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17MAT11

First Semester B.E. Degree Examination, Jan./Feb. 2021
Engineering Mathematics – I

Time: 3 hrs. Max. Marks: 100

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

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-1

1 a. Find the n^{th} derivative of $\dfrac{x}{(x-1)(2x+3)}$ **(06 Marks)**

b. Find the angle of intersection of the curves $r = \dfrac{a}{1+\cos\theta}$ and $r = \dfrac{b}{1-\cos\theta}$. **(07 Marks)**

c. Find the radius of curvature of the curve $x^4 + y^4 = 2$ at the point (1, 1). **(07 Marks)**

OR

2 a. If $y = e^{a\sin^{-1}x}$ prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - (n^2+a^2)y_n = 0$. **(06 Marks)**

b. Find the pedal equation of $r^2 = a^2 \sec 2\theta$. **(07 Marks)**

c. Find the radius of curvature of the curve $r^n = a^n \sin n\theta$. **(07 Marks)**

Module-2

3 a. Obtain the Taylor's expansion of $\tan x$ about $x = \dfrac{\pi}{4}$ upto third degree terms. **(06 Marks)**

b. Evaluate $\underset{x\to 0}{\text{Lt}} \left(\dfrac{2^x + 3^x + 4^x}{3}\right)^{1/x}$ **(07 Marks)**

c. If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$ show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$ **(07 Marks)**

OR

4 a. If $u = \sin^{-1}\left(\dfrac{x^2y^2}{x+y}\right)$ then show that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} = 3\tan u$. **(06 Marks)**

b. Obtain the Maclaurin's expansion of $\log(\sec x)$ upto fourth degree terms. **(07 Marks)**

c. If $x + y + z = u$, $y + z = v$, $z = uvw$ find the Jacobian $J\left(\dfrac{x, y, z}{u, v, w}\right)$ **(07 Marks)**

Module-3

5 a. If $\phi = x^2 + y^2 + z^2$, $\vec{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$ then find grad ϕ, div $\vec{F}$ and curl $\vec{F}$. **(06 Marks)**

b. A particle moves on the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is the time. Find the components of velocity and acceleration at $t = 1$ in the direction of the vector $i - 3j + 2k$. **(07 Marks)**

c. Prove that $\text{curl}(\phi\vec{A}) = \phi\,\text{curl}\vec{A} + (\text{grad}\phi \times \vec{A})$ **(07 Marks)**

OR

6 a. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $x^2 + y^2 - z = 3$ at (2, −1, 2) **(06 Marks)**

b. Show that the vector field $\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ is irrotational and find ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

c. Prove that $\text{div}(\phi\vec{A}) = \phi\,\text{div}\,\vec{A} + (\text{grad}\phi \cdot \vec{A})$ **(07 Marks)**

Module-4

7 a. Obtain the reduction formula for

$$\int_0^{\pi/2} \cos^n x\, dx$$ **(06 Marks)**

b. Solve $\frac{dy}{dx} = xy^3 - xy$ **(07 Marks)**

c. A body originally 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 minutes from the original? **(07 Marks)**

OR

8 a. Evaluate $\int_0^{2a} \frac{x^2}{\sqrt{2ax - x^2}} dx$ **(06 Marks)**

b. Solve $(x^2 + y^2 + x)dx + xy\,dy = 0$ **(07 Marks)**

c. Obtain the orthogonal trajectories of the family of curves $r^n = a \sin n\theta$. **(07 Marks)**

Module-5

9 a. Find the rank of the matrix

$$A = \begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$$ **(06 Marks)**

b. Diagonalize the matrix $\begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$ **(07 Marks)**

c. Using Rayleigh's power method find the largest eigen value and the corresponding eigen vector of the matrix

$$A = \begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ taking $(1\ 1\ 1)^T$ as the initial eigen vector. **(07 Marks)**

