Roll No. ......................

**Total No. of Questions : 09]** **[Total No. of Pages : 03**

# B.Tech. (Sem. - 2nd)

## ENGINEERING MATHEMATICS - II

**SUBJECT CODE : AM - 102 (2k4 & Onwards)**

**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 and C.
3) Select atleast **Two** questions from Section - B and C.



## Section - A

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

a) Define Rank of a matrix. What is the rank of a non singular matrix of order $n$?

b) Reduce the following differential equation into exact differential equation. $(x^2y - 2xy^2)dx - (x^3 - 3x^2y)dy = 0$

c) Solve the equation $\frac{d^4y}{dx^4} + 2\frac{d^2y}{dx^2} + y = 0$.

d) State the condition when the system of non-homogeneous simultaneous linear equations has a unique solution and infinite solutions.

e) Find $div.\vec{F}$ where $\vec{F} = \text{grad}\,(x^3 + y^3 + z^3 - 3xyz)$.

f) State
   (i) Stoke's theorem
   (ii) Gauss divergence theorem.

g) What is Random Variable? Give an example to explain the definition.

h) Define Probability. A and B throw alternately a pair of dice. A wins if he throws 6 before B throws 7 and B wins if he throw 7 before A throws 6. If A begins, find his chance of winning.

i) What is Hermitian matrix give an example?

j) Prove that $\nabla.\nabla\times\vec{F}=0$.

## Section - B

*(Marks : 8 each)*

***Q2)*** Using Gauss-Jordan method, find the inverse of the matrix $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 3 & -3 \\ -2 & -4 & -4 \end{bmatrix}$.

***Q3)*** Determine the rank of the matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ and hence state whether the row vectors are Linearly independent or Linearly Dependent.

***Q4)*** Solve

(a) $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + y = xe^x \sin x$.

(b) Use method of variation of parameters to solve $\dfrac{d^2y}{dx^2} + 4y = \tan 2x$.

***Q5)*** A particle of mass '$m$' executes S.H.M in the line joining the points A and B, on a smooth table and is connected with these points by elastic strings whose tensions in equilibrium are each T. If $l$, $l'$ be the extensions of the strings beyond their natural lengths, find the time of an oscillation.

## Section - C

*(Marks : 8 each)*

***Q6)*** Show that the following vectors are solenoidal.

(a) $(x+3y)\hat{i} + (y-3z)\hat{j} + (x-2z)\hat{k}$

(b) $\nabla\phi \times \nabla\chi$

***Q7)*** Verify Divergence theorem for $\vec{F} = (x^2 - yz)\hat{i} + (y^2 - zx)\hat{j} + (z^2 - xy)\hat{k}$ taken over the rectangular parallelopiped $0 \le x \le a$, $0 \le y \le b$, $0 \le z \le c$.

*Q8)* In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and S.D. of the distribution.

*Q9)* 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 |

Test the hypothesis that the data follow a binomial distribution.

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