

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 1156

Roll No.

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**B.Tech.**

(SEM. I) ODD SEMESTER THEORY  
EXAMINATION 2013-14

**ENGINEERING MATHEMATICS – I***Time : 3 Hours**Total Marks : 100*

**Note :-** Attempt questions from each Section as per instructions.  
The symbols have their usual meaning.

**SECTION-A**

1. Attempt all parts of this question. Each part carries 2 marks.

**(2×10=20)**

- (a) If  $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ ;  $B = \{2, 3, 5, 7\}$  then find  $A \cap B$  and hence show that  $A \cap B = B$ .
- (b) Define Power Set of any set A. If  $A = \{1, 2, 3, 4\}$  find  $P(A)$ .
- (c) Find the value of n such that  ${}^n P_5 = 42 \times {}^n P_3$ ,  $n > 4$ .
- (d) How many chords can be drawn through 21 points ?
- (e) Find the coordinate of the focus axis the equation of the directrix and latus rectum of the parabola  $y^2 = 8x$ .
- (f) Find the equation of the ellipse the major along the x-axis and passing through the points (4, 3) and (-1, 4).
- (g) What is the value of  $\lim_{x \rightarrow \infty} \sin x$  ?

- (h) At what point is the function  $\frac{x+5}{(x-3)(x-7)}$  continuous?
- (i) Differentiate  $\sin(ax^2 + bx + c)$  with respect to  $x$ .
- (j) Is Rolle's theorem applicable to the function  $f(x) = x^{2/3}$  in  $[-2, 1]$ ?

### SECTION-B

2. Attempt any three parts of this question :  $(10 \times 3 = 30)$

- (a) In how many ways can a team of 3 boys and 3 girls be selected from 5 boys and 4 girls?
- (b) Find the equation of the ellipse whose centre is at the origin, foci are  $(0, 1)$ ,  $(-1, 0)$  and eccentricity is  $\frac{1}{2}$ .

(c) Find the derivatives of  $\frac{1}{x^2}$  using first principle.

(d) Find  $\frac{dy}{dx}$  when  $y = x^{\log x} + (\cos x)^{\sin x}$

(e) Find the  $\lim_{z \rightarrow 1} \frac{z^{1/3} - 1}{z^{1/6} - 1}$ .

### SECTION-C

Note :- Attempt any two parts from each question of this Section.

$(5 \times 2 \times 5 = 50)$

3. (a) If  $A = \{1, 2, 3\}$ ,  $B = \{3, 4\}$  and  $C = \{4, 5, 6\}$  find :
- (i)  $(A \times B) \cap (A \times C)$
- (ii)  $(A \times B) \cup (A \times C)$ .

(b) If  $f(x) = x^2$  and  $g(x) = 2x + 1$  be two real functions. Find  $(f+g)(x)$ ,  $(f-g)(x)$ ,  $(fg)(x)$  and  $(f/g)(x)$ .

(c) Find the domain and range of the real function  $f(x) = \sqrt{9-x^2}$ .

4. (a) Find the distance of the point  $(-1, 1)$  from the line  $12(x+6) = 5(y-2)$ .

(b) Find the equation of the circle with radius 5 whose centre lies on  $x$ -axis and passes through  $(2, 3)$ .

(c) Find the equation of the hyperbola having foci  $(0, \pm\sqrt{10})$  passing through  $(2, 3)$ .

5. (a) Find  $\lim_{x \rightarrow \pi/2} \frac{\tan 2x}{x - \pi/2}$ .

(b) Find  $\frac{dy}{dx}$ , where  $x = a \left[ \cos t + \log \tan \left( \frac{t}{2} \right) \right]$ ,  $y = a \sin t$ ,  $a$  is constant.

(c) If  $x\sqrt{1+y} + y\sqrt{1+x} = 0$ , show that  $\frac{dy}{dx} = \frac{1}{(1+x)^2}$ .

6. (a) Find the derivation of  $f(x) = \sin 2x + \cos 2x$  with respect to  $x$ .

(b) Find  $\frac{dy}{dx}$  if  $y = \cos^{-1} \left( \frac{a+b \cos x}{b+a \cos x} \right)$ .

(c) Discuss the continuity of the function :

$$f(x) = \begin{cases} \frac{x^2 - x - 6}{x^2 - 2x - 3}, & x \neq 3 \\ \frac{5}{3}, & x = 3 \end{cases} \text{ at point } x = 3.$$

7. (a) Determine  $n$  if  ${}^{2n}C_3 : {}^n C_3 = 12:1$ .
- (b) Find  $r$  if  $5 \times {}^4P_r = 6 \times {}^5P_{r-1}$ .
- (c) Find the number of different 8 letter arrangements that can be made from the letters of the word DAUGHTER so that :
- (i) All vowels occur together.
  - (ii) All vowels do not occur together.