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B. Tech. (Sem. - 2nd)

ENGINEERING MATHEMATICS - II

SUBJECT CODE : AM - 102

Paper 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. 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 $x\frac{dy}{dx}+y=x^3y^6$.

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

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 sin2t is applied and damping force is negligible. Assume that initially the weight is at rest in the equilibrium position.

Section - C

[Marks : 8 Each]

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

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

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