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Total No. of Questions : 09]

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B. Tech. (Sem. - 2<sup>nd</sup>)

ENGINEERING MATHEMATICS - II

SUBJECT CODE : AM - 102Paper ID : [A0120]

[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours

Maximum Marks : 60

Instruction to Candidates:

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Five** questions from Section - B & C.
- 3) Select atleast **Two** questions from Section - B & C.

## Section - A

Q1)

[Marks : 2 Each]

a) State Cayley Hamilton theorem.

b) Prove that the following matrix is orthogonal  $A = \begin{bmatrix} -2/3 & 1/3 & 2/3 \\ 2/3 & 2/3 & 1/3 \\ 1/3 & -2/3 & 2/3 \end{bmatrix}$ .

c) Find the directional derivative of  $f(x,y,z) = xy^2 + yz^2$  at the point  $(2, -1, 1)$  in the direction of vector  $\hat{i} + 2\hat{j} + 2\hat{k}$ .

d) If  $uf = \nabla V$ , where  $u, v$  are scalar fields and  $f$  is a vector field show that  $f \cdot \text{curl } f = 0$ .

e) Solve  $\frac{dy}{dx} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0$ .

f) Find the inverse transformation of

$$y_1 = x_1 + 2x_2 + 5x_3.$$

$$y_2 = -x_2 + 2x_3$$

$$y_3 = 2x_1 + 4x_2 + 11x_3.$$

g) Define types of Errors in a testing of Hypothesis.

h) If the probability of a bad reaction from a certain injection is 0.001 determine the chance that out of 2000 individuals more than two will get a bad reaction.

i) Solve  $x \frac{dy}{dx} + y = x^3 y^6$ .

j) Solve  $y - 2px = \tan^{-1}(xp^2)$ .

### Section - B

[Marks : 8 Each]

Q2) Diagonalize

$$A = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$$

and hence find  $A^8$ . Find the modal matrix.

Q3) Solve

(a)  $(y + x)dy = (y - x)dx$ .

(b)  $(x - 2y + 1)dx + (4x - 3y - 6)dy = 0$ .

Q4) Solve

(a)  $xp^2 - yp - y = 0$ .

(b)  $(D^2 + 1)y = \operatorname{cosec}x \cdot \cot x$ .

Q5) A 32kg weight is suspended from a spring having constant 4kg/ft prove that the motion is one of resonance if a force  $16 \sin 2t$  is applied and damping force is negligible. Assume that initially the weight is at rest in the equilibrium position.

[Marks : 8 Each]

Q6) If  $V$  is the region in the first octant bounded by  $y^2 + z^2 = 9$  and the plane  $x = 2$  and  $\vec{f} = 2x^2y\hat{i} + y^2\hat{j} + 4xz^2\hat{k}$ . Then evaluate  $\iiint_V (\nabla \cdot \vec{f}) dv$ .

Q7) Prove that poisson distribution is the limiting case of binomial distribution for very large trials with very small probability.

Q8) The length of life  $x$  of certain computers is approximately normally distributed with mean 800 hours and standard deviation 40 hours. If a random sample of 30 computers has an average life of 788 hours, test the null hypothesis that  $\mu = 800$  hours against the alternative that  $\mu \neq 800$  hours at 5% level of significance.

Q9) State Gauss's Divergence theorem and using it evaluate  $\iint_s \vec{A} \cdot \vec{n} ds$ , where

$\vec{A} = 2xy\hat{i} + yz^2\hat{j} + xz\hat{k}$  and  $s$  is the surface of the region bounded by  $x = 0$ ,  $y = 0$ ,  $z = 0$ ,  $y = 3$  and  $x + 2z = 6$ .

