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320351(14)

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

(New Scheme)

(Civil Engg. Branch)

MATHEMATICS-III

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

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

Unit-I

1. (a) Write down Fourier series of $f(x)$ for an even function in the range $(-\pi, \pi)$. 2

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

(c) Obtain a half range cosine series for

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

deduce the sum of the series

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

(d) The following table gives the variations of periodic current over a period

t (second)	0	T/6	T/3	T/2	2T/3	5T/6	T
A (amp)	1·98	1·30	1·05	1·30	–0·88	–0·25	1·98

Show that there is a direct current part of 0·75 in the variable current and obtain the amplitude of the first harmonic. 7

Unit-II

2. (a) If $L\{f(t)\} = \bar{f}(s)$, then $L^{-1}\dfrac{\overline{f(s)}}{s}$ is equal to 2

(b) (i) Find the Laplace transform of $f(t)$ where 3

$$f(t)=\begin{cases}\cos(t-2\pi/3); & t>2\pi/3\\ 0; & <t<2\pi/3\end{cases}$$

(ii) Find the Laplace transform of $f(t)$ where 4

$$f(t)=\frac{\cos 2t-\cos 3t}{t}$$

(c) Find the inverse Laplace transform of the following :

(i) $\log\left[\frac{(s^2+1)}{s(s+1)}\right]$

(ii) $L^{-1}\left[\frac{1}{(s+a)(s+b)}\right]$ 7

using Convolution theorem.

(d) Using Laplace transform method, to solve : 7

$$y''+4y'+3y=e^{-t},\ y(0)=y'(0)=1$$

Unit-III

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

PTO

$$z=f(x+at)+g(x-at)$$

(b) Solve : 7

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

(c) Solve : 7

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

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

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

given

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

Unit-IV

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

(b) Find the analytic function $z=u+iv$, if

$$u-v=\frac{x-y}{x^2+4xy+y^2}$$ 7

(c) Evaluate

$$\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2 (z-2)} dz$$

where c is the circle $|z| = 3$. 7

(d) Evaluate :

$$\int_{-\infty}^{\infty} \frac{x^2 \, dx}{(x^2+1)(x^2+4)}$$ 7

Unit - V

5. (a) Define moment generating function. 2

(b) Out of 800 families with 5 children each, how many would you expect to have

(i) 3 boys

(ii) 5 girls

(iii) either 2 or 3 boys

Assume equal probabilities for boys and girls. 7

(c) If the probability of a bad reaction from a certain injection is 0·001, determine the chance that out 2000 individuals more than two will get a bad reaction. 7

(d) Assuming that the diameters of 1,000 brass plugs that consecutively from a machine form normal distribution with mean 0·7515 cm and standard deviation 0·0020 cm, how many of the plugs are likely to be rejected if the approved diameter is

$0 \cdot 752 \pm 0 \cdot 004$ cm 7