation for the current and the power consumed in a series R-C circuit when a sinusoidal voltage is applied across it. Also draw the waveforms of voltage current and power, and relevant phasor diagrams. **(08 Marks)**

b. Show that two wattmeters are sufficient to measure three phase power consumed in a 3-phase load, using relevant phasor diagram. Also derive the expression for the power factor. **(06 Marks)**

c. A parallel circuit consists of 20Ω in series with an inductive reactance of 15Ω in one branch and a resistance of 30Ω in series with a capacitive reactance of 20Ω in the other branch. Determine the current and power dissipated in each branch if the total current drawn is $10\angle -30^\circ$ Amps. **(06 Marks)**

Module-3

5 a. Derive the EMF equation of a single phase transformer. **(06 Marks)**

b. With a neat sketch, illustrate 2 way and three way control of lamps. **(08 Marks)**

c. A single phase, 25 KVA transformer has 1000 primary turns and 2500 secondary turns. The net cross – sectional area of the core is $100cm^2$,when the primary winding is connected to 550V, 50Hz supply, calculate :

i) The maximum value of flux density in the core
ii) The voltage induced in the secondary winding
iii) The primary and secondary full load currents
iv) Voltage induced per turn on primary and secondary. **(06 Marks)**

OR

6 a. Develop an expression for the efficiency of a transformer and hence obtain the condition for the maximum efficiency. **(06 Marks)**

b. In a 100KVA, 2000/200V single phase transformer, the iron and full load copper losses are 960watts and 1200watts respectively. Calculate the efficiency at i) full load, upf ii) half full load, 0.8pf iii) The load KVA corresponding to the maximum efficiency. **(06 Marks)**

c. What is earthing? With a neat figure, explain plate and pipe earthing. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the construction of a dc generator, and state the function of each part. **(08 Marks)**

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

c. An 8 pole lap connected armature has 960 conductors, a flux of 40mwb/pole and a speed of 400rpm. Calculate the emf generated. If the armature were wave connected, at what speed must it be driven to generate 400V? **(06 Marks)**

OR

8 a. Develop the emf equation of a DC generator. **(06 Marks)**

b. Sketch the torque Vs I_a characteristics and speed Vs I_a characteristics of dc shunt motor and dc series motor and explain. **(08 Marks)**

c. A 4 pole DC shunt motor takes 22A from 220V supply. The armature and field resistances are 0.5Ω and 100Ω respectively. The armature is lap connected with 300 conductors. If the flux per pole is 20mwb, calculate the speed and gross torque. **(06 Marks)**

Module-5

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

b. Explain how stationary armature is advantageous in case of an alternator. **(05 Marks)**

c. A 16 pole, 3 phase alternator has star connected winding with 144 slots and 10 conductors /slot. The flux per pole is 0.03wb and the speed is 375rpm. Find the frequency and line emf generated. Given : $K_d = 0.96$, $K_p = 1$. **(07 Marks)**

OR

10 a. Derive the Emf equation of a synchronous, generator, with K_p and K_d. **(08 Marks)**

b. Define the slip of an induction motor and derive the expression for frequency of rotor current. **(06 Marks)**

c. A 6 pole induction motor is supplied form a 3ϕ, 50Hz supply has a rotor frequency of 2.3Hz. Solve for the percentage slip and the speed of the motor. **(06 Marks)**

CBCS SCHEME

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18ELN14/24

First/Second Semester B.E. Degree Examination, July/August 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 diode characteristics under forward and reverse biased condition with neat diagram. **(06 Marks)**

b. What is a voltage regulator? Explain with a neat diagram the working of a zener voltage regulator. **(06 Marks)**

c. With a neat diagram and waveforms, explain the working of a bridge rectifier. Derive the efficiency of this rectifier. **(08 Marks)**

OR

2 a. Explain the working of a centre tap full wave rectifier, with a neat diagram and waveform. Derive the ripple factor for it. **(08 Marks)**

b. What is an LED? Explain the working of an LED, with a neat diagram. **(06 Marks)**

c. In the zener voltage regulator, $V_Z = 10V$, $R_S = 1\ K\Omega$, $R_L = 2\ K\Omega$. If the input voltage V_i is varied from 22 V to 40 V, find the maximum and minimum value of zener current. [Refer Fig.Q2(c)]

