

Roll No. \_\_\_\_\_

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**2E2301**

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**B. Tech. II Sem. (Main/Back) Exam., May - 2019**

**MA - 102 Engineering Mathematics - II**

**Time: 3 Hours**

**Maximum Marks: 80**  
**Min. Passing Marks: 28**

*Instructions to Candidates:*

*Attempt any five questions including Question No. 1, which is compulsory. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

*Units of quantities used/calculated must be stated clearly.*

*Use of following supporting material is permitted during examination.*

*(Mentioned in form No. 205)*

1. NIL

2. NIL

**Q.1** Compulsory, Answer for each sub-question be given in about 25 words –

- (a) Suppose a matrix A has rank 5 and we find a matrix B after applying elementary column operations on A. What will be the rank of B? [2]
- (b) A  $3 \times 3$  matrix has Eigen values 2, 3, 4, then find the Eigen values of  $\text{adj}(A)$ . [2]
- (c) Define periodic functions. [2]
- (d) Write Dirichlet's conditions for Fourier series. [2]
- (e) Identify the functions  $p(t)$  and  $q(t)$  if the differential equation - [2]

$$\frac{dx}{dt} = \frac{x+t^2-2x\sqrt{t}}{t}$$

is written in the form  $dx/dt + p(t)x = q(t)$ .

- (f) Find solution of the initial value problem  $y'' + y^2 = 0$ ,  $y(0) = 5$ . [2]
- (g) What is the difference between Complete solution and General solution of a partial differential equation? [2]
- (h) Write the general linear partial differential equation of first order having two independent variables and one dependent variable. [2]

Q.2 (a) If A be a  $3 \times 3$  matrix with real entries whose eigenvalues are 1, -1, 2. [8]

Suppose that for  $\alpha, \beta, \gamma \in \mathbb{R}$

$$\alpha A^{-1} = -A^2 + \beta A + \gamma I$$

where I is the  $3 \times 3$  identity matrix, then find values  $\alpha, \beta, \gamma$ .

(b) Obtain the Fourier series for the function  $f(x) = x^2, -\pi < x < \pi$ . Hence show that

$$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}. \quad [8]$$

Q.3 (a) If  $f(x) = \begin{cases} x, & 0 < x < \pi/2 \\ \pi - x, & \pi/2 < x < \pi \end{cases}$  [8]

Then find half range sine series.

(b) Solve :

(i)  $(xy \sin xy + \cos xy) y dx + (xy \sin xy - \cos xy) x dy = 0$

(ii)  $(x + 2y^2) (dy/dx) = y$  [8]

Q.4 (a) Solve the following system of equations : [8]

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110$$

(b) Solve : [8]

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

Q.5 (a) Apply the method of variation of parameters to solve [8]

$$\frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = e^{-x} \log x.$$

(b) Apply Charpit's method to find complete integral of [8]

$$z^2 (p^2 z^2 + q^2) = 1.$$

Q.6 (a) Solve [8]

$$\frac{d^2y}{dx^2} - (2 \tan x) \frac{dy}{dx} + 5y = (\sec x) e^x.$$

- (b) Find the Eigen values and the corresponding Eigen vectors of the matrix [8]

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

- Q.7 (a) Using harmonic analysis, obtain the first three terms in the Fourier series expansion of  $y$ , as given below : [8]

x	0	1	2	3	4	5
y	9	18	24	28	26	20

- (b) Determine the values of  $k$  such that the rank of matrix  $A$  is 3, where [8]

$$A = \begin{bmatrix} 1 & 1 & -1 & 0 \\ 4 & 4 & -3 & 1 \\ k & 2 & 2 & 2 \\ 9 & 9 & k & 3 \end{bmatrix}$$