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BAI1303

Engineering Mathematics - III
(New) (1050)

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 the questions are compulsory.
5. Figures to the right indicate full marks.
6. Use of non programmable calculator and statistical data is allowed.
7. Neat diagram must be drawn whenever necessary.

1. Solve **any four.** 20

i) Solve $(D-1)^2(D+1)^2 y = \sin^2 \frac{x}{2} + e^x + 2$ where $D = \frac{d}{dx}$.

ii) Solve $(D^4 - 1)y = \cos x \cdot \cosh x$ where $D = \frac{d}{dx}$.

iii) Solve $(D^2 + 3D + 2)y = e^{e^x}$ by using general method.

iv) Solve $(D^2 + 2D + 1)y = e^{-x} \log x$ by variation of parameters.

v) Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = \sin(\log x^2)$.

vi) A horizontal rod at length '2ℓ' with concentrated load 'w' at centre and ends freely hinged satisfy the differential equation $EI \frac{d^2y}{dx^2} = py - \frac{w}{2} x$ with conditions $y = 0$ at $x = 0$ and $\frac{dy}{dx} = 0$ at $x = 0$. Find deflection 'y'.

1

P.T.O.

2.   Attempt **any two.**

a)   i)   Solve $\dfrac{dx}{dt} = 2y$, $\dfrac{dy}{dt} = 2z$, $\dfrac{dz}{dt} = 2x$.   **7**

     ii)   Solve $\dfrac{dx}{1} = \dfrac{dy}{3} = \dfrac{dz}{5z + \tan(y - 3x)}$.   **3**

b)   A Homogenous rod of conducting material of length 'ℓ' has its ends kept at zero temperature. The temperature at the centre is 'T' and falls uniformly to zero at the two ends. Find u (x, t).   **10**

c)   Solve the boundary value problem subject to the given conditions.   **10**

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \qquad 0 \le x \le 10,\ 0 \le y \le \infty$$

$u(0, y) = 0$ for all y

$u(10, y) = 0$ for all y

$u(x, \infty) = 0$

$u(x, 0) = 20\,x,\ 0 \le x \le 5$

$\qquad\qquad = 20(10 - x)\ 5 \le x \le 10$

3.   Attempt **any two.**

a)   i)   The adjoining table gives weight at the students at two classes. Calculate the coefficient of variation of the two distributions. Which series is more variable ?   **6**

Weight in kgs	20 - 30	30 - 40	40 - 50	50 - 60	60 - 70
Class A	7	10	20	18	7
Class B	5	9	21	15	6

     ii)   Given the following information

$\gamma_{xy} = 0.8$, $\Sigma xy = 60$, $\sigma_y = 2.5$, $\Sigma x^2 = 90$ where x, y are deviations from the respective means. Find the number of items.   **4**

b) p) The first four moments of a distribution about the value 4 of the variable are -1.5, 17, -30 and 108. Find the moments about the point $x = 2$ and central moments. **6**

q) If the two lines of regression are $4x - 5y + 30 = 0$ and $20x - 9y - 107 = 0$. Which of these is the line of regression of x on y and y on x. Find γ_{xy} and σ_y when $\sigma_x = 3$. **4**

c) l) Find Karl pearson's coefficient of correlation between age and playing habit of people from the following information. **6**

Age group	15 - 20	20 - 25	25 - 30	30 - 35	35 - 40	40 - 45
No. of people	200	270	340	360	400	300
No. of player	150	162	170	180	180	120

m) Given the following values. **4**

x	3	5	6	8	9	11
y	2	3	4	6	5	8

Find the equations of regression.
i) y on x
ii) x on y

4. Attempt **any two**.

a) i) With the usual notations, find 'p' for a binomial random variable x if $n = 6$ and if $9 P(x = 4) = P(x = 2)$. **6**

ii) Fit a poisson distribution of the following data. **4**

Number at deaths	0	1	2	3	4
Frequency	122	60	15	2	1

b) p) A set at examination marks is approximately normally distributed with a mean of 75 and standard deviation of 5. If the top 5% of students grade 'A' and the bottom 25% get grade 'F'.
What marks is the lowest 'A' and what mark is the highest 'F'. **6**

q) A die rolled 100 times with the following distribution. **4**

Number	1	2	3	4	5	6
Observed Frequency	17	14	20	17	17	15

c) l) The mean and variance at a binomial distribution are 3 and 2
        respectively find the probability that variate takes the values   **6**
        i)   Less than or equal to 2.
        ii) Greater than or equal to 7.

m) The average test marks in a particular class is 79. The standard
    deviation is '5'. If the marks are distributed normally, how many
    students in a class of 200 did not receive marks between
    75 and 82 ?   **4**

5.   Attempt **any two.**

a) i) In a random sample of 400 persons from a large population,
        120 are females. Can it be said that males and females are in
        the ratio 5:3 in the population ? Use 1% of level of significance.   **6**

    ii) Define :
        a) Hypothesis.
        b) Null Hypothesis.
        c) Alternative Hypothesis.   **4**

b) p) A machine put out 20 imperfect items in a sample at 500. After
        the machine was overhauled it put out 5 imperfect items in a
        batch of 100. Has the machine improved after overhauling.   **6**

    q) Given the following data at two distributions, test wether the
        difference between the sample mean is significant.   **4**

Distribution	Mean	S. D.	Sample size
A	100	12	80
B	95	10	70

c) l) A sample of size 400 was drawn and the sample mean was found
        to be 99. Test whether this sample could have come from a normal
        population with mean 100 and variance 64 at 5% level at
        significance.   **6**

m) A die was thrown 9000 times and these 3220 yeilded a 3 or 4.
    Can the die be regarded as unbiased ?   **4**

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