

(i) Printed Pages : 3 Roll No. ....

(ii) Questions : 9 Sub. Code : 

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**Bachelor of Arts (FYUP) 4<sup>th</sup> Semester  
(2056)**

**MATHEMATICS**

**Paper : Calculus-2 (Common with B.Sc. 4<sup>th</sup> Sem. FYUP)**

**Time Allowed : Three Hours] [Maximum Marks : 80**

**Note :— Attempt Five questions in all, selecting one question from each unit. Q. No 1 Compulsory.**

1. (a) Find the Cartesian coordinates of a point, whose polar coordinates are  $(-2, 30^\circ)$ .
- (b) Prove that the radius of curvature of a straight line is zero.
- (c) Examine for concavity upward & concavity downward for curve  $y = x^3 - 6x^2 + 9x + 1$ .
- (d) Evaluate  $\int \operatorname{sech}^2 x \cdot \operatorname{cosech}^2 x \, dx$ . 4×4=16

**UNIT-I**

2. (a) Determine 'a' and 'b' so that the curve  $ax^3 + 3bx^2$  has a point of inflexion at  $(-1, -2)$ .
- (b) Examine the curve  $x^3 + 2x^2 + 2xy - y^2 + 5x - 2y = 0$  for a double point and show that it is a cusp. 8+8=16

3. Show that the asymptotes of the curve :

$$(x^2 - y^2)(y^2 - 4x^2) + 6x^3 - 5x^2y - 3xy^2 + 2y^3 - x^2 + 3xy - 1 = 0$$

cut the curve in at most eight points which lies on a unit circle. 16

### UNIT-II

4. Trace the curve  $y = (x + 1)^2 (x - 3)$ . 16

5. (a) Find the radius of curvature at origin of the curve  $3x^2 + 4x^3 - 12y = 0$ .

(b) Find the points on the parabola  $y^2 = 8x$  at which radius of curvature is  $7\frac{13}{16}$ . 8+8=16

### UNIT-III

6. (a) Evaluate  $\int \frac{dx}{3\sinh x + 5\cosh x}$

(b) Let  $I_{m,n} = \int x^m (\log x)^n dx; x > 0, m, n \in \mathbf{N}$  Connect  $I_{m,n}$  with  $I_{m,n-1}$ . 8+8=16

7. (a) Obtain reduction formula for  $\int_0^{\pi/2} \cos^n x dx; n \in \mathbf{N}$

(b) If  $\int \frac{\sin nx}{\sin x} dx, n \in \mathbf{N}$  then connect it with  $I_{n-2}$ .

10+6=16

## UNIT-IV

8. (a) Use Simpson's rule to approximate  $\int_{-3}^3 x^4 dx$ , where  $n = 3$ .

Compare it with the exact value.

- (b) Use summation of series to evaluate

$$\lim_{n \rightarrow \infty} \left[ \frac{1}{n} + \frac{1}{n+1} + \frac{1}{n+2} + \dots + \frac{1}{5n} \right].$$

$$8+8=16$$

9. (a) Find the length of the arc of the curve  $y = (x+1)^{3/2}$  on  $[3, 8]$ .

- (b) A loop of curve  $y^2 = x^2(1-x^2)$  is rotated about the  $x$ -axis. Find the volume generated.

$$8+8=16$$