Indian Maritime University

(A Central University, Govt of India)

End Semester Examinations – December 2022

Programme Name: B Tech (ME)

Semester: II

Subject Code: UG11T3202

Subject Name: Mathematics II

Date: 24.12.2022	Max Marks: 70
Duration: 03 Hrs	Pass Marks: 35

General Instructions

(i) All Sections (A, B & C) are to be attempted.
(ii) Options, if any, are specified in respective section.
(iii) Scientific calculator is permitted.

Section A

Multiple choice questions /Fill up the blanks [10x1=10 Marks]

1. If f(x) is an even function defined in (-c, c) then which of the statement is true for the Fourier series expansion of f(x)
   A. a_o= o B. a_n=0 C. b_n=o D. none of these

2. Find the Euler's coefficient a_n when a function f(x) = x, - π ≤ x ≤ π is expressed as Fourier Series.
   A. $-\frac{4(-1)^n}{n\pi}$ B. $\frac{4(-1)^n}{n\pi}$
   C. $\frac{2(-1)^n}{n\pi}$ D. 0

3. Laplace transform of sin 3t =______________ (Fill up the blank)

4. Convolution theorem is used for

   A. Solving Differential Equation B. For finding Particular Integral
   C. Fourier series D. Finding Inverse Laplace Transform

5. L^{-1} (1/s) = __________
   A. 0 B. 1 C. t D. none of these

6.The integrating factor of the given differential equation is $\frac{dx}{dy} + 3\frac{x}{y} = \frac{1}{y^2}$

$$\frac{dx}{dy} + \frac{3x}{y} = \frac{1}{y^2}$$

A. e^{y^3} B. y^3 C. x^3 D. $-y^3$

7. What is the general solution of the differential equation $\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 9x = 0$

A. $x = (C_1 + C_2 t)e^{-3t}$ B. $x = (C_1 + C_2)e^{-3t}$

C. $x = C_1 + C_2 t e^{-3t}$ D. $x = C_1 + C_2 e^{-3t}$

8. If A and B are independent and P(A)=1/2 and P(B) = 1/3 then value of

A. 5/6 B. 1/6 C. 1/3 D. ½

9. The value of k=____________for which the random variable x has the following probability distribution function. (Fill up the blank)

x	-2	-1	0	1	2	3
$p(x)$	0.1	k	0.2	$2k$	0.3	k

10. Which Probability distribution has same mean, median and mode

A. Binomial B. Poisson C. Normal D. Geometric

Section B

Answer the following [5x2 = 10 Marks]

11. Obtain the coefficient a_0 of Fourier series for $f(x)= e^x$ in the interval $0<x<2\pi$.

12. Solve : $\frac{dy}{dx} = e^{-2y}(e^{3x} + x^2)$

13. Find the Laplace transforms of $e^{2t} \cos 4t$.

14. Solve : $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = 0$

15. Find mean for the following probability distributing function

$f(x) = 2x ; \quad 0 \leq x \leq 1$

Section C

Answer any 5 out of 7 questions

16. Find the Fourier series of $f(x)=x^2$ in the interval $(0, 2\pi)$.
Hence deduce that $\frac{\pi^2}{12} = \frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+\cdots$ (10)

17. a) Solve the given exact differential equation
$(x^4 - 2xy^2 + y^4)\,dx - (2x^2y - 4xy^3 + \sin y)\,dy = 0$ (05)

b) Solve: $\frac{dy}{dx}+\frac{3y}{x}=\frac{\sin x}{x^3}$ (05)

18. a) Solve $(D^2+3D+2)\,y = \sin 2x$ (05)
b) Solve by the method of variation of parameters $(D^2+1)y = \sec x$ (05)

19. a) Evaluate $\int_0^\infty e^{-3t}\, t^5\, dt$ (05)
b) Find Inverse Laplace transform of $\left[\frac{1}{\{(s-1)(s+2)(s+1)\}}\right]$ (05)

20. a) Find Inverse Laplace transforms of $\frac{1}{s^2(s+5)}$ (05)

b) Using Convolution theorem evaluate $L^{-1}\left[\frac{1}{(s+a)(s+b)}\right]$ (05)

21. a) A factory has two Machines-I and II. Machine-I produces 60% of items and Machine-II produces 40% items of the total output. Further 2% of the items produced by Machine-I are defective whereas 4% produced by Machine-II are defective. If an item is chosen and is found to be defective, what is the probability that it is from the Machine –I. (05)
b) The random variable x has the probability distribution as shown below.

X:	1	2	3	4
P(x):	0.3	0.2	0.4	0.1

Find i) $P(0.5<x<3.5)$ ii) Expected value of x,
iii) Variance iv) Standard deviation (05)

22.a) The probability that a pen manufactured by a company will be defective is 1/10. If 12 such pens are manufactured, find the probability that

(i) exactly two will be defective
(ii) At least two is defective
(iii) None will be defective (05)

b) In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to be defective. The blades are supplied in packets of 10, Using Poisson distribution calculate the approximate number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets. (05)