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15MATDIP41

## Fourth Semester B.E. Degree Examination, Feb./Mar. 2022 Additional Mathematics – II

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 a. Find the rank of the matrix :

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

(06 Marks)

- b. Show that the following system of equations is inconsistent.

$$\begin{aligned} 2x - 3y + 7z &= 5 \\ 3x + y + 3z &= 13 \\ 2x + 19y - 47z &= 32. \end{aligned}$$

(05 Marks)

- c. If the eigen values of the matrix  $\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$  are  $-2, 3, 6$  find the eigenvectors corresponding to each of the eigenvalue.

(05 Marks)

OR

- 2 a. Compute the eigenvalues of the matrix

$$\begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$$

(06 Marks)

- b. Solve by Gauss elimination method :

$$\begin{aligned} x + y + z &= 9 \\ 2x - 3y + 4z &= 13 \\ 3x + 4y + 5z &= 40. \end{aligned}$$

(05 Marks)

- c. Compute inverse of a matrix  $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$  applying Cayley – Hamilton theorem.

(05 Marks)

### Module-2

- 3 a. Solve  $(D^2 - 5D + 6)y = 0$ .

(06 Marks)

- b. Solve  $\frac{d^2y}{dx^2} + 8y = \sin(3x)$ .

(05 Marks)

- c. Solve by the method of undetermined coefficients the differential equation :

$$\frac{d^2y}{dx^2} + \frac{2dy}{dx} + 4y = 2x^2 + 3e^{-x}.$$

(05 Marks)

OR

- 4 a. Solve  $\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = e^{4x}$ . (06 Marks)
- b. Solve  $\frac{d^2y}{dx^2} - \frac{4dy}{dx} + 4y = e^{2x} \cos x$ . (05 Marks)
- c. Solve by the method of variation of parameters,  $\frac{d^2y}{dx^2} + 4y = \tan(2x)$ . (05 Marks)

**Module-3**

- 5 a. Find Laplace transform of  $f(t) = 6 + e^{3t} + \sin(4t) + \cos(6t) + t^4$ . (06 Marks)
- b. Find  $L\left\{\int_0^t \sin(4t) dt\right\}$  applying Laplace transforms of integrals rule. (05 Marks)
- c. If  $f(t) = \begin{cases} t^2 & 0 < t < 2 \\ t & t > 2 \end{cases}$   
Express  $f(t)$  in terms of unit step function and hence find the Laplace transform. (05 Marks)

OR

- 6 a. Find L.T. of:  
i)  $\sin(5t) \cos(2t)$     ii)  $\cos^2(3t)$ . (06 Marks)
- b. Apply rule of transforms derivatives to find  $L\{f'(t)\}$  for  $f(t) = \cos t$  where  $f'(t) \equiv$  derivative of  $f(t)$ . (05 Marks)
- c. Find the Laplace transform of the periodic function :  
 $f(t) = E \sin(\omega t) \quad 0 < t < \frac{\pi}{\omega}$   
 $= 0 \quad \frac{\pi}{\omega} < t < \frac{2\pi}{\omega}$  (05 Marks)

**Module-4**

- 7 a. Find inverse Laplace transform :  
 $\frac{1}{s^{\frac{3}{2}}} - \frac{2s}{s^2 + 64} + \frac{10}{s^2 - 100} + \frac{1}{s+8} + \frac{1}{s}$ . (06 Marks)
- b. Find :  
 $L^{-1}\{\bar{f}(s)\}$  if  $\bar{f}(s) = \frac{1}{s(s-1)(s-2)}$ . (05 Marks)
- c. Solve using Laplace transforms :  
 $\frac{dx}{dt} + 5x - 2y = t$   
 $\frac{dy}{dt} + 2x + y = 0$   
Given  $x = 0, y = 0$  at  $t = 0$ . (05 Marks)

OR

- 8 a. Find :  
 $L^{-1}\left\{\frac{3s+4}{s^2+2s+2}\right\}$ . (06 Marks)
- b. Find :  $L^{-1}\left\{\log\sqrt{\frac{s+3}{s+4}}\right\}$ . (05 Marks)
- c. Apply Laplace transform method to solve  
 $y''' + 2y'' - y' - 2y = 0$   
given  $y(0) = y'(0) = 0$   
and  $y''(0) = 6$ . (05 Marks)

Module-5

- 9 a. Explain the terms :  
i) Probability  
ii) Sample space  
iii) Mutually exclusive events with an example. (06 Marks)
- b. If three coins are thrown find the probability that,  
All the three are heads  
Atleast one tail occurs. (05 Marks)
- c. If  $P(A) = \frac{1}{4}$   $P(B) = \frac{1}{3}$   $P(A \cap B) = \frac{1}{12}$  find the conditional probabilities,  
i)  $P(A/B)$  ii)  $P(B/A)$ . (05 Marks)

OR

- 10 a. For any, two events A and B state the 'law of addition' of probabilities. Also for two independent events A and B state the 'law of multiplication' of probabilities. (06 Marks)
- b. If three persons hit a target with probabilities  $P(A) = \frac{1}{2}$   $P(B) = \frac{1}{3}$   $P(C) = \frac{1}{4}$ . Find the probability that, i) All hit the target ii) Target not hit. (05 Marks)
- c. In a bolt factory three machines A, B, C produce 20%, 30% and 50% of the total output and of their outputs 5%, 4%, 3% are defective respectively. If a bolt is chosen randomly and found defective, find the probability that bolt was manufactured by machine A. (05 Marks)

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