No. of Printed Pages : 5

BEY–019

BACHELOR OF SCIENCE (APPLIED SCIENCE—ENERGY) (BSCAEY)

Term-End Examination

December, 2025

BEY-019 : REAL ANALYSIS AND DISCRETE MATHEMATICS

Time : 3 Hours *Maximum Marks : 70*

Note : *(i) Question No. **1** is compulsory.*

*(ii) Answer any **six** questions from the remaining question nos. **2** to **9**.*

(iii) Use of scientific (non-programmable) calculator is allowed.

(iv) Symbols have their usual meanings.

1. State whether the following statements are True *or* False ? Justify your answer with a short proof or a counter example : 5×2=10

(a) Every continuous function is differentiable.

(b) The contrapositive statement for $p \rightarrow q$ is $\sim p \rightarrow \sim q$.

(c) $y^2 - 4y - 2x = 0$ represents a parabola.

(d) The relation ($\leq$) on the set of integers is an anti-symmetric relation.

(e) For the function :

$$f(x) = \begin{cases} 7 \ , & x < 2 \\ ax + b, & x > 2 \\ a + 5 \ , & x = 2 \end{cases}$$

the values of 'a' and 'b' are 2 and 5 respectively, provided $f(x)$ is continuous at $x = 2$.

2. (a) Out of 50 people in a group, 24 speak English, 15 speak Hindi, 18 speak Sanskrit, 6 speak English and Hindi, 8 speak English and Sanskrit, 5 Hindi and Sanskrit and 10 people do not

speak any of the three languages. Find, how many speak : 6

(i) All the three languages,

(ii) Hindi but not Sanskrit, and

(iii) English and Sanskrit but not Hindi.

(b) Let $f : \mathbb{N} \to Y$ be a function defined as $f(x) = 4x + 3$, where $Y = \{y \in \mathbb{N} : y = 4x + 3 \text{ for some } x \in \mathbb{N}\}$.

Show that f is invertible. Find the inverse. 4

3. (a) Find the domain and range of the real function $f(x) = \sqrt{9 - x^2}$. 5

(b) Let R be a relation from $\mathbb{N}$ to $\mathbb{N}$ defined by $R = \{(a, b) : a, b \in \mathbb{N} \text{ and } a = b^2\}$.

Are the following true ?

(i) $(a, b) \in R$ implies $(b, a) \in R$

(ii) $(a, b) \in R$, $(b, c) \in R$ implies $(a, c) \in R$

Justify your answer in each case. 5

4. (a) Find the co-ordinates of the point which divides the line joining the points (4, 7) and (3, – 5) in the ratio 3 : 4. 5

(b) Show that the equation :

$$x^2 + y^2 - 2x + 6y - 6 = 0$$

is a circle. Find its centre and radius. 5

5. (a) Write the first five terms of an Arithmetic Progression whose third and eleventh terms are 21 and 85 respectively. 5

(b) A man deposited ₹ 10,000 in a bank at the rate of 5% simple interest annually. Find the amount in the 15th year since he deposited the amount and also calculate the total amount after 20 years. 5

6. (a) Solve the following difference equation : 5

$$y_{t+2} - 4y_t = 5.$$

(b) What do you understand by a phase diagram ? What is it used for ? 5

7. (a) Evaluate : 5

$$\lim_{x \to 3} \left(\frac{1}{x - 3} - \frac{3}{x^2 - 3x} \right).$$

(b) Find : 5

$$\frac{dy}{dx} \text{ if } x = 2 + 4t^2,\ y = 9t^2 + 3t + 1.$$

8. (a) Evaluate : 5

$$\int_1^4 |x - 2|\, dx\,.$$

(b) Evaluate : 5

$$\int x^3 . a^x dx.$$

9. (a) Using integration, find the area bounded by the line $y = 3x + 2$, the x-axis and the ordinates $x = 0$ and $x = 1$. 5

(b) Find $\frac{dy}{dx}$, where $y = u^2$, $u = 3v$, $v = \frac{x}{x + 1}$. 5

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