(ii) Use Millman's theorem to find the current through $(5 + j\,5)$ impedance in Fig. 9.

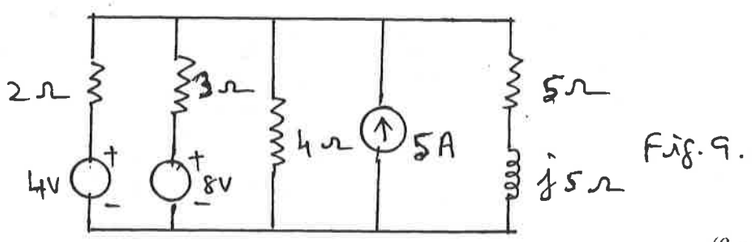


Fig. 9.

(6 marks)

Module 4

14. (a) Three impedances $Z_R = 8 - j\,6\ \Omega$, $Z_Y = 6 + j\,4\Omega$ and $Z_B = 10 + j\,5\Omega$ are connected in star across a 400 V, 50 Hz, 3-phase 3 wire RBY sequence symmetrical source. Find

(i) potential of star point of load w.r.t. supply neutral.

(ii) line currents.

(iii) total real, reactive and apparent powers.

(iv) balanced delta connected resistors that would take same real power as above from the same supply.

Or

(b) Three 100 Ω non-inductive resistances are connected in (i) star ; (ii) delta across a 400 V, 50 Hz, 3-phase mains. Calculate the power taken from the supply system in each case. In the event of one of the three resistances getting open circuited, what would be the value of total power taken from the mains in each of the two cases ?

(12 marks)

Module 5

15. (a) Write the (i) incidence ; (ii) basic cut-set ; and (iii) basic loop matrices for the oriented graph shown in Fig. 10. Selct the tree T {1, 2, 3, 4}.

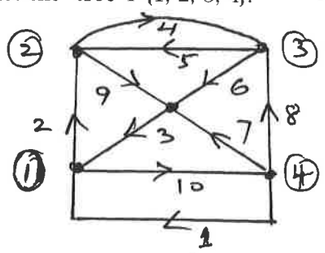


Fig. 10.

Or

(b) For the network shown in Fig. 11, write (i) the incidence matrix ; (ii) reduced incidence matrix by taking node 4 as reference. Select a tree and write basic cut-set matrix.

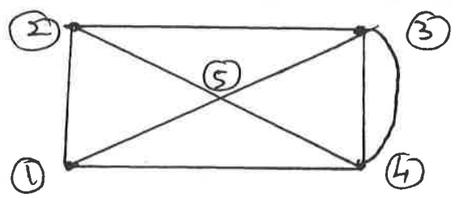


Fig. 11

(12 marks)

[5 × 12 = 60 marks]

G 1974

(Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Third Semester

Branch : Electrical and Electronics Engineering

ELECTRIC CIRCUIT THEORY (E)

(Prior to 2007 admissisons—Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Explain the step-by-step procedure of performing node analysis of a network.
2. Define and explain unilateral and bilateral elements, with the help of suitable examples.
3. Two coupled coils with self inductance $L_1 = 0.4$ H and $L_2 = 0.15$ H have a coupling coefficient of 0.7. If the current in the first coil is $i_1 = 6 \sin 100\,t$ Amp, determine the voltage in the second coil.
4. Explain single tuned and double tuned coupled coils, giving one specific application of each.
5. State and explain substitution theorem, with the help of an example.
6. What is impedance matching ? Where and why the maximum power transfer theorem is applied ?
7. Three impedances $8 + j\,5\ \Omega$ each are connected in Y across a 220 V, 50 Hz, 3ϕ system. Find the total, real, reactive, apparent powers of the load.
8. A 3-phase balanced 400 V ABC source is connected to an unbalanced star-connected load having $R_A = 4\Omega$, $R_B = 3\Omega$ and $R_C = 5\Omega$. Find the neutral shift voltage.
9. Explain with examples (i) .PROBE ; (ii). TRAN statements in PSPICE.
10. Relate incidence matrix and cut-set matrix.

