DEPARTMENT OF MATHEMATICS

M.Sc. Mathematics

P.G. PROGRAMME

SYLLABUS

Effective from the Academic Year 2016-2017

Loyola College (Autonomous)

Chennai- 600 034

RESTRUCTURING-2016 (2016-17 batch ONWARDS) PG – Arts/ Science / Commerce / Social Work

Part	Semester 1	Semester 2	Summer Vacation	Semester 3	Semester 4	Total Hours
Major Core (MC)	30(20 C)	24(20 C)	– –	20(15 C)	30(24 C)	104(79 C)
Elective Subject (ES)	– –	4(3 C)	– –	4(3 C)	– –	8(6 C)
Inter - Disciplinary (ID)	– –	– –	– –	6(5 C)	– –	6(5 C)
Self study Paper (SSP)				Outside class hours(2C)		(2 C)
Summer Training Program (STP)	– –	– –	3 to 4 weeks (1 C)	– –	– –	(1 C)
Life Skills Training (LST)	– –	2h + 2h# (2 C)	– –	– –	– –	2+2# (2 C)
Extension Activities	LEAP	LEAP(3 C)	– –	– –	– –	(3 C)

Total Hours (Total Credits)	30 (20 C)	30+2# (23+5 C)	–-(1 C)	30 (23+2 C)	30 (24 C)	120+2# (90+6+2*)C

Note: A theory paper shall have 5 to 6 contact hours and a practical session shall have 3 to 5 contact hours.

LOYOLA COLLEGE (AUTONOMOUS)
CHENNAI - 600 034.

New format of the subject codes from the 2016 regulation

Subject codes are 10 characters long:

1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th

- 1st & 2nd digits – last two digits of regulation year in YY format (If 2016, it will be 16).
- 3rdalphabet: U – UG / P – PG / M – M.Phil. / D – Ph.D.
- 4th & 5thalphabets: department wise program code(example – MT / CO / HT.....)
- 6th digit: Semester for UG/ PG / M.Phil. and year for Ph.D.
- 7th & 8th alphabet: Category of paper or group of category of papers (GE/RL/OL/HE/OR/AL /ES/SK/MS/CM/CC/ .....)
- 8th & 9th digits: subject number range (01 to 99).

For example,

Example 1:16UCH1MC01

16 – Admitted in 2016
U – UG student
CH – Chemistry Student
1 – 1st Semester subject
MC01 – Major paper

Example 2:16PCO2ID01

16 – Admitted in 2016
P – PG student
CO – Commerce Student
2 – 2nd Semester subject
ID01 – Inter disciplinary paper

- For subjects which are carried forward from one regulation to the next, the ·rst two digits representing the regulation alone will change.
- Subjects which are not carried forward from one regulation to the next, will not appear in the new regulation.
- For new subjects which need to be added to a regulation, a new subject code must be created in continuation of the last created code under that type/category.
- Subject codes which are identical (except for the ·rst two digits which represent the regulation year) are treated as equivalent for the purpose of syllabus / question paper setting / conducting examination / etc.

DEPARTMENT OF MATHEMATICS,

PG SYLLABUS

Sem	Sub. Code	Subject Title	Hrs per Week	Credits	T/ L/ P
I	16PMT1MC01	LINEAR ALGEBRA	6	4	T
I	16PMT1MC02	REAL ANALYSIS	6	4	T
I	16PMT1MC03	ORDINARY DIFFERENTIAL EQUATIONS	6	4	T
I	16PMT1MC04	COMPUTER ALGORITHMS	6	4	T
I	16PMT1MC05	PROBABILITY THEORY AND STOCHASTIC PROCESS	6	4	T
II	16PMT2MC01	ALGEBRA	6	5	T
II	16PMT2MC02	MEASURE THEORY AND INTEGRATION	6	5	T
II	16PMT2MC03	PARTIAL DIFFERENTIAL EQUATIONS	6	5	T
II	16PMT2MC04	COMPLEX ANALYSIS	6	5	T
II	16PMT2ES01	FORMAL LANGUAGES AND AUTOMATA THEORY	4	3	T

II	16PMT2ES02	NUMBER THEORY AND CRYPTOGRAPHY	4	3	T
II	16PHE2FC01	LIFE SKILLS TRAINING	2+2	2	T

III	16PMT3MC01	TOPOLOGY	5	4	T
III	16PMT3MC02	FUZZY SETS AND APPLICATIONS	5	4	T
III	16PMT3MC03	OPERATIONS RESEARCH	5	4	T
III	16PMT3MC04	ALGORITHMIC GRAPH THEORY	5	3	T
III	16PMT3TP01	SUMMER TRAINING PROGRAMME	3-4	1	P
III	16PMT3ID01	MATHEMATICAL COMPUTING USING R AND MATLAB	4	3	T
III	16PMT3ID02	MATHEMATICAL COMPUTING USING R AND MATLAB - LAB	2	2	L
III	16PMT3ES01	COMBINATORICS	4	3	T
III	16PMT3ES02	DIFFERENTIAL GEOMETRY	4	3	T
IV	16PMT4MC01	FUNCTIONAL ANALYSIS	6	5	T
IV	16PMT4MC02	NUMERICAL METHODS USING C^{++}	3	3	T
IV	16PMT4MC03	NUMERICAL METHODS USING C^{++}-LAB	3	2	L
IV	16PMT4MC04	CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS	6	5	T

IV	16PMT4MC05	CLASSICAL MECHANICS	6	5	T
IV	16PMT4PJ01	PROJECT	6	4	P

16PMT1MC01 LINEAR ALGEBRA

SEMESTER	**I**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

To introduce the basic concepts and methods in the study of Linear Transformation on finite dimensional Vector spaces and their Matrix Forms.

Unit 1: Characteristic values – Annihilating polynomials – Invariant subspaces – Simultaneous Triangulation; Simultaneous Diagonalization. (1+15+2 hrs)

Unit 2: Direct sum decompositions-Invariant direct sums-The Primary Decomposition theorem-Cyclic subspaces and Annihilators. (1+15+2 hrs)

Unit 3: Cyclic Decompositions and the Rational form-the Jordan form-Computation of invariant factors. (1+15+2 hrs)

Unit 4: Inner products-Inner product Spaces -Linear functionals and adjoints-Unitary operators-Normal operators. Forms on Inner product spaces-Positive forms. (1+15+2 hrs)

Unit 5: Bilinear forms-symmetric bilinear forms-skew-symmetric bilinear forms-Group preserving bilinear forms. (1+15+2 hrs)

Book for Study:

Kenneth Hoffman & Ray Kunze, Linear Algebra, Prentice-Hall of India, 1975.

Unit 1: Sections: 6.2 – 6.5.
Unit 2: Sections: 6.6 – 7.1.
Unit 3: Sections: 7.2 – 7.4.
Unit 4: Sections: 8.1 – 8.5., 9.1 – 9.3

Unit 5: Sections: 10.1-10.4

Books for Reference:

1. Alka Marwaha, An Introduction To Linear Algebra, PHI Learning, First Edition, e-Book, 2014.
2. M.Artin, Algebra, Prentice Hall of India, 1991.
3. Ben Noble, James W. Daniel, Applied Linear Algebra, Pearson, 3rd edition, 1987.
4. Promode Kumar Saikia, Linear Algebra, Pearson, First Edition, e-book, 2009.
5. Stephen H. Friedberg, Arnold J. Insel and Lawrence E. Spence, Linear Algebra, Eastern Economy Edition, Fourth Edition, 2014.

16PMT1MC02 REAL ANALYSIS

SEMESTER	**I**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

- To have a detailed study of continuity, uniform continuity, differentiability Riemann Stieltjes Integral and the calculus on R^n
- To give a brief study of convergence of sequences and series, Fourier series and Fourier Integral.

