

Seat
No.

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मजल - 001

Engineering Mathematics - III
(113101)

P. Pages : 4

Time : Three Hours

Max. Marks : 80

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. Use of non-programmable calculator is allowed.
5. Figure to the right indicate full marks.
6. Assume suitable data, if necessary.
7. All questions are compulsory.

1. Solve **any two**.

- a) i) Solve $(D^3 + 3D^2 + 3D + 1)y = e^{-x}$ 4
- ii) Solve $(D^2 - 2D + 1)y = xe^x \sin x$ 4
- b) i) Solve $\frac{d^2y}{dx^2} + 4y = 4\sec^2 2x$ by variation of parameter method. 4
- ii) Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x + \frac{1}{x^3}$ 4
- c) Solve $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 5y = e^x \cos 3x$ 8

2. Attempt **any two**.

- a) The differential equation satisfy by beam, uniformly loaded with one end fixed and second subjected to tensile force \underline{P} given by

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

Find equation of elastic curve for the beam under condition $y = 0, \frac{dy}{dx} = 0$

when $x = 0 \left(EI = \frac{P}{n^2} \right)$

8

- b) Solve $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$ subjected to conditions

- i) u is finite for all t .
 ii) $u(0, t) = 0$, for all t
 iii) $u(l, t) = 0$ for all t

iv) $u(x, 0) = \frac{u_0 x}{l}$; $0 \leq x \leq l$

8

- c) Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subjected to condition -

- i) $u(x, \infty) = 0$; for all x
 ii) $u(0, y) = 0$; for all y
 iii) $u(1, y) = 0$; for all y
 iv) $u(x, 0) = \sin^3 \pi x$; $0 \leq x \leq 1$

8

3. Attempt **any two**.

- a) i) If first four moment about $x = 2$ are 2, 20, 40 and 50. Calculate coefficient of skewness and Kurtosis.
- ii) Calculate first four central moment from the following data.

4

4

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

- b) i) 20% razor blades produce in a company turn out to be defectives. Find probability that out of 10 razor blades, chosen at random, atmost two will be defective. 4

- ii) In a sample of 1000 cases, the mean of certain test is 14 and S.D. 2.5. Assuming distribution to be normal, find how many students scored between 12 and 15 ?
[Given $p(z = 0.40) = 0.1554$ and $p(z = 0.80) = 0.2881$] 4

- c) The following marks have been obtained by a class of students in Mathematics.

Paper I	80	45	55	56	58	60	65	68	70	75	85
Paper II	81	56	50	48	60	62	64	65	70	74	90

obtain regression lines and coefficient of correlation. 8

4. Attempt **any two**.

- a) i) Explain the procedure for testing of hypothesis for large sample. 4

- ii) A sample of 400 electric bulbs from a company A ; gave an average life 1225 hours and S.D. of 42 hours, whereas sample of 200 bulbs from company B gave an average life 1265 hours and S.D. 60 hours. Can we say that both companies are producing bulbs of same average life. 4

- b) i) A machine produce 16 defectives in a batch of 500. After it over hauled it produces 3 defectives in a batch of 100. Has the machine been improved ? 4

- ii) In order to start a new S.T. bus to a certain remote village, it is required to get the average fare of Rs. 400 daily. Reports on number of passangers for 21 days, revealed that the average daily collection of fare was Rs. 390 with S.D. of Rs. 40. Do these data supports the demand of people for starting new S.T. bus to the village ? [Given $t_{(20, 0.05)} = 1.725$]. 4

- c) From the following table showing that the number of plants having certain characters test the hypothesis that flower colour is independent of flatness of leaf $\left[\chi^2_{(1, 0.05)} = 3.84\right]$. 8

	Flat Leaves	Curled leaves	Total
White Flower	99	36	135
Red flower	20	5	25
Total	119	41	160

5. Attempt **any two**.

- a) i) Find directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction along $2\bar{i} - 3\bar{j} + 6\bar{k}$. 4
- ii) Show that $\bar{F} = (2xz^3 + 6y)\bar{i} + (6x - 2yz)\bar{j} + (3x^2z^2 - y^2)\bar{k}$ is irrotational vector field. Hence find its scalar potential ϕ . 4
- b) i) Prove that $\bar{F} = \frac{1}{x^2 + y^2}(x\bar{i} + y\bar{j})$ is solenoidal. 4
- ii) Show that $\bar{F} = \frac{\bar{r}}{r^3}$ is solenoidal as well as irrotational vector field. 4
- c) Find the surface of equi-pressure in a case of steady motion of liquid which has velocity potential $\phi = xy + yz + xz$ and is under the action of force $\bar{F} = (y + z)\bar{i} + (x + z)\bar{j} + (x + y)\bar{k}$. 8
