

Total No. of Questions : 8]

[Total No. of Printed Pages : 3

Roll No

BE-3001(EC)-CBGS

B.E., IV Semester

Examination, December 2020

Choice Based Grading System (CBGS)

Mathematics - III

Time : Three Hours

Maximum Marks : 70

- Note:** i) Attempt any five questions.
ii) All questions carry equal marks.

1. a) Find a Fourier series to the function $f(x) = x - x^2$ from $x = -\pi$ to $x = \pi$. Also deduce 7

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \dots = \frac{\pi^2}{12} \dots$$

- b) Find the Laplace transform of the following: 7

i) $t^3 \cos 4t$

ii) $\int_0^t \frac{e^t \sin t}{t}$

2. a) Find half range cosine series of $f(x) = \sin\left(\frac{\pi x}{l}\right)$ in the range $0 < x < l$. 7

- b) Find the Fourier sine and Fourier cosine transform of

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2 - x, & 1 < x < 2 \\ 0, & x > 2 \end{cases} \quad 7$$

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[2]

3. a) Using parseval's identity, show that

$$\int_0^{\infty} \frac{dx}{(x^2 + a^2)(x^2 + b^2)} = \frac{\pi}{2ab(a+b)} \quad 7$$

- b) Solve by Laplace transform $(D + 1)^2 y = 3te^{-t}$, $t > 0$,
subject to the conditions $y = 4$, $Dy = 2$ when $t = 0$. 7

4. Using finite Fourier transform, solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, given

$$u(0, t) = 0, u(6, t) = 0$$

$$u(x, 0) = \begin{cases} 1, & 0 < x < 3 \\ 3, & 3 < x < 6 \end{cases} \quad 14$$

5. a) The p.d.f. of a random variate X is given by

$$p(x) = \begin{cases} K & \text{if } x = 0 \\ 2K, & \text{if } x = 1 \\ 3K, & \text{if } x = 2 \\ 0, & \text{otherwise} \end{cases} \quad 7$$

- i) Find the value of K
ii) Evaluate $P(X < 2)$, $P(X \leq 2)$
iii) Find distribution function of X.

- b) Find mean and standard deviation of the binomial distribution. 7

6. a) Fit a Poisson distribution to the following: 7

| | | | | | |
|------|----|----|----|---|---|
| $x:$ | 0 | 1 | 2 | 3 | 4 |
| $f:$ | 46 | 38 | 22 | 9 | 1 |

- b) Prove that the mean deviation from the mean of the normal distribution is $4/5$ times its standard deviation. 7

[3]

7. a) Using the method of least squares, find the second degree parabola of y on x from the following data: 7

| | | | | | |
|-------|------|------|------|------|------|
| $x :$ | 1 | 2 | 3 | 4 | 5 |
| $y :$ | 1090 | 1220 | 1390 | 1625 | 1915 |

- b) A random variable has the probability law.

$$dF = \frac{x}{a^2} e^{-x^2/2a^2} dx, 0 \leq x < \infty.$$

Find the distance between the quartiles and obtain standard deviation. 7

8. a) Find Laplace transform of unit step function and Dirac Delta Function. 7

b) Evaluate $L^{-1} \left\{ \frac{5S + 3}{(S - 1)(S^2 + 2S + 5)} \right\}$. 7

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