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B. E. (Third Semester) Examination, Nov.-Dec. 2019

(New Scheme)

(CS Engg. Branch)

MATHEMATICS-III

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Attempt all questions. Part (a) is compulsory from each question. Attempt any* ***two*** *parts from (b), (c) and (d).*

Unit-I

1. (a) If $f(x) = x^2$ is defined in the interval $[0, 2\pi]$ find the value of a_0. 2

(b) If $f(x) = \frac{(\pi - x)^2}{4}$ in the range 0 to 2π

show that

$$f(x) = \frac{\pi^2}{12} + \sum_{n=1}^{\infty} \frac{\cos nx}{n^2}.$$ 7

(c) If $f(x) = |\cos x|$, expand $f(x)$ as a Fourier series in the interval $(-\pi, \pi)$. 7

(d) Obtain the constant term and the coefficient of the first sine and cosine terms in the Fourier expansion of y as given in the following table : 7

x :	0	1	2	3	4	5
y :	9	18	24	28	26	20

Unit-II

2. (a) Find Laplace transform of : 2

$$e^{-t} \sin^2 t$$

(b) Prove that :

$$\int_0^{\infty} \frac{e^{-at} - e^{-bt}}{t}\, dt = \log \frac{b}{a}.$$ 7

(c) Use convolution theorem evaluate : 7

$$L^{-1}\left\{ \frac{1}{(s+1)^2 (s+9)^2} \right\}$$

(d) Use transform method to solve :

$$(D^2 - 1)\, x = a \cosh t$$

$$x(0) = x'(0) = 0.$$ 7

Unit-III

3. (a) Write the polar form of Cauchy Riemann equation. 2

(b) Determine the analytic function whose real part is

$$\log \sqrt{x^2 + y^2}$$ 7

(c) Find the residue

$$f(z) = \frac{z^3}{(z-1)^4 (z-2)(z-3)}$$

at its poles and hence evaluate

$$\oint_c f(z)\, dz,$$

where $c : |z| = 2 \cdot 5$ 7

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(d) By Integrating around a unit circle, evaluate

$$\int_0^{2\pi} \frac{d\theta}{17-8\cos\theta}$$ 7

Unit-IV

4. (a) Form the partial differential equation

$$z = f\left(x^2 - y^2\right).$$ 2

(b) Solve the partial differential equation :

$$x^2 (y-z) p + y^2 (z-x) q = z^2 (x-y)$$ 7

(c) Solve :

$$\left(D^2 - DD' - 2D'^2\right) Z = (y-1)\, e^x$$ 7

(d) Solve the equation by the method of separation of variables :

$$3\frac{\partial u}{\partial x} + 2\frac{\partial u}{\partial y} = 0,\ u(x,0) = 4e^{-x}$$ 7

Unit-V

5. (a) The probability that a pen a manufactured by a

company will be defective is $\frac{1}{10}$. If 12 such pens are manufactured, find the probability that exactly two will be defective. 2

(b) X is a continuous random variable with probability density function given by

$$f(x) = Kx \quad (0 \le x < 2)$$
$$= 2K \quad (2 \le x < 4)$$
$$= -Kx + 6K \quad (4 \le x < 6)$$

Find K and mean value of X. 7

(c) The following data are the number of seeds germinating out of 10 on damp filter paper for 80 sets of seeds. Fit a binomial distribution to these data : 7

x :	0	1	2	3	4	5	6	7	8	9	10
f :	6	20	28	12	8	6	0	0	0	0	0

(d) 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, use Poisson distribution to calculate the approximate number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets. $\left(e^{-0.02} = 0 \cdot 9802\right)$. 7