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Roll No. : .....

**337351(14)**

**B. E. (Third Semester) Examination, Nov.-Dec. 2021**

**(New Scheme)**

**(Mech., Production and Automobile Engg. Branch)**

**MATHEMATICS-III**

***Time Allowed : Three hours***

***Maximum Marks : 80***

***Minimum Pass Marks : 28***

***Note : Attempted all question. Part (a) of each question is compulsory having 2 marks. Attempt any two parts from (b), (c) and (d) having 7 marks.***

**Unit-I**

1. (a) The value of  $b_n$  in the Fourier series of  $f(x)$ .

Where  $f(x) = |x|$  in  $(-\pi, \pi)$ .

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(b) Expand  $f(x) = x \sin x$  as a Fourier series in the interval  $0 < x < 2\pi$ . 7

(c) Find a Fourier series to represent  $x^2$  in the interval  $(-l, l)$ . 7

(d) The turning moment  $T$  is given for a series of values of the crank angle  $\theta = 75^\circ$ . 7

$\theta$  : 0    30    60    90    120    150    180

$T$  : 0    5224    8097    7850    5499    2626    0

Obtain the first four terms in a series of sines to represent  $T$  and calculate  $T$  for  $\theta = 75^\circ$ .

**Unit-II**

2. (a) Find : 2

$$L[t \cos at]$$

(b) (i) Evaluate :

$$\int_0^{\infty} t e^{-2t} \sin t \, dt$$

(ii) Find :

$$L^{-1}[\cot^{-1}(s/2)]$$

(c) Apply convolution theorem to evaluate : 7

$$L^{-1}\left\{\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right\}$$

(d) Solve  $ty'' + 2y' + ty = \cos t$  given that  $y(0) = 1$ . 7

**Unit-III**

3. (a) Form the partial differential equation 2

$$f(x^2 + y^2, z - xy) = 0$$

(b) Solve : 7

$$(x^2 - yz)p + (y^2 - zx)q = z^2 - xy$$

(c) Solve : 7

$$(D^2 - DD' - 2D')^2 z = (y-1)e^x$$

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- (d) Solve by the method of separation of variables. 7

$$3 \frac{\partial u}{\partial x} + 2 \frac{\partial u}{\partial y} = 0, u(x, 0) = 4e^{-x}$$

**Unit-IV**

4. (a) State Cauchy's theorem. 2

- (b) Evaluate : 7

$$\oint_C \frac{e^z}{(z^2 + \pi^2)^2} dz$$

where  $C : |z| = 4$ .

- (c) Find Taylor's expansion of

$$f(z) = \frac{2z^3 + 1}{z^2 + z}, \text{ about the point } z = i. \quad 7$$

- (d) Evaluate : 7

$$\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2 + 1)(x^2 + 4)}$$

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**Unit-V**

5. (a) Determine the binomial distribution for which mean = 2 (variance) and mean variance = 3. Also find  $P(x \leq 3)$ . 2

- (b) A variate  $X$  has the probability distribution : 7

$x$	:	-3	6	9
$p(x)$	:	1/6	1/2	1/3

Find  $E(X)$  and  $E(X^2)$  Hence evaluate

$$E(2X + 1)^2.$$

- (c) If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals more than two will get a bad reaction. 7

- (d) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and S.D. of the distribution. 7

$$[P(0 \leq z \leq 0.5) = 0.19, P(0 \leq z \leq 1.4) = 0.42]$$