

B.Tech. Semester-II
Engineering Mathematics –II (AM-102)

A0119

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- (i) Show that vectors $(1, -1, 0), (0, 1, -1), (0, 2, 1), (1, 0, 3)$ are linearly dependent.
- (ii) Prove that if π is Eigen value of A then $\frac{1}{\pi}$ is an Eigen value of A^{-1}
- (iii) Define exact differential Equation. For what values of 'a' and 'b' the differential $Ey^n (y + x^3)dx + (ax + by^3)dy = 0$ is Exact?
- (iv) Solve two differential equation $\frac{dy}{dx} + uxy + xy^3 = 0$
- (v) A particle is executing simple harmonic motion with amplitude 20 cm and time period 2 seconds. Find the Equation of motion of the particle.
- (vi) A particle moves along the curve $x = 2t^2, y = t^2 - 4t, z = 3t - 5$ where t is time. Find the Components of its velocity at time $t = 1$ in the direction of $\hat{i} - 3\hat{j} + 2\hat{k}$
- (vii) Find the work done by a force $\vec{F} = 2x^2y\hat{i} + 3xy^2\hat{j}$ if it displaces a particle in xy plane from $(0, 0)$ to $(L, 4)$ along the curve $y = 4x^2$
- (viii) If $\vec{E}$ & $\vec{H}$ are irrotational vector prove that $\vec{E} \times \vec{H}$ is solenoidal vector.
- (ix) Out of 800 families with 4 children each how many families would be expected to have (i) no girl (ii) at most two girls? Assume equal probabilities for boys and girls.
- (x) State any two applications of t-test.

PART A:

Q. 2: a) Solve the following system of Equation

$$4x - 3y - 9z + 6w = 0$$

$$2x + 3y + 3z + 6w = 6$$

$$4x - 21y - 39z - 6w = -24$$

b) Find Eigen Values and Eigen Vectors for the matrix.

$$A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & 1 & 2 \\ 0 & 1 & 2 \end{bmatrix}$$

Q. 3: a) Find an integrating factor and solve the differential Equation.

$$(e^{x+y} + ye^y)dx + (xe^y - 1)dy = 0$$

b) Solve the differential Eqⁿ,

$$y = x^4 p^2 - px, \quad \text{where } p = \frac{dy}{dx}$$

Q. 4: a) Find the general solution of $16y^{11} + 8y^1 + y = 48 x e^{\frac{-x}{4}}$ where $y^1 = \frac{dy}{dx}$

b) Solve by variation of parameter method.

$$\frac{d^2 y}{dx^2} + 16 y = 32 \sec 2x$$

Q. 5: a) A particle is moving in a straight line with S. H. M. has velocities v_1 , and v_2 hen its distances from two centre are x_1 and x_2 respectively. Show that period of motion is

$$2\pi \sqrt{\frac{x_1^2 - x_2^2}{v_2^2 - v_1^2}}$$

b) An e. m. f. $E \sin pt$ is applied at $t=0$ a circuit containing a capacitance C and inductance L . The current I satisfies the Equation $L \frac{di}{dt} + \frac{1}{C} \int i dt = E \sin pt$. If $p^2 = \frac{1}{LC}$ and initially the current 'i' and charge 'q' all zero, show that the current at time t is $\frac{Et}{2L} \sin pt$, where $i = \frac{dq}{dt}$

Q. 6: a) If $\hat{r} = x\hat{i} + y\hat{j} + z\hat{k}$, $r = |\hat{r}| = \sqrt{x^2 + y^2 + z^2}$, prove that

$$\nabla \left\{ r \nabla \left(\frac{1}{r^3} \right) \right\} = \frac{3}{r^4}$$

b) Find the directional derivative of $\phi = e^{2x} \cos yz$ at the origin in the direction of tangent to the curve $x = a \sin t$, $y = a \cos t$, $z = at$ at $t = \frac{\pi}{4}$

Q. 7: a) Apply Green's Theorem to Evaluate $\int_C (x^2 y dx + x^2 dy)$ here C is the boundary describing counter clockwise of the triangle with the vertices (0, 0) (1, 0) (1)

b) Using divergence theorem Evaluate to $\iint \hat{F} \cdot d\hat{s}$ where $\hat{F} = 4x\hat{i} - 2y^2\hat{j} + z^2\hat{k}$ and S is the surface bounds the region $x^2 + y^2 = 4$; $z = 0$ and $z = 3$

Q. 8: a) In a normal distribution, 12% of the items are under 30 and 85% are under 60. Find the mean and standard deviation of the distribution.

b) Fit a parabola $y = a + bx + cx^2$ to the following data

x : 1 2 3 4

y : 1.7 1.8 2.3 3.2

Q. 9: a) A random sample of size 16 has 53 as mean. The sum of squares of the deviations from mean 153. Can this sample be regarded as taken from the population having 56 as mean.

b) Test for goodness of fit of a uniform distribution to the following data obtained when a die is tossed 120 times.

Face :	1	2	3	4	5	6
Observed:	20	22	17	18	19	24
Expected :	20	20	20	20	20	20
