



RM-6001

**B. E. - I (Sem. - I) (All) Examination**  
**May / June - 2010**  
**Engineering Mathematics - I**

Time : 3 Hours]

[Total Marks : 100

**Instructions :**

(1)

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| नीचे दशांशके निशानीवाणी विगतो उत्तरवडी पर अवश्य कभवी.<br>Fillup strictly the details of signs on your answer book.                             |  | Seat No. :           |
| Name of the Examination :  |  | <input type="text"/> |
| Name of the Subject :  |  | <input type="text"/> |
| Subject Code No. : <input type="text" value="6"/> <input type="text" value="0"/> <input type="text" value="0"/> <input type="text" value="1"/> |  | <input type="text"/> |
| Section No. (1, 2.....) : <input type="text" value="1&amp;2"/>   |  |                      |
|  |  | Student's Signature  |

- (2) All questions are compulsory.  
(3) Figures to the right indicate marks.  
(4) Draw the figure whenever it is necessary.

**SECTION- I**

1 (a) Do as directed : 10

(1) Find Taylor series expansion of  $f(x) = \ln x$ , at point  $a = 1$

(2) If  $y = \sin(ax + b)$  then state  $y_n$ .

(3) Evalaute  $\lim_{x \rightarrow y} \frac{x^y - y^x}{x^x - y^y}$

(4) Prove that the logarithm of complex number is a multi valued function.

(5) Using relation between circular and hyperbolic functions prove that  $\cosh^2 x - \sinh^2 x = 1$

(b) State and prove Leibnitz's theorem for the  $n^{\text{th}}$  derivative of the product of two functions. 4

- (c) Attempt the following : 6
- (1) Obtain the first four terms of the Taylor's series of  $\cos x$  about  $x = \pi/4$ .
- (2) Find the Maclaurin series expansion of  $f(x) = \ln \sec x$  up to six terms.
- 2** (a) Define radius of curvature for polar form. Show that the radius of curvature at any point  $(r, \theta)$  on the curve  $r^2 = a^2 \sec 2\theta$ , is proportional to  $r^3$ . 5
- (b) Expand  $\log(x + \sqrt{x^2 + 1})$  up to first four terms by Maclaurin's theorem. 4
- (c) Attempt any two of the following : 6
- (1)  $\lim_{x \rightarrow 2} \left[ \frac{1}{x-2} - \frac{1}{\ln(x-1)} \right]$
- (2)  $\lim_{x \rightarrow 0} \frac{2 \tan x \sec x}{xe^x}$
- (3)  $\lim_{x \rightarrow a} (a-x) \tan\left(\frac{\pi x}{2a}\right)$
- 3** (a) State and prove De Moivre's theorem. 4
- (b) Attempt any two of the following : 8
- (1) If  $x_r = \cos \frac{\pi}{2^r} + i \sin \frac{\pi}{2^r}$  then prove that  $x_1 \cdot x_2 \cdot x_3 \cdot \dots = -1$ .
- (2) If  $\alpha$  and  $\beta$  are the roots of the equation  $x^2 - 2x + 4 = 0$ , then prove that  $\alpha^6 + \beta^6 = 128$ .
- (3) Expand  $\cos^5 \theta \sin^7 \theta$  in a series of sine of multiples of  $\theta$ .
- (c) Prove that  $\tan^{-1}(\sin \theta) = \cosh^{-1}(\sec \theta)$  3

## SECTION– II

- 4 (a) Do as directed : 10
- (1) Define asymptote.
  - (2) Define linear differential equation of first order and give its general solution.
  - (3) Sketch the curve  $r = a(1 + \sin \theta)$
  - (4) Give the arc length of the curve  $x = x(t)$  and  $y = y(t)$ .
  - (5) Define order and degree of the ordinary differential equation.
- (b) Trace the curve  $y^2 = ax^3$  5
- (c) Attempt any one of the following : 4
- (1) Find the area bounded by the curve  $x^{2/3} + y^{2/3} = a^{2/3}$
  - (2) Find the length of the Lemniscate  $r^2 = a^2 \cos 2\theta$ .
- 5 (a) Solve any three of the following : 9
- (1)  $(x^3y^3 + xy)dx = dy$
  - (2)  $(x^4 - 2xy^2 + y^4)dx - (2x^2y - 4xy^3 + \sin y)dy = 0$
  - (3)  $x(x - y)dy - y(x + y)dx = 0$
  - (4)  $x^2(y + 1)dx + y^2(x - 1)dy = 0$
- (b) Attempt any two of the following : 6
- (1)  $(y - px)(p - 1) = p$
  - (2)  $y = 2px - p^2$
  - (3)  $xyp^2 - (x^2 + y^2)p + xy = 0$

**6** Attempt any two of the following :

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- (1) A simple electric circuit contains a resistance of 10 ohms and inductance 4 henries in series with an induced emf of  $100 \sin 200t$  volts. If initially current is zero, find the current at time  $t=0.01$ .
- (2) Formulate MC-model for the spread of technological innovation. Obtain the solution and interpret the result.
- (3) State and formulate differential equation model for electric network (RC-circuit with variable emf). Obtain its solution, analyse it and write its interpretation.

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