

Roll No.

(06/21-II)

5396

B.C.A. EXAMINATION

(For Batch 2011 & Onwards)

(Fourth Semester)

MATHEMATICAL FOUNDATIONS-IV

BCA-246

Time : Three Hours

Maximum Marks : 80

Note : Attempt Five questions in all, selecting one question from each Unit. Q. No. 1 is compulsory.

(Compulsory Question)

1. (a) If $u = \log \left(\frac{x^2 + y^2}{xy} \right)$, then find $\frac{\partial^2 u}{\partial y \partial x}$ and $\frac{\partial^2 u}{\partial x \partial y}$ and show that $\frac{\partial^2 u}{\partial y \partial x} = \frac{\partial^2 u}{\partial x \partial y}$.

(5-08/3) B-5396

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- (b) Verify Euler's theorem for the following function :

$$\frac{x^2 - y^2}{x^2 + y^2}.$$

- (c) If $y^3 - 3ax^2 + x^3 = 0$, then prove that $\frac{d^2y}{dx^2} + 2\frac{a^2x^2}{y^5} = 0$.

- (d) Find reduction formula for $\int \tan^n x dx$.
 (e) Find the area bounded by $y^2 = 4ax$ and its latus rectum.
 (f) Find the surface area of a sphere of radius 'a'.
 (g) Define Beta function.
 (h) Define right circular cylinder. $2 \times 8 = 16$

Unit I

2. (a) If u is a homogeneous function of x and y of degree n , then show that :

$$x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = n(n-1)u.$$

B-5396

2

- (b) State and prove Euler's theorem. 8

3. Discuss the maxima and minima of the function $f(x, y, z) = \sin x \sin y \sin z$, where x, y, z are angles of a triangle. 16

Unit II

4. (a) Evaluate $\int_0^{\pi/2} \sin^n x dx$, where n is a positive even and odd integer. 8

- (b) Find the length of the arc $x^2 + y^2 - 2ax = 0$ in the first quadrant. 8

5. Find the whole length of the astroid $x^{2/3} + y^{2/3} = a^{2/3}$. 16

Unit III

6. (a) Find the area between the curves

$$y^2 = \frac{x^3}{2a-x} \text{ and its asymptote. } 8$$

(5-08/4) B-5396

3

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