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B. Tech. (Sem. - 2nd)

ENGINEERING MATHEMATICS - II

SUBJECT CODE : AM - 102

Paper ID : [A0119]

[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 at least **Two** questions from Section - B & C.

Section - A

Q1) [*Marks : 2 Each*]

a) Find the inverse transformation of

$y_1 = x_1 + 2x_2 + 5x_3$

$y_2 = -x_2 + 2x_3$

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

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

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

d) Solve $\frac{d^4x}{dt^4} + 4x = 0$.

e) Show that the two functions $\sin 2x$, $\cos 2x$ are independent solution of $y'' + 4y = 0$.

f) Prove that the following matrix is orthogonal.

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

g) Find a unit vector normal to the surface $xy^3z^2 = 4$ at the point $(-1, -1, 2)$.

P.T.O.

h) If $uf = \nabla v$, where u, v are scaler fields and f is a vector field show that f. curl $f = 0$.

i) A five figure number is formed by the digit 0, 1, 2, 3, 4 without repetition. Find the probability that the number is divided by 4.

j) Define types of errors in a testing of Hypothesis.

Section - B

[*Marks : 8 Each*]

Q2) Verify Cayley Hemilton Theorem for the matrix.

$$A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$$

and hence find $B = A^8 - 11A^7 - 4A^6 + A^5 + A^4 - 11A^3 - 3A^2 + 2A + I.$, A^{-1} and A^4.

Q3) Solve $(2y^2 + 4x^2y)\,dx + (4xy + 3x^3)\,dy = 0$.

Q4) (a) Solve $(x^2 + y^2)\,(1 + p)^2 = 2\,(x + y)\,(1 + p)\,(x + yp) - (x + yp)^2$.

(b) Solve $(D^2 - 2D + 1)\,y = xe^x \sin x$.

Q5) A particle of mass m moves in a straight line under the action of force mn^2x which is always directed towards a fixed point "O" on the Line. Determine the displacement $x(t)$ if the resistance to the motion is $2\lambda tmnv$ given that initially $x = 0$, $x = x_0$, where $0 < \lambda < 1$.

Section - C

[*Marks : 8 Each*]

Q6) If $\vec{A} = (x - y)\,\hat{i} + (x + y)\,\hat{j}$ evaluate $\oint_c \vec{A}\,d\vec{r}$ around the curve c consisting of $y = x^2$ and $y^2 = x$.

Q7) State Green's theorem and using it find the area of the region in the first quadrant bounded by the curve $y = x$, $y = \frac{1}{x}$, $y = \frac{x}{4}$.

Q8) Out of 800 families with 5 children each, how many should you expect to have (a) 3 boys (b) 5 girls (c) either 2 or 3 boys. Assume equal probabilities for boys and girls.

Q9) An ambulance service company claims that an average it takes 20 minutes between a call for an ambulance and the patients arrival at the hospital. If in 6 calls the time taken (between a call and arrival at hospital) are 27, 18, 26, 15, 20, 32. Can the company claim be accepted?