(10 × 4 = 40 marks)

Part B

Answer **either** *(a)* **or** *(b) of each module.*
Each full question carries 12 *marks.*

Module 1

11. (a) Using mesh-current analysis, find the current through 24 Ω resistor in the circuit in Fig. 1.

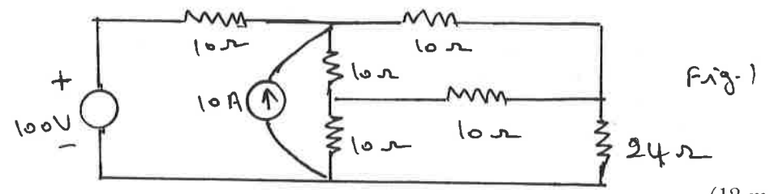


Fig. 1

(12 marks)

Or

(b) (i) Convert the active network in Fig. 2 by a single voltage source in series with an impedance.

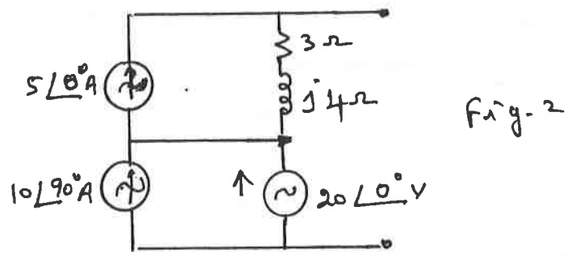


Fig. 2

(6 marks)

(ii) Calculate the power taken by 5 Ω resistor of Fig. 3. using node voltage method.

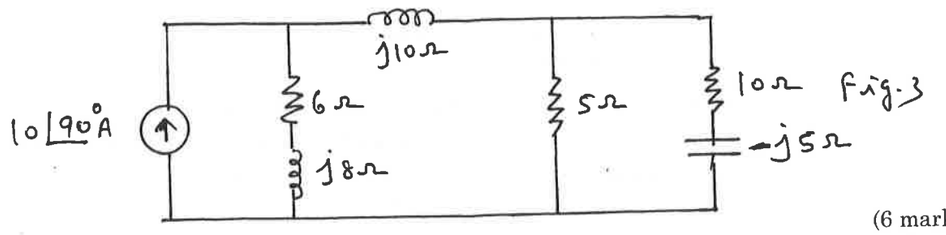


Fig. 3

(6 marks)

Module 2

12. (a) (i) Find the effective inductance as seen from terminals A-B of the network shown in Fig. 4 if $K_{12} = 0.6$ and $K_{23} = 0.8$.

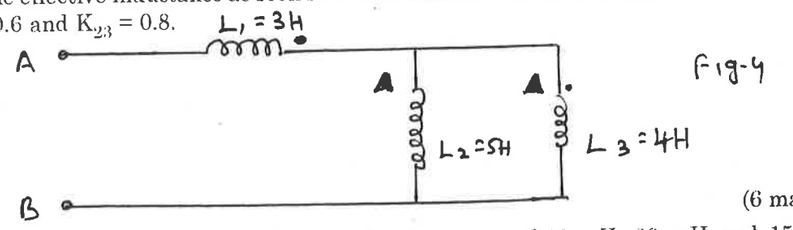


Fig-4

(6 marks)

(ii) Three coils connected in series have self inductances of 10 mH, 20 mH and 15 mH respectively. The resistance of each coil is 5 Ω. The mutual inductances are $M_{12} = 6$ mH, $M_{23} = 8$ mH and $M_{13} = 5$ mH. The fluxes of coils 1 and 2 are in opposition, those of coils 1 and 3 are cumulative and those of 2 and 3 are in opposition. Find what capacitance must be connected in parallel with the above circuit so that the combination behaves like a pure resistance at 50 Hz.

(6 marks)

Or

(b) (i) Two coils have 60 and 500 turns respectively wound on a closed iron circuit of sections 50 cm.^{2} and mean length 100 cm. Find the self inductance of each coil. Also determine the mutual inductance and coefficient of coupling between the coils if the permeability of iron is 1000.

(6 marks)

(ii) In the circuit shown in Fig. 5, find the voltage across the 10 ohm resistor.

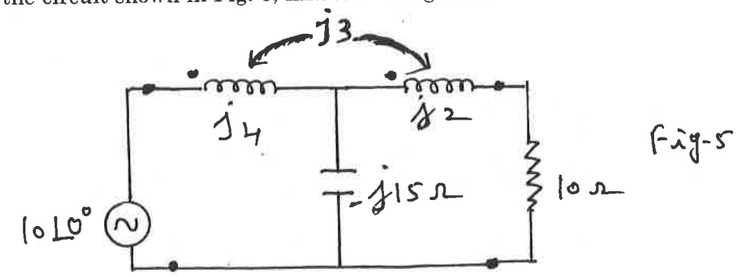


Fig-5

(6 marks)

Module 3

13. (a) (i) Demonstrate reciprocity theorem by taking I_x as response in the network shown in Fig. 6.

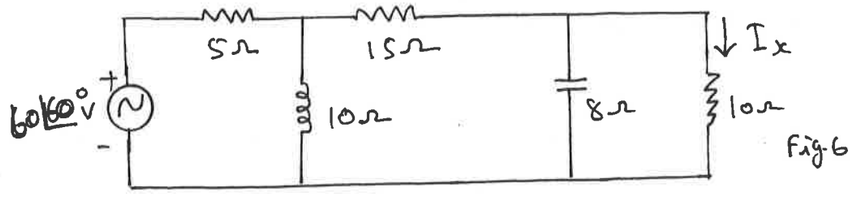


Fig-6

(6 marks)

(ii) Calculate the value of impedance to be connected across terminals *a-b* of the network shown in Fig. 7 that would receive maximum power from the source and the value of such power.

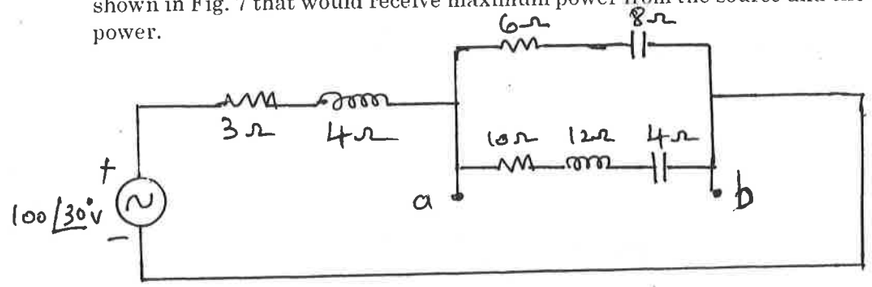


Fig. 7

(6 marks)

Or

(b) (i) Find the current through 5 Ω resistor in Fig. 8 and hence verify reciprocity theorem.

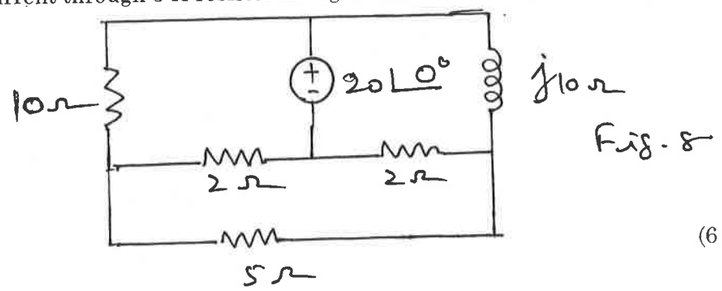


Fig. 8

(6 marks)

G 1996 **(Pages : 3)** **Reg. No.....**

Name.....

B.TECH DEGREE EXAMINATION, MAY 2010

Third Semester

Branch : Electrical and Electronics Engineering

POWER GENERATION AND DISTRIBUTION (E)

(Prior to 2007 Admissions – Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 4 *marks.*

1. What is load curve? Explain its importance in power system.
2. What is Tariff? Explain the factors to be considered while framing the tariff.
3. Compare the radial distribution system and ring main system.
4. Why capacitors are needed in LT lines? Explain the size choice of LT capacitors.
5. What is Kelvin's law? Explain its limitations.
6. Explain the adverse effect of low power factor in power system.
7. With help of neat sketches explain the construction of three core cable.
8. Explain Murray loop test for determining cable fault.
9. With help of neat sketches explain a voltage doubler circuit.
10. Define the wave front and wave tail of an impulse wave.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. (a) Clearly explain the terms plant capacity factor and plant use factor.

    (b) The capital cost of a hydro power station of 50 MW capacities is Rs. 1000/kW. The annual depreciation charges are 10% of the capital cost. A royalty of Rs. 1 per kW per year and Re. 0.01 per kWh generated is to be paid for using the river water for generation of power. The maximum demand on the power station is 40 MW and annual load factor is 60%. The annual cost of salaries, maintenance charge etc. is Rs. 7,00,000. If 20% of this expense is also chargeable as fixed charges, calculate the generation cost in two part form.

(5 + 7 = 12 marks)

Or

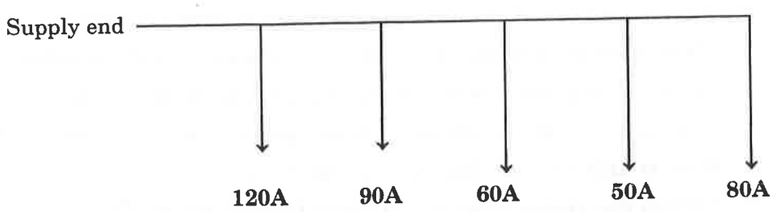
Turn over

(c) A base load station having a capacity of 18 MW and a standby station having a capacity of 20 MW share a common load. Find annual load factor, Use factor and capacity factors of the two power stations from the following data :

Annual standby station output	=	7.35×10^6 kWh
Annual base load station output	=	101.35×10^6 kWh
Peak load on the standby station	=	12 MW
Hours of use of standby station during the year	=	2190

(12 marks)

12. (a) A 2-wire DC distributor is 250 m long. It is to be loaded as shown in Figure below at 50 m intervals. If the maximum voltage drop is not to exceed 10 V and the resistivity of core material is 1.73 μΩ-cm, determine the maximum cross sectional area of eac conductor.



(12 marks)

Or

(b) A 3-phase ring distributor ABCD fed at A at 11 kV supplies balanced loads of 40 A at 0.8 pf lagging at B, 50 A, 0.707 pf lagging at C and 30 A at 0.8 pf lagging at D, the load currents being referred to the supply voltage at A. The impedances per phase of the various sections are : Section AB = (1 + j2) Ω, Section BC = (2 + j3) Ω, Section CD = (1 + j1) Ω, Section DA = (3 + j4) Ω

Calculate the currents in various sections and station bus bar voltages at B, C and D.

(12 marks)

13. (a) Write a short note on rules for supply of electricity.

(b) A 2-conductor cable 1 km long is required to supply a constant current of 200 A throughout the year. The cost of cable including installation is Rs. (20a + 20) per metre where 'a' is the area of X-section of the conductor in cm^2. The cost of energy is 5 P per kWh and the interest and the depreciation charges amount to 10%. Calculate the most economical conductor size. Assume resistivity of the conductor material to be 1.73μΩ-cm.

(5 + 7 = 12 marks)

Or

(c) Explain the calculation of powerfactor correction.

(d) Derive an expression for most economical powerfactor in power system.

(5 + 7 = 12 marks)

14. (a) Derive an expression for insulation resistance of a cable.

(b) A single core cable of conductor diameter 2 cm and lead sheath of diameter 5.3 cm is to be used on a 66 kV, 3-phase system. two intersheaths of diameter 3.1 cm and 4.2 cm are introduced between the core and lead sheath. If the maximum stress in the layers is the same, find the voltages on the intersheaths.

(5 + 7 = 12 marks)

Or

(c) What is grading of cables? Explain the various methods of grading of cables.

(12 marks)

15. (a) With help of neat sketches, explain the working of cascaded transformers arrangement for high alternating voltage generation, Also obtain the simplified equivalent circuit.

(12 marks)

Or

(b) With a neat sketch describe the working of a Van De Graaff electrostatic generator. What are the factors that limit the output voltage?

(12 marks)

[5 × 12 = 60 marks]

G 1966 (Pages : 2) Reg. No.....

Name.....

