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Total No. of Questions : 09]

[Total No. of Pages : 04

B. Tech. (Sem. - 1st / 2nd)

ENGINEERING MATHEMATICS - II

SUBJECT CODE : AM - 102 (New)

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 atleast **Two** questions from Section - B & C.

Section - A

Q1) **(Marks : 2 each)**

a) If $A = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 1 & 3 \\ 0 & 0 & 2 \end{bmatrix}$, then the determinant of AB is

(i) 4, (ii) 8, (iii) 16, (iv) 32

b) The rank of the matrix $A = \begin{bmatrix} 1 & 1 & -1 \\ 2 & -3 & 4 \\ 3 & -2 & 3 \end{bmatrix}$ is - - - - - - - -.

c) Two balls of m_1 and m_2 gms are projected vertically upward such that the velocity of projection of m_1 is double that of m_2. If the maximum height to which m_1 and m_2 rise, be h_1 and h_2 respectively, then

(i) $h_1 = 2h_2$ (ii) $2h_1 = h_2$ (iii) $h_1 = 4h_2$ (iv) $4h_1 = h_2$

d) The complementary part of the differential equation

$x^2y'' - xy' + y = \log x$ is - - - - - .

e) The particular integral of $(D^2 + a^2)\, y = \sin ax$ is

(i) $\frac{-x}{2a} \cos ax$ (ii) $\frac{x}{2a} \cos ax$

(iii) $\frac{-ax}{2} \cos ax$ (iv) $\frac{ax}{2} \cos ax$.

f) If $u = \left(x^2 + y^2\right)^{-1/2}$, then $\nabla \cdot (\nabla u)$ is

(i) 0 (ii) 1 (iii) –1 (iv) 2

g) Maximum value of the directional derivative of $f = x^2 - 2y^2 + 4z^2$ at point $(1, 1, -1)$ is - - - - - - - .

h) Average scores of three batsman A, B, C are respectively 40, 45, 55 and their standard deviations are respectively 9, 11, 16. Which batsman is more consistant?

i) If the correlation coefficient is zero, then regression lines are

(i) parallel (ii) perpendicular

(iii) coincident (iv) intersect at 45°.

j) The probability that a leap year should have 53 sundays is

(i) $\frac{2}{7}$ (ii) $\frac{1}{7}$

(iii) 0.3 (iv) 0.5

Section - B

(Marks : 8 each)

Q2) (a) Find the values of a, b, c if the matrix

$$A = \begin{bmatrix} 0 & 2b & c \\ a & b & -c \\ a & -b & +c \end{bmatrix}$$

is orthogonal.

(b) If $A = \begin{bmatrix} -1 & 2+i & 5-3i \\ 2-i & 7 & 5i \\ 5+3i & -5i & 2 \end{bmatrix}$

Show that A is a Hermitian matrix and iA is a skew - Hermitian matrix.

Q3) Solve the following:

(a) $xy\,(1 + xy^2)\,\dfrac{dy}{dx} = 1$

(b) $\dfrac{dy}{dx} = \dfrac{-\left(3x^2 + 6xy^2\right)}{6x^2y + 4y^3}$

(c) $(px - y)\,(x + py) = 2p$.

Q4) Solve the following:

(a) $(D - 2)^2\, y = 8\{e^{2x} + \sin 2x + x^2\}$.

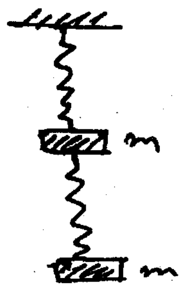
(b) $x^3y''' + 2x^2y'' + 2y = 10\left(x + \dfrac{1}{x}\right)$.

Q5) (a) Solve

$$(D^2 - 1)\, y = e^{3x}\cos 2x - e^{2x}\sin 3x$$

using method of undetermined coefficients.

(b) Two particles each of mass m gms are suspended from two springs of same stiffness coefficient k. After the system comes to rest, the lower mass is pulled l cms downwards and released. Discuss their motion.



Section - C

(Marks : 8 each)

Q6) (a) What is conservative field? Show that

$$\overline{F} = \left(y^2\cos x + z^3\right)\hat{i} + \left(2y\sin x - 4\right)\hat{j} + \left(3xz^2 + 2\right)\hat{k}$$

is conservative. Find its scalar potential.

(b) Use Divergence theorem to evaluate

$$\int_S \overline{F} \cdot d\overline{S} \text{ where}$$

$$\overline{F} = x^3\hat{i} + y^3\hat{j} + z^3\hat{k}$$

and S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$.

Q7) (a) Show that the function $\phi = a \cos mx$ is not a valid velocity potential flow function of liquid.

(b) Test whether the motion specified by

$$\overline{q} = k^2\left(x\hat{j} - y\hat{i}\right)/\left(x^2 + y^2\right) \text{ (}k\text{ is constant)}$$

is a possible motion of a liquid.

Q8) (a) Discuss Binomial frequency distribution. The probability that a bomb dropped from a plane hits the target is $\frac{1}{3}$. If 6 bombs are dropped, find the probability that atleast two will hit the target.

(b) The pressure and volume of a gas are related by the equation $pv^{\alpha} = k$, α and k being constants. Find the equation to the following set of values.

p (kg/cm^2)	0.5	1.0	1.5	2.0	2.5	3.0
v (litres)	1.62	1.00	0.75	0.62	0.52	0.46

Q9) (a) Discuss Chi-square test and its properties. Use this to test the hypothesis that data follows a binomial distribution for the problem in which a set of five similar coins is tossed 320 times and the result is

No. of heads :	0	1	2	3	4	5
Frequency :	6	27	72	112	71	32

(b) Two independent samples of size 7 and 6 have the following values:

Sample A :	28	30	32	33	33	29	34
Sample B :	29	30	30	24	27	29	

Examine whether the samples have been drawn from normal populations having the same variance. Given the values of F at 5% level for 16, 57 degrees of freedom is 4.95 and for 15, 67 degrees of freedom is 4.39.