

This question paper contains 4+2 printed pages]

II B.E. (III Semester)

323

Math. III

II B.E. (Third Semester) (Main/Back)

EXAMINATION, Dec., 2005

(New Four Year Semester Scheme)

(Branch : (1) Electronics and Communication Engg.

(2) Electronic Instrumentations and Control Engg.

(3) Applied Electronics and Instrumentation Engg.

(4) Fashion Technology)

MATHEMATICS—III

Time : Three Hours

Maximum Marks : 80

Attempt any *Five* questions.

All questions carry equal marks.

1. Solve the equations :

(i) $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + y = \frac{1}{(1-x)^2}$ 5

(ii) $(1-x^2) \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x(1-x^2)^{3/2}$ 5

(iii) $\frac{d^2y}{dx^2} + (3\sin x - \cot x) \frac{dy}{dx} + 2\sin^2 x \cdot y = e^{-\cos x} \cdot \sin^2 x$ 6

1,500

P.T.O.

2. (a) Solve by the method of variation of parameters :

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x.$$

8

(b) Solve in series :

$$4x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = 0.$$

8

3. (a) Solve the equations (any two) :

(i) $pz - qz = z^2 + (x+y)^2.$

(ii) $z = px + qy - 2\sqrt{pq}.$

(iii) Solve by Charpit's method :

$$2xz - px^2 - 2qxy + pq = 0.$$

4+4

(b) Derive Newton's backward interpolation formula.

Define the operator Δ, V, E and δ .

Show that :

(i) $\Delta = EV$

(ii) $(1 + \Delta)(1 - V) = 1.$

4+2+2

4. (a) Use Stirling formula to compute u_{32} from the following data :

$$u_{20} = 14.035, u_{25} = 13.674, u_{30} = 13.257.$$

$$u_{35} = 12.734, u_{40} = 12.089, u_{45} = 11.309.$$

8

2

323

(b) Find missing figure in the following table :

x	f(x)
10	43
15	-
20	29
25	32
30	-
35	77

5. (a) Use the Modified Euler's method with one step to find the value of y at $x = 0.1$, to five significant figures, where :

$$\frac{dy}{dx} = x^2 + y$$

$$y_0 = 1$$

and $y_0 = 0.94$ when $x_0 = 0.$ $x_1 = 0.1$
 $y_1 = ?$

8

(b) Find $y(2)$, if $y(x)$ is the solution of :

$$\frac{dy}{dx} = \frac{1}{2}(x+y). \quad y = f(x, y)$$

assuming $y(0) = 2, y(0.5) = 2.636, y(1.0) = 3.595$

and $y(1.5) = 4.968.$

8

3

323

P.T.O.

6. (a) Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ of $y = x^{1/3}$ at $x = 50$ from the following table :

x	y
50	3.6840
51	3.7084
52	3.7325
53	3.7563
54	3.7798
55	3.8030
56	3.8259

- (b) A and B throw alternatively with a pair of dice. The one who throws 9 first wins. Show that the chances of their winning are 9 : 8. 6
- (c) A coin is tossed 4 times. What is the probability of getting :
- (i) two heads; 4
- (ii) at least two heads ? 4
7. (a) Define Poisson distribution. Find mean and variance of the Poisson distribution. 6

- (b) Define normal distribution. What is the mean and variance of the normal distribution ? 4
- (c) If the heights of 300 students are normally distributed with mean 64.5 inches and standard deviation 3.3 inches, how many students have heights :
- (i) Less than 5 feet; 6
- (ii) Between 5 feet and 5 feet 9 inches. 6
8. (a) Find Fourier series to represent the function :

$$f(x) = \sin ax, \quad -\pi < x < \pi,$$

a being a fraction. 8

- (b) Define Harmonic analysis. The turning moment T units of the crank shaft of a steam engine is given for a series to the values of the crank-angle θ in degrees :

θ°	T
0	0
30	5224
60	8097

90	7850
120	5499
150	2626
180	0

Find the first four terms in a series of sines to represent T . Also calculate T when $\theta = 75^\circ$. 8