Engineering Mathematics- III
(1010)

P. Pages : 4

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. All questions are compulsory.
5. Figures to the right indicate full marks.
6. Use of non-programmable calculator and statistical data is allowed.
7. Write all subquestions of a particular equation at one place.

1. Attempt **any four.** 20

a) $(D^2 + 5D + 6)y = e^{-2x} \cos ec^2 x \, [1 - 2\cot x]$

b) $(D^2 - 1)\, y = x\cos x + e^x \cdot 3^x$

c) $(D^3 - 7D - 6)\, y = e^{2x}(1 + x)$

d) $(D^3 + D)y = \sec x$ by method of V.P.

e) $(2x + 3)^2 \dfrac{d^2 y}{dx^2} - 2(2x + 3)\dfrac{dy}{dx} - 12\, y = 6x$

f) The whirling speed of a shaft of length 'ℓ' is given by

$$\frac{d^4 y}{dx^4} - a^4 y = 0 \text{ where } a^4 = \frac{Ww^2}{9EI}$$

and y is displacement at a distance x from one end. If the ends of the shaft are constrained in long bearings so that the slopes at each end is zero. Show that the shaft will whirl when $\cos a l \cdot \cosh a l = 1$

2.   Attempt **any two.**

a)   i)   Solve $\dfrac{d^2x}{dt^2} + 4x + 5y = t^2$, $\dfrac{d^2y}{dt^2} + 5x + 4y = t + 1$.   7

     ii)   Solve $\dfrac{dx}{y+z} = \dfrac{dy}{z+x} = \dfrac{dz}{x+y}$.   3

b)   If $V = X \cos ay$ satisfy the equation $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = 0$, find general form of X,

also find the solution of above equation subject to the following conditions. 10
   i)   v = 0 at $x = \infty$
   ii) $V = 12 \cos y + \cos 5y$ at x = 0.

c)   Solve $\dfrac{\partial u}{\partial t} = \dfrac{\partial^2 u}{\partial x^2}$ if i) u is finite for all t

   ii) $u(o, t) = 0$
   iii) $u(\pi, t) = 0$
   iv) $u(x, o) = \pi x - x^2$ where $0 \le x \le \pi$ 10

3.   Attempt **any four.**   20

a)   Find $L\left\{ e^{-3t} \int_0^t t \sin 4t \, dt \right\}$.

b)   Find $L\left\{ \cos^3 t + \sqrt{1 + \sin 2t} \right\}$

c)   Evaluate $\displaystyle\int_0^\infty \dfrac{e^{-t}[1 - \cos t]}{t} dt$

d)   Find $L^{-1}\left\{ \dfrac{1}{s} \log\left[\dfrac{s^2 + a^2}{s^2 + b^2} \right] \right\}$

e) Find $L^{-1}\left\{\dfrac{S+7}{[S^2+2S+2]^2}\right\}$

f) Solve using Laplace transform

$y'' - 3y' + 2y = 12\,e^{-2t}$ Given $y(0) = 2$, $y'(0) = 6$.

4. **Attempt any two.**

a) i) Find the coefficient of skewness and kurtosis of following distribution.   **6**

Class	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Freq.	10	20	40	20	10

  ii) Find the coefficient of variation from the data   **4**

x	814	819	825	826	830	832	835	840	842	844
f	2	1	1	1	2	1	2	2	2	1

b) i) Find the coefficient of co-rrelation between x and y from given table.   **5**

x	10	14	18	22	26	30
y	18	12	24	16	30	36

  ii) Given

	x series	y series
Mean	18	100
S. D.	14	20

and coefficients of co-rrelation is 0.8 find most probable value of y if x = 70.   **5**

c) i) Explain :   **4**
    a) Skewness
    b) Kurtosis and comment on nature.

  ii) The regression equations are

$8x - 10y + 66 = 0$ and $40x - 18y = 214$ the value of variance of x is 9 find mean values of x and y, Also find coefficient of co-rrelation between x and y, Also find standard deviation of y.   **6**

5.   Attempt **any two.**

a)   i)   Prove that the following data represent Poisson distribution   5

x	0	1	2	3	4
f	109	65	22	3	1

      ii)   Solve the following integral equation.   5

$$\int_{0}^{\infty} f(x)\cos\lambda x\, dx = e^{-\lambda}, \lambda > 0$$

b)   i)   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.   5

      ii)   Find the Fourier cosine Integral of   5

$$f(x) = e^{-x} + e^{-2x}, \ x \geq 0$$

c)   i)   The mean and variance of Binomial distribution are 6 and 2
              respectively find $P[r \geq 1]$.   5

      ii)   Find Fourier transform of $f(x) = e^{\frac{-x^2}{2}}$.   5

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