OR

10 a. Using Gauss-Siedel method, solve

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3y + 20z = 25$$

using (0, 0, 0) as the initial approximation to the solution. **(06 Marks)**

b. Show that the linear transformation $y_1 = 2x_1 + x_2 + x_3$, $y_2 = x_1 + x_2 + 2x_3$, $y_3 = x_1 - 2x_3$ is regular and find the inverse transformation. **(07 Marks)**

c. Reduce the quadratic form $8x^2 + 7y^2 + 3z^2 - 12xy + 4xz - 8yz$ into the canonical form. **(07 Marks)**

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17PHY12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
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, $h = 6.63 \times 10^{-34}$ JS
Mass of electron, $m_e = 9.1 \times 10^{-31}$ kg
Charge on electron, $e = 1.6 \times 10^{-19}$ C
Boltzmann constant = 1.38×10^{-23} JK^{-1}
Avagadro number = 6.02×10^{26}/kmol

Module-1

1 a. What is ultra violet catastrophe? Deduce Planck's law of radiation to Wien's law and Rayleigh Jeans law. **(06 Marks)**

b. State Heisenberg's uncertainty principle. Prove that electron cannot exist inside the nucleus. **(06 Marks)**

c. Explain the physical significance of wave function. **(04 Marks)**

d. Calculate the momentum of an electron and the de Broglie wavelength associated with it if its kinetic energy is 1.5 KeV. **(04 Marks)**

OR

2 a. Derive the expression for time independent one dimensional Schrodinger wave equation. **(06 Marks)**

b. Define group velocity and phase velocity. Arrive at the relation between group velocity and phase velocity. **(06 Marks)**

c. Explain Compton effect and its physical significance. **(04 Marks)**

d. An electron is confined in a one dimensional infinite potential well of width 2 Å. Calculate its energy in ground and first excited state. **(04 Marks)**

Module-2

3 a. State law of mass action. Obtain an expression for electrical conductivity of intrinsic semiconductors. **(06 Marks)**

b. What is Fermi Energy? Explain the variation of Fermi factor with temperature and energy. **(07 Marks)**

c. What is critical field? Discuss temperature dependence of critical field in superconductors. **(03 Marks)**

d. Calculate the relaxation time of conduction electrons in a metal of resistivity 1.54×10^{-8} Ω-m if the metal has 5.8×10^{28} conduction electrons per m^3. **(04 Marks)**

OR

4 a. What are superconductors? Explain the BCS theory of Superconductivity. **(06 Marks)**

b. Discuss the failures of classical free electron theory. **(06 Marks)**

c. Explain MAGLEV vehicles. **(04 Marks)**

d. The electron concentration in an n-type semiconductor is $5 \times 10^{17}/m^3$. Calculate the conductivity of the material if the drift velocity of electron is 350 m/s in an electric field of 1000 V/m. **(04 Marks)**

Module-3

5 a. Describe the construction of semiconductor diode laser and explain its working. **(06 Marks)**

b. Discuss point to point communication with neat block diagram. **(04 Marks)**

c. Explain three different types of losses in optical fiber. **(06 Marks)**

d. A laser operating at 632.8 nm emits 3.182×10^{16} photons per second. Calculate the output power of the laser. If the input power is 100 Watt, calculate the percentage power converted into coherent light energy. **(04 Marks)**

OR

6 a. Obtain an expression for numerical aperture of an optical fibre and arrive at the condition for propagation of a signal in an optical fibre. **(06 Marks)**

b. What is Holography? Explain the recording and reconstruction of hologram with suitable ray diagram. **(07 Marks)**

c. Explain LIDAR used in the measurement of pollutants in the atmosphere. **(03 Marks)**

d. Calculate the attenuation in an Optical fibre of length 500 m, when a light of signal of power 100 mW emerges out of the fiber with a power 90 mW. **(04 Marks)**

Module-4

7 a. What are Miller indices? Derive an expression for interplanar distance interms of Miller indices. **(05 Marks)**

b. Explain in brief the seven crystal systems with lattice parameters and necessary figures. **(07 Marks)**

c. Define primitive and non-primitive cell. Mention types of unit cell. **(04 Marks)**

d. Calculate the density of diamond, given that the cube edge of its unit cell is 3.57 $\mathring{A}$ and the atomic weight of carbon is 12.01. **(04 Marks)**

OR

8 a. Describe the construction and working of Bragg's X-ray spectrometer. **(06 Marks)**

b. Explain the crystal structure of diamond with neat diagram and calculate its atomic packing factor. **(06 Marks)**

c. Explain Allotropy and polymorphism with examples. **(04 Marks)**

d. Draw the following planes in cubic unit cell: (1 1 1) (2 0 2) (1 2 T) and (0 T 1) **(04 Marks)**

Module-5

9 a. Discuss the variation of density of energy states for 3D, 2D, 1D and 0D structures. **(06 Marks)**

b. Describe the construction and working of Reddy shock tube. **(06 Marks)**

c. Explain ball milling method to produce nanoparticles. **(04 Marks)**

d. What are shock waves? Mention any three applications of shock waves. **(04 Marks)**

OR

10 a. Describe the principle, construction and working of scanning electron microscope. **(07 Marks)**

b. Explain pyrolysis method of obtaining carbon nanotubes. **(05 Marks)**

c. Distinguish between subsonic and supersonic waves. **(04 Marks)**

d. Mention Rankine-Hugoniot equations for shock waves. **(04 Marks)**

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17CHE12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
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. What are reference electrodes? Explain the construction and working of Calomel electrode. Justify that it is a reversible electrode. **(07 Marks)**

b. What are Concentration Cells? Explain the construction and working of electrolyte concentration cells. **(07 Marks)**

c. What are batteries? Describe the construction and working of Li-MnO_2 battery with one application. **(06 Marks)**

OR

2 a. Define standard electrode potential. Derive Nernst equation for single electrode potential. **(06 Marks)**

b. Write any two differences between conventional cells and fuel cells. Explain the construction and working of methanol oxygen fuel cell with one application. **(08 Marks)**

c. Describe the construction and working of Ni-MH battery with one application. **(06 Marks)**

Module-2

3 a. What is differential aeration corrosion? Explain its types. **(07 Marks)**

b. Define anodization. Explain anodization of aluminium with one application. **(07 Marks)**

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

OR

4 a. What is tinning? Explain the steps involved in it diagrammatically. **(06 Marks)**

b. Write a short note on :
(i) Polarization (ii) Decomposition potential **(06 Marks)**

c. What are the advantages of electroless plating over electroplating? Explain electroplating of chromium for Hard Purpose. **(08 Marks)**

Module-3

5 a. What is knocking in IC engines? Explain its mechanism with chemical reactions. How can it be prevented? **(08 Marks)**

b. Write a note on biodiesel and power alcohol. **(06 Marks)**

c. What is doping? Explain the purification of silicon by zone refining. **(06 Marks)**

OR

6 a. Define Net and Gross calorific value of fuel. Explain the experimental determination of calorific value of solid fuel using Bomb calorimeter. **(08 Marks)**

b. What is photovoltaic cell? Explain the working of photovoltaic cell with neat diagram. **(06 Marks)**

c. Explain doping of silicon by diffusion technique. **(06 Marks)**

Module-4

7 a. What is conducting polymer? Explain the mechanism of conduction in polyaniline and give the applications. **(07 Marks)**

b. Explain the following factors influencing the T_g :
(i) Flexibility
(ii) Branching and Cross linking
(iii) Intermolecular forces. **(06 Marks)**

c. Explain the manufacture, properties and uses of polycarbonates. **(07 Marks)**

OR

8 a. What are adhesives? Explain the synthesis and applications of epoxy resin. **(07 Marks)**

b. Explain structure-property relationship of polymers with respect to
(i) Crystallinity (ii) Chemical resistivity (iii) Elasticity. **(06 Marks)**

c. What are polymer composites? Explain the preparation, properties and uses of Kevlar fiber. **(07 Marks)**

Module-5

9 a. Explain Winkler's method of determination of dissolved oxygen. Give the reactions involved. **(07 Marks)**

b. Define COD. 25 ml of industrial effluent requires 12.5ml of 0.5N $K_2Cr_2O_7$ for complete oxidation. Calculate COD of the sample. Assuming that the effluent contains only oxalic acid, calculate the amount of oxalic acid present in 1 dm^3 of water. Given equivalent mass of oxalic acid is 45. **(07 Marks)**

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

OR

10 a. What are scales and sludge? What are their causes and harmful effects? How are they prevented? **(08 Marks)**

b. Explain synthesis of nano materials by sol-gel process. **(06 Marks)**

c. Write a note on fullerences. Mention its applications. **(06 Marks)**

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17PCD13/23

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
Programming in C and Data Structure

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define an algorithm? Write an algorithm to find perimeter and area of a circle. **(06 Marks)**

b. Write the structure of a C program. Explain with an example. **(06 Marks)**

c. What is an idemitifier? Classify the following as valid and invalid identifier. If invalid give reason.
i) _apple ii) continue iii) one_10 iv) #abc123 v) avErAgE. **(08 Marks)**

OR

2 a. Explain printf( ) and scanf( ) function with example. **(08 Marks)**

b. Convert the following mathematical expression into C expression :

i) $E = \frac{e^{\sqrt{x}} + e^{\sqrt{y}}}{x \sin \sqrt{y}}$

ii) $a + \frac{b(ad+e)}{b-a} - \frac{c}{d}$. **(06 Marks)**

c. Write a C program to find simple interest and display the results. **(06 Marks)**

Module-2

3 a. Explain switch statement with syntax and example. **(08 Marks)**

b. Differentiate between while and do while loops. **(06 Marks)**

c. Write a C program to reverse an integer number and check whether it is a palindrome or not. **(06 Marks**

OR

4 a. List all branching statements. Explain any two with proper syntax and example. **(08 Marks)**

b. Explain break and continue statement with example. **(06 Marks)**

c. Write a C program to find a factorial of a number using for loop. **(06 Marks)**

Module-3

5 a. What is an array? How one and two dimensional arrays declared and initialized? Give an example. **(08 Marks)**

b. Write a C program to concatenate two strings without using built in function strcat( ). **(06 Marks)**

c. What is C function? Write a C function to find cube of a number. Display the result in main( ) function. **(06 Marks)**

OR

6 a. Explain any four string manipulation functions with example. **(08 Marks)**

b. Write a C program to read N elements and find biggest element in an array. **(06 Marks)**

c. Write a C program to check a number is a prime number or not using recursion. **(06 Marks)**

Module-4

7 a. What is a structure? Write a syntax of structure declaration with an example. (06 Marks)
b. Write a C program to pass structure variable as function argument. (08 Marks)
c. What is file? Explain fopen( ) and fclose( ) with example. (06 Marks)

OR

8 a. Write a C program to maintain a record of 'N' employee detail using an array of structure with three fields(id, name, salary) and print details of employees whose salary is above 10000. (08 Marks)
b. Write a C program to open a file for input, read in a series of numbers until end of file (eof) and display each number on the monitor. (06 Marks)
c. Explain fgetc( ), fgets( ), fputc( ) and fputs( ) function with syntax. (06 Marks)

Module-5

9 a. What is a pointer? Write a C program to read two numbers and function to swap these numbers using pointers. (06 Marks)
b. Explain different dynamic memory allocation function in C with syntax. (08 Marks)
c. What is Stack? Explain operation of stack. (06 Marks

OR

10 a. What are primitive and non primitive data types explain with example. (06 Marks)
b. Explain any two preprocessor directives in C with example. (08 Marks)
c. What is queue? Explain its application. (06 Marks)

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17CIV13/23

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
Elements of Civil Engineering and Engineering 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 briefly the impact of Civil Engineering infrastructural development on the National Economy. **(05 Marks)**

b. Explain the following with examples : i) Rigid body and Elastic body ii) Equilibrium and Equilibrant iii) Scalar and Vector. **(09 Marks)**

c. Explain briefly the scope of the following Civil Engineering fields : i) Structural Engineering ii) Hydraulic Engineering. **(06 Marks)**

OR

2 a. Distinguish between Rigid Pavement and Flexible Pavement. **(06 Marks)**

b. List the System of forces. **(04 Marks)**

c. Find the magnitude and direction of the resultant force acting at a point.
i) 80N towards North ii) 20N towards North East iii) 40N towards East
iv) 60N in a direction inclined 30^0 East of South.
v) 70N in a direction inclined 60^0 South of West. **(10 Marks)**

Module-2

3 a. State and prove Lami's theorem. **(06 Marks)**

b. Explain briefly dynamic friction. **(04 Marks)**

c. A body of weight 100N is suspended by which two strings 5m and 4m length attached at same horizontal line 6m apart. Find tension in the strings. **(10 Marks)**

OR

4 a. Explain briefly the Laws of Static friction. **(06 Marks)**

b. Explain : i) Angle of friction ii) Limiting friction. **(04 Marks)**

c. An effort of 200N is required just to move a certain body up an inclined plane of angle 15^0 the force acting parallel to the plane. If the angle of inclination of the plane is made 20^0. The effort required again applied parallel to the plane is found to be 230N. Find the weight of the body and coefficient of friction. **(10 Marks)**

Module-3

5 a. Mention the different types of supports, with neat sketch. **(06 Marks)**

b. Determine completely one resultant of the free force shown in sketches. The forces are in Newton and squares are 100mm × 100mm and also find moment about A.

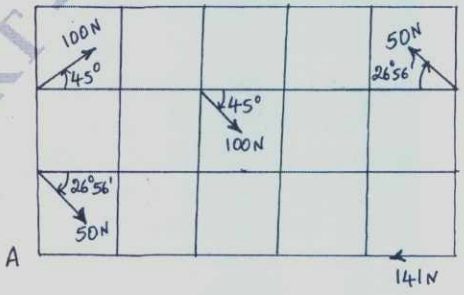

Fig.Q5(b)

(14 Marks)

OR

6 a. State and prove Varignon's theorem. **(08 Marks)**

b. Determine the reactions @ the supports of the beam shown in fig. Q6(b) below.

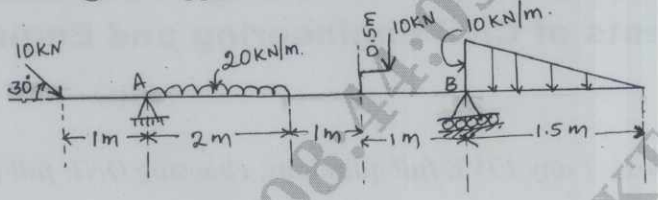

Fig.Q6(b) **(12 Marks)**

Module-4

7 a. State and prove Parallel Axis theorem. **(06 Marks)**

b. Determine the coordinates of the centroid of the plane area shown in fig. Q7(b), with respect to 'O'.

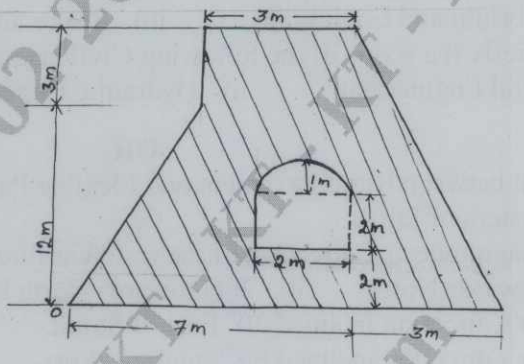

Fig.Q7(b) **(14 Marks)**

OR

8 a. Explain : i) Centre of Gravity ii) Axis of Reference iii) Axis of Symmetry. **(06 Marks)**

b. Find the Polar moment of Inertia for the shaded area.

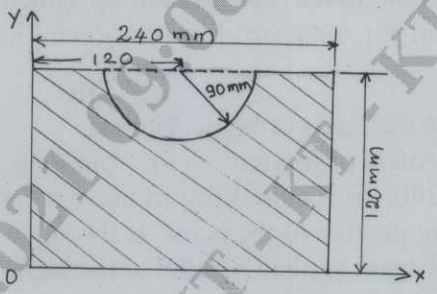

Fig.Q8(b) **(14 Marks)**

Module-5

9 a. A motar car takes 10 secs to cover 20m and 15 secs to cover 40m. Find the uniform acceleration of the car and velocity at the end of 15 secs. **(10 Marks)**

b. A stone dropped into a well is heard to strike the water after 4 secs. Find the depth of the well. If the velocity of sound is 350 m/sec. **(10 Marks)**

OR

10 a. Prove that the path traced by the projectile is parabola. **(06 Marks)**

b. Explain the terms used with projectiles. **(04 Marks)**

c. A cricket ball thrown by a fielder from a height of 2m at an angle of 30^0 to the horizontal with an initial velocity of 20m/sec. hits the wickets at a height of 0.5m from the ground. How far was the fielder from the wickets? **(10 Marks)**

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17ELE15/25

First/Second Semester B.E. Degree Examination, Jan./Feb. 2021
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 Ohm's law. Mention what are limitations of Ohm's law. **(06 Marks)**

b. What is the difference of potential between the points X and Y, in the network shown in Fig.Q1(b).

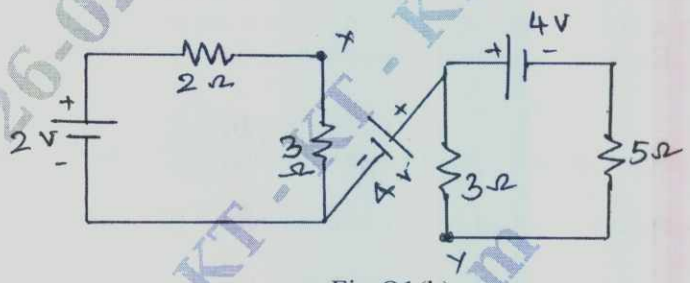

Fig.Q1(b) **(06 Marks)**

c. A coil of 1000 turns is wound on a silicon steel ring of relative permeability 1200. The ring has a mean diameter of 10 cm and cross sectional area of 12 sq.cm. When a current of 4 ampere flows through the coil, determine:

(i) Flux in the core
(ii) Inductance of the coil
(iii) The EMF induced in the coil, if the flux falls to zero in 15 milliseconds
(iv) Now, if another similar coil is placed such that 70% magnetic coupling exists between the coils, find the mutual inductance? **(08 Marks)**

OR

2 a. Mention the three methods used to link conductors with flux to get induced emf. Name the machine/apparatus which each is applicable? **(06 Marks)**

b. State and explain Faraday's laws of electromagnetic induction, Lenz's law and Fleming's right hand rule. **(06 Marks)**

c. Determine the currents in all the branch of the network shown in Fig.Q2(c).

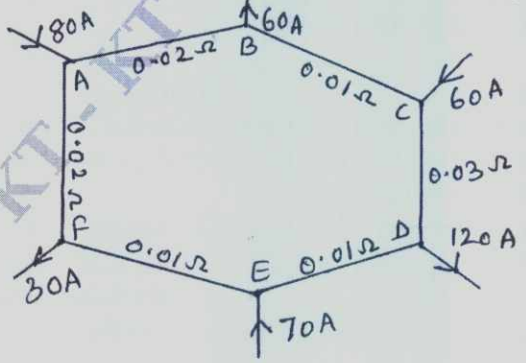

Fig.Q2(c) **(08 Marks)**

Module-2

3 a. With usual notations, derive the EMF equation of a DC generator. **(06 Marks)**

b. With the help of neat diagram, explain the construction and working of Electro-dynamo meter type Wattmeter. **(06 Marks)**

c. A 4 pole, DC shunt motor takes 22 amp from a 250 volts, DC supply. $R_a = 0.5\ \Omega$, and $R_f = 125\ \Omega$. The armature is wave wound with 300 conductors. If the per pole is 0.02 web, determine: (i) Speed (ii) Torque developed (iii) Power developed **(08 Marks)**

OR

4 a. With a neat diagram, explain the construction and working of an Induction type energy meter. **(06 Marks)**

b. Sketch torque versus armature current and speed versus armature current characteristics of a DC shunt and DC series motor. Mention their applications. **(06 Marks)**

c. Draw a neat sketch representing the cut-section view of DC machine. Name the different parts. Explain important features of parts involved there on. **(08 Marks)**

Module-3

5 a. Derive an expression for average value and RMS value of a sinusoidal varying AC voltages. **(06 Marks)**

b. Why Fuse is required in an electric circuit? What are the materials normally used as fuse wires? **(06 Marks)**

c. Two impedances of $Z_1 = 10 + j15\Omega$ and $Z_2 = 6 - j8\Omega$ are connected in parallel. If the total current supplied is 15 Amp, what is the power taken by each branch? **(08 Marks)**

OR

6 a. What is power factor in ac circuits? Which of the following works at: unity pf, lagging pf, leading pf?
(i) Electric iron (ii) Incandescent lamp (iii) Condenser bank
(iv) Induction motor (v) Choke **(06 Marks)**

b. Define domestic wiring. What important factors are to be considered in domestic wiring? **(06 Marks)**

c. A current of average value 14.14 Amp is flowing in a circuit to which a voltage of peak value of 282.8 volts is applied. Determine:
(i) $Z_1 = R \pm j \times \Omega$ (ii) Power if V lags I by $\frac{\pi}{6}$ radians. **(04 Marks)**

d. A circuit consists of resistance of 10 Ω, an inductance of 16 mH and a capacitance of 150 μf series. A supply of 100 V at 50 Hz is given to the circuit. Find the current, power factor and power consumed by the circuit. **(04 Marks)**

Module-4

7 a. With a neat sketch, explain the constructional features of salient pole alternator. **(06 Marks)**

b. Deduce the relationship for the line and phase values of voltage and current in a 3 phase balanced STAR connections. **(06 Marks)**

c. A delta connected load consists of 6Ω resistances in series with an 8Ω inductive reactance in each phase. A supply voltage of 440 Volts, at 50 Hz is applied to the load. Find:
(i) Phase current (ii) Line current (iii) Power factor
(iv) TRUE power consumed by load (v) Reactive power (vi) Apparent power **(08 Marks)**

OR

8 a. With usual notations, derive an expression for EMF equation of an alternator. **(06 Marks)**

b. A 3 phase, 50 Hz, 16 pole generator with star connected winding has 144 slots with conductor/slot is 10. The flux/pole is 24.8 mweb is sinusoidally distributed. The coil is full pitched. Determine: (i) Speed (ii) EMF/Phase (iii) Line voltage **(06 Marks)**

c. Show that in a three phase, balanced circuit, two wattmeters are sufficient to measure the total three phase power. **(08 Marks)**

Module-5

9 a. Explain the principle of operation of a single phase transformer and derive its EMF equation. **(06 Marks)**

b. A 4 pole, 50 Hz, 3 phase induction motor runs at a speed of 1460 rpm. Find:
(i) Synchronous speed
(ii) The slip
(iii) The frequency of the induced emf in the rotor. **(06 Marks)**

c. In a 25 KVA, 2000/200 volts transformer has iron loss of 350 Watts and full load copper loss of 500 Watts respectively. Calculate the efficiency at
(i) upf, full load
(ii) 0.8 pf, $3/4^{th}$ full load
(iii) 0.75 pf, ½ full load
(iv) Also determine maximum efficiency of a transformer for full load, at 0.9 pf. **(08 Marks)**

OR

10 a. Explain working of a 3 phase induction in detail with the help of diagram. **(06 Marks)**

b. What are the transformer losses? On what factors do they depend? And how they are minimized? **(06 Marks)**

c. A 250 KVA, 11000/415 Volts, 50 Hz, single phase transformer has 800 turns secondary. Determine:
(i) Number of primary turns
(ii) Maximum value of flux
(iii) Voltage induced per turn
(iv) The rated primary and secondary currents **(08 Marks)**

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CBCS SCHEME

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17MAT21

Second Semester B.E. Degree Examination, Jan./Feb. 2021
Engineering Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Solve $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = e^{3x}$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 3\sin x$ **(07 Marks)**

c. Solve by the method of undetermined coefficients

$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 4y = 2x^2 + 3e^{-x}$ **(07 Marks)**

OR

2 a. Solve $(D^4 + 4D^3 - 5D^2 - 36D - 36)y = 0$ **(06 Marks)**

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

c. Solve by variation of parameters method $\frac{d^2y}{dx^2} + a^2y = \tan ax$ **(07 Marks)**

Module-2

3 a. Solve $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x$ **(06 Marks)**

b. Solve $xy\left(\frac{dy}{dx}\right)^2 - (x^2 + y^2)\frac{dy}{dx} + xy = 0$ **(07 Marks)**

c. Find the general and singular solution of $y = px - \sin^{-1}p$. **(07 Marks)**

OR

4 a. Solve $(1+x)^2\frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = \sin(2\log(1+x))$ **(06 Marks)**

b. Solve $p^2 + 2py\cot x = y^2$, where $p = \frac{dy}{dx}$ **(07 Marks)**

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

Module-3

5 a. Form the partial differential equation from $xyz = \phi(x + y + z)$ **(06 Marks)**

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

c. Find all possible solutions of the one-dimensional heat equation $U_t = c^2 U_{xx}$ by the method of separation of variables. **(07 Marks)**

OR

6 a. Form the partial differential equation from $z = f(x + at) + g(x - at)$, where a is a constant. **(06 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x^2} = a^2 z$, given that at $x = 0$, $\frac{\partial z}{\partial x} = a \sin y$ and $z = 0$. **(07 Marks)**

c. With suitable assumptions, derive the one dimensional wave equation as $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ **(07 Marks)**

Module-4

7 a. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y\,dx\,dy$ by changing the order of integration. **(06 Marks)**

b. Evaluate $\int_{-1}^{1} \int_0^{z} \int_{x-z}^{x+z} (x + y + z)\,dx\,dy\,dz$ **(07 Marks)**

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

OR

8 a. Evaluate $\int_0^a \int_y^a \frac{x}{x^2 + y^2}\,dx\,dy$ by changing to polar coordinates. **(06 Marks)**

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

c. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$ **(07 Marks)**

Module-5

9 a. Find Laplace transform of t(Sinat + Cosat) **(06 Marks)**

b. Find the Laplace transform of the periodic function of period 2a given by

$$f(t) = \begin{cases} t, & 0 < t < a \\ 2a - t, & a < t < 2a \end{cases}$$ **(07 Marks)**

c. Using convolution theorem find $L^{-1}\left[\frac{s}{(s^2 + a^2)^2}\right]$ **(07 Marks)**

OR

10 a. Express $f(t) = \begin{cases} \text{Cos}t, & 0 < t < \pi \\ \text{Cos}2t, & \pi < t < 2\pi \\ \text{Cos}3t, & t > 2\pi \end{cases}$ in terms of unit-step function and hence find L(f(t). **(06 Marks)**

b. Find the inverse Laplace transform of

i) $\frac{s^2 - 3s + 4}{s^3}$ and ii) $\frac{s + 2}{s^2 - 4s + 13}$ **(07 Marks)**

c. Solve by Laplace transform method $\frac{d^2x}{dt^2} - 2\frac{dx}{dt} + x = e^t$ with $x = 2$, $\frac{dx}{dt} = -1$ at $t = 0$. **(07 Marks)**

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