B.TECH DEGREE EXAMINATION, MAY 2010

Third Semester

Branch : Electrical and Electronics Engineering

MECHANICAL TECHNOLOGY (E)

(Prior to 2007 Admissions – Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*

Each question carries 4 *marks.*

1. Differentiate between a Newtonian fluid and Non-Newtonian fluid giving examples.
2. What is Vapour Pressure? How is it related to saturation pressure?
3. Differentiate between the Lagrangian and Eulerian description of fluid motion.
4. What do you mean by a Hydraulic gradient line?
5. Give the classification of hydraulic turbines.
6. What do you mean by Cavitation? What are its effects?
7. What is the use of foot valve for a Centrifugal pump?
8. What is a hydraulic Ram?
9. What is the function of air vessels in reciprocating pumps?
10. Define Slip and coefficient of discharge of a reciprocating pump.

(10 × 4 = 40 marks)

Part B

Each question carries 12 *marks.*

11. A differential Manometer is connected to two pipes whose centres are at 3 metre difference in height. Higher level pipe is carrying liquid of specific gravity 0.9 at a pressure of 1.8 bar and the other pipe is carrying liquid of specific gravity of 1.5 at a pressure of 1 bar. The centre of pipe carrying low pressure liquid is 2 m above the higher level of mercury in the manometer. Find out the difference in mercury level in manometer.

Or

12. Derive an expression for the total hydrostatic force acting and for the centre of pressure for a plane surface immersed in water and inclined by an angle θ to the free surface of water.

(12 marks)

Turn over

13. Derive the Euler's equation of motion for a unidirectional steady flow and get the Bernoullis equation from it.

Or

14. A pipe line 30 cm in diameter and 1500 m long is used to connect two tanks and has a slope of 1 in 100. The water level in the first tank is 10 m above inlet of the pipe and water level in the second tank is 2 m above the outlet of the pipe. Considering only frictional losses, determine the flow rate through the pipe. Take $f = 0.005$. Also draw the Hydraulic gradient line and Total energy line.

(12 marks)

15. (a) With a sketch, explain the details of a Pelton Wheel.

(b) Differentiate between Inward Radial flow and Outward Radial flow reaction turbines.

(8 + 4 = 12 marks)

Or

16. (a) What is the use of draft tube in a reaction turbine? Explain how the net head on the reaction turbine is increased with the use of draft tube.

(b) What is specific speed of a turbine?

(8 + 4 = 12 marks)

17. Derive an expression for the power developed by the impeller of a Centrifugal Pump per unit weight of water.

Or

18. Write notes on : (i) Propeller pump ; (ii) Jet pump ; (iii) Airlift pump.

(12 marks)

19. What is indicator diagram of a Reciprocating pump? Explain the effect of friction in suction and delivery pipes on Indicator diagram.

(12 marks)

Or

20. (a) What are the advantages of a centrifugal pump over a reciprocating pump?

(b) Explain Acceleration head in a reciprocating pump.

(4 + 8 = 12 marks)

[5 × 12 = 60 marks]

G 1989 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Third Semester

Branch : Electrical and Electronics Engineering

ELECTRICAL AND ELECTRONIC MEASUREMENTS (E)

(Prior to 2007 admissions—Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Define galvanometer sensitivity. How it is expressed ?
2. Explain how iron losses occur in a magnetic material.
3. Explain measurement of earth resistance.
4. Describe the working of Kelvin's double bridge method as used to measure low resistance.
5. List the advantages and disadvantages of Maxwell bridge.
6. Draw the arrangement of a typical Anderson bridge.
7. What will happen when the secondary of a current transformer is opened while the primary is energised ? Why ?
8. Draw the phasor diagram of a current transformer and explain.
9. State laws of illumination.
10. What is a thermocouple ? Name two commonly used junction materials.

(10 × 4 = 40 marks)

Part B

Answer **either** *Section (a)* **or** *(b) in each module.*
Each full question carries 12 *marks.*

Module I

11. (a) (i) Explain the method of Lloyd-Fischer square of measuring iron losses in a ferromagnetic material.

(6 marks)

(ii) Describe a method for finding B-H curve of a magnetic material using a ballisitic galvanometer.

