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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. Answer sheet 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. Attempt **any two** sub questions from each unit.
5. Figures to the right indicates full marks.
6. Use of non - programmable calculator is allowed.
7. Assume suitable data, if necessary.

UNIT – I

1. Attempt **any two.**

a) i) Solve $\left(D^2+2D+1\right)y = xe^{-x}\cos x.$ **4**

ii) Solve $\left(D^2+3D+2\right)y = x^2+2x+3.$ **4**

b) i) Solve $\left(D^2+1\right)y = \frac{1}{1+\sin x}$ by V. P. Method. **4**

ii) Solve $u = r\,\frac{d}{dr}\left(r\,\frac{du}{dr}\right)+ar^3.$ **4**

c) Solve $\left(D^4-1\right)y = \sinh x \cosh x + 2^x.$ **8**

UNIT – II

2. Attempt **any two.**

a) The differential equation satisfy by a beam, uniformly loaded with one end fixed and second subjected to tensile force P, is given by $EI\frac{d^2y}{dx^2} - Py = \frac{-w}{2}x^2$. **8**

Show that the elastic curve for the beam under condition $y = y' = o$ when $x = o$

is, $y = \frac{W}{2p}\left[x^2 - \frac{2}{n^2} - \frac{2\cosh nx}{n^2} \right]$ where $EI = \frac{P}{n^2}$.

b) **8**

Solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with conditions.

i) u is finite for all t.
ii) u (o,t) = 0, $\forall t$.
iii) $u\ (\pi, t) = 0,\ \forall t$
iv) $u\left(x, o\right) = \pi x - x^2,\ 0 < x < \pi.$

c) **8**

Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ With conditions.

i) $u\left(x, \infty\right) = 0.$
ii) $u(\ o, y\ ) = 0\ ,\ \forall y,$
iii) $u(\ \pi, y\ ) = 0,\ \forall y.$
iv) $u(x, o) = u_0\ ,\ 0 < x < \pi.$

UNIT - III

3. Attempt **any two.**

a) i) The first four moment about the value 4 are -1.5, 17, -30 and 108. Calculate. β_1, β_2. **4**

ii) Calculate first four central moments from data. **4**

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	1	6	10	15	11	7

b) i) On the basis of past record it has been found that there is 70% chance of power cut in a city on any particular day. What is the probability that from 1st to 10th date of the month there are 7 or more days without power cut. **4**

ii) A manufacturer of envelopes knows that the weight of envelopes is normally distributed with mean 1.9 gm and S.D. of 0.1 gm. Find how many envelopes weighing 2 gm or more can be expected in a given packet of 1000 envelopes. **4**

$[\text{Given } P(Z=1)=0.3413]$

c) Two lines of regression are 5y-8x+17 = 0, 2y - 5x + 14 =0. **8**

If $\sigma_y^2 = 16$ find.

i) Mean values of x and y.

ii) σ_x^2

iii) r (x,y).

UNIT - IV

4. Attempt **any two.**

a) i) Write properties of χ^2 - distribution **4**

ii) The mean life time of sample of 100 bulbs produce by company is computed to be 1570 hours with S. D. of 120 hours. The company claims that the average life of bulbs produce by it is 1600 hours using 5% LOS is the claim acceptable ? **4**

b) i) In a sample of 400 parts produce by a company the number of defective part was found to be 30. The company however claims that only 5% parts produce by it are defectives. Test the claim of company at 0.05 LOS ? **4**

ii) The following results are obtain from a sample of 10 boxes of biscuits.
Mean weight = 490 gm
S. D. of weight = 9 gm.
Could the sample came from a population having a mean of 500 gm ?
[Given $t_{(9,0.05)} = 2.26$]. **4**

c) The following information is obtained concerning an investigation of 50 ordinary shops of small size. Can it be inferred that shops run by women are relatively more in villages than in town ? **8**

$\left[\text{Given } \chi_1^2 = 3.84\right]$.

	Shops	
	In Town	In Village
Run by Men	17	18
Run by women	3	12

UNIT - V

5. Attempt **any two.**

a) i) Find D.D of $\phi = xy^2 + yz^3$ at (1,-1,1) along the direction normal to the surface $x^2 + y^2 + z^2 = 16$ at (1, 2, 2). **4**

ii) Show that $\left(ye^{xy}\cos z\right)\bar{i} + \left(xe^{xy}\cos z\right)j.\ e^{xy}\sin z\ \bar{k}$ is irrotational vector field. Hence find its scalar potential. **4**

b) i) If $\bar{F} = (x + y + 1)\,\bar{i} + \bar{j} - (x + y)\,\bar{K}$ then show that $\bar{F} \cdot \text{curl}\,\bar{F} = 0$. **4**

ii) Show that : **4**

$$\nabla \cdot \left[r\ \nabla \left(\frac{1}{r^n} \right) \right] = \frac{n(n-2)}{r^{n+1}}$$

c) Find surfaces of equipressure in case of steady motion of a fluid which has velocity potential. **8**
$\phi = xy + yz + xz$ and is under the action of force.
$\bar{F} = (mz + ny)\,\bar{i} + (nx + \ell z)\,\bar{j} + (\ell y + mx)\,\bar{k}$.

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