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SVIS-N 326 A-17

B.Sc. VIth Semester Degree Examination

Mathematics

(Fluid Mechanics, Statistical Analysis, Calculus of Variation & Topology)

Paper : 6.2

(New)

Time : 3 Hours larks : 80

Instructions to Candidates :

1) Answer all Sections.

SECTION - A

I. Answer any ten of the following : **(10 × 2 = 20)**

1) Define compressible fluids.

2) Write the expression for Density an specific volume.

3) Explain Lagrangian method of Describing fluid motion.

4) Define topology.

5) What are open sets and closed sets?

6) If (X,T) be a topological space where $X = \{a, b, c, d\}$ and $T = \{\phi, X, \{b\}, \{a, b\}, \{a, b, d\}\}$, Then find T - neighbourhood of a.

7) Define correlation.

8) Given $\bar{x} = 18$, $\bar{y} = 100$, $\sigma_x = 14$, $\sigma_y = 20$ & $r = 0.8$. Find the regression lines.

9) Find mean of Poisson distribution.

10) Prove that $\delta\left(\frac{dy}{dx}\right) = \frac{d(\delta_y)}{dx}$.

11) Explain Geodesics.

12) Show that $y = -x^3 + C_1x + C_2$ is a curve on which the functional $\int_0^1 \left[(y')^2 - 12xy\right]dx$ assumes extremum.

SECTION - B

II Answer any four of the following : **(4 × 6 = 24)**

1) Derive equation of continuity and obtain the equation of continuity for compressible and incompressible fluid.

2) Derive expression for local and individual time rate of change.

3) Determine the acceleration of moving fluid at a point (2, 1, 1), at t = 0.25 sec. If $u = yz + t$, $v = xz - t$, $w = xy$.

4) Solve the variational problem $\delta\int_0^1 \left(x + y + y'^2\right) dx = 0$ under the conditions $y(0) = 1$, $y(1) = 2$.

5) Derive Euler's equation.

6) Prove that Geodesics on a plane are straight lines.

SECTION - C

III Answer any **six** of the following. **(6 × 6 = 36)**

1) Let (X, T) be a topological space and $x \in$ x be arbitrary then

   i) There exists at least one neighbourhood of x.

   ii) For each neighbourhood N of x, $x \in$ N.

   iii) If M is a superset of a neighbourhood N of x then M is also neighbourhood of x.

2) Let X be a non-empty set and $x \in X$, let there be associated a collection N(x) of sub-sets of X called neighbourhoods satisfying the following conditions

   N_1) $N(x) \neq \phi, \forall x \in X$

   N_2) $N \in N(x) \Rightarrow x \in N$

   N_3) $N \in N(x), M \subset N \Rightarrow M \in N(x)$

   N_4) $N \in N(x), M \in N(x) \Rightarrow N \cap M \in N(x)$

   N_5) $N \in N(x) \Rightarrow \exists M \in N(x)$ such that $M \subset N$ and $M \in N(y), \forall y \in M$.

   Then there exists a unique topology T on X.

3) i) In a topological space (X, T) an arbitrary inter section of closed sets is closed.

ii) In a topological space (X, T) a finite union of closed sets is closed.

4) Find an equation of the best fitting straight line for the data

x :	62	64	65	69	70	71	72
y :	65.7	66.8	67.2	69.3	69.8	70.5	70.9

5) The numerical value of correlation coefficient does not exceed unity i.e. $-1 \le r \le 1$.

6) Find correlation coefficient and regression lines for the data

x :	1	2	3	4	5
y :	2	5	3	8	7

7) Find the value of K for which the following distribution represents a discrete probability distribution. Hence find its mean and S.D. also find $P(x \le 1)$ and $P(x > 1)$

x :	−3	−2	−1	0	1	2	3
P(x) :	K	2K	3K	4K	3K	2K	K

8) Find Mean & S.D. of normal distribution.

9) Find the value of C for which

$$f(x)=\begin{cases} Cx^2 & 0<x<3 \\ 0 & \text{otherwise} \end{cases}$$ is a probability density function. Also find

i) $P(1 < x < 2)$

ii) $P(x \le 1)$

iii) $P(x > 1)$

iv) Mean

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