<table>
<thead>
<tr>
<th>Course Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>MTM 101</td>
<td>Algebra-I</td>
<td>4</td>
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<td>MTM 102</td>
<td>Real Analysis-I</td>
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<td>MTM 103</td>
<td>Topology</td>
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<td>MTM 104</td>
<td>Differential Geometry of Manifolds-I</td>
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<td>MTM 105</td>
<td>Set Theory &amp; Complex Analysis</td>
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**Semester –II**

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<tr>
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<tr>
<td>MTM 201</td>
<td>Algebra-II</td>
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<tr>
<td>MTM 202</td>
<td>Real Analysis-II</td>
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<td>MTM 203</td>
<td>Analytic Dynamics</td>
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<td>MTM 204</td>
<td>Differential Geometry of Manifolds-II</td>
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<td>MTM 205</td>
<td>Theory of Optimization</td>
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**Semester –III**

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<tbody>
<tr>
<td>MTM 301</td>
<td>Hydrodynamics</td>
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</tr>
<tr>
<td>MTM 302</td>
<td>Nor med Linear Spaces &amp; Theory of Integration</td>
<td>4</td>
</tr>
<tr>
<td>MTM 303</td>
<td>Numerical Analysis</td>
<td>4</td>
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**ELECTIVE**

Any two of the following

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<tr>
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<tbody>
<tr>
<td>MTM 304</td>
<td>Mathematical Modeling</td>
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<tr>
<td>MTM 305</td>
<td>Operations Research</td>
<td>4</td>
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<tr>
<td>MTM 306</td>
<td>Discrete Mathematics</td>
<td>4</td>
</tr>
<tr>
<td>MTM 307</td>
<td>Advanced Topology</td>
<td>4</td>
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<tr>
<td>MTM 308</td>
<td>Integral Equations</td>
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**Semester –IV**

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<td>MTM 401</td>
<td>Functional Analysis</td>
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<td>MTM 402</td>
<td>Partial Differential Equations</td>
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**ELECTIVE (Any three of the following)**

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<tr>
<td>MTM 403</td>
<td>Fluid Mechanics</td>
<td>4</td>
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<tr>
<td>MTM 404</td>
<td>Numerical Solution of Partial Differential Equations</td>
<td>4</td>
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<td>MTM 405</td>
<td>Number Theory and Cryptography</td>
<td>4</td>
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<td>MTM 406</td>
<td>Fuzzy Sets and Applications</td>
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<td>MTM 407</td>
<td>Advanced Graph Theory</td>
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<td>MTB 408</td>
<td>Advanced Topology</td>
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<td>MTB 409</td>
<td>Integral Equations</td>
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<tr>
<td>MTB 410</td>
<td>Non-linear Dynamical Systems</td>
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<td><strong>Grand Total</strong></td>
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*More Elective papers can be added subject to the availability of subject experts.

**SEMESTER- I**

**MTM 101 Algebra-I**

Credits : 4


**References:**


References:

MTM 104  Differential Geometry of Manifolds-I   Credits : 4


References:


MTM 105  Set Theory & Complex Analysis   Credits : 4


**References:**


**SEMESTER - II**

**MTM 201**  
**Algebra–II**  
**Credits :**  
4


**References:**


**MTM 202 Real Analysis-II Credits : 4**


**References:**


**MTM 203 Analytic Dynamics Credits : 4**

Rotation of a vector in two and three dimensional fixed frame of references. Kinetic energy and angular momentum of rigid body rotating about its fixed point. Euler dynamic and geometrical equations of motion. Generalized coordinates, momentum and force components. Lagrange equations of motion under finite forces, cyclic coordinates and conservation of energy. Lagrangian approach to some known problems—motions of simple, double, spherical and cycloidal pendulums, motion of a particle in polar system, motion of a particle in a
rotating plane, motion of a particle inside a paraboloid, motion of an insect crawling on a rod rotating about its one end, motion of masses hung by light strings passing over pulleys, motion of a sphere on the top of a fixed sphere and Euler dynamic equations.
Lagrange equations for constrained motion under finite forces. Lagrange equations of motion under impulses, motion of parallelogram about its centre and some of its particular cases. Small oscillations for longitudinal and transverse vibrations. Equations of motion in Hamiltonian approach and its applications on known problems as given above. Conservation of energy. Legendre dual transformations. Hamilton principle and principle of least action. Hamilton-Jacobi equation of motion, Hamilton-Jacobi theorem and its verification on the motions of a projectile under gravity in two dimensions and motion of a particle describing a central orbit. Phase space, canonical transformations, conditions of canonicality, cyclic relations, generating functions, invariance of elementary phase space, canonical transformations form a group and Liouville theorem. Poisson brackets, Poisson first and second theorems, Poisson, Jacobi identity and invariance of Poisson bracket.

