3E1636

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B.Tech. III - Semester (Main/Back) Examination, Dec. - 2016

Automobile Engg.

3AE6A Advanced Engg. Mathematics

AE,ME,PI

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 26

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 Inverse Discrete Fourier Transform of the sequence $\{D_0, D_1, D_2\} = \{0, 1-\omega^2, 1-\omega\}$ **(8)**

b) Obtain the Fourier transform of $f(x) = \begin{cases} x^2 & for\ |x| \le a \\ 0 & for\ |x| > a \end{cases}$ Hence evaluate

$$\int_0^\infty \cos\left(\frac{as}{2}\right)\left[\left(a^2s^2-2\right)\sin as + 2as\cos as\right] \Big/ 3 \; ds \quad \textbf{(8)}$$

OR

1. a) Solve the integral equation $\int_0^\infty F(x)\cos sx\,dx = \begin{cases} 1-s & 0 \le s \le 1 \\ 0 & s > 1 \end{cases}$ Hence deduce that

$$\int_0^\infty \frac{\sin^2 t}{t^2}\,dt = \pi/2 \quad \textbf{(8)}$$

b) Heat flow in an infinite bar with given initial temperature u(x,t) is governed by

$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}; t > 0; -\infty < x < \infty$ satisfying u(x,0) = f(x). **(8)**

Unit - II

2. a) Find the Laplace transform of $\sin\sqrt{E}$. Hence deduce $L\left[\frac{\cos\sqrt{t}}{\sqrt{t}}\right] = \left(\frac{\pi}{s}\right)^{\frac{1}{2}} e^{\frac{-1}{4s}}$ **(8)**

b) i. Find $L^{-1}\left[\frac{S}{S^4+4a^4}\right]$ **(4)**

ii. Apply convolution theorem to evaluate $L^{-1}\left[\frac{1}{S^2(S^2-a^2)}\right]$ **(4)**

OR

2. a) Solve $ty''+y'+4ty=0$; given that $y(0)=3$; $y'(0)=0$. **(8)**

b) Solve $\frac{\partial u}{\partial t}=\frac{\partial^2 u}{\partial x^2}$; $u(x,0)=3\sin 2\pi x$ u (0, t) = 0; u (1, t) = 0, where 0<x<1, t>0. **(8)**

Unit - III

3. a) In a bolt factory, machines A,B and C manufacture reps. 25%, 35% and 40% of the total of their output 5,4,2 percent are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machine A, B or C. **(5)**

b) Six dice are thrown 729 times. How many times do you expect atleast three dice to show a five or a six? **(5)**

c) Assume that the probability of an individual coal mines being killed in a mine accident during a year is $\frac{1}{2400}$. Use Poisson's distribution to calculated the probability that in a mine employing 200 miners there will be at least one fatal accident in a year. **(6)**

OR

3. a) In a certain factory turning out razor blades, there is a small chance of 0.002 for any blade to be defective. The blades are supplied in packets of 10. Using Poisson distribution, find the number of packets containing no defective, one defective and two defective blades respectively in a consignment of 10,000 packets. **(8)**

b) In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and S.D of the distribution. **(8)**

Unit - IV

4. a) Define operators δ *and* μ. Prove that

$$\delta[f(x)g(x)]=\mu[f(x)]\delta[g(x)]+\mu[g(x)]\delta[f(x)]$$ **(4)**

b) Show that $\left(\frac{\Delta^2}{E}\right)e^x\frac{E(e^x)}{\Delta^2(e^x)}=e^x$ **(4)**

c) Use Stirling's formula to compute $u_{12.2}$ from the following table :

x_0 :	10	11	12	13	14
$10^5 u_x$:	23967	28060	31788	35209	38368

(8)

OR

4. a) Using Lagrange's interpolation formula, find f(4).

x :	0	2	3	6
f(x) :	-4	2	14	158

(8)

b) Find the value of y at x = 0.23 and x = 0.29 from the following tables of values.

x :	0.20	0.22	0.24	0.26	0.28	0.30
y :	1.6596	1.6698	1.6804	1.6912	1.7024	1.7139

(8)

Unit - V

5. a) Find $y'(0)$ *and* $y''(0)$ from the data :

x :	0	1	2	3	4	5
y :	4	8	15	7	6	2

(8)

b) Find the value of $\log_e^2$ from $\int_0^1 \frac{x^2}{1+x^3} dx$ by using Simpson's 1/3 rule **(8)**

OR

5. a) Use modified Euler's method to solve $\frac{dy}{dx} = x + \sqrt{y}$, with initial conditions y=1 at x=0, for x=0.6 in steps of 0.2. **(8)**

b) Use Milne's method to obtain y at x = 0.4 for the differential equation.

$\frac{dy}{dx} = 2e^x - y$ given that

x :	0	0.1	0.2	0.3
y :	2	2.01	2.04	2.09

(8)