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15MATDIP41

Fourth Semester ME, Degree Examination, Dec.2019/Jan.2020
Additional Mathematics - II

Time: 3 hrs.

Max. Marks: 80

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

Module-1

- 1 a. Find the rank of the matrix by

$$A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix} \text{ by applying elementary row transformations.} \quad (06 \text{ Marks})$$

- b. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 3 \end{bmatrix}$ using Cayley-Hamilton theorem. (05 Marks)

- c. Solve the following system of equations by Gauss elimination method.
 $+y + 4z = 12, \quad 4x + 11 - z = 33, \quad 8x - 3y + 2z = 20$ (05 Marks)

OR

- 2 a. Find the rank of the matrix $\begin{bmatrix} -1 & -3 & -1 \\ 2 & 3 & -1 \\ 0 & 1 & 1 \\ 1 & 1 & -1 \end{bmatrix}$ by reducing it to echelon form. (06 Marks)

- b. Find the eigen values of $A = \begin{bmatrix} 7 & -4 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ (05 Marks)

- c. Solve by Gauss elimination method: $x + y + z = 9, \quad x - 2y + 3z = 8, \quad 2x - 4y - z = 3$ (05 marks)

Module-2

- 3 a. Solve $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 11y = 0$ (05 Marks)

- b. Solve $y'' - 4y' + 13y = \cos 2x$ (05 Marks)

- c. Solve by the method of undetermined coefficients $y'' + 3y' + 2y = 12x^2$ (06 Marks)

OR

- 4 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = 0$ (05 Marks)

- b. Solve $y'' + 4y' - 12y = e^{2x} - 3 \sin 2x$ (05 Marks)

- c. Solve by the method of variation of parameter $\frac{dy}{dx} + y = \tan x$ (06 Marks)

Module-3

- 5 a. Find the Laplace transform of
 i) $e^{-2} \sinh 4t$ ii) $e^{-2t}(2\cos 5t - \sin 5t)$ (06 Marks)

- b. Find the Laplace transform of $f(t) = t^2, 0 < t < 2$ and $f(t+2) = f(t)$ for $t > 2$. (05 Marks)

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c. Express $f(t) = \begin{cases} t & 0 < t < 4 \\ 5 & t > 4 \end{cases}$ in terms of unit step function and hence find $L[f(t)]$. (05 Marks)

OR

6 a. Find the Laplace transform of i) $t \cos at$ ii) $\frac{\cos at - \cos bt}{t}$ (06 Marks)

b. Given $f(t) = \begin{cases} E & 0 < t < a/2 \\ -E & a/2 < t < a \end{cases}$ where $f(t+a) = f(t)$. Show that $L[f(t)] = \frac{E}{s} \tan^{-1} \frac{as}{4}$ (05 Marks)

c. Express $f(t) = \begin{cases} 0 & 0 < t < 1 \\ 1 & 1 < t < 2 \\ 2 & t > 2 \end{cases}$ in terms of unit step function and hence find $L[f(t)]$. (05 Marks)

Module-4

7 a. Find the inverse Laplace transform of i) $\frac{2s-1}{s^2+4s+29}$ ii) $\frac{s^2+2}{s^2+36} + \frac{4s-1}{s^2+25}$ (06 Marks)

b. Find the inverse Laplace transform of $\log \frac{s^2+1}{s^2+4}$ (05 Marks)

c. Solve by using Laplace transforms $y'' + 4y' + 4y =$ given that $y(0) = 0, y'(0) = 0$. (05 Marks)

OR

8 a. Find the inverse Laplace transform of $\frac{1}{(s+1)(s+2)(s+3)}$ (06 Marks)

b. Find the inverse Laplace transform of $\frac{\cot^{-1} \frac{5+a}{b}}{b}$ (05 Marks)

c. Using Laplace transforms solve the differential equation $y''' + 2y'' - 2y = 0$ given $y(0) = y'(0) = 0$ and $y''(0) = 6$. (05 Marks)

Module-5

9 a. State and prove Baye's theorem. (06 Marks)

b. The machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine "C". (05 Marks)

e. The probability that a team wins a match is $3/5$. If this team play 3 matches in a tournament, what is the probability that i) win all the matches ii) lose all the matches. (05 Marks)

OR

10 a. If A and B are any two events of S. which are not mutually exclusive then $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. (06 Marks)

b. If A and B are events with $P(A \cap B) = 7/8, P(A \cap B) = 1/4, P(A \cup B) = 5/8$. Find $P(A), P(B)$ and $P(A \cap B)$. (05 Marks)

c. The probability that a person A solves the problem is $1/3$, that of B is $1/2$ and that of C is $3/5$. If the problem is simultaneously assigned to all of them what is the probability that the problem is solved? (05 Marks)