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320351(14)

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

NOV-DEC 2020

(New Scheme)

(Civil, Agriculture Engg. Branch)

MATHEMATICS-III

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : *Part (a) is compulsory. Attempt any **two** parts from (b), (c) and (d) of each question. All question carry equal marks.*

Unit-I

1. (a) In the Fourier series expansion of $f(x) = |\sin x|$ in $(-\pi, \pi)$, the value of $a_0 =$ 2

(b) Obtain a half range cosine series for :

$$f(x)=\begin{cases} kx, & 0 \le x \le l/2 \\ k(l-x), & l/2 \le x \le l \end{cases}$$

Deduce the sum of the series :

$$\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots\infty .$$ 7

(c) Expand $f(x)=x\sin x$ as a Fourier series in $(0,\ 2\pi)$. 7

(d) Obtain the constant term and the coefficients 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 the Laplace transform of $e^{2t}\cos^2 t$. 2

(b) Find the Laplace transform of half wave rectified sine wave defined as :

$$f(t)=\begin{cases} \sin wt, & 0<t<\pi/w \\ 0, & \pi/w<t<2\pi/w \end{cases}$$

and $f(t+2\pi/w)=f(t)$. 7

(c) Find

$$L^{-1}\left\{\frac{s^2}{(s^2+a^2)(s^2+b^2)}\right\}$$ by using convolution theorem. 7

(d) Solve the equation by transform method :

$$\frac{d^2y}{dt^2}+2\frac{dy}{dt}+5y=e^{-t}\sin t$$

where $y(0)=0$ and $y'(0)=1$. 7

Unit-III

3. (a) Solve : 2

$$\frac{\partial^3 z}{\partial x^3}-4\frac{\partial^3 z}{\partial x^2\,\partial y}+4\frac{\partial^3 z}{\partial x\,\partial y^2}=0$$

(b) Solve : 7

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

(c) Solve :

$$(D+D'-1)(D+2D'-3)z = 4+3x+6y$$ 7

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

$$4\frac{\partial u}{\partial x}+\frac{\partial u}{\partial y}=3u$$

given

$u = 3e^{-y} - e^{-5y}$ when $x = 0$. 7

Unit-IV

4. (a) Find the value of

$$\int_C \frac{z+4}{z^2+2z+5}\,dz,$$

if C is the circle $|z+1| = 1$. 2

(b) Prove that the function $f(z)$ defined by :

$$f(z)=\frac{x^3(1+i)-y^3(1-i)}{x^2+y^2}\,(z\neq 0),$$

$f(0)=0$ is continuous and the C-R equations are satisfied at the origin yet $f'(0)$ does not exist. 7

(c) Find the Taylor's and Laurent's series expansion of the function

$$\frac{z^2-1}{(z+2)(z+3)}$$

about $z = 0$ in the regions :

(i) $|z| < 2$

(ii) $|z| > 3$ 7

(d) Find the residue of :

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

at its poles and hence evaluate $\oint_C f(z)\,dz$

where C is the circle $|z-i| = 2$ 7

Unit - V

5. (a) If $f(x)$ has probability density $Cx^2, 0<x<1$, determine the C and find the probability that $1/3 < x < ½$. 2

(b) The frequency function of a continuous random variable is given by :

$$f(x) = y_0 x(2-x),\ 0 \le x \le 2$$

Find the value of y_0, mean and variance of x. 7

(c) If 10 percent of rivets produced by a machine are defective, find the probability that out of 5 rivets chosen at random :

(i) none will be defective,

(ii) one will be defective and

(iii) atleast two will be defective 7

(d) The frequency of accidents per shift in a factory is as shown in the following table :

Accident per shift	0	1	2	3	4
Frequency	180	92	24	3	1

Calculate the mean number of accidents per shift the corresponding Poisson distribution and compare with actual observations. 7