Unit 1: Continuity-Limits of functions-continuous functions-continuity and compactness-continuity and connectedness-discontinuities-monotonic functions-Differentiation-derivative of a real function-mean value theorems-continuity of derivatives. (2+15+1 Hrs)

Unit 2: Riemann – Stieltjes Integral - Definition and properties of the Integral – Integration and Differentiation. (2+15+1 Hrs)

Unit 3: Sequences and series of functions - Pointwise Convergence – Uniform Convergence – Stone - Weierstrass Theorem (2+15+1 Hrs)

Unit 4: Fourier series and Fourier Integral – Orthogonal Systems of Functions –Theorem on Best Approximation – Fourier Series of a Function Relative to an Orthonormal System – Properties of the Fourier Coefficients – Riesz-Fischer Theorem – Convergence and Representation Problems for Trigonometric Series – Riemann-Lebesgue Lemma – Dirichlet Integrals – An Integral Representation for the Partial Sums of a Fourier Series – Riemann's Localization Theorem – Sufficient Conditions for Convergence of a Fourier Series at a Particular Point – Cesaro Summability of Fourier Series – Consequences of Fejer's Theorem – Weierstrass Approximation Theorem. (2+15+1 Hrs)

Unit 5: Function of several variables - Linear transformation – Differentiation – The Contraction theorem – The Inverse Function theorem - The Implicit Function theorem. (2+15+1Hrs)

Books for Study:

1. Walter Rudin, Principles of Mathematical Analysis, Third Edition, McGraw Hill, 1976.
2. [Chapter 4:4.1-4.31, Chapter 5:5.1-5.12, Chapter 6: 6.1 – 6.22, Chapter 7: 7.1 – 7.27, Chapter 9: 9.1 – 9.29]
3. T. M. Apostol, Mathematical Analysis, Addison – Wesley, 1974. [Chapter 11: 11.1 – 11.15]

Books for Reference:

1. N. L. Carothers, Real Analysis , Cambridge University Press, First Edition, e-book,2000.

2. Lawrence M Graves, The Theory of Functions of Real Variables, Dover Publications, Second Edition edition, e.book, 2012.

3. Royden H. L., Real Analysis, PHI; 4 edition 2011.
4. Sharma & Vasishtha , Real Analysis, Krishna Prakashan Media (P) Ltd.; 43rd edition , 2014.

16PMT1MC03 ORDINARY DIFFERENTIAL EQUATIONS

SEMESTER	**I**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

To introduce the basic theory of ordinary differential equations and apply to dynamical problems of practical interest.

Unit 1: Linear Homogeneous and Non-Homogeneous Differential Equations – Basic Concepts – Initial and Boundary Value Problems – Linear Differential Equations of Higher Order – Linear Dependence and Wronskian – Basic Theory of Linear Equations – Method of Variation of Parameters – Two Useful Formulae – Homogeneous Linear equations with Constant Coefficients. (2+15+1Hrs)

Unit 2: Method of Frobenius – Legendre's Equation and its Solutions – Generating Function for the Legendre Polynomials – Further Expressions for the Legendre Polynomials – Explicit Expressions – Special Values of the Legendre Polynomials – Orthogonality Properties of the Legendre Polynomials. (2+15+1Hrs)

Unit 3: Bessel's Equation and its Solutions – Generating Function for Bessel Functions – Integral Representations for Bessel Functions – Recurrence Relations. (2+15+1Hrs)

Unit 4: Existence and Uniqueness of Solutions: Lipschitz Condition – Successive Approximation – Picard's Theorem

for Initial Value Problem – Linear Homogeneous Boundary Value Problem (BVP) – Linear Non-homogeneous BVP – Strum-Liouville Problem – Green's Functions – Non-

existence of Solutions – Picard's Theorem for BVP. (2+15+1Hrs)

Unit 5: Stability of Non-linear Systems: Stability of Quasi-linear Systems – Stability of Autonomous Systems – Stability of Non-autonomous Systems – A Particular Lyapunov Function. (2+15+1Hrs)

Books for Study:

1. S.G. Deo, V. Ragavendra, Ordinary Differential Equations and Stability Theory, Tata McGraw-Hill Publishing Company Ltd., 1980.
   Unit 1: Chapter 1: Sections 2.1 – 2.6.
   Unit 4: Chapter 5: Sections 5.2 – 5.4, Chapter 7: Sections 7.1 – 7.5. Unit 5: Chapter 9: Sections 9.1 – 9.5.
2. W.W.Bell, Special functions for Scientists and Engineers, Dover Publications, 2004.
   Unit 2: Chapter 1: Sections 1.1, 1.2, Chapter 3: Sections 3.1 – 3.5.
   Unit 3: Chapter 4: Sections 4.1 – 4.4

Books for Reference:

1. G.F. Simmons, S.G. Krantz, Differential Equations: Theory, Technique and Practice, Tata McGraw-Hill Publishing Company Ltd., 2007.
2. E.A. Coddington, An Introduction to Ordinary Differential Equations, Prentice-Hall of India, New Delhi, e-Book, 2012.
3. M.D. Rainsinghania, Ordinary & Partial Differential Equation, S Chand, New Delhi, e-Book, 2014.
4. W.E. Boyce, R.C. Diprma, Elementary Differential Equations and Boundary Value Problems, John Wiley and Sons, NY, 2001.

16PMT1MC04 COMPUTER ALGORITHMS

SEMESTER	**I**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives: To motivate the students to Computational Mathematics, a recent trend in both educational and industrial fields.

Unit 1: Algorithm – Definition, Time Complexity.

Elementary Data Structures – Stacks, Queues, Trees, Priority Queues, Heaps, Heap sort, Graphs. (1+16+1Hrs)

Unit 2: Divide and Conquer – General method, Binary search,

Merge sort, Quick sort (1+16+1Hrs)

Unit 3: The Greedy Method – Knapsack problem, Job

sequencing with deadlines, optimal storage on tapes, optimal merge patterns. (1+16+1Hrs)

Unit 4: Basic traversal – Inorder, Preorder, Postorder traversals, Breadth first search and traversal, Depth first search and traversal**,** Backtracking – Sum of subsets, n-Queens problem (n = 4, 8). (1+16+1Hrs)

Unit 5: NP – Hard and NP – complete problems – Basic Concepts, Cook's Theorem(Statement only), Conjunctive Normal Form(CNF) – Satisfiability reduces to Clique Decision Problem(CDP), The Clique Decision Problem(CDP) reduces to The Node Cover Decision Problem (1+16+1Hrs)

Book for Study:

Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications, second edition, Reprinted 2010.
Unit 1: Chapters 1, 2 – Sections - 1.1, 1.2, 2.1-2.4, 2.6

Unit 2: Chapter 3 – Sections - 3.1, 3.3, 3.5, 3.6
Unit 3: Chapter 4 – Sections - 4.3, 4.5, 4.7, 4.8

Unit 4: Chapter 6,7 – Sections - 6.1, 6.2, 7.1, 7.2, 7.3
Unit 5: Chapter 11 – Sections - 11.1, 11.2, 11.3 (11.3.1, 11.3.2 only)

Books for Reference:

1. Alfred V.Aho, John E.Hopcroft and Jeffrey D.Ullman, Data Structures and Algorithms, Addison-Wesley, 1983.
2. M. Gary and S. Johnson, Computers and Interactability: A guide to theory of NP-Completeness, W. H. Freeman & Company, 1979.
3. Thomas H.Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India, 2004.
4. Thomas H. Cormen , Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, Third edition, Massachusetts Institute of Technology, e-Book, 2008.
5. Robert Sedgewick and Kevin Wayne, *Algorithms*, Fourth edition, *Princeton University, e-Book*, 2011.

16PMT1MC05 PROBABILITY THEORY AND STOCHASTIC PROCESSES

SEMESTER	**I**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objective:

- To provide basics of probability theory with applications in stochastic processes.

