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337351(14)

B. E. (Third Semester) Examination, April-May 2020

NOV-DEC 2020

(New Scheme)

(Mech., Production and Automobile Engg. Branch)

MATHEMATICS-III

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

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

Unit-I

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

(b) Prove that $x^2 = \frac{\pi^2}{3} + 4\sum_{n=1}^{\infty}(-1)^n \frac{\cos nx}{n^2}$, in the interval $-\pi < x < \pi$. 7

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

(d) Obtain the 1st three coefficients in the Fourier cosine series for y, where y is given in the following table. 7

x	:	0	1	2	3	4	5
y	:	4	8	15	7	6	2

Unit-II

2. (a) Find the Laplace transform of $e^{-3t}\sin 5t \cdot \sin 3t$. 2

(b) Prove that : $\int_0^{\infty} \frac{e^{-t}\sin^2 t}{t}dt = \frac{1}{4}\log 5$ 7

(c) Using convolution theorem, evaluate : 7

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

(d) Use transform method to solve : 7

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$$

$$y = \frac{dy}{dt} = 0, \text{ when } t = 0$$

Unit-III

3. (a) Form the partial differential equation : 2

$$z = f(x^2 - y^2)$$

(b) Solve the partial differential equation 7

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

(c) Solve : 7

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

(d) Solve the equation by the method of separation of variable : 7

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

Unit-IV

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

(b) Determine the analytic function whose real part is

$$\frac{y}{x^2+y^2}.$$ 7

(c) Find the residue of $f(z)=\dfrac{z^3}{(z-1)^4(z-2)(z-3)}$ at its poles and hence evaluate $\oint_C f(z)\,dz$, where $C:|z|=2\cdot5$. 7

(d) By integrating around a unit circle, evaluate : 7

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

Unit-V

5. (a) Define Distribution function of the continuous random variable. 2

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

$$\begin{aligned} f(x) &= Kx && (0\le x<2)\\ &= 2K && (2\le x<4)\\ &= -Kx+6K && (4\le x<6)\end{aligned}$$

Find K and mean value of x. 7

(c) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six? 7

(d) Fit Poisson's distribution to the following and calculate theoretical frequencies $\left(e^{-0\cdot5}=0\cdot61\right)$: 7

Deaths	:	0	1	2	3	4
Frequency	:	122	60	15	2	1