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SEAT No. :

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S.E. (Automobile & Mechanical Engg.)/(Mechanical Sandwich)/ (Automation & Robotics Engg.)

ENGINEERING MATHEMATICS - III

(2019 Pattern) (Semester - IV) (207002)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Q.1 is compulsory.***
2) ***Solve Q.2 or Q.3, Q.4 or Q.5, Q.6 or Q.7, Q.8 or Q.9.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Choose the correct option :

a) If the data is presented in the form of frequency distribution then standard deviation 'σ' is by **[1]**

i) $\frac{1}{N}\Sigma f(x-\bar{x})^2$ ii) $\sqrt{\frac{1}{N}\Sigma f(x-\bar{x})^2}$

iii) $\frac{\Sigma fx}{N}$ iv) $\frac{1}{N}\Sigma f(x-\bar{x})$

b) The first moment of the distribution about the value 5 is 2- Arithmatic mean of the distribution is **[2]**

i) 5 ii) 2

iii) 4 iv) 7

c) In a poisson distribution if $3p\,(r=4) = p\,(r=5)$ then $p\,(r=6)$ is given by **[2]**

i) $\frac{e^{-12}(12)^6}{6!}$ ii) $\frac{e^{-18}(18)^6}{6!}$

iii) $\frac{e^{-15}(15)^6}{6!}$ iv) $\frac{e^{-10}(10)^6}{6!}$

P.T.O.

d) If $\phi = xy^2 + yz^3$ then $\nabla\phi$ at (1, 1, 1) is ..... **[2]**

i) $2\bar{i} + \bar{j} + \bar{k}$ ii) $2\bar{i} + \bar{j} - \bar{k}$

iii) $2\bar{i} - \bar{j} - \bar{k}$ iv) $2\bar{i} - \bar{j} + \bar{k}$

e) The most general solution of the partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$, representing metel plate having length y and breadth $x \to 0$ is. **[2]**

i) $(c_1 \cos mx + c_2 \sin mx)(c_3 e^{my} + c_4 e^{-my})$

ii) $(c_1 e^{mx} + c_2 e^{-mx})$

iii) $(c_1 e^{mx} + c_2 e^{-mx})(c_3 \cos my + c_4 \sin my)$

iv) $(c_1 e^{my} + c_2 e^{-my})$

f) The value of $\nabla \times \bar{r} =$ ..... **[1]**

i) r ii) $\bar{r}$

iii) 3 iv 0

Q2) a) The first four moments of a given distribution about the value 4 are –1.5, 17, –30 and 108. **[5]**

Calculate the moments about mean, also find β_1 & β_2.

b) Find the coefficient of correlation for the data **[5]**

x	10	14	18	22	26	30
y	18	12	24	6	30	36

c) Fit a second degree parabola $y = a + bx + cx^2$ using least square method. **[5]**

x	–3	–2	–1	0	1	2	3
y	12	4	1	2	7	15	30

OR

Q3) a) The first four moments about the working mean 30.2 are 0.255, 6.222, 30.211 and 400.25. **[5]**

Calculate the first four moments about the mean

b) Obtain regression lines for the following data **[5]**

x	2	3	5	7	9	10	12	15
y	2	5	8	10	12	14	15	16

c) Fit a straight line for the following data **[5]**

x	3	5	7	9	11
y	2.3	2.6	2.8	3.2	3.5

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Q4) a) A is one of the Eight horses entered for a race and is to be ridden by one of the two jockeys B and C. It is 2 to 1 that B rides, in which care all the horses are equally likely to win, whereas with rider C, A's chance is doubled. **[5]**

i) Find the probability that A wins.

ii) What are odds against A's winning?

b) The probability of a man hitting a target is $\frac{1}{3}$. If he fires 5 times, what is the probability of his hitting the target at least twice? **[5]**

c) Number of road accidents on a highway during a month follows a poisson destribution with mean 5. Find the probability that in a certain month, number of accidents on the highway will be **[5]**

i) Less than 3

ii) More than 5

OR

Q5) a) There are three envelopes containing ₹100, ₹400, and ₹700 respectively. A player selects an envelop and keep with him, what he gets. Find the expected gain of the player. **[5]**

b) In a certain examination test 2000 students appeared in a subject of statistics. Average marks obtained were 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks. Supposing that marks are distributed normally. Given Area corresponding to $z = 2$ is 0.4772. **[5]**

c) The table below gives number of books issued from a certain library on the various days of a week. **[5]**

Days	Mon	Tue	Wed	Thurs	Fri	Sat	Sun
No. of books issued	120	130	110	115	135	110	
$(o_i - e_i)^2$	0	100	100	25	225	100	

Test at 5% l.o.s Whether issuing the book is day dependent. Where $\chi^2_{5,0.05} = 11.07$.

Q6) a) Find angle between tangents to the curve $\bar{r} = (t^3 + 2)\bar{i} + (4t - 3)\bar{j} + (t^2 - 6)\bar{k}$ at $t = 0$, $t = 1$. **[5]**

b) Find the function $f(r)$ so that $f(r)\bar{r}$ is solenoidal. **[5]**

c) Find the work done in moving a particle once round the circle $x^2 + y^2 = 9$ in XY - plane, if field of force is $\bar{F} = (2x - y + z)\,\bar{i} + (x + y - z^2)\,\bar{j} + (3x - 2y + 4z)\bar{k}$ **[5]**

OR

Q7) a) Find the directional derivative of $\phi = xy^2 + yz^3$ at (2, –1, 1) in the direction of normal to the surface along $x \log z - y^2 - 4 = 0$ at (–1, 2, 1). **[5]**

b) Solve any one **[5]**

i) Prove that $\nabla \times [\bar{a} \times (\bar{b} \times \bar{r})] = \bar{a} \times \bar{b}$

ii) Prove that $\nabla^4 (\log r) = \frac{2}{r^4}$

c) Evaluate $\oint_C \bar{F}.d\bar{r}$ by Stoke's theorem where $\bar{F} = y^2\bar{i} + x^2\bar{j} - (x + z)\bar{k}$ and C is boundary of the triangle with vertices at (0, 0, 0), (1, 0, 0), (1, 1, 0) **[5]**

Q8) a) If $\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}$ represents the vibrations of string of length l fixed at both ends. Find the solution with following conditions. **[8]**

i) $y(0, t) = 0$ ii) $y(l, t) = 0$

iii) $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$ iv) $y(x, 0) = k(lx - x^2), 0 \le x \le l$

b) Solve $\frac{\partial v}{\partial t} = k\frac{\partial^2 v}{\partial x^2}$ if **[7]**

i) v (x, t) is finite ii) $\left(\frac{\partial v}{\partial x}\right)_{x=0} = 0, \forall t$

iii) $v(l, t) = 0, \forall t$ iv) v $(x, 0) = v_0$, (constant), $0 < x < l$

OR

Q9) a) An infinitely long uniform metal plate is enclosed between lines y = 0 and $y = l$ for $x > 0$. The temperature is zero along edges $y = 0$, $y = l$ and at infinity. If the edge $x = 0$ is kept at a constant temperature u_0, find the temperature distribution $u(x, y)$. **[8]**

b) Use fourier cosine transform to solve **[7]**

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \; 0 < x < \infty, \; t > 0$$

subject to

i) $\left(\frac{\partial u}{\partial x}\right)_{x=0} = 0, \; t > 0$

ii) $u(x, 0) = x, 0 < x < 1$

$= 0, x > 1$

iii) $|u(x,t)| < m$

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