Unit 1: Probability mass function-Standard discrete distributions function- Marginal- Joint - Conditional distribution – Correlation – Exact sampling distributions (χ^2 ,

t, F). (1+15+2=18 Hrs)

Unit 2: Modes of Convergence- Markov - Chebyshev's and Jensen inequalities - Weak and strong law of large numbers – Borel Cantelli lemma-Probability Generating function- Central limit theorem. (1+15+2=18 Hrs)

Unit 3: Methods of estimation- Unbiasedness – Consistency – Sufficiency- Factorisation theorem (Neymann)- MVU estimators- Maximum likelihood estimators- Properties of estimators. (1+15+2=18Hrs)

Unit 4: Testing of hypothesis: Standard parametric tests based on normal distribution - Non parametric-Wald- Wolfowitz Run test, Median test, sign test. (1+15+2=18Hrs)

Unit 5: Markov chains with finite and countable state space – Classification of states- limiting behavior of *n*- step transition probabilities- Stationary distribution- Poisson process and its properties – Pure birth process – Birth and death process. (1+15+2=18Hrs)

Books for Study:

1.S.C.Gupta and V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2002.

UNIT I: 5.3.1, 5.3.2,5.4.3,5.5.1, 5.5.3, 5.5.5, 15.2, 15.3.1-15.3.5, 16.2.1- 16.2.6, 16.3.1- 16.3.3, 16.5.1, 16.5.2, 16.6.1-16.6.3

UNIT II: 7.5, 7.6, 7.7, 7.8, 7.9

UNIT III: 17.2.1, 17.2.2, 17.2.3, 17.2.4, 17.6.1-17.6.4.

UNIT IV: 18.2.1- 18.2.4, 18.5.1- 18.5.2, 18.7.1, 18.7.3- 18.7.6

2. S.K.Srinivasan and K.M Mehata, Probability and Random

Process, Tata McGraw- Hill Publishing, New Delhi, 1978.

UNIT V: 9.1, 9.2, 9.3, 9.4, 9.5

Books for References:

1. Bhat.B.R, Modern probability theory, Wiley Eastern Limited, New Delhi, 1988.
2. Emanuel parzen, Stochastic process, Dover publications, e-Book, 2015.
3. Hisashi Kobayashi, Probability, Random processes and Statistical analysis, Cambridge university press, e-Book, 2011
4. Rohatgi.V.K and Ehsanes Saleh.A.K.Md., An introduction to Probability and Mathematical Statistics, Wiley Eastern Limited, 2002.
5. Ross.S. M, Stochastic Processes, John holy & Sons Press, New York, 1982.
6. Ross.S.M, Introduction to Probability Models, Academic Press Inc., 9th edition.2007.

16PMT2MC01 ALGEBRA

SEMESTER	**II**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objective: To introduce to the students the general concepts in Abstract Algebra and to give a foundation in various algebraic structures.

Unit 1: Another counting principle - Class equation for finite groups and applications - Sylow's theorems (1+16+1Hrs)

Unit 2: Finite abelian groups (Theorem 2.14.1 only) - Polynomial rings - Polynomials over the Rational Field - Polynomial Rings over Commutative Rings. (1+16+1Hrs)

Unit 3: Extension fields - Roots of polynomials - More about roots (1+16+1Hrs)

Unit 4: Elements of Galois theory - Solvability by radicals
(1+18+1Hrs)

Unit 5: Finite fields - Wedderburn's Theorem on finite division rings. (1+14+1Hrs)

Book for Study:

I. N. Herstein, Topics in Algebra, Wiley Eastern Limited, New Delhi, II Edition, Reprint 2014.
Unit 1: Chapters 2 – Sections - 2.11(Omit Lemma 2.11.3), 2.12 (Omit Lemma 2.12.2, Lemma 2.12.5)
Unit 2: Chapters 2, 3 – Sections - 2.14 (Theorem 2.14.1 only), 3.9, 3.10, 3.11
Unit 3: Chapters 5 – Sections - 5.1, 5.3, and 5.5
Unit 4: Chapters 5 – Sections - 5.6, 5.7
Unit 5: Chapters 7 – Sections - 7.1, 7.2 (Theorem 7.2.1 only)]

Books for Reference:

1. Artin M, Algebra, Prentice Hall of India, 1991.
2. David A. Cox, Galois Theory, Second edition, Wiley & Sons Inc., e-Book, 2012.
3. Jacobson N, Basic Algebra I, Second Edition, Dover publications Inc., e-Book, 2012.
4. Jacobson N, Basic Algebra, Hindustan Publishing Corp. Vol I, 1982.
5. Lang S, Algebra, 2nd Edition, Addison Wesley (1965).

16PMT2MC02 MEASURE THEORY AND INTEGRATION

SEMESTER	**II**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

- To provide a basic course in Lebesgue Measure and Integration and a study of inequalities and the L^p-

spaces.

- To study signed measures and decomposition theorems.

Unit 1: Measure on the Real Line: Introduction – Lebesgue Outer Measure – Measurable Sets – Borel Sets - Regular Measure – Measurable Functions – Borel and Lebesgue Measurable Functions. (2+15+1 Hrs)

Unit 2: Integration of Functions of a Real Variable – Integration of non-negative Functions – Lebesgue Integral – Fatou's Lemma – Lebesgue Monotone Convergence Theorem – The General Integral – Lebesgue Dominated Convergence Theorem – Integration of Series – Riemann and Lebesgue Integrals. (1+16+1 Hrs)

Unit 3: Abstract Measure Spaces – Measures and Outer Measures – Extension of Measure – Uniqueness of the Extension – Completion of a Measure – Measure Spaces Integration with respect to a Measure. (1+16+1 Hrs)

Unit 4: Inequalities and the L^P Spaces: L^P Spaces – Convex Functions – Jensen's Inequality – Inequalities of Holder and Minkowski – Convergence in Measure – Almost Uniform Convergence. (1+16+1 Hrs)

Unit 5: Signed Measures and their Derivatives – Signed measures and the Hahn decomposition –The Jordan decomposition – The Radon Nikodym Theorem – Some Applications of the Radon Nikodym Theorem**.** (1+16+1 Hrs)

Book for Study:

G.de Barra, Measure Theory and Integration, Wiley Eastern Ltd, Second Edition, 2013.

Unit 1: Chapters: 2.1 – 2.5

Unit 2: Chapters: 3.1 – 3.4

Unit 3: Chapters: 5.1 – 5.6

Unit 4: Chapters: 6.1 – 6.4, 7.1 – 7.2

Unit 5: Chapters: 8.1 – 8.4

Books for Reference:

1. Halmos. P.R, Measure theory, Springer International Student Edition, 1987.

2. Munroe. M.E., Introduction to Measure and Integration, Addison Wesley, Mass, 1953.

3. Rana. I.K., An introduction to Measure and Integration, Narosa Publishing House, 1997.

4. Rudin. W., Principles of Mathematical Analysis, Macmillan, 1968.

5. Williamson. J.H, Lebesgue Integration, Dover publications, e-book, Dover edition, 2014.

6. Yeh. J, Real Analysis: Theory of Measure and Integration, World Scientific Publishing Co. Pte. Ltd, e-book, 3rd edition, 2014.

16PMT2MC03 PARTIAL DIFFERENTIAL EQUATIONS

SEMESTER	**II**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

To learn the basics of analytical and numerical methods to solve Partial Differential Equations.