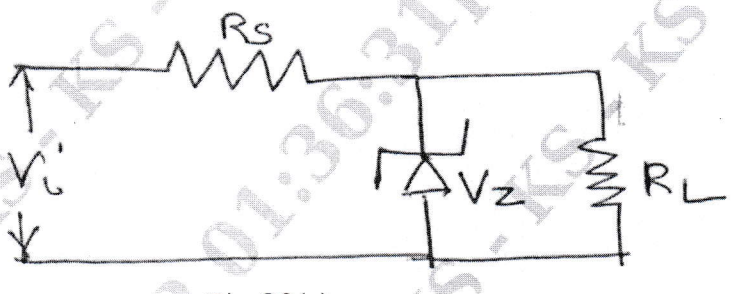

Fig.Q2(c) **(06 Marks)**

Module-2

3 a. With a neat graph for the drain characteristics of an N channel JFET, explain the following:
(i) Cut-off voltage (ii) ohmic region
(iii) Pinch off voltage (iv) Break-down **(08 Marks)**

b. What is commutation? Explain one method of commutation of an SCR with neat diagram. **(06 Marks)**

c. For an n channel JFET, $I_{DSS} = 9$ mA and $V_{GS(off)} = -8$ V (maxm), using these values determine the drain current for VGS = 0V; –1 V, and –4 V. **(06 Marks)**

OR

4 a. With neat circuit diagrams, explain the construction and operation of an enhancement type MOSFET. **(08 Marks)**

b. How is CMOS used as an inverter? Explain with neat diagram. **(06 Marks)**

c. Explain the switching action of an SCR using two transistor model. **(06 Marks)**

Module-3

5 a. With neat diagrams and explanation analyze a differential input op-amp amplifier. **(06 Marks)**

b. With respect to an op-amp, explain the following and give their ideal values:
(i) CMRR
(ii) PSRR
(iii) Input offset voltage
(iv) Input offset current **(08 Marks)**

c. With relevant diagram and derivation show how an op-amp can be used as inverting summing amplifier (Adder). **(06 Marks)**

OR

6 a. Explain how an op-amp can be used as a difference amplifier with neat diagram. **(08 Marks)**

b. For the circuit of the inverting amplifier shown in Fig.Q6(b), calculate the following:
(i) Closed loop gain A_f (ii) Output voltage V_0
(iii) Input current I_1 (iv) Feedback current I_f

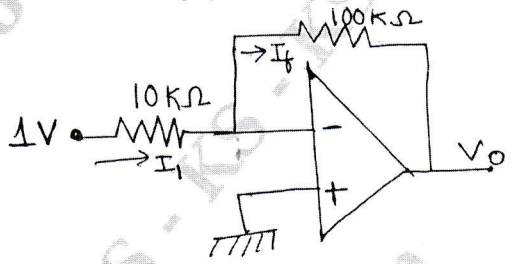

Fig.Q6(b) **(06 Marks)**

c. For the circuit Fig.Q6(c), calculate the output voltage of V_{01} and V_{02}.

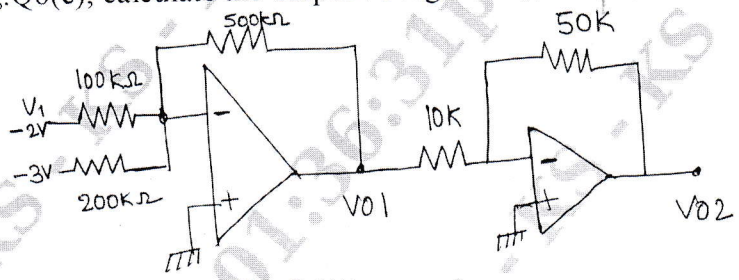

Fig.Q6(c) **(06 Marks)**

Module-4

7 a. How does a transistor voltage amplifier work? Explain and also derive the equation for voltage gain. **(08 Marks)**

b. With relevant diagrams and equations, explain the concept of positive and negative feedback amplifier concept. **(06 Marks)**

c. Determine the voltage gain and the ac output voltage if r'e = 50 Ω for the circuit shown in Fig.Q7(c). What value of R_C will get a voltage gain of 50?

