B.A./B.Sc. II (SEMESTER-IV) PAPER-I Differential Equations & Mechanics

Programme: Diploma Class: B.A./B.Sc.	Year: Second	Semester: Fourth	
		Subject: Mathematics	
Course Code: B030401T		Course Title: Differential Equations & Mechanics	

Course outcomes:

CO1: The objective of this course is to familiarize the students with various methods of solving differential equations, partial differential equations of first order and second order and to have qualitative applications.

CO2: A student doing this course is able to solve differential equations and is able to model problems in nature using ordinary differential equations. After completing this course, a student will be able to take more courses on wave equation, heat equation, diffusion equation, gas dynamics, nonlinear evolution equation etc. These entire courses are important in engineering and industrial applications for solving boundary value problem.

CO3: The object of the paper is to give students knowledge of basic mechanics such as simple harmonic motion, motion under other laws and forces.

CO4: The student, after completing the course can go for higher problems in mechanic such as hydrodynamics, this will be helpful in getting employment in industry.

Credits: 6	Core Compulsory / Elective
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Lectures-Tutorials-Practical (in hours per week): L-T-P: 6-0-0

Part- A

Differential Equations

Unit	Topics	No. of Lectures
I	Second order linear differential equations with variable coefficients: The complete Solution in terms of A known Integral, Removal of the first order Derivative (normal form), Solution by Changing the Independent Variable, variation of parameters, Method of Operational Factors.	10
II	Bessel and Legendre functions and their properties, Orthogonal properties, recurrence Formula and generating Function.	10
III	Origin of first order partial differential equations. Partial differential equations of the first order and degree one, Lagrange's solution, Partial differential equation of first order and degree greater than one. Charpit's method of solution, Surfaces Orthogonal to the given system of surfaces.	9
IV	Origin of second order PDE, Solution of partial differential equations of the second and higher order with constant coefficients, Classification of linear partial differential equations of second order, Solution of second order partial differential equations with variable coefficients, Monge's method of solution.	9

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Part- B

Mechanics

Unit	Topics	No. of Lectures
V	Frame of reference, work energy principle, Forces in three dimensions, Poinsot's central axis, Wrenches, Null lines and planes.	10
VI	Virtual work, Stable and Unstable equilibrium, Potential energy test, Z-test, stability of a body resting on a fixed rough surface.	9
VII	Velocities and accelerations along radial and transverse directions, and along tangential and normal directions, Simple Harmonic motion, Motion under other law of forces.	9
VIII	Elastic strings, Motion in resisting medium, Constrained motion, Motion on smooth and rough plane curves. Central orbit. Kepler's laws of motion,	9

Suggested Readings (Part-A Differential Equations):

1. G.F. Simmons, **Differential Equations with Application and Historical Notes**, Tata –McGraw Hill 2002
2. B. Rai, D.P. Choudhary & H. J. Freedman, **A Course of Ordinary Differential Equations**, Narosa 2002
3. Ian N. Snedden, **Elements of Partial Differential Equations**, Dover Publication 2013
4. L.E. Elsgolts, **Differential Equation and Calculus of variations**, University Press of the Pacific. 1970
5. Suggested digital platform: NPTEL/SWAYAM/MOOCs

Suggested Readings (Part-B Mechanics):

1. R.C. Hibbeler, **Engineering Mechanics-Statics**, Prentice Hall Publishers 2010
2. R.C. Hibbeler, **Engineering Mechanics-Dynamics**, Prentice Hall Publishers 2012
3. A. Nelson, **Engineering Mechanics Statics and Dynamics**, Tata McGraw Hill 2009
4. J.L. Synge & B.A. Griffith, **Principles of Mechanics**, Tata McGraw Hill 2018
5. Suggested digital platform: NPTEL/SWAYAM/MOOCs

This course can be opted as an elective by the students of following subjects: Engg. and Tech. (UG), Economics (UG/PG), B.Sc. (C.S.)

Suggested Continuous Evaluation Methods: Max. Marks: 25

SN	Assessment Type	Max. Marks
1	Class Tests	10
2	Online Quizzes/ Objective Tests	5
3	Presentation	5
4	Assignment	5

Course prerequisites: To study this course, a student must have Certificate Course in Applied Mathematics

Suggested equivalent online courses:

Further Suggestions:

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