(6 marks)

Or

(b) A galvanometer has the following data : B = 0.1 Wb/m.^{2}, coil dimensions = 1.9 × 2.1 cm., number of turns = 230, C = 0.1 × 10^{-6} N-m/rad., J = 0.25 × 10^{-6} kg.-m.^{2}, total resistance, including external resistance = 1600 Ω. Calculate (i) G ; (ii) Total resistance for critical damping ; (iii) damping ratio ; (iv) frequency of undamped and damped oscillations.

(12 marks)

Module 2

12. (a) Describe any *three* types of potentiometers. Draw their neat sketches. Explain their construction and working principle in detail.

Or

(b) Explain the working of Earth Megger with the help of neat diagrams. Explain any *one* practical application in detail.

(12 marks)

Module 3

13. (a) Sketch the Hay's bridge and explain its applications. Derive the equations and draw the phasor diagram.

Or

(b) What are the advantages and demerits of a Schering bridges ? A Schering bridge has the following constants :—

Arm AB : Capacitor of 0.5 μF in parallel with 1 kΩ resistance.
Arm BC : Resistance of 3 kΩ.
Arm CD : Unknown C_x and R_x in series.
Arm DA : Capacitor of 0.5 μF.

Frequency : 1000 Hz

Determine (i) the unknown C_x and R_x and (ii) Dissipation factor.

(12 marks)

Module 4

14. (a) What are ratio and phase angle errors of a current transformer ? Derive expressions for ratio and phase angle errors in terms of the transformer parameters and the load.

Or

(b) A 100/5A current transformer, at its rated load of 25 VA, has an iron loss of 0.2 W and a magnetizing current of 1.5 A. It is supplying rated output to a meter having a ratio of resistance to reactance of 5. Calculate its ratio error and phase angle.

(12 marks)

Module 5

15. (a) Define and explain MSCP and MHCP. Describe how MHCP is determined. (12 marks)

Or

(b) (i) Why cold junction compensation is necessary in thermocouple measurements ? Explain the different methods of such compensation.

(6 marks)

(ii) Explain the various errors in measurement of temperature using thermocouple and their compensation.

(6 marks)

[5 × 12 = 60 marks]

G 1982 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Third Semester

Branch : Electrical and Eelctronics Engineering

ELECTROMAGNETIC THEORY (E)

(Prior to 2007 admissions—Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 4 *marks.*

1. Express $\vec{A} = y\vec{a}_x + (x+z)\vec{a}_y$ at P (– 2, 6, 3) in cylindrical form.
2. State and explain divergence theorem.
3. Define and explain monopole and dipole.
4. Define and distinguish between potential and potential gradient.
5. Derive an expression for capacitance between coaxial cylinders.
6. State and explain the boundary conditions for an electric field prevailing at the interface between a conductor and a dielectric.
7. State and explain Biot-Savart's law, representing it in vectorial form.
8. What is meant by "skin effect" ? What is its significance ? Explain.
9. State and explain Maxwell's equation in integral form.
10. Explain how Faraday's law can be used to extend one of the Maxwell's equations from static to time varying electromagnetic fields.

(10 × 4 = 40 marks)

Part B

Answer **either** *section (a)* **or** *(b) from each module.*
Each full question carries 12 *marks.*

Module 1

11. (a) A vector field $D = \left[\frac{5r^2}{4}\right] I_r$ is given in spherical co-ordinates. Evaluate both sides of Divergence theorem for the volume enclosed between

(i) $r = 1$ and $r = 2$, and

(ii) $\theta = 0$ to $\theta = \frac{\pi}{4}$ and $r = 4$.

(12 marks)

Or

Turn over

(b) (i) Consider a line charge distribution with change density ρ_1c/m along the line between $(0, 0, -a)$ and $(0, 0, a)$ in cylindrical co-ordinates. Obtain an expression for the electric field intensity at $(r, \phi, 0)$.

(6 marks)

(ii) A charge of uniform density $\rho_s = 0.5$ nc/m^2 covers the infinite plane $-x + 3y - 6z = 6$m. Find the electric field intensity on the side containing the origin.

(6 marks)

Module 2

12. (a) Potential is given by $V = 2(x + 1)^2 (y + 2)^2 (z + 3)^2$ in free space. At a point p $(2, -1, 4)$ calculate :

(i) Potential at point p.

(ii) Electric field intensity at point p.

(iii) Flux density D at point p.

(iv) Volume charge distribution ρ_v at p.

(v) Unit vector in potential gradient direction at p.

(12 marks)

Or

(b) (i) A point charge of 15 nC is situated at the origin and another point charge of – 12 nC is at the point (3, 3, 3) m. Find the potential at the point $(0, -3, -3)$.

(6 marks)

(ii) The potential in a certain region is $V = x^2 + 3y^2 + 9z$. Calculate the electric field intensity at P $(1, -2, 3)$.

(6 marks)

Module 3

13. (a) (i) Starting from fundamentals, derive an equation for the capacitance between two concentric spherical shells of radii a and b $(b > a)$.

(8 marks)

(ii) Explain the method of electrical images and discuss its applications. (4 marks)

Or

(b) (i) If $V = \frac{5xy}{z}$ volts, calculate the energy stored in a capacitor if $0 < x < 4$ cm ; $0 < y \leq 2.5$ cm and $0 < z < 0.5$ cm. (6 marks)

(ii) Three parallel plates are separated by 5 mm., 4 mm. and 2 mm. and filled with $\epsilon_r = 2$, 4 and 5 respectively. If the area of the plates are 10 cm.^{2}, calculate the effective capacitance.

(6 marks)

Module 4

14. (a) (i) Explain vector magnetic potential. (4 marks)

(ii) Two narrow circular coils A and B having a common axis, are placed 10 cm. apart. Coil A has 10 turns of radius 5 cm. with a current of 1 A passing through it. If the magnetic field at the centre of the coil A to be zero, what current should be passed through coil B, if coil B has single turn with radius 7.5 cm. ?

(8 marks)

Or

(b) A steel pipe is constructed of a material with $\mu_R = 200$ and $\mu = 5 \times 10^5$ mho/m. The outer and inner radii are 8 mm. and 6 mm. respectively. and the length is 100 m. If the total current carried by the pipe is 2 cos $10^4 \pi t$ amps. find

(i) the skin depth. (ii) effective resistance.

(iii) d.c. resistance. (iv) time-average powerloss.

(12 marks)

Module 5

15. (a) (i) Are the four Maxwell's equations independent ? Explain. (4 marks)

(ii) An a.c. voltage source $v = V. \cos wt$ is connected across a parallel plate capacitor C. Verify that the displacement current in the capacitor is the same as the conduction current in the wires.

(8 marks)

Or

(b) (i) Starting from Maxwell equations, derive an expression for wave equation in $\vec{H}$ for uniform plane waves in a conducting medium for sinusoidal time variations of the fields.

(6 marks)

(ii) A coaxial line has an inner conductor of diameter 0.5 cm. and outer conductor of diameter 2 cm. The outer conductor is grounded. The inner conductor is held at 200 volts and carries a current of 10 amperes. Obtain the Poynting vector.

(6 marks)

[5 × 12 = 60 marks]

G 1962 (Pages : 3) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2010

Third Semester

Branches : Civil, Mechanical, Electrical and Electronics, Electronics and Communication, Applied Electronics and Instrumentation, Instrumentation and Control, Electronics and Instrumentation, Automobile Engineering

ENGINEERING MATHEMATICS—II (CMEPLANSU)

(Prior to 2007 admissions)

[Supplementary]

Time : Three Hours Maximum : 100 Marks

Answer **one** *full question from each module.*
Each full question carries 20 *marks.*

Module 1

1. (a) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction of $2\vec{i} - 3\vec{j} + 6\vec{k}$. (5 marks)

(b) Find the value of λ if the vector $\left(\lambda x^2 y + yz\right)\hat{i} + \left(xy^2 - xz^2\right)\hat{j} + \left(2xyz - 2x^2y^2\right)\hat{k}$ has zero divergence. Also find the curl of the above vector when it has zero divergence. (8 marks)

(c) If n is a non-zero constant, show that $\nabla^2 r^n = n(n+1)\, r^{n-2}$. (7 marks)

Or

(d) $\vec{\nabla} = \vec{w} \times \vec{r}$, where $\vec{w}$ is a constant vector show that, $\vec{w} = \frac{1}{2}\text{curl } \vec{V}$. (5 marks)

