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 FYB.COM, SEM II, SUPPLEMENTARY EXAMINATION, MAY/JUNE 2015  
 (Revised syllabus w.e.f 2013)  
**MATHEMATICAL TECHNIQUES**

**Duration: 2 hours**

**Max.Marks : 80**

- Instructions:** 1) All question are compulsory (choice is internal)  
 2) Start each new question on a fresh page  
 3) Figures to the right indicate full marks  
 4) Use of calculators allowed  
 5) graph papers issued on request

**Q.1 Attempt the following:**

**(5 x 4=20)**

- a) Find the coordinates of the point which divides segment AB internally in the ratio 4: 3, if  
 $A \equiv (-3,4), B \equiv (5,2)$
- b) Find  $\frac{dy}{dx}$  where  
 i.  $y = (3x^2 + 2x)(2x + 3)$   
 ii.  $y = x^7 \cdot \log x$
- c) If  $f(x) = \begin{cases} 3, & -3 \leq x < -1 \\ -6x - 3, & -1 \leq x \leq 0 \\ 3x - 3, & 0 < x \leq 1 \end{cases}$ ,  
 i. State the domain of f.  
 ii. Find  $f(-2), f(\frac{1}{2}), f(0), f(-1), f(2)$ , if it exist
- d) Evaluate the following integrals:  
 i.  $\int_1^2 (x^2 + x + 1) dx$   
 ii.  $\int (10x - 500)^4 + \frac{1}{60-9x} dx$

**OR**

**Q.I Attempt the following:**

**(5 x 4=20)**

- w) Find the coordinates of the points on the y-axis which are at a distance of 5 units from the point(4,1).
- x) Find  $\frac{dy}{dx}$  where:  
 i.  $y = 5x + x^5 + 5 + 5\sqrt{x}$   
 ii.  $y = (2x + 3)\sqrt{x}$
- y) If  $f(x) = \frac{x+3}{4x-5}, g(x) = \frac{3+5x}{4x-1}$ , show that  $f(g(x)) = x$ .
- z) Evaluate the following integrals:  
 i.  $\int \left( 3x + \frac{2}{x} - \frac{5}{\sqrt[3]{x}} \right) dx$   
 ii.  $\int \frac{x^2+2x+2}{\sqrt{x}} dx$

**Q.2 Attempt the following:**

**(5 x 4=20)**

- a) Evaluate the following :  
 i.  $\lim_{x \rightarrow 3} \frac{x^3-27}{\sqrt{x^2+7}-4}$  ii.  $\lim_{x \rightarrow 3} \frac{x}{x-3} - \frac{9}{x^2-3x}$
- b) The demand function is given by  $p = 100 + 2D - D^2 + D^3$ , where p-price and D-demand. Find the total revenue, average revenue and marginal revenue when demand is 10.
- c) Food I contains 6 units of vitamin A per gram, 7 units of vitamin B per gram and cost Rs.12 per gram. Food II contains 8 units of vitamin A per gram, 12 units of vitamin B per gram and cost Rs.20 per gram. The daily requirements of vitamin A and vitamin B are 400 units and 480 units respectively. Find the minimum cost of the mix of these foods.
- d) Find  $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$  where  $u = x^2 + y^2$ .

**OR**

**Q.II Attempt the following:**

**(5 x 4=20)**

- w) Examine the continuity of following function at  $x = 0$  :

$$f(x) = \begin{cases} \frac{\sqrt{2+x} - \sqrt{2-x}}{x}, & x \neq 0 \\ 0, & x = 0 \end{cases}$$

- x) Find the elasticity of  $y$  with respect to  $x$ , if  $y = 1 + 2x - x^2$  for  $x = 10$ .
- y) Aruna wants to purchase buttons. She needs at least 20 large buttons and at least 30 small buttons. The shopkeeper sells buttons in two forms (i) boxes and (ii) cards. Each box contains 10 large and 5 small buttons and each card contains 2 large and 5 small buttons. Find the most economical way in which she should purchase the buttons, if a box cost Rs.25 and a card Rs.10.
- z) If the production function is  $Q = L^2 - 2LK + 2K^2$  where  $L$  is the labour and  $K$  is the capital, find the marginal physical productivity of labour and capital when  $L = 1$  and  $K = 2$ .

**Q.3 Attempt the following:**

(5 x 4=20)

- a) Which of the following yields more effective interest: 8% p.a. compounded quarterly or 8.4% p.a. compounded semi-annually?
- b) Find the coordinates of point which divides segment AB externally in the ratio 3:2, if  $A \equiv (0,5)$ , and  $B \equiv (-7,2)$ .
- c) If the marginal revenue and the marginal cost for an output  $x$  of a commodity are given as  $MR = 5 - 4x + 3x^2$  and  $MC = 3 + 2x$ , and if fixed cost is zero find the profit function and the profit when the output is  $x = 4$ .
- d) Differentiate the following with respect to  $x$ :
- $y = \frac{e^x - x^2}{2x^2 + 2x}$
  - $y = \frac{x^2 - 3x + 5}{2x + 1}$

OR

**Q.III Attempt the following:**

(5 x 4=20)

- w) A person deposits in a financial institution Rs. 15000 at the end of each year for 3 years. What is the accumulated amount at the end of 3 years taking interest compounded at 12 % p.a.?
- x) If the distance between the points  $(a, -5)$  and  $(2, a)$  is 13, find  $a$ .
- y) The demand and supply functions for a commodity is respectively given by  $p = 20 - 3x$  and  $p = 2x$ . Find the consumer's surplus at the point of equilibrium.
- z) Differentiate the following with respect to  $x$ :
- $y = \log(3x^2 - 4x + 2)$
  - $y = x + \sqrt{1 - x^2}$ .

**Q.4 Attempt the following:**

(5 x 4=20)

- a) In how many years will Rs.6500 amount to Rs.7865 at 7% p.a. simple interest?
- b) Find the ratio in which the X-axis divides the segment joining the points  $(-2,3)$  and  $(4, -6)$ . Also find the coordinates of the point of division.
- c) Find the values of  $x$ , for which the functions  $f(x) = x^3 - 6x^2 - 15x + 5$  is
- Increasing
  - Decreasing.
- d) Evaluate the following integrals:
- $\int_2^3 (x+1)(x+2)(x+3) dx$
  - $\int_0^1 \frac{1}{3x+1} dx$

OR

**Q.IV Attempt the following:**

(5 x 4=20)

- w) Find the maturity amount of a 2 year fixed deposit of Rs.10000 at 10% p.a. if the interest is compounded quarterly.
- x) Find the equation of the line passing through  $(-5,4)$  and perpendicular to  $2x - 3y = 5$ .
- y) Find the value of  $x$  for which the total cost function has minima and maxima where  $C = x^3 - 9x^2 + 24x + 17$ .
- z) Evaluate the following integrals:
- $\int \frac{(x+3)(x-7)}{x} dx$
  - $\int \frac{(6-7x)^4 - (6-7x)^8}{(6-7x)^5} dx$