Seat No. | | | | | | |

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मजल - 020

Engineering Mathematics -III
(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. Use of non-programmable calculator is allowed.
6. Assume suitable data, if necessary.
7. Figures to the right indicate full marks.

1. Attempt **any four.** **20**

a) Solve $(D^2 + 13D + 36)y = e^{-4x} + \sin h\, x$

b) Solve $(D^2 - 2D + 4)y = e^x \cos^2 x$

c) Solve $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$

d) Solve $(D^2 + 3D + 2)y = e^{e^x}$ by V.P. method.

e) Solve $u = r\frac{d}{dr}\left(r\frac{du}{dr}\right) + ar^3$

f) The differential equation satisfy by a beam uniformly Loaded with one end fixed and second subjected to a tensile force P is given by

$$EI\frac{d^2y}{dx^2} - Py = \frac{-W}{2}x^2$$

Find the equation of elastic curve for the beam under condition

$y = \frac{dy}{dx} = 0$ when $x = 0$. $\left[\text{given } EI = \frac{P}{n^2}\right]$.

2. Attempt **any two.**

a) i) Solve : $\frac{dy}{dt} + x = \cos t, \frac{dx}{dt} + y = \sin t$ **6**

ii) Solve : $\frac{dx}{mz - ny} = \frac{dy}{nx - lz} = \frac{dz}{ly - mx}$ **4**

b) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subjected to conditions. **10**

i) $u(x, \infty) = 0$, for all x

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

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

iv) $u(x, 0) = 100 \sin\left(\frac{\pi x}{10}\right); 0 < x < 10.$

c) Solve $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$ subjected to conditions. **10**

i) U is finite for all t.

ii) u = 0, when x = 0 and x = ℓ.

iii) $u = \frac{\mu_0 x}{\ell}$, when $t = 0$ and $0 < x < \ell$.

3. Attempt **any four.** **20**

a) Calculate coefficient of variation from following data.

C.I.	0 – 10	10 – 20	20 – 30	30 – 40	40 – 50	50 – 60
f	5	9	15	12	10	3

b) Calculate first four central moments from data :

x	0	1	2	3	4	5	6	7	8
f	1	8	28	56	70	56	28	8	1

c) The first four moments about x = 2 are 2, 20, 40 and 50. Calculate coefficient of skewness and kurtosis.

d) Obtain coefficient of correlation between population density and death rate from data related to 5 cities.

Population density	200	500	400	700	300
Death rate	12	18	16	21	10

e) Estimate value of y when x = 9, from data :

x	6	2	10	4	8
y	9	11	5	8	7

f) Define Kurtosis. Explain types of kurtosis.

4. Attempt **any four.** **20**

a) A urn contain 9 balls, two of which are red, three are blue and four are black. Three balls are drawn from the urn at random. What is the probability that the balls are of different colour ?

b) 20% of bolts produce by a machine are defectives. Determine the probability that 4 bolts chosen at random, atmost 2 will defectives.

c) In poisson's distribution, $p(r=1) = 2p(r=2)$ find $p(r<4)$.

d) A sample of 100 dry battery cells tested to find the length of life; produce the following result. $\bar{x} = 12$ hours, $\sigma = 3$ hours.
Assuming the data to be normally distributed what percentage of battery cell are expected to have
i) more than 15 hours
ii) between 12 and 14 hours
[Given P(z=1) = 0.3413, P(z=0.67) = 0.2485].

e) Fit poisson's distribution to the set of observation. Also calculate theoretical frequencies.

x	0	1	2	3	4
f	122	60	15	2	1

f) The table below gives the no. of air craft accidents that occurs in various days of week. Test whether the accidents are uniformly distributed at 5% Los ? $\left[\text{Given}\chi^2_{(6,0.05)} = 12.59\right]$

Days	Mon.	Tue	Wed.	Thu.	Fri.	Sat.	Sun
No. of accident	14	18	12	11	15	14	14

5. A) Attempt **any two.** **8**

a) Write any four Advantages of sampling.

b) Write down main steps in testing of significance of a large sample.

c) Write test for goodness of fit using χ^2 – test .

B) Attempt **any two.** **12**

p) The mean height obtained from a sample of size 100 taken from population is 160 cm. If S.D. of height is 8cm. Test whether the mean height is 163cm against less than 163 cm.

q) A machine produce 20 defectives in a batch of 400. After over haulting it produce 10 defectives in a batch of 300.
Has machine improved ?

r) The I.Q. of student and economic condition of 1000 students of an engineering college were noted as given below.

I.Q. / Economic Condition	High	Low	Total
Rich	100	300	400
Poor	350	250	600
Total	450	550	1000

Find out whether there is any association between IQ and economic condition. $\left[\chi^2_{(1,0.05)} = 3.84\right]$.

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