MM-07
PARTIAL DIFFERENTIAL
EQUATIONS & MECHANICS

(Questions will be set from each unit/section)

Units	Topics

Partial Differential Equations:

I

Examples of PDE. Classification.

Transport Equation - Initial Value Problem. Non homogeneous equation. Laplace's equation - Fundamental Solution, Mean value Formula, Properties of solutions, Energy Methods.

Wave equation - Solution by Spherical Means, Non-homogeneous Equations, Energy Methods.

II

Nonlinear First Order PDE - Complete Integrals, Envelopes, Characteristics, Hamilton - Jacobi Equations (Calculus of Variations, Hamilton's ODE, Legendre Transform, Hopf-Lax Formula, Weak Solutions, Uniqueness).

Representation of Solutions - Separation of variables, Similarity Solutions (Plane and Travelling Waves, Solitons, Similarity under Scaling), Fourier and Laplace Transform, Hopf - Cole Transform, Hodograph and Legendra Transform, Potential Functions.

Mechanics :- Analytical Dynamics:

III

Generalized coordinates. Holonomic and Non-holonomic systems. Scleronomic and Rheonomic systems. Generalized potential. Lagrange's equations of first kind. Lagrange's equations of second kind. Uniqueness of Solution. Energy equation for conservative fields.

Hamilton's variables, Donkin's theorem Hamilton canonical equations. Cyclic coordinates Routh's equations. Poisson's Bracket. Poission's Identity. Jacobi-Poisson Theorem.

IV

Hamilton's Principle. Principle of least action. Poincare cartan Integral invariant whittaker's equations. Jacobi's equations. Statement of Lee Hwa Chung's theorem.

Hamilton - Jacobi equation. Jacobi theorem. Method of spearction of variables. Largrange Brackets Conoition of cononical character of a Transformation interm of Lagrange brackets and Peisson brackets. Invariance of Lagrange brackets and Poisson brackets under cononical transformations.

Gravitation:

V

Attraction and potential of rod, disc, spherical shells and sphere. Surface integral of normal attraction (application & Gauss theorem). Laplace and Poisson equations. Workdone by self attracting systems. Distributions for a given potential. Equipotential Surfaces. Surface and solid harmonics surface density in term of surface harmonics.