

## Mathematics

Internal Exam for Sem V Session (2019-22)

Core paper - XI

F.M. 15

Answer any three ques but Q. No. 01 is compulsory.

① (a) Define function of two variable.

(b) Prove that  $\nabla \cdot (\nabla \times \vec{u}) = 0$

(c) Evaluate  $\text{div curl } \vec{v}$

(d) Define an irrotational vector.

(e) Find  $\int_0^1 \int_0^1 xy \, dx \, dy$ .

② Show that the f<sup>n</sup> f defined by

$$f(x, y) = \begin{cases} \frac{x^3 - y^3}{x^2 + y^2}, & (x, y) \neq (0, 0) \\ 0 & \text{is continuous at } (0, 0) \end{cases}$$

= 0 is continuous at (0, 0)

③ If  $u = \log(x^2 + y^2 + z^2 - 3xyz)$  show that

$$\text{(i) } \frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = \frac{3}{x+y+z}$$

④ Prove that  $\text{div}(\vec{u} \times \vec{v}) = \vec{v} \text{curl } \vec{u} - \vec{u} \text{curl } \vec{v}$

⑤ State & prove Stoke's theorem:

or

State & prove Green's theorem.

## Mathematics

Internal exam for Sem V

Session (2019-22)

Core paper - XII

F.M. - 15

Answer any three ques. but Q.N.01 is compulsory.

- (1) (a) Define external direct product.
  - (b) Define internal direct product.
  - (c) Define group actions.
  - (d) Define inner Automorphism.
  - (e) Define commutator subgroup.
- (2) Every finite group  $G$  is isomorphic to a permutation group. (i.e. Cayley's theorem)
  - (3) Show that  $a \rightarrow a^{-1}$  is an automorphism of a group  $G$  iff  $G$  is abelian.
  - (4) State & prove index theorem.
  - (5) If  $G$  is an internal direct product of its subgroups  $H$  &  $K$  then prove that  $H$  &  $K$  have only the identity in common.



Mathematics

DSE 1.1 (LPP)

Internal Exam for Sem I Session (2019-22)

Answer any ~~two~~ ques but Q.N.01 is compulsory.

1) (a) Define a convex set in  $\mathbb{R}^n$

(b) Define line segment.

(c) Define an assignment problem.

(d) Define game theory.

(e) Define Duality.

2) Find the dual of the following LPP

$$\text{Maximize } Z = 2x_1 + 3x_2 + x_3$$

$$\text{Subject to } 4x_1 + 3x_2 + x_3 = 6$$

$$x_1 + 2x_2 + 5x_3 = 4$$

$$\text{and } x_1, x_2, x_3 \geq 0$$

3) Solve the transportation problem:

		To			
		1	2	3	Available
From	I	2	7	4	5
	II	3	3	7	8
	III	5	4	1	7
	IV	1	6	2	14
Requirement		7	9	18	

Mathematics

Internal Exam (2019-22)

F.M. 15

Sem V Paper DSE 2.2 (Prob + stat.)

Answer any three ques but Q. No. 1 is compulsory.

- ① (a) Define sample space.
- (b) Define Random variable.
- (c) Define negative binomial.
- (d) Define independent events.
- (e) The bivariate function  $f(x, y)$  is called joint probability density function if \_\_\_\_\_  
(i)  $f(x, y) \leq 0$  (ii)  $f(x, y) < 0$ , (iii)  $f(x, y) \geq 0$  (iv)  $f(x, y) > 0$
- (2) Prove that  $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- (3) state and prove theorem of Total Probability
- (4) prove theorem of compound probability.
- (5) prove that for any two events A & B  
 $P(A \cap B) \leq P(A) \leq P(A \cup B) \leq P(A) + P(B)$