Internal Assessment
M.A./M.Sc. Semester III Examination 2018 (for DDE)
Subject – Mathematics (Applied Stream)

Use separate answer-sheet for each paper (**Answer of each paper should be limited to one A4 size page**)

Notation and symbols have their usual meanings

Time: 2 Hours Full Marks: 25

Paper MAG-301 [Methods of Applied Mathematics-I]

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

1. Define a compact operator T on a Hilbert space H. Is T bounded on H? Justify your answer. 2+1+2
2. Determine the values of λ for which the integral equation $u(x)=\frac{5x}{6}+\lambda\int_0^1 xsu(s)ds$ admits unique solution in [0,1]. 5

Paper MAG-302

UNIT I [Methods of Applied Mathematics-II]

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

1. Determine the fundamental solution of $\frac{du}{dx}-u=0.$ 3
2. When is a boundary value problem said to be ill-posed? Give an example of it. 2+1

Unit-II [Theory of Electro Magnetic Fields]

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

1. State Biot-Savart law for a steady line current.
2. Show that $\nabla^2 V=0$ inside a conductor where V denotes the electrostatic potential.

Paper MAG 303

UNIT I [Continuum Mechanics-II]

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

1. Give the geometrical interpretation of first strain invariant.
2. Define stress quadric due to Cauchy.

Unit-II [Dynamical Systems]

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

1. State Hartmann Grobmann theorem.
2. Define limit cycle.

Paper MAS-304 [Viscous Flows, Boundary Layer Theory & Magneto-Hydrodynamics-I]
Special Paper I

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

1. Write down the basic assumptions for boundary layer flows. Mention the importance of Prandtl's boundary layer theory in fluid mechanics. Define boundary layer thickness. 2+1+2

2. State Newton's law of viscosity for the motion of viscous fluid. Define non-Newtonian fluid. Give an example of it. 2+2+1

Paper MAS-305 [Advanced Operations Research-I]
Special Paper II

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

1. (a) State the Kuhn-Tucker's necessary conditions to maximize $z = f(x_1, x_2, ..., x_n)$ subject to the constraints $g_i(x_1, x_2, ..., x_n) \le b_i, i = 1, 2, ..., m.$

   (b) Write down the Kuhn-Tucker's necessary conditions to maximize

   $f(x_1, x_2, x_3) = -x_1^2 - x_2^2 - x_3^2 + 4x_1 + 6x_2$

   subject to $x_1 + x_2 \le 2,\ 2x_1 + 3x_2 = 12$ and $x_1, x_2, x_3 \ge 0.$

   (c) Under what conditions, the Kuhn-Tucker's necessary conditions are sufficient for maximization and minimization problems? 2+2+1

2. (a) Write down the advantages and disadvantages of Wolfe's method?

   (b) Write down the iterative formula for conjugate gradient method.

   (c) What are Karlin's and Slater's constraint qualifications? 2+2+1