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3E1636

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B.Tech. III Semester (Main/Back) Examination - 2014
Mechanical Engg.
3ME6A Advanced Engg. Mathematics
Common to 3PI6A and 3AE6A

Time : 3 Hours

Maximum Marks : 80
 Min. Passing Marks : 24

Instructions to Candidates:

Attempt any **five** questions, selecting **one** question from each **unit**. All questions carry **equal** marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Find the fourier cosine transform of the following function:

$$f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \\ 0, & x > 2 \end{cases} \quad (8)$$

- b) Find the discrete fourier transform of the sequence:

$$\{g_k\} = \{1, 0, -1\} \quad (8)$$

OR

1. a) Find the fourier transform of the function:

$$f(x) = \begin{cases} 1, & |x| < a \\ 0, & |x| > a \end{cases}$$

and hence evaluate: $\int_0^{\infty} \frac{\sin s}{s} ds$ (8)

- b) Solve the following partial differential equation: $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$, given that

$$u_x(0,t) = 0, u(x,0) = \begin{cases} x, & 0 \leq x \leq 1 \\ 0, & x > 1 \end{cases} \text{ and } u(x,t) \text{ is bounded and } x > 0, t > 0. \quad (8)$$

Unit - II

2. a) Find the Laplace transform of the following:

i) $t^2 e^{2t}$

ii) $\frac{\sin^2 t}{t}$

(3+5=8)

b) Find the inverse Laplace transform with the help of convolution theorem:

$$\frac{s}{(s^2 + a^2)^2}$$

(8)

OR

2. a) Solve the following differential equation:

$$(D^2 + 3D + 2)x = 1, D \equiv \frac{d}{dt} \text{ with } x(0) = 0, x'(0) = 0$$

(8)

b) Solve the following differential equation:

$$\frac{\partial u}{\partial t} = 2 \frac{\partial^2 u}{\partial x^2}, \text{ where } u = u(x, t).$$

Boundary condition: $u(0, t) = 0 = u(5, t)$ and $u(x, 0) = 10 \sin 4\pi x$.

(8)

Unit - III

3. a) Calculate the first four moments about the mean for the following distribution:

x: 6 7 8 9 10 11 12

y: 3 6 9 13 8 5 4

(8)

b) A driver has two taxis, which he hires out day by day. The number of demands for a taxi on each day is distributed as a poisson variate with mean 1.5. Calculate the proportion of days on which

i) Neither of the cars is used.

ii) Some demand is refused. (given $e^{-1.5} = 0.2231$)

(8)

OR

3. a) Fit a straight line to the following data treating y as the dependent variable:

x: 1 2 3 4 5

y: 5 7 9 10 11

(8)

b) Calculate the coefficient of correlation from the following data:

x:	1	3	5	7	8	10	
y:	8	12	15	17	18	20	(8)

Unit - IV

4. a) Prove that:

- | | | |
|--------------------------------------|---|-----|
| i) $\nabla \equiv \Delta E^{-1}$ | ii) $(I + \Delta)(I - \nabla) \equiv I$ | |
| iii) $\delta \equiv E^{-1/2} \Delta$ | iv) $\mu \delta \equiv \frac{1}{2} \Delta (I + E^{-1})$ | (8) |

b) The area A of a circle of diameter d is given for the following values:

d:	80	85	90	95	100	
A:	5026	5674	6362	7088	7854	(8)

Find the approximate value of the area of circle of diameters 82. Use Newton's forward interpolation formula.

OR

4. a) Using Lagrange's interpolation formula to evaluate the value of $f(6)$ from the following data:

x:	3	7	9	10	
f(x):	168	120	72	63	(8)

b) Find the real root of the equation $x^3 - 3x - 5 = 0$ correct to four places of decimals by Newton Raphson method. (8)

Unit - V

5. a) Find the first derivative at $x=1.1$ from the following table:

x:	1.0	1.2	1.4	1.6	1.8	2.0	
f(x):	0.0000	0.1280	0.5440	1.2960	2.4320	4.0000	(8)

b) Use Simpson's $\frac{3}{8}$ rule to evaluate the following: $\int_0^1 \frac{dx}{1+x^2}$. Hence obtain the approximate value of π . (6+2=8)

OR

5. a) Use Euler's method to solve: $\frac{dy}{dx} = \frac{y^2 - x}{y^2 + x}$, given $y(0)=1$ find y for $x=0.4$ (take $h=0.1$). (8)

b) Use Runge-Kutta fourth order method to solve $\frac{dy}{dx} = -2xy^2$, $y(0)=1$ with $h=0.2$ for $x=0.2$ and 0.4 . (4+4=8)