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Shri S. H. Kelkar College of Arts, Commerce and Science, Devgad

F.Y.BSC SEMESTER-I Examination-November 2023

Course: Mathematics Paper-I | **Course Code: USMT101**

Maximum marks: 75 | **Duration: 2 ½Hrs**

Instructions:

All questions are compulsory and carry equal marks

Figures to the right indicate full marks

Q.1 Attempt any four of the following **20**

a) Define the terms 1) Least Upper Bound 2) Greatest Lower Bound 3) Neighbourhood of a point.

b) By applying Hausdroff property Find disjoint neighbourhoods of 1.5 and 1.6

c) Find the least upper bound of set $S = \{x \in R \mid |x + 12| \leq 12\}$

d) Show that if $S = \left\{\frac{1}{n} : n \in N\right\}$ $then\ infs = 0$

e) State and prove Cauchy Schwarz inequality.

Q.2 Attempt any four of the following **20**

a) Examine whether the sequences 1) $x_n = \frac{4}{n+1}$ 2) $x_n = 3n^2 + 2$ is bounded or not?

b) Using definition of limit show that $\lim_{n\to\infty}\left(\frac{2n+3}{n+1}\right) = 2$

c) State and prove Sandwich theorem

d) Define the following terms 1) Monotonic Sequences 2) Cauchy Sequences

e) Find the convergence of $a_n = \left(1 + \frac{3}{n}\right)^{4n}$

Q.3 Attempt any four of the following **20**

a) Explain ordinary differential equation with suitable example

b) Solve $(2x^3 + 3y)dx + (3x + y - 1)dy = 0$

c) Solve $y^2dx + (x^2 - xy)dy = 0$

d) Find the solution of $\frac{dy}{dx} + y = x$

e) Determine the orthogonal trajectories of hyperbolas $xy = c$

Q.4 Attempt any three of the following **15**

a) State 1) Arithmetic-Geometric mean inequality 2) Archimedean property 3) Hausdroff property

b) Prove that a converging sequence has unique limit

c) By using Sandwich theorem show that the sequence $x_n = \left(\frac{\sin n}{n}\right)$ is convergent

d) Find the particular solution of equation $\frac{dy}{dx}\left(\frac{d^2y}{dx^2}\right) - x = 0$ $given\ y(1) = 2, y'(1) = 1$