(e) If U and V are differentiable scalar fields, prove that $\nabla U \times \nabla V$ is solenoidal. (8 marks)

(f) If $r = |\vec{r}| = \sqrt{x^2 + y^2 + z^2}$, prove that $\nabla f(r) = \frac{\vec{r}}{r} \cdot \frac{df}{dr}$ and hence find ∇r^n. (7 marks)

Module 2

2. (a) Find the total work done in moving a particle in a force field : $f = 3xy\,\vec{i} + y\vec{j} + 2xz\vec{k}$ once round the circle in the xy-plane whose centre is at the origin and radius equal to 2 units. (5 marks)

Turn over

(b) Using divergence theorem, prove that $\iiint_V \nabla\phi\, dV = \iint_S \phi \cdot \vec{n}\, dS$. (15 marks)

Or

(c) Using Green's theorem in the plane, evaluate $\oint_C \left(3x^2 - 8y^2\right) dx + (4y - 6xy)\, dy$ where C is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. (15 marks)

(d) Find $\int_C \vec{A} \cdot d\vec{r}$ along the curve C defined by $x = t^2 + 1$, $y = 2t^2$, $z = t^3$ from $t = 1$ to $t = 2$, where $\vec{A} = 3xy\,\hat{i} - 5z\,\hat{j} + 10x\,\hat{k}$. (5 marks)

Module 3

3. (a) Show that $z\bar{z}$ is differentiable but not analytic at the point $z = 0$. (5 marks)

(b) Obtain the Cauchy-Riemann equations of a function $f(z) = u(x, y) + iv(x, y)$ in Cartesian form. (7 marks)

(c) If u and v are harmonic functions, show that $u_y - v_x + i\left(u_x + v_y\right)$ is analytic function. (8 marks)

Or

(d) If $f(z) = u + iv$ is analytic function, prove that $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$. (5 marks)

(e) Discuss the transformation $w = \sin z$. Find the mappings of $z = a$ and $y = b$ in the z-plane to the w-plane. (7 marks)

(f) Find the bilinear transformation which maps $z = 0, -i, -1$ to $W = i, 1, 0$ respectively. (8 marks)

Module 4

4. (a) Using divided difference interpolation formula find the cubic polynomial that approximates y. The table of corresponding values of x and y is given below :

x :	0	1	2	5
y :	2	3	12	147

(10 marks)

(b) Using Stirling's formula, find $f(28)$ from the following data :—

x :	20	25	30	35	40
$f(x)$:	49225	48310	47232	45284	44305

(10 marks)

Or

(c) Applying Newton's backward difference formula, obtain a polynomial of degree 4 in x :

x :	1	2	3	4	5
y :	1	−1	1	−1	1

(10 marks)

(d) In the table below, the values of y are consecutive terms of a series of which 36.2 is the 7th term. Evaluate the first and tenth terms of the series :

x :	3	4	5	6	7	8	9
y :	4.8	8.4	14.4	23.3	36.2	50.8	71.4

(10 marks)

Module 5

5. (a) Calculate the value of $\int_0^{\pi/2} \sin x\, dx$ by (i) Trapezoidal rule ; (ii) Simpson's $\frac{1}{3}$ rule, using 11 ordinates, in both cases. (12 marks)

(b) A curve is drawn to pass through the points given by the following table :—

x :	1	1.5	2	2.5	3	3.5	4
y :	2	2.2	2.7	2.8	3	2.5	2.1

Estimate the area bounded by the curve, z-axis and the lines $x = 1$, $x = 4$. (8 marks)

Or

(c) A rod is rotating in a plane. The following table gives the angle θ in radians through which the rod has turned for various values of the time t second :

t :	0	0.2	0.4	0.6	0.8	1.0	1.2
θ :	0	0.12	0.44	1.12	2.02	3.40	4.67

Calculate the angular velocity and the angular acceleration of the rod, when $t = 0.6$ second. (12 marks)

(d) Evaluate $\int_0^1 \frac{dx}{1+x^2}$ by Simpson's rule taking $h = \frac{1}{4}$. Hence compute an approximate value of π. (8 marks)

[5 × 20 = 100 marks]