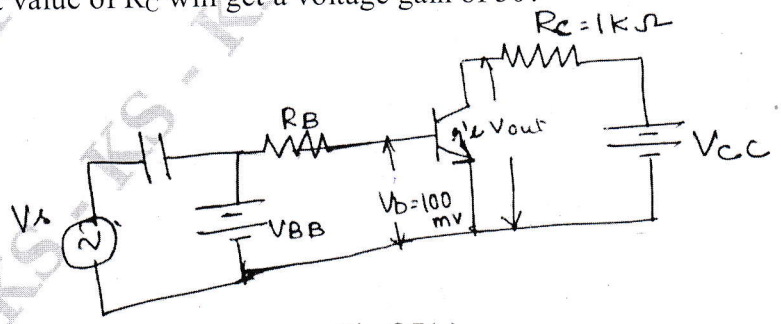

Fig.Q7(c) **(06 Marks)**

OR

8 a. How does a transistor function like a switch? Explain with relevant diagrams. **(06 Marks)**

b. With a neat circuit diagram, explain RC phase shift oscillator. Write the equation for the frequency of oscillation. **(08 Marks)**

c. With relevant diagram, explain the internal block diagram of IC 555 Timer. **(06 Marks)**

Module-5

9 a. Realize a full adder using two half adders. Derive the expression for sum and carry. **(08 Marks)**

b. Convert the following as indicated:

(i) $(F\ A\ C\ E)_{16} = (\quad)_2$

(ii) $(1001101)_2 = (\quad)_8$

(iii) $(126)_8 = (\quad)_{10}$

(iv) $(1689)_{10} = (\quad)_{16}$ **(08 Marks)**

c. Subtract 11010 from 10111 using 2's complement method. **(04 Marks)**

OR

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

b. Explain the working of a RS latch with neat diagram and function table. **(06 Marks)**

c. Prove the following identities using truth table:

(i) $\overline{A \cdot B} = \overline{A} + \overline{B}$

(ii) $A \cdot (A + B) = A$ **(06 Marks)**

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CBCS SCHEME

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18CIV14/24

First/Second Semester B.E. Degree Examination, July/August 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. ***Missing data, if any, may be suitably assumed.***

Module-1

1 a. Explain the role of Civil Engineering in the infrastructure development of the Country. **(08 Marks)**

b. State the scope of Civil Engineering in : i) Structural Engineering ii) Geotechnical Engineering iii) Transportation Engineering. **(06 Marks)**

c. State and explain Basic Idealization of Mechanics. **(06 Marks)**

OR

2 a. State and explain the effect of Infrastructural facilities on Social – Economic development of a Country. **(08 Marks)**

b. State and explain Parallelogram Law of Forces. **(04 Marks)**

c. Determine the Resultant force and Position of Resultant force with respect to Point 'O' of the plate shown in Fig. Q2(c) for the system of forces. **(08 Marks)**

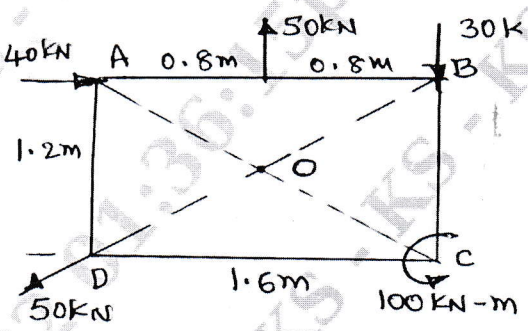


Fig. Q 2(c)

Module-2

3 a. State and explain Lami's theorem. **(04 Marks)**

b. State the Laws of Dry Friction. **(04 Marks)**

c. Find tension in string if the system is in Equilibrium shown in Fig. Q3(c). **(12 Marks)**

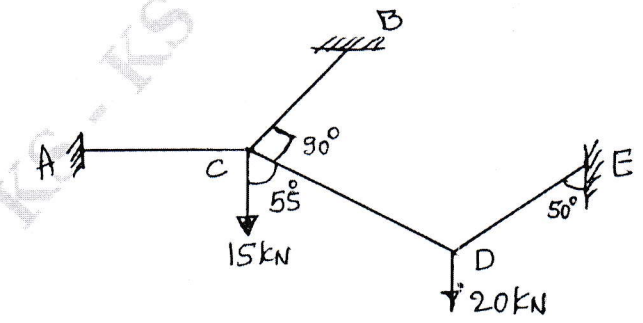


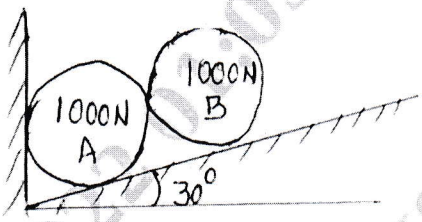
Fig. Q 3(c)

