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M.E. DEGREE EXAMINATIONS: DECEMBER 2009

First Semester

STRUCTURAL ENGINEERING

MAT501: Applied Mathematics for Structural Engineering

Time: Three Hours **Maximum Marks: 100**

Answer ALL Questions:-

PART A (10 x 2 = 20 Marks)

1. Find the Laplace transform of $e^{-2s}\frac{s}{s^2-4}$
2. Express $L\left(\frac{\partial^2 u}{\partial t^2}\right)$
3. Write the necessary condition for $I = \int_{x_1}^{x_2} f(x, y, y')dx$ to be an extremum.
4. Find the extremal of the functional $I = \int_0^1 (x^2 - y'^2)dx$
5. A continuous r.v x has the p.d.f $f(x) = Ax^3$, $1 \le x \le 2$, find A.
6. The regression equations are 8x-10y +66 = 0, 40x -18y = 214, find the correlation coefficient.
7. What is principle of least squares?
8. If r_{12} =0.86, r_{13} =0.65,r_{23}=0.72,find $r_{12.3}$
9. What is neuro fuzzy system?
10. Explain Genetic algorithm.

PARTB (5 x 16 = 80 Marks)

11. a) A string is stretched and fixed between two points (0, 0) and (l, 0).Motion is initiated by displacing the string into the form u =λ sin (πx/l) and released from rest at time t=0. Find the displacement of any point on the string at any time t.

(OR)

b) Solve $u_{tt} = C^2 u_{xx}$, x>0, t>0 u(0,t) =A_0sinωt, t>0, A_0 is a constant u (x,0)=0, u_t(x,0), $x \ge 0$ u is bounded as $x \to \infty$.

12. a) i) On which curve the functional $\int_0^{\frac{\pi}{2}}(y'^2 - y^2 + 2xy)dx$ with y (0) =0, y $(\pi/2)$ =0, b extremized.

(8)

ii) Find the extremals of the functional $\int_0^1\left(2x+\left(\frac{dx}{dt}\right)^2+\left(\frac{dy}{dt}\right)^2\right)dt$ x(0) =1, y(0)=1, x(1)=1.5, y(1) =1 .

(8)

(OR)

b) Solve the B.V.P $y'' + y + x = 0$, $0 \le x \le 1$ $y(0) = y(1) = 0$ by Rayleigh – Ritz method.

13. a) i) Calculate the correlation coefficient between the height of father (in inches) an height of Son (in inches)

Height of Father :	65	66	67	67	68	69	70	71
Height of Son :	67	68	65	68	72	72	69	71

ii) If X is a normal variate with μ =30, and σ = 5.Find

(i) P $(26 \le X \le 40)$ (ii) P $(X \ge 45)$ (iii) P $(|X - 30|) \ge 5$.

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(OR)

b) i) Find the M.G.F, mean and variance of the Binomial distribution.

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ii) The mileage which car owners get with a certain type of radial tyre is a ran variable having exponential distribution with mean 40,000 k.m. Find the probabil that one of these tyres will last. (i) at least 20,000km (ii) at most 30,000km.

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14. a) In a trivariate distribution:

$\sigma_1 = 2$, $\sigma_2 = \sigma_3 = 3$, $r_{12} = 0.7$, $r_{23} = r_{31} = 0.5$

Find (i) $r_{23.1}$ (ii) $R_{1.23}$ (iii) $b_{12.3}$, $b_{13.2}$ and (iv) $\sigma_{1.23}$

(OR)

b) i) Fit the straight line to the data:

x:	3	4	5	6	7
y:	6	9	10	11	12

(8

ii) Let $x_1, x_2, x_3, \ldots\ldots\ldots\ldots x_n$ be a random sample from the uniform distribution with p.d.f:

$$f(x,\theta) = \begin{cases} \frac{1}{\theta}, & 0 < x < \theta, \theta > 0 \\ 0, & \text{otherwise} \end{cases}$$

Find the maximum likelihood estimator for θ. (8)

15. a) i) Explain simple operations on Fuzzy sets with examples. (8)

ii) What is Neural Network Architecture? Explain with an example. (8)

(OR)

b) i) Give Geometrical representation of fuzzy sets. (8)

ii) Show that the mid-point of the unit cube is maximally fuzzy. (8)

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