

Roll No.

BCA-104(O)

B. C. A. (First Semester)
 EXAMINATION, Dec., 2013

(Old Course)

Paper Fourth

MATHEMATICAL FOUNDATIONS OF COMPUTER
 SCIENCE - I

Time : Three Hours]

[Maximum Marks : 75

Note : Section A is compulsory. Attempt any seven questions out of ten questions from Section B and one question from Section C.

(Numerical/Analytical/Problematic Questions)

- Define the following terms with proper example :
 - Singleton set
 - Universal set
- Evaluate :

$$\lim_{x \rightarrow 0} \frac{\sqrt{1 + \sin x} - \sqrt{1 - \sin x}}{x}$$

3. If an ellipse of eccentricity 'e' and semi-major axis 'a' revolves about its minor axis show that the surface of the spheroid thus generated is :

$$2\pi a^2 \left[1 + \frac{1-e^2}{2e} \log \left(\frac{1+e}{1-e} \right) \right]$$

P. T. O.

Handwritten notes and calculations, including a large integral expression:

$$\int_{-\infty}^{\infty} \frac{1}{1+x^2} dx = \int_{-\infty}^{\infty} \frac{1}{1+i^2 x^2} dx = \int_{-\infty}^{\infty} \frac{1}{1-x^2} dx$$

Handwritten text at the bottom of the page.

Section - B

(Short Answer Type Questions)

4. If :

$$f(x) = \begin{cases} \frac{x-|x|}{2} & x \neq 0 \\ Ax^2 & x = 0 \end{cases}$$

Show that $\lim_{x \rightarrow 0} f(x)$ does not exist.

6

5. Discuss the continuity of the function :

$$f(x) = \frac{\sin x}{x} \text{ for } x \neq 0, f(0) = 1$$

6

6. Find dy/dx of $\ln \sqrt{\frac{1+\sin x}{1-\cos x}}$.

6

7. Find the value of 'C' by the Lagrange's Mean value theorem, if $f(x) = Ax^2 + Bx + C$, where A, B, C are constants and $A \neq 0$.

6

8. Find the maximum and minimum values of $x^5 - 5x^4 + 5x^3 - 10$.

6

9. If the surface area of an open cylinder is 100 cm^2 , find its maximum capacity.

6

10. Evaluate : $\int \frac{1}{2x^2 + x - 1} dx$

6

11. Evaluate : $\int_0^{\pi/2} \frac{\cos^2 \theta}{\cos^2 \theta + 4 \sin^3 \theta} d\theta$

6

544

12. Find the value of a, b, c such that :

6

$$\lim_{x \rightarrow 0} \frac{x(a+b \cos x) - c \sin x}{x^5} = 1$$

13. In a group of athletic teams in a certain school, 21 are in the basket ball team, 26 in the hockey team, 29 in the football team. If 14 play hockey and basketball, 12 play football and basketball, 15 play hockey and football, 8 play all the three games. Find :

3, 3

(i) How many players are there in all ?

(ii) How many play only football ?

Section - C

(Long Answer Type Questions)

14. Find the centre of gravity of the volume formed by the revolution of the cycloid $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ about the axis of y.

15

15. Find by triple integration the volume of a solid bounded by the sphere $x^2 + y^2 + z^2 = 4$ and the paraboloid $x^2 + y^2 = 3z$.

15

16. Prove that :

15

$$\int_{x=0}^1 \int_{y=0}^1 \frac{(x-y)}{(x+y)^3} dx dy \neq \int_{x=0}^1 \int_{y=0}^1 \frac{(x-y)}{(y+x)^3} dy dx$$

544