OR

4 a. Define i) Coefficient of friction ii) Angle of friction. **(04 Marks)**

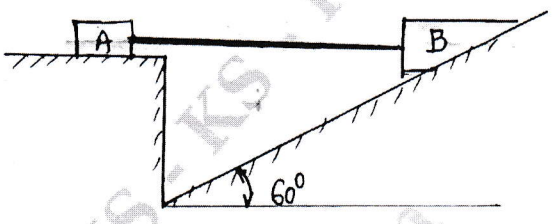
b. Find Contact Pressure at surfaces of contact for the system shown in Fig. Q4(b) for two identical cylinders. **(06 Marks)**

Fig. Q 4(b)



c. Two Blocks A and B are connected by a horizontal rod and are supported on two rough planes as shown in Fig. Q4(c). The coefficient of friction of block A is 0.25 and for block B is 0.35. Find smallest weight of block A for which equilibrium can exit. If the weight of block B is 1500N. **(10 Marks)**

Fig. Q 4(c)



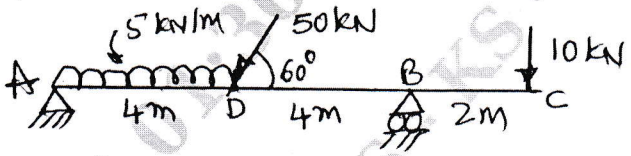
Module-3

5 a. State and explain different types of loads with neat sketches. **(06 Marks)**

b. State the assumptions made in truss analysis. **(04 Marks)**

c. Determine the support reactions of the overhanging beam shown in Fig. Q5(c). **(10 Marks)**

Fig. Q 5(c)



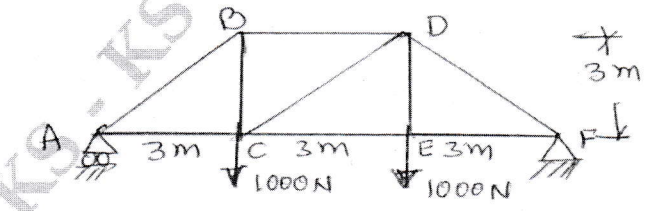
OR

6 a. Distinguish between Statically determinate and Indeterminate beams with examples. **(06 Marks)**

b. State and explain different types of supports with neat sketches. **(06 Marks)**

c. Determine the forces in members of the truss shown in Fig. Q6(c) by using method of Joints. **(08 Marks)**

Fig. Q 6(c)



Module-4

7 a. Define Moment of Inertia , Centroid , Centre of Gravity , Radius of Gyration and Polar Moment of Inertia. **(05 Marks)**

b. State and Prove Parallel Axis theorem. **(05 Marks)**

c. Determine the Centroid of shaded area shown in Fig. Q7(c), with respect to 'O'. **(10 Marks)**

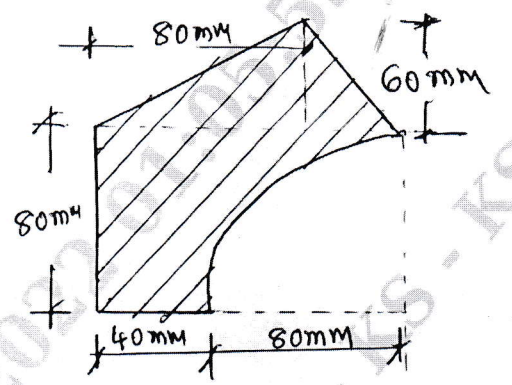


Fig. Q 7(c)

OR

8 a. Determine the Centroid of Semicircle about Horizontal diametrical axis. **(05 Marks)**

b. Determine the Moment of Inertia of Triangle about axis passing through Base. **(05 Marks)**

c. Find Radius of Gyration of the area shown in Fig. Q8(c) about Centroidal X - axis. **(10 Marks)**

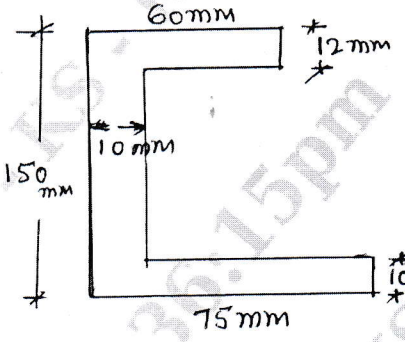


Fig. Q 8(c)

