3E1636

Roll No. _____ [Total No. of Pages : 3

3E1636

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:

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

b) Find the discrete fourier transform of the sequence:

$\{g_k\}=\{1,0,-1\}$ **(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

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

Unit - II

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

i) $t^2 e^{3t}$

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:

$(D^2+3D+2)x=1,\ D\equiv\frac{d}{dt}$ with $x(0)=0,\ x'(0)=0$ **(8)**

b) Solve the following differential equation:

$\frac{\partial u}{\partial t}=2\frac{\partial^2 u}{\partial x^2}$, 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) $\delta \equiv E^{-\frac{1}{2}}\Delta$ iv) $\mu\delta \equiv \frac{1}{2}\Delta\left(I+E^{-1}\right)$ **(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

Find the approximate value of the area of circle of diameters 82. Use Newton's forward interpolation formula. **(8)**

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)**