Unit 1: Introduction – Formation of partial differential equation – Solution of partial differential equation of first order – Integral surfaces passing through a given curve – The Cauchy problem for first order equations – First order non-linear – Compatible system of first order equations – Charpit's method. (1 + 16 + 1 hrs)

Unit 2: Fundamental concepts – Classification of second order

PDE – Canonical forms – Adjoint operators – Riemann's method. (2 + 15 + 1 hrs)

Unit 3: Elliptic Differential Equations – Occurrence of Laplace and Poisson equations – Boundary Value problems – Separation of variables – Dirichlet problems for a rectangle - Neumann problem for a rectangle – Interior Dirichlet problem for a circle – exterior Dirichlet problem for a circle – Interior Neumann Problem for a circle – solution of Laplace equation in cylindrical – Solution of Laplace equation in spherical coordinates. (1 + 16 + 1 hrs)

Unit 4: Parabolic Differential Equations – Occurrence of Diffusion Equation – Boundary Conditions – Elementary Solutions of Diffusion equation – Separation of Variables method – Solution of diffusion equation in cylindrical – Solution of diffusion equation in spherical coordinates - Hyperbolic Differential Equations – Occurrence of Wave equation – Derivation of one dimensional wave equation – solution of one dimensional wave equation by Canonical Reduction – Initial Value problem; D'Alembert's solution – Vibrating String – Variables separable solution – periodic solution of one – dimensional wave equation in cylindrical – periodic solution of one – dimensional wave equation in spherical polar coordinates – Uniqueness of the solution for the wave equation. (1 + 16 + 1 hrs)

Unit 5: Green's function – Introduction – Green's function forLaplace Equation – The Method of Images – The Eigen function Method – Green's function for Wave equation – Green's function for Diffusion equation – Laplace Transform method – Solution of Partial Differential Equation - Fourier Transforms method – Solution of Diffusion Equation – Solution of Wave Equation – Solution of Laplace Equation. (1 + 16 + 1 hrs)

Books for Study:

K. Shankar Rao, Introduction to Partial Differential Equations, Prentice-Hall of India private limited, , Second Edition, 2007.
Unit 1: Chapter 0 - Sections – 0.1, 0.4 – 0.7, 0.9 – 0.11

Unit 2: Chapter 1 - Sections – 1.1 – 1.5
Unit 3: Chapter 2 - Sections – 2.1, 2.2, 2.5 – 2.12
Unit 4: Chapter 3, 4 - Sections – 3.1 – 3.3, 3.5 – 3.7, 4.1 – 4.5, 4.8, 4.9, 4.11
Unit 5: Chapter 5, 6, 7 - Sections – 5.1 – 5.6, 6.13, 7.11 – 7.13

Books for Reference:

1. Greenspan Donald, Introduction to Partial Differential Equations, Dover Publications, First Edition, 2000.
2. Robert C. McOwen, Partial Differential Equations: Methods and Applications, Prentice-Hall, Second Edition, 2003.
3. K. Sankara Rao, Introduction to Partial Differential Equations, PHI, Third edition, e-Book, 2010.
4. Sharma J. N. and Kehar Singh, Partial Differential Equations for Engineers and Scientists, Alpha Science Intl Ltd., Second Edition, 2009.
5. Sneddon I. N., Elements of Partial Differential Equations, Dover Publications, e-Book, 2013.

16PMT2MC04 COMPLEX ANALYSIS

SEMESTER	**II**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objectives:

1. To lay the foundation for topics in Advanced Complex Analysis
2. To develop clear thinking and analyzing capacity for research.

Unit 1: Power series representation of analytic functions – zeros of an analytic function - the index of a closed curve – Cauchy's theorem and integral calculus – the homotopic version of Cauchy's theorem – Goursat's theorem.

(2 + 14 + 2 hrs)

Unit 2: Schwarz lemma – Convex functions –Hadamard's three circles theorem - The Arzela Ascoli theorem – The Riemann mapping theorem. (2 + 14 + 2 hrs)

Unit 3: Weierstrass factorization theorem – the factorization theorem of the sine function – the Gamma function – the Riemann Zeta function. (2 + 14 + 2 hrs)

Unit 4: Mittag-Leffler's theorem – Jensen's formula –The genus and order of an entire function - Hadamard's factorization theorem. (2 + 14 + 2 hrs)

Unit 5: Simply periodic functions – Doubly periodic functions – Elliptic functions – the Weierstrass theory. (2 + 14 + 2 hrs)

Books for Study:

1. Ahlfors L.V., Complex Analysis, McGraw-Hill, New York, 3rd edition,1986.
   Unit 5: Chapter 7: Sections 1, 2.1 – 2.2, 2.4, 3.1 – 3.3
2. John B. Conway, Functions of one complex variable, Springer International, 1987.
   Unit 1: Chapter 4: Sections 2 – 5, 6.1 – 6.10, 8;
   Unit 2: Chapter 6: Sections 2, 3; Chapter 7: Sections 1.21 – 1.28, 2 - 4.
   Unit 3: Chapter 7: Sections 5 - 8;
   Unit 4 Chapter 8: Sections 3; Chapter 11: Sections 1–3

Books for Reference:

1. Elias M. Stein, Rami Shakarchi, Complex Analysis, Princeton University Press, Princeton & Oxford, New Jersey, e-book, 2003.
2. Hille. E., Analytic Function Theory, 2nd Revised edition, volumes I and II, Chelsea, New York, 2012.
3. Markushewich, A.I., Theory of Functions of a complex

variable, 2nd Revised edition, Volumes I, II and III, Chelsea, New York, 2005.

16PMT2ES01 FORMAL LANGUAGES AND AUTOMATA

SEMESTER	**II**	**CREDITS**	**3**
CATEGORY	**ES(T)**	**NO.OF HOURS/ WEEK**	**4**

Objective: To provide an insight to theoretical computer science and to get across to the students the notion of effective computability, using mathematical models.

Unit 1: Finite Automata and Regular Expressions

An informal picture of finite automata – Deterministic finite automata - Nondeterministic finite automata. An application: Text search– Finite automata with epsilon-transitions – Regular expressions – Finite automata and regular expressions. (1+10+1 Hrs)

Unit 2: Properties of Regular Languages

Proving languages not to be regular – Closer properties of regular languages – Decision properties of regular languages – Equivalence and minimization of automata. (1+10+1 Hrs)

Unit 3: Context - Free Grammars and Languages

Context-Free grammars – Parse trees – Ambiguity in grammars and languages – Normal forms for Context Free grammars. Chomsky Normal form. (1+10+1 Hrs)

Unit 4: Pushdown Automata

Definition of the pushdown automaton – The languages of a PDA – Equivalence of PDA's and CFG's. (1+10+1 Hrs)

Unit 5: Introduction to Turing Machines

The Turing machine – Programming techniques for Turing machines. (1+10+1 Hrs)

Books for Study:

Johne E.Hopcroft, Rajeev Motwani, Jeffery D. Ullman, Introduction to Automata Theory, Languages and

Computation, Pearson Education, Second Edition, 2001.
Unit 1: Chapters 2, 3 – Sections - 2.1 – 2.5, 3.1 – 3.2

Unit 2: Chapters 4 – Sections - 4.1 – 4.4
Unit 3: Chapters 5 – Sections - 5.1, 5.2, 5.4, 7.1
Unit 4: Chapters 6 – Sections - 6.1-6.3
Unit 5: Chapters 8 – Sections - 8.2, 8.3

Books for Reference:

1. J E Hopcroft and Rajeev Motwani, Introduction to Automata Theory Languages and Computation, Pearson New International Edition, e-Book, 2013.
2. Linz Peter, Introduction to Formal Languages and Automata, Narosa Publishing House, New Delhi, 1999
3. Martin, C. John., Introduction to Languages and the Theory of Computation. Tata McGraw Hill, New Delhi, 2006.
4. Shyamalendu Kandar, Introduction to Automata Theory, Formal Languages and Computation, Pearson Education, e-Book, 2013.

16PMT2ES02 NUMBER THEORY AND CRYPTOGRAPHY

SEMESTER	**II**	**CREDITS**	**3**
CATEGORY	**ES(T)**	**NO.OF HOURS/ WEEK**	**4**

Objectives:

1. To introduce the basic concepts of number theory.
2. To introduce the students to arithmetic topics, both ancient and very modern, which have been at the centre of interest in applications, especially in cryptography.

Unit 1: Some Topics in Elementary Number Theory

Time estimates for doing arithmetic – Divisibility and the Euclidean algorithm – Congruences – Some applications to factoring . (1+10+2 hrs)

Unit 2: Finite Fields and Quadratic Residues

Finite fields – Existence of multiplicative generators of finite fields – Existence and uniqueness of finite fields with prime power number of elements – Explicit construction - Quadratic residues and reciprocity. (1+10+2 hrs)

Unit 3: Cryptography and Public Key Cryptography

Some simple cryptosystems – Enciphering matrices - The idea of public key cryptography – RSA – Discrete log – Knapsack. (1+10+2 hrs)

Unit 4: Primality and Factoring

Pseudo primes – The rho method – Fermat factorization and factor bases – The continued fraction method. (1+10+2 hrs)

Unit 5: Elliptic Curves

Introduction – Basic facts – Elliptic curve cryptosystems – Elliptic curve primality test. (1+10+2 hrs)

Book for Study:

Neal Koblitz, A course in number theory and cryptography, 2nd Edition, Springer Verlag, 1994.