Module-5

9 a. Define : i) Displacement ii) Velocity iii) Acceleration iv) Retardation v) Path. **(05 Marks)**

b. State Newton's laws of Motion. **(03 Marks)**

c. A bullet fired upwards at an angle of 30° to the horizontal from top of hill of height 80m and bullet strikes the ground which is 80m lower than the point of protection if the initial velocity of bullet is 100m/sec.
Find i) Maximum height the bullet rise above the point of projection.
ii) The velocity with which it strikes the ground.
iii) Time of flight of bullet. **(12 Marks)**

OR

10 a. Define : i) Trajectory ii) Time of flight iii) Range. **(03 Marks)**

b. Define Super elevation and state the importance of super elevation. **(05 Marks)**

c. A body falling freely under the action of gravity passes two points 20m apart vertically in 0.4 seconds. From what height above the higher point the body starts to fall.
Take g = 9.8 m/sec^2. **(12 Marks)**

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CBCS SCHEME

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18ME15/25

First/Second Semester B.E. Degree Examination, July/August 2022
Elements of Mechanical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain renewable and non-renewable energy sources with suitable examples. **(06 Marks)**

b. Sketch and explain the working principle of flat-plate collector. **(10 Marks)**

c. What are the differences between fossil fuels and bio-fuels? **(04 Marks)**

OR

2 a. Define Zeroth law, First law and Second law of thermodynamics. **(06 Marks)**

b. With a neat sketch, explain the process of formation of steam. **(06 Marks)**

c. Find the enthalpy and specific volume of 1 kg of steam at 8 bar. The dryness fraction is 0.9, superheated steam temperature is 300°C and the specific heat of the steam is 2.25 kJ/kg°K. Assume T_S = 170.4 °C, V_S = 0.2403 m^3/kg, V_f = 0.001115 m^3/kg, h_f = 720.94 kJ/kg, h_{fg} = 2046.5 kJ/kg, h_g = 2767.5 kJ/kg. **(08 Marks)**

Module-2

3 a. With a neat sketch, explain the construction and working of Babcock and Wilcox boiler. **(12 Marks)**

b. List the boiler mountings and accessories by mentioning their functions. **(08 Marks)**

OR

4 a. Sketch and explain the working principle of Pelton wheel turbine. **(08 Marks)**

b. Explain the working principle of centrifugal pump. **(08 Marks)**

c. What is cavitation? Briefly explain. **(04 Marks)**

Module-3

5 a. Give the broad classification of I.C. engines and with a neat sketch, explain the various parts of an I.C. engine. **(12 Marks)**

b. 4-stroke diesel engine has a Piston diameter of 250 mm, stroke length of 400 mm, mean effective pressure is 4 bar, dia of brake drum is 1m and speed is 500 rpm. Calculate the IP, BP and FP by assuming an effective brake load of 400 N. **(08 Marks)**

OR

6 a. List the important properties of a good refrigerant. **(04 Marks)**

b. Sketch and explain the working principle of vapour compression refrigeration system. **(10 Marks)**

c. Explain the working principle of air-conditioner. **(06 Marks)**

Module-4

7 a. Classify ferrous and non-ferrous materials and list the application of it. **(05 Marks)**

b. What is a composite material and classify the various composite materials? **(05 Marks)**

c. Explain TIG and MIG welding. **(10 Marks)**

OR

8 a. Derive the expression for a length of a belt for a open belt drive. (10 Marks)
b. List the advantages of gear drives over belt drives. (04 Marks)
c. A gear wheel of 20 teeth drives another gear having 36 teeth running at 200 rpm. Calculate the speed of driving wheel and velocity ratio. (06 Marks)

Module-5

9 a. Explain any three lathe operations with simple sketch. (06 Marks)
b. Sketch and explain taper turning by Tailstock offset method. (06 Marks)
c. Explain the construction and working of vertical milling machine. (08 Marks)

OR

10 a. Sketch and explain the components of a CNC machine. (08 Marks)
b. List the advantages of CNC machines over conventional machines. (04 Marks)
c. List and explain any one type of robot configuration system. (08 Marks)

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