

3E1416

B.Tech. IIIrd Semester (Main/Back) Examination, Feb. - 2011
3A16 Advanced Engineering Mathematics
(Common For Mech., AE & PI)

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 may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)

Unit - I

1. a) Obtain the Fourier series for the function $f(x) = x^2$ in the interval $-\pi < x < \pi$ and deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$. (8)

b) The following table gives the variations of periodic current over a period :

t Sec	:	0	$\frac{6}{T}$	$\frac{3}{T}$	$\frac{2}{T}$	$\frac{3}{2T}$	$\frac{6}{5T}$	T
A amp	:	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Find by practical harmonic analysis find the direct current in the variable current and obtain the first harmonic. (8)

OR

a) Find half range. Cosine series for the function $f(x) = (x-1)^2, 0 < x < 1$ hence

deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$. (8)

b) Solve $\frac{\partial^2 n}{\partial x^2} + \frac{\partial^2 n}{\partial y^2} = 0$ satisfying the conditions :

$n(0, y) = n(l, y) = n(x, 0) = 0$ and $n(x, a) = \text{Sin}\left(\frac{n\pi x}{l}\right)$. (8)

(1)

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$$\int_1^{-1} x^m P_n(x) dx = \frac{2^{n+1} \binom{n}{m}}{\sqrt{2n+1}}, \quad m = n$$

$$0, \quad m < n, \quad n \in \mathbb{Z}$$

b) Prove that : (8)

ii) $x = 2J_0J_1 + 6J_1J_2 + \dots + 2(2n+1)J_nJ_{n+1} + \dots$

i) $\frac{d}{dx} (x J_n J_{n+1}) = x (J_n^2 - J_{n+1}^2)$

a) Prove that (8)

OR

$$P_{n+1}' + P_n' = P_0 + 3P_1 + 5P_2 + \dots + (2n+1)P_n$$

b) Prove that (8)

iii) $J_3 + 3J_1' + 4J_0'' = 0$

i) $J_2 - J_0 = 2J_0'$

3. a) Prove that (8)

Unit - III

(8) $(D^3 - D^2 - D + 1)y = 8te^{-t}$ Given that $y(0)=0, y'(0)=1, y''(0)=0$.

b) Use Laplace transform technique to solve

a) Find $L^{-1} \frac{a(s^2 - 2a^2)}{s^4 + 4a^4}$ (8)

OR

(8) $(D^2 + 2D + 5)y = e^{-t} \sin t, \quad y(0) = 0, y'(0) = 1$

b) Use Laplace transform technique to solve

$$L \left(\frac{\cos \sqrt{t}}{S} \right) = \left(\frac{S}{\pi} \right)^{\frac{1}{2}} C_{\frac{1}{4S}}$$

2. a) Find the Laplace transform of $\sin \sqrt{t}$. Hence show that (8)

Unit - II

(3)

[Contd....

b) A rod is rotating in a plane. The following table gives the angle θ (in radians), through which the rod has turned for various values of time t (Sec)

t	0	0.2	0.4	0.6	0.8	1.0	1.2
θ	0	0.12	0.49	1.12	2.02	3.20	4.67

Calculate the angular velocity and angular acceleration of the rod when $t = 0.2, t = 0.6$ second.

(8)

$$83x + 11y - 4z = 95$$

$$7x + 52y + 13z = 104$$

$$3x + 8y + 29z = 71$$

5. a) Using Gauss - Seidal iterative method, solve the following system of equations

Unit - V

Find $f(0.44), f(1.55)$ by using appropriate interpolation formula.

b) Given:

t	0.0	0.5	1.0	1.5	2.0	2.5	3.0
$f(t)$	0.000	0.191	0.341	0.433	0.477	0.494	0.499

(8)

$$x + \log_{10} x - 0.5 = 0$$

a) Find the real root of the equation

(8)

OR

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

(6)

x	1	2	4	5
y	16	48	88	100

b) From the table given below find the value of y for $x = 3$ using Lagrange's interpolation formula,

(5)

4. a) Evaluate: $\Delta^n [\text{Sin}(ax+b)]$

(5)

Unit - IV

- a) Use Milne's P - C method to solve the equation
 $\frac{dy}{dx} = x + y$ with $y(0) = 0, h = 0.1$ compute the value of y for $0.4 \leq x \leq 0.6$
 (8)
- b) Use Simpson's $\frac{1}{3}$ and $\frac{8}{8}$ rule to evaluate the following :
 $\int_1^0 \frac{dx}{1+x}$ Hence obtain the approximate value of \log_2 in each case.
 (8)

OR