Unit 1: Chapter I: Sections: 1 – 4.

Unit 2: Chapter II: Sections: 1 – 2.

Unit 3: Chapter III: Sections: 1 – 2 and Chapter IV: Sections: 1 – 4. : Chapter IV: Sections: 1 – 4

Unit 4: Chapter V: Sections: 1 -4.

Unit 5: Chapter VI: Sections: 1 -3.

Books for Reference:

1. An Introduction to Number Theory and Cryptography, James, S. Kreft, Lawrence .C., Washington, Chapman

&hall / CRC, 2 nd edition, e – Book, 2013.

2. Herstein, I.N., Topics in Algebra, 2nd Edition, Wiley, 1975.
3. Introduction to Number Theory, Anthony Vazzana, Martin Erickson, David Garth, Chapman and Hall / CRC, 2 nd edition, e – Book, 2007.
4. Tom M. Apostal, Introduction to Analytic Number Theory, Springer International Student Edition, 1989.
5. William Sallings, Cryptography and Network Security, 4th Edition, Prentice Hall, 2006.

16PHE2FC01 LIFE SKILLS TRAINING

SEMESTER	**II**	**CREDITS**	**2**
CATEGORY	**FC(T)**	**NO.OF HOURS/ WEEK**	**2+2**

OBJECTIVES OF PG SYLLUBUS

1. To improve and sustain the primal level of competence and performance of PG students through an advanced training of holistic development of oneself.
2. To empower through various skills and strengthen them to face the future life issues and challenges.
3. To equip them with practical and value based learning of soft skills for a better life in future.

INSIDE CLASS HOURS (2 hrs)

Unit – I: Constructing Identity

Self Image – Understanding self image – shadows down the lane – self acceptance - **Self Knowledge** – Knowing oneself - **Self confidence –** Guilt and grudges - Power of belief – positive thinking– optimizing confidence - **Self development –** perception, attitude and Behavioural change, developing a healthy and balance personality - **Self esteem –** signs - indicators

Unit – II: Capacity Building

Motivation – Definition, types (Intrinsic and Extrinsic), Theories (Maslow's hierarchical needs, etc), Factors that affect motivation, Challenges to motivation, Strategies to keep

motivated, motivational plan. **Time Management Skills**– steps to improve time management, overcoming

procrastination, assessing and planning weekly schedule, challenges, goal settings, components of goal settings, consequences of poor time management, control of interruption and distractions. Communication, public speaking, talents, creativity, learning,

Unit – III: Professional Skills

Leadership development skills – difference between leader and manager, different styles and their utilities, functions of leadership, application of knowledge, overcoming from obstacles, influential skills and Leadership qualities. **Application skills** – Managing Career and self-direction, Visionary thinking, formulating strategies, shaping strategies, building organizations relationships, change management. Project Management Skills, Independent working skills, Writing skills, Public Speaking, analytical Skills, Neo Research and Development. **Problem solving skills** – Process, approaches and its components, creative problem solving, Tools and techniques, application of SMART analysis and barriers to problem solving.

Unit – IV: Life Coping Skills

Life skills – Personal and reproductive Health, love, sex, marriage and family – family life education – Gender Equity - child bearing and Childrearing practices, Geriatric Care - adjustability **Human Relationship** – formal and informal - peer group – friends – same and other gender - family – Colleagues – community – emotional intelligence - **Stress Coping skills –** Definition of stress, strategies to alleviate stress, problem and emotion focused coping, techniques to reduce stress, stress reaction phases, crisis intervention steps, creating positive affirmations, Signs, Symptoms and Reactions of Stress.

Unit – V: Social Skills

Human Rights Education, Understanding Human Rights, International and national mechanisms, protection and

preservation of HRs, Human Rights in the context of new, technological and electronic society, **Peace Education,** Social Harmony in the context of religious fundamentalism and fanaticism, Understanding Peace and Justice, Conflict Resolution Strategies

Reference books

1. Healing Your Emotional Self: A Powerful Program to Help You Raise Your Self-Esteem, Quiet Your Inner Critic, and Overcome Your Shame by Beverly Engel
2. Self-knowledge and self-discipline by B. W. Maturin
3. Motivation: Biological, Psychological, and Environmental (3rd Edition) by Lambert Deckers
4. Getting Things Done: The Art of Stress-Free Productivity by David Allen
5. Managerial Skills in Organizations by Chad T. Lewis
6. Social Intelligence: The New Science of Human Relationships by Daniel Goleman

Competence building	**Career Preparatory Training**
Power talk	Interview Guidance
Emotional Intelligence	Group Dynamics
Stress management	Leadership skills
Decision Making	Negotiation Skills
Positive image building	Creative writing

OUTSIDE THE CLASS HOURS (2 hrs)

- Each student will choose either of the above-mentioned modules and is expected to undergo a training/workshop in that module.
- She/he will have to accomplish ten hrs outside the class hours to fulfill the 2 credits.

Methodology

Inputs, ABL model, Documentaries, group activities and Interaction, Special workshop by professionals.

Evaluation

There will be end test and a Project for 'inside the class hours'. Viva Voce will be conducted for the 'Outside the class hours'.

16PMT3MC01 TOPOLOGY

SEMESTER	**III**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**5**

Objectives:

To study topological spaces, continuous functions, connectedness, compactness, countability and separation axioms.

Unit 1: Metric Spaces:

Partially ordered sets, lattices, metric spaces, definitions and examples, open sets and closed sets, convergence, completeness and Baire's theorem, continuous mappings, spaces of continuous functions, Euclidean and Unitary spaces.

Unit 2: Topological Spaces:

Definitions and examples, elementary concepts, open base and open subbase, weak topologies and the function algebras. Compactness: Compact spaces, product of spaces, Tychonoff's theorem and locally compact spaces and compactness for metric spaces, Ascolis theorem.

Unit 3: Separation Axioms:

T_1 spaces, Hausdorff's spaces, completely regular spaces and normal spaces, Urysohn's lemma, the Tietze extension theorem, the Urysohn's imbedding theorem, the Stone-Cech compactification.

Unit 4: Connectedness:

Connected spaces, the components of a space totally

disconnected spaces and locally connected spaces.

Unit 5: Approximation:

The Weierstrass approximation theorem, the Stone-Weierstrass theorem, locally compact Hausdorff's spaces, the extended Stone-Weiertrass theorem.

Books for study:

George F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Book Company, 2000 [Part One Chapters 1 to 7]

Books for References:

1. Dugundji, J., Topology, Prentice Hall of India, New-Delhi, 1975.
2. Evans, L., Thompson, R., Introduction to Algebraic Topology.
3. Joshi. K.D., Introduction to General Topology, Wiley Eastern Limited, New Delhi-1983.
4. Munkres, R. James., A first course in Topology, Pearson Education Pvt. Ltd., Delhi-2002.
5. Massey, W.S., Algebraic Topology, An Introduction, Harcourt, Brace & World, Inc., U.S.A-1967.
6. Steen. L.A., Seebach. J.A., Counter examples in Topology, Holt, Rinehart and Winston, Inc., U.S.A-1970.

16PMT3MC02 FUZZY SETS AND APPLICATIONS

SEMESTER	**III**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**5**

Objectives:

1. To introduce basic concepts, theories and tools in Fuzzy set theory.

2. To introduce Fuzzy Set applications in real world problems wherein the existing tools and methodologies are proved to be insufficient.

Unit 1: Introduction - Review of the notion of membership - The concept of a fuzzy subset - Dominance relations - Simple operation on fuzzy subsets - Set of fuzzy subsets for E and M finite - Properties of the set of the fuzzy subsets - Product and algebraic sum of two fuzzy subsets. (1+13+1 Hrs)

Unit 2: Fuzzy graphs - Fuzzy relations - Composition of fuzzy relations - Fuzzy subsets induced by a mapping - Conditioned fuzzy subsets - Properties of fuzzy binary relation - Transitive closure of a fuzzy binary relation - Paths in a finite fuzzy graph. (1+13+1 Hrs)

Unit 3: Fuzzy preorder relations - Similitude sub relations in a fuzzy preorder - Antisymmetry - Fuzzy order relations - Antisymmetric relations without loops - Ordinal relations - Ordinal functions in a fuzzy order relation - Dissimilitude relations - Resemblance relations - Dissemblance relations. (1+13+1 Hrs)

Unit 4: Pattern recognition, Fuzzy Clustering, Fuzzy Pattern Recognition and its applications. (1+13+1 hrs)

Unit 5: Fuzzy Set Theoretic Applications in Engineering domain (including software domain) - Financial domain - Social domain (including political) - Medical domain (including psychological) - Environmental domain - Cultural domain (including creative forms). (1+13+1 hrs)

Books for Study:

A. Kaufmann, Introduction to the Theory of Fuzzy Subsets – Volume 1, Academic Press, New York 1975. [Chapter:

Sections 1-8, 10-26]

Klir G.J. and Yuan Bo, Fuzzy Sets and Fuzzy Logic: Theory and Applications, Prentice-Hall of India, New Delhi, 2002. [Chapter: Sections 13.1-13.3, 16.2, 16.4, 16.7, 17.2, 17.3]

Books for Reference:

1. Zimmermann, Fuzzy Set Theory and its Applications, Kluwer Academic Publishers, 1975.
2. Lotfi A. Zadeh, Fuzzy Sets and Their Applications to Cognitive and Decision Processes, Academic Press, New York, 1975.
3. Bart Kosko, Neural Networks and Fuzzy Systems, Prentice-Hall of India, New Delhi, 2003.

16PMT3MC03 OPERATIONS RESEARCH

SEMESTER	**III**	**CREDITS**	**4**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**5**

Objective: To provide the students mathematical techniques to model and analyse decision problems, with effective application to real life in optimization of objectives.

Unit 1: Sensitivity Analysis in Linear Programming:

Introduction - Sensitivity analysis - Change in objective function coefficient - Change in availability of resources - Change in the input - out coefficient.

Integer Programming:

Types of integer programming problems and applications – Gomory's cutting plane method – The branch and bound method. (1+13+1 hrs)

Unit 2: Goal Programming:

Difference between LP and GP approach-Concept of goal programming-Goal programming model formulation- Single goal with multiple subgoals- Goal programming applications-

Graphical solution method.

Selective Inventory Control Techniques:

ABC,VED, HML, FSN,XYZ,S-OS,SDE analysis.

Queuing Models:

Essential features of queueing system-Queueing process-Queue discipline-Classification of queueing model- M/M/1, M/M/S, $M/E_k/1$ queuing models. (1+13+1 hrs)

Unit 3: Replacement and Maintenance Models:

Replacement of items that deteriorate- Replacement policy of items whose maintenance cost increases with time and money value constant- Replacement policy of items whose maintenance cost increases with time and money value changes- Replacement of items that failcompletely- Replacement problem. (1+13+1 hrs)

Unit 4: Dynamic Programming:

Dynamic programming terminology – Developing optimal decision policy – The general algorithm-Dynamic programming under certainty – Shortest route problem - Multiplicative separable return functions and single additive constraints -Dynamic programming approach for solving linear programming problem. (1+13+1 hrs)

Unit 5: Optimization Methods:

Direct substitution method- Lagrange multiplier method

Non Linear Programming Methods:

The general non linear programming problem– Kuhn Tucker conditions – Quadratic Programming by Wolfe's Method (Theory only), Beale's method. (1+13+1 hrs)

Book for Study:

J.K. Sharma, Operations Research-Theory and Applications,

Macmillan Publishers, Fifth Edition, 2013.

Unit 1: Chapter 6, 7 – Sections 6.1,6.2.6.2.1,6.2.2,6.2.3,

7.2,7.3,7.4,7.6

Unit 2: Chapter 8,14,16 - Sections-8.2,8.3, 8.3.1,8.4, 8.4.1,8.5,8.6,14.13, 16.2,16.2.2, 16.2.3,16.5, 16.6.1, 16.7.1,16.9.1

Unit 3: Chapter 17 - Sections-17.3, 17.3.1, 17.3.2, 17.4, 17.4.1, 17.4.2, 17.5, 17.5.1, 17.5.2

Unit 4: Chapter 20 - Sections-20.2, 20.3, 20.3.1, 20.4, 20.4.1, 20.4.2, 20.5

Unit 5: Chapter 23, 24- Sections-23.3.1, 23.3.2, 24.4, 24.4.1, 24.4.2, 24.4.3

Books for Reference:

1. 1. Fredrich. S. Hillier and Gerald . J. Liberman, Bodhibrata Nag, Preetam Basu, Introduction to Operations Research , Mc Graw Hill Education Publishers, Ninth Edition, e-Book,2012.
2. Hadley, Non-linear and Dynamic Programming, Addition Wesley, 1964.
3. Hamdy A. Taha , Operations Research:An introduction, Pearson Education Asia Editions, Ninth Edition, 2014.
4. N.K.Jaiswal, Military Operations Research: Quantitative Decision Making, Springer International, e-Book, 2012.
5. Kantiswarup, Gupta and Man Mohan, Operations Research,Sultan Chand and Sons, Fifteenth Edition, 2010.
6. Nash and Sofer, Linear and Nonlinear Programming, McGraw-Hill, Second Edition, 2008.
7. Prem Kumar Gupta and D.S.Hira, Operations

Research, S.Chand & Company Ltd, New Delhi, Sixth Edition, 2001.

8. Ravindran, Philips and Soleberg, Operations Research – Principle and Practice, John Wiley and sons, Second Edition,2007.
9. S.D.Sharma, Operations Research: Theory, Methods and Applications, Kedar Nath Ram Nath, Meerut, Seventeenth Edition, 2014.
10. G.Srinivasan, Operations Research: Principles and Applications, Prentice Hall of India, e-Book, 2010.

16PMT3MC04 ALGORITHMIC GRAPH THEORY

SEMESTER	**III**	**CREDITS**	**3**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**5**

Objectives: To provide the foundation of the graph theoretic notions and to design algorithms and analyze the techniques

Unit 1: Fundamental Concepts – Definition – Matrices and Isomorphism – Connection in Graphs – Bipartite Graphs – Eulerian Circuits – Counting and Bijections – Trees – Properties of Trees – Shortest Path. (1+13+1 hrs)

Unit 2: Maximum Matching – Hall's Matching Condition – Min Max Theorem – Independent Sets and Covers – Connectivity – Edge connectivity – Blocks – Embedding and Euler's Formula Characterization of Planar Graphs – Preparation For Kuratowski's Thedrem – Convex Embedding - Hamilton Cycles – Necessary Conditions – Sufficient Conditions. (1+13+1 hrs)

Unit 3: Intersection Graph – Interval Graphs – How to explore a graph - Characterizing Triangulated Graphs – Recognizing Triangulated Graphs by Lexicographic Breadth–First Search – Triangulated Graphs as Intersection Graphs. (1+13+1 hrs)

Unit 4: Split Graphs – Characterizing Split Graphs – Degree

Sequences and Split Graphs - Characterizing Permutation Graphs – Permutation Labeling. (1+13+1 hrs)

Unit 5: Interval Graphs – Some Characterizations of Interval Graphs – Circular Arc Graphs. (1+13+1 hrs)

Books for Study:

1. Douglas B West, Introduction to Graph Theory, PHI Learning Pvt. Ltd., Second Edition, 2011.

Unit 1: Chapter 1, 2 – Sections - 1.1, 1.2, 1.3, 2.1, 2.3

Unit 2: Chapter 3, 4, 6, 7 – Sections - 3.1, 4.1, 6.1, 6.2, 7.2

2. M. C. Golumbic, Algorithmic Graph Theory and Perfect Graphs, Annals of Discrete Mathematics 57, Second Edition, 2004.
   Unit 3: Chapter 1, 3, 4 – Sections – 1. 1, 1.3, 2. 3, 4. 2, 4. 3, 4. 5
   Unit 4: Chapter 6, 7 – Sections – 6. 2, 6. 3, 7. 2, 7. 3
   Unit 5: Chapter 8 – Sections – 8. 1, 8. 2,8.3, 8. 6

Books for Reference:

1 Alan Gibbons, Algorithmic Graph Theory, Cambridge University Press, First Edition, 1985.
2 Jay Yellen, Jonathan L. Gross, Handbook of Graph Theory (Discrete Mathematics and Its Applications), CRC Press, First edition, e-Book, 2007.
3 John Adrian Bondy, U S R Murty, Graph Theory with Applications, Elsevier Science Ltd/North-Holland, 1976.
4 Nora Hartsfield, Gerhard Ringel, Pearls in Graph Theory: A Comprehensive Introduction (Dover Books on Mathematics), Dover Publications, e-Book, 2013.
5 W.D. Wallis, A Beginner's Guide to Discrete Mathematics, Birkhäuser Publications, Second edition, e-Book, 2011.

16PMT3TP01 SUMMER TRAINING PROGRAMME

SEMESTER	**III**	**CREDITS**	**1**
CATEGORY	**P(P)**	**NO.OF HOURS/ WEEK**	**3-4**

1. A staff member of a department (GUIDE) will be monitoring the performance of the candidate.
2. The summer training program falls between Semester II and III. Students are expected to undergo this training soon after the second semester examinations.
3. The training will commence not later than one week after the completion of the semester examination
4. Organizations for the summer placement must be confirmed before the commencement of the second continuous internal tests.
5. Students must submit letter of induction to the respective guide within the first week of the internship.
6. The student has to spend a total of 20 working days in the respective field.
7. Students are expected to submit weekly reports along with daily time sheets to the respective supervisors.
8. The reports will be used to evaluate the student's performance.
9. Students should submit a letter of completion from the organization duly signed by the authorities.
10. If the staff is satisfied with the performance of student, he/she will be marked "COMPLETED" at the end of the semester and the details will be submitted to COE office through the HOD

16PMT3ID01 MATHEMATICAL COMPUTING USING R AND MATLAB

SEMESTER	**III**	**CREDITS**	**3**
CATEGORY	**ID(T)**	**NO.OF HOURS/ WEEK**	**4**

Objective:

- Understand the basics in Matlab Desktop and R Workspace

- Be able to do simple and complex calculations using Matlab and R
- Be able to carry out numerical computations and analyses

Unit 1: Overview of R Environment – R editor – Workspace – Data type in R – Matrix Operations - Importing and Exporting Dataset from Flat files – Combining datasets using cbind and Rbind – Variable creation using mathematical operator – Variable creation using conditional statement, For loop, While Loop. (1+16+1 Hrs)

Unit 2: Sorting dataset – Drop and Keep variables – Conditional subset – Drawing random sample – Merging datasets – Inner join, Full Join , Right outer join, Left outer join – Reshaping datasets - Statistical measures – Diagrammatic representations - Pie, Histogram, Line Chart, Box Plot, Scatter Plot. (1+16+1 Hrs)

Unit 3: Parametric and Non Parametric testing of Statistical Hypothesis – One Sample t test – two group t test – paired t test – One way ANOVA- Two way ANOVA – Latin Square Design – Sign Test – Wilcoxon – Mann Witney – Kruskal Wallis – Chi-square test of Independence - Simple Correlation – Multiple Linear Regression – Binary Logistic Regression. (1+16+1 Hrs)

Unit 4: The MATLAB environment, basic commands, data types, variables, Assignment statement, mathematical operators, Managing workspace, Handling of Arrays, Matrix operations and analysis, program structures - if statement, for loop, while loop, break statement , Creating-saving and running m-files, Functions based on arguments, Nested functions, File I/O handling, Debugging techniques.

(1+16+1 Hrs)

Unit 5: Elementary Mathematics - Trigonometry, exponentials ,logarithms, rounding, remainders, descriptive statistics, Polynomials, Data visualization - 2D and 3D plotting, Random number generation, Integration , Double Integration, Differentiation, Partial Differentiation, Matrix Operations, Linear Equations, Eigenvalues and Eigen vectors, Matrix Analysis. (1+16+1 Hrs)

Books for Study:

1. Rndall E.Schumacker, Learning Statistics using R, Sage Publication, 2015.
2. Jared P.Lander, R for Everyone, Pearson Education, 2014.
3. Matlab A practical introduction to programming and problem solving , Third edition By Stormy Attaway, Elsiver , Butterworth Heinemann Publication.
4. William J Palm III, Introduction to Matlab 7 for Engineers, McGraw Hill, 2005.

Books for Reference:

1. David Baez-Lopez, Matlab with applications to engineering, physics and finance, CRC Press, 2010.
2. Dingyu Xue Yangquan chen, Solving Applied Mathematical Problems with MATLAB, CRC Press, 2008.
3. Norman Matloff, The Art of R Programming, No Starch Press, Inc., 2011.

16PMT3ID02 MATHEMATICAL COMPUTING USING R AND MATLAB – LAB

SEMESTER	**III**	**CREDITS**	**2**
CATEGORY	**ID(L)**	**NO.OF HOURS/ WEEK**	**2**

Objective:

- Understand the basics in Matlab Desktop and R Workspace

- Be able to do simple and complex calculations using Matlab and R
- Be able to carry out numerical computations and analyses

Overview of R Environment

- Matrix Operations
- Variable creation using conditional statement, For loop, While Loop

Dataset and Diagrammatic representations

- Sorting dataset
- Statistical measures
- Diagrammatic representations

Statistical Hypothesis

- Parametric and Non Parametric testing of Statistical Hypothesis
- Correlation
- Regression

MATLAB environment

- basic commands – data types
- Mathematical operators
- Handling of Arrays
- Matrix operations and analysis
- Program structures - if statement, for loop, while loop, break statement
- Creating-saving and running m-files
- Functions based on arguments, Nested functions
- File I/O handling, Debugging techniques.(1+16+1 Hrs)

Elementary Mathematics

- Trigonometry, exponentials ,logarithms , rounding, remainders, descriptive statistics
- Polynomials

- Data visualization - 2D and 3D plotting
- Random number generation
- Integration , Double Integration,

- Differentiation, Partial Differentiation
- Matrix Operations, Linear Equations, Eigenvalues and Eigen vectors, Matrix Analysis.

Books for Study:

1 Rndall E.Schumacker, Learning Statistics using R, Sage Publication, 2015.
2 Jared P.Lander, R for Everyone, Pearson Education, 2014.
3 Matlab A practical introduction to programming and problem solving , Third edition By Stormy Attaway, Elsiver , Butterworth Heinemann Publication.
4 William J Palm III, Introduction to Matlab 7 for Engineers, McGraw Hill, 2005.

Books for Reference:

1. David Baez-Lopez, Matlab with applications to engineering, physics and finance, CRC Press, 2010.
2. Dingyu Xue Yangquan chen, Solving Applied Mathematical Problems with MATLAB, CRC Press, 2008.
3. Rodrigo Ribeiro, R Language: for Absolute Beginners, Kindle edition, e – book, 2012.
4. Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma, MATLAB and its Applications in Engineering, Butterworth-Heinemann; 3 edition, e–book, 2013.
5. Norman Matloff, The Art of R Programming, No Starch Press, Inc., 2011.

16PMT3ES01 COMBINATORICS

SEMESTER	**III**	**CREDITS**	**3**
CATEGORY	**ES(T)**	**NO.OF HOURS/ WEEK**	**4**

Objectives:

1. To introduce to the student the branch of Discrete

Mathematics that deals with enumeration and existence problems

2. To help students to face questions on Discrete Mathematics in various competitive examinations

Unit 1: Basic Combinatorial Numbers – Stirling Numbers – First Kind – Second Kind. (1+10+1 Hrs)

Unit 2: Generating Functions – The Algebra of Formal Power Series – Generating Functions for Permutations – Generating Functions for Partitions – Recurrence Relations. (1+10+1 Hrs)

Unit 3: Symmetric Functions – Monomial Symmetric Function – Complete Homogeneous Symmetric Function – Elementary Symmetric Function – Power Sum Symmetric Function. (1+10+1 Hrs)

Unit 4: Multinomial – Multinomial Theorem – Inclusion and Exclusion Principle – Applications of the Sieve Formula – Euler Function- Permutations with Forbidden Positions – The Menage Problem – Problem of Fibonacci. (1+10+1 Hrs)

Unit 5: Polya Theory – Necklace Problem – Burnside's Lemma- Cycle Index of a Permutation Group – Cycle Index for the Alternating Group – Polya's Enumeration Theorem-1. (1+10+1 Hrs)

Book for Study:

Krishnamurthy, V., Combinatorics Theory and Applications, Affiliated East-West Press Private Limited, New Delhi, 1985.

Unit 1: P: 5-20.

Unit 2: P: 29-48.

Unit 3: P: 52-61.

Unit 4: P: 66-95.

Unit 5: P: 101-126.

Books for Reference:

1. V.K. Balakrishnan, Combinatorics, Schuam Series, 1996.

2. Lint, J.H. Van and Wilson, R.M., A course in

Combinatorics, Cambridge University Press, Second Edition, Reprint 2007.

3. Chen Chuan-Chong, Principles and Techniques in Combinatorics, WSPC, e-Book, 1992.
4. John Riordan, Introduction to Combinatorial Analysis (Dover Books on Mathematics), Dover Publications, e-Book, 2012.

16PMT3ES02 DIFFERENTIAL GEOMETRY

SEMESTER	**III**	**CREDITS**	**3**
CATEGORY	**ES(T)**	**NO.OF HOURS/ WEEK**	**4**

Objective:

To teach some applications of abstract algebra and analysis to geometrical problems and facts.

Unit 1: Curves – Analytical representation – Arc length, tangent – Osculating plane – Curvature – Torsion – Formula of Frenet. (1+10+1 hrs)

Unit 2: Contact – Natural equations – Helics – General solution of the natural equations – Evolutes and Involutes. (1+10+1 hrs)

Unit 3: Elementary theory of Surfaces – Analytic representation – First Fundamental form – Normal, Tangent plane – Developable Surfaces. (1+10+1 hrs)

Unit 4: Second Fundamental form – Meusnier Theorem – Euler's Theorem – Dupin's Indicatrix – Geodesics – Some simple problems. (1+10+1 hrs)

Unit 5: The Fundamental Equations – Gauss – Equations of Gauss and Weingarten – Theorem of Gauss and Equations of Coddazi – Curvilinear Coefficients in space – Some Applications of Gauss and Coddazi Equations – Fundamental Theorem of Surface Theory. (1+10+1 hrs)

Book for Study:

1. Dirk J. Struik, Lectures on Classical Differential Geometry, Dover Publications, Second Edition, 1988.

Unit 1: Chapter 1 - Sections – 1.1 – 1. 6

Unit 2: Chapter 1 - Sections – 1.7 – 1. 11

Unit 3: Chapter 2 - Sections – 2.1 – 2. 4

Unit 4: Chapter 2, 4 - Sections – 2.5 – 2. 8, 4. 2

Unit 5: Chapter 3 - Sections – 3.1 – 3. 6

Books for Reference:

1. Andrew Pressley, Elementary Differential Geometry, Springer Publication, Second Edition, 2010.
2. Dirk J Struik, Lectures on Classical Differential Geometry, Dover Publications, Second Edition, e-Book, 2012.
3. Erwin Kreyszig, Differential Geometry, Dover Publications, First Edition, e-Book, 2013.
4. Gupta, Malik, Pundir, Differential Geometry, Pragati Prakashan, Thirteenth Edition, 2010.
5. Heinrich W Guggenheimur, Differential Geometry, Dover Publications, Second Edition, e-Book, 2012.
6. Mittal, Agarwal, Differential Geometry, Krishna Prakashan, Thirtieth Edition, 2014.
7. Somasundaram D., Differential Geometry, Narosa Book Distributors, 2008.
8. Thorpe J A, Elementary Topics in Differential Geometry, Springer, First Edition, 1994.
9. Venkatachalapthy S G, Differential Geometry, Margham Publications, First Edition, 2012.
10. Willmore T J, An Introduction to Differential Geometry, Dover Publications, Reprint Edition, 2012.

16PMT4MC01 FUNCTIONAL ANALYSIS

SEMESTER	**IV**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objective:

To study the details of Banach and Hilbert Spaces and to introduce Banach algebras.

Unit 1: Vector Spaces – Subspaces – Quotient Spaces – Dimension of Vector Spaces, Hamel Basis – Algebraic Dual – Second Dual – Convex Sets – Hahn Banach Theorem – Extension form. (1+15+2 hrs)

Unit 2: Banach Spaces – Dual Spaces – Hahn Banach Theorem in Normed Spaces – Uniform Boundedness Principle – Lemma F. Riesz- Application to Compact Transformation. (1+15+2 hrs)

Unit 3: The Natural Embedding of a Normed Space in its Second Dual – Reflexivity – Open Mapping and Closed Graph Theorems – Projections. (1+15+2 hrs)

Unit 4: Hilbert Spaces – Inner Product – Basis Lemma – Projection Theorem – Dual-Riesz Representation Theorem – Orthonormal Sets – Fourier Expansions – Dimensions – Riesz Fischer Theorem – Adjoint of an Operator – Self-adjoint, Normal and Unitary Operator, Projections. (1+15+2 hrs)

Unit 5: Finite Dimensional Spectral Theory and Banach Algebra – Finite Dimensional Spectral Theory – Regular and Singular Elements – Topological Divisor of Zero – The Spectrum – Formula for the Spectral Radius – Topological Vector Spaces– The Radical and Semi-Simplicity – The Gelfand Mapping – The Gelfand Mapping Theorem – Involutions in Banach Algebras. (1+15+2 hrs)

Books for Study:

1. Goffman, H.C., Pedrick, G., First course in Functional

Analysis, Prentice Hall of India, 7th Reprint,2002.
Unit 1: Sections: 2.1-2.6.

Unit 2: Sections: 2.8, 2.9, 2.11 – 2.17.

Unit 3: Sections: 2.20, 2.21.

Unit 4: Sections: 4.1, 4.2, 4.4, and 4.7

2. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill Private Limited, Reprint 2015.

Unit 4: Chapter 10: 56, 57, 58 &59.

Unit 5: Chapter12: 66-69, Chapter 13: 70 &72

Books for Reference:

1. G. Bachman and L.Narici, Functional Analysis Academic Press, New York, 1966.
2. E. Kreyszig, Introductory Functional Analysis with Applications, John wiley & Sons, New York, 1978.
3. Limaye, B.V., Functional Analysis, Wiley Eastern Ltd, New Delhi, 2014.
4. W. Rudin, Functional Analysis, Second Edition, Tata McGraw-Hill Publishing Company, New Delhi, 2006.
5. G.F.Simmons, Introduction to topology and Modern Analysis, Tata McGraw Hill Edition 2004, 9th reprint.
6. Thamban Nair, Functional Analysis, PHI, 2014.
7. R.E. Edwards, Functional Analysis: Theory and Applications, Dover Publications, e-book, 2012.
8. Peter D. Lax, Functional Analysis (Pure and Applied Mathematics: A Wiley Series of Texts, Monographs and Tracts), Wiley-Interscience; First edition, e-book, 2014.

16PMT4MC02 NUMERICAL METHODS USING C++

SEