Internal Assessment

M.A./ M.Sc. Semester-III Examination,2019(CDOE,BU)

Subject: Mathematics (Pure Stream)(old)

Answer of MPG301(I & II) together should be limited to one A4 size page,
Answer of MPG302(I & II) together should be limited to one A4 size page,
Answer of MPG303(I & II) together should be limited to one A4 size page,
Answer of MPS304(AFA OR DGM) should be limited to one A4 size page,
Answer of MPS305 should be limited to one A4 size page.

Notations and symbols have their usual meanings

Time: 2 Hours | **Full Marks: 25**

Paper :MPG 301
(Unit-I)
(Modern Algebra-II)

Answer any **one** question. Only **first** answer will be evaluated. 1×3 = 3

1. **Show that every subgroup of a nilpotent group is nilpotent.**
2. **Prove that no group of order 8 is simple.**

(Unit-II)
(General Topology-I)

Answer any **one** question. Only **first** answer will be evaluated. 1×2 = 2

1. **State Tietz's Extension theorem.**
2. **State Urysohn's lemma.**

Paper:MPG302
(Unit-I)
(Graph Theory)

Answer any **one** question. Only **first** answer will be evaluated. 1×4= 4

1. **Let *G(V,E)* be a simple connected graph with n vertices such that $d(v) \geq \frac{n}{2}$ for all $v \in V$. Show that *G* is Hamiltonian.**
2. **Prove that every closed odd walk contains an odd cycle.**

Unit-II
(Set Theory-I)

Answer any **one** question. Only **first** answer will be evaluated. 1×1=1

1. **State Schröder-Bernstein theorem.**
2. **If *u,v,w* are cardinal numbers then show that *u(vw)=(uv)w* .**

Paper :MPG303
(Unit-I)
(Set Theory-II & Mathematical Logic)

Answer any **one** question.Only **first** answer will be evaluated. $1\times3=3$

1. **State and prove the principle of transfinite induction.**
2. **Prove that formal axiomatic theory L is consistent.**

(Unit-II)
(Functional Analysis-II)

Answer any **one** question.Only **first** answer will be evaluated. $1\times2=2$

1. **Prove that intersection of any number of convex sets in a linear space X is a convex set in X.**
2. **State Banach-Steinhaus theorem.**

Paper :MPS304
(Special Paper-1)
(Advanced Functional Analysis-I)

Answer any **one** question.Only **first** answer will be evaluated. $1\times5=5$

1. a) **Prove that every Hilbert space is strictly convex .**
   b) **Prove that every metrizable locally convex space is bornological.**

   (3+2)

2. **When is a set of linear space said to be symmetric? Prove that a convex set C *of* a linear space X is balanced if and only if C is symmetric .**

   (1+4)

Paper :MPS304
(Special Paper-1)
(Differential Geometry of Manifolds-I)

Answer any **one** question.Only **first** answer will be evaluated. $1\times5=5$

1. **When is a vector field on a smooth manifold said to be complete? Is every vector field on $\mathbb{R}$ complete? Support your answer.**

   (2+3)

2. **Define local flow of a vector field on a smooth manifold. Give an example of a local flow of a vector field on $\mathbb{R}^2$ which is not a global flow .**

   (2+3)

Paper :MPS305
(Special Paper-2)
(Operator Theory and Applications-I)

Answer any **one** question.Only **first** answer will be evaluated. 1×5= 5

1. **Prove that a linear transformation E is an orthogonal projection if and only if it is a projection operator.**
2. **Let X be a finite dimensional normed linear space and let $A: X \to Y$ be a linear transformation. Show that A is compact.**

Internal Assessment
M.A./ M.Sc. Semester-III Examination,2019(CDOE)
Subject: Mathematics (AppliedStream)(old)

Answer of MAG301 should be limited to one A4 size page,
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Answer of MAS304 should be limited to one A4 size page,
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Notations and symbols have their usual meanings

Time: 2 Hours Full Marks: 25

Paper :MAG301
(Methods of Applied Mathematics-I)

Answer any **one** question. Only **first** answer will be evaluated. 1×5=5

1. **Show that the derivative of a generalised function is a continuous linear functional on K ,K being the test function space.**
2. **Define Fourier transform of a generalised function and obtain the Fourier transform of 1 .** **(2+3)**

Paper :MAG302
(Unit-I)
(Method of Applied Mathematics-II)

Answer any **one** question. Only **first** answer will be evaluated. 1×3=3

1. **What is meant by Neumann BVP? Obtain a necessary condition for the existence of solution of Neumann BVP for the Laplace equation .**

   (1+2)
2. **State and prove Dirichlet principle for harmonic function .**

   (1+2)

(Unit-II)
(Theory of Electro Magnetic Fields)

Answer any **one** question. Only **first** answer will be evaluated. 1×2=2

1. **Use Biot-Savart law to prove that the magnetic monopole does not exist .**
2. **Determine the electrostatic potential at a point due to an electric dipole .**

Paper :MAG303
(Unit-I)
(Continuum Mechanics-II)

Answer any **one** question. Only **first** answer will be evaluated. 1×3=3

1. **Define strain energy function . Write down the form of strain energy function for an isotropic elastic medium .**

   (2+1)
2. **Define 'deformation function' and 'deformation gradient tensor' for the motion of a deformable body.**

   (1.5+1.5)

(Unit-II)
(Dynamical Systems)

Answer any **one** question. Only **first** answer will be evaluated. 1×2=2

1. **Define conservative dynamical systems . Give an example of it .**
2. **Mention the importance of Hartmann-Grobmann theorem in dynamical system .**

Paper :MAS304
(Special Paper-1)
(Viscous Flows,Boundary Layer Theory and Magneto-hydrodynamics-I)

Answer any **one** question.Only **first** answer will be evaluated. 1×5= 5

1. **Explain continuum hypothesis in the context of motion of viscous fluid . When does this hypothesis break down ?**

   (3+2)

2. a) What do you mean by 'slow motion'?

b) Provide physical interpretation of boundary layer displacement thickness .

(2+3)

Paper :MAS305
(Special Paper-2)
(Advanced Operations Research-I)

Answer any **one** question.Only **first** answer will be evaluated. $1\times5=5$

1. **State the Beale's algorithm for solving Quadratic Programming Problem .**
2. **Discuss Fibonacci search method for solving one-dimensional nonlinear minimization problem .**