P P SAVANI UNIVERSITY

Forth Semester of B. Tech. Examination

May 2022

SESH2051 Mathematical Methods for Computation

18.05.2022, Wednesday **Time: 09:00 a.m. To 11:30 a.m.** **Maximum Marks: 60**

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in same answer sheet.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Answer the Following: (Any Six)

Q - 1 Solve $(D^2 + D)y = x^2 + 2x + 4$. **[05]**

Q - 2 Using the method of variation of parameters, solve $(D^2 - 2D + 2)y = e^x \tan x$. **[05]**

Q - 3 Solve $(D^2 + 2)y = x^3 + x^2 + e^{-2x} + \cos 3x$. **[05]**

Q - 4 Solve $p(1 + q) = qz$. **[05]**

Q - 5 Solve $(4D^2 - 4DD' + D'^2) = 16\log(x + 2y)$. **[05]**

Q - 6 Solve $pz - qz = z^2 + (x + y)^2$. **[05]**

Q - 7 Find the Laplace transform of $f(t) = \begin{cases} t^2, & 0 < t < 1 \\ 4t, & t > 1 \end{cases}$ **[05]**

Q - 8 Find the inverse Laplace transform of $\frac{1}{(s-2)(s+2)^2}$. **[05]**

SECTION – II

Answer the Following: (Any Six) **[05]**

Q - 1 Find the Fourier series of $f(x) = x - x^3$ in the interval $(-1,1)$. **[05]**

Q - 2 Find the half-range cosine series of $f(x) = x$ in the interval $(0,2)$. **[05]**

Q - 3 Find the Fourier sine integral of $f(x) = e^{-bx}$. Hence, show that $\frac{\pi}{2}e^{-bx} = \int_0^\infty \frac{\omega \sin \omega x}{b^2+\omega^2} d\omega$ **[05]**

Q - 4 Find the arithmetic mean, standard deviation and Coefficient of Variation for the following data: **[05]**

Value	Number
12.5	4
13.0	19
13.5	30
14.0	63
14.5	66
15.0	29
15.5	18
16.0	1

Q - 5 Calculate the coefficient of correlation for the following data: **[05]**

x	5	9	13	17	21
y	12	20	25	33	35

Q - 6 The number of bacterial cells (y) per unit volume in a culture at different hours (x) is given below: **[05]**

x	0	1	2	3	4	5	6	7	8	9
y	43	46	82	98	123	167	199	213	245	272

Calculate the regression line of y on x. Also, estimate y corresponding to $x = 15$ hours.

Q - 7 In a bolt factory, machines A, B, C manufacture 25%, 35%, and 40% of the total output and out of the total manufacturing, 5%, 4%, and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. Find the probabilities that it is manufactured from Machine B. **[05]**

Q - 8 A discrete random variable X has mean 6 and variance 2. If it is assumed that the distribution is binomial, find the probability that $5 \leq X \leq 7$. **[05]**

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