References:
1. A. S. Ramsay, Dynamic – Part II.

MTM 204 Differential Geometry of Manifolds-II Credits: 4


References:

**MTM 205 Theory of Optimization**

Credits : 4


**References:**

**Semester –III**

**MTM 301 Hydrodynamics**

Credits : 4

Equation of continuity, Boundary surfaces, streamlines, Irrotational and rotational motions, Vortex lines, Euler’s Equation of motion, Bernoulli’s theorem, Impulsive actions. Motion in two-dimensions, Conjugate functions, Source, sink, doublets and their images, conformal
mapping, Two-dimensional irrotational motion produced by the motion of circular cylinder in an infinite mass of liquid, Theorem of Blasius, Motion of a sphere through a liquid at rest at infinity. Liquid streaming past a fixed sphere, Equation of motion of a sphere.

Stress components in real fluid, Equilibrium equation in stress components, Transformation of stress components, Principal stress, Nature of strains, Transformation of rates of strain, Relationship between stress and rate of strain, Navier-Stokes equation of motion.

References:

MTM 302 Normed Linear Spaces and Theory of Integration Credits : 4

References:

MTM 303 Numerical Analysis Credits : 4
Matrix inversion method, Matrix factorization, Tridiagonal systems. Numerical solutions of system of simultaneous first order differential equations and second order initial value problems (IVP) by Euler and Runge-Kutta (IV order) explicit methods.


References:
7. Naveen Kumar, *An Elementary Course on Variational Problems in Calculus*.

ELECTIVE (Any two of the following)

<table>
<thead>
<tr>
<th>MTM 304</th>
<th>Mathematical Modeling</th>
<th>Credits :4</th>
</tr>
</thead>
</table>

Simple situations requiring mathematical modeling, techniques of mathematical modeling, Classifications, Characteristics and limitations of mathematical models, Some simple illustrations. Mathematical modeling through differential equations, linear growth and decay models, Non-linear growth and decay models, Compartment models, Mathematical modeling in dynamics through ordinary differential equations of first order. Mathematical models through difference equations, some simple models, Basic theory of linear difference equations with constant coefficients, Mathematical modeling through difference equations in economic and finance, Mathematical modeling through difference equations in population dynamics and genetics. Situations that can be modeled through graphs. Mathematical models in terms of Directed graphs, Mathematical models in terms of signed graphs, Mathematical models in terms of weighted digraphs. Mathematical modeling through linear programming, Linear programming models in forest management, Transportation and assignment models.

References:


**MTM 305  Operations Research  Credits : 4**


**References:**


**MTM 306  Discrete Mathematics  Credits : 4**


References:
2. Narsingh Deo, *Graph Theory with Applications to Engineering and Computer Science*, Prentice-Hallof India.

MTM 307 Advanced Topology Credits: 4

References:

MTM 308 Integral Equations Credits : 4

References:
SEMESTER – IV

MTM 401 Functional Analysis Credits : 4


References:

MTM 402 Partial Differential Equations Credits : 4


**References:**

**ELECTIVE (Any Three of the following)**

**MTM 403 Fluid Mechanics Credits : 4**


**References:**

**MTM 404 Numerical Solutions of Partial Differential Equations Credits : 4**

References:

**MTM 405 Number Theory and Cryptography**

Credits: 4


References:

**MTM 406 Fuzzy Sets and Applications**

Credits: 4

References:

MTM 407  Advanced Graph Theory  Credits: 4


References:
1 D.B. West, Graph Theory, Pearson Publ. 2002.
2 F. Harary, Graph Theory, Narosa Publ. ND.
MTM 408  
**Advanced Topology**  
Credits : 4


**References:**

MTM 409  
**Integral Equations**  
Credits : 4


**References:**
1. Abdul J. Jerry, Introduction to Integral Equations with applications, Marcel Dekkar Inc. NY.
2. L.G.Chambers, Integral Equations: A short Course, Int. Text Book Company Ltd. 1976,

MTM 410  
**Non-Linear Dynamical Systems**  
Credits : 4

First order continuous autonomous systems – some terminology, classification of fixed points of autonomous systems, attractors and repellors, natural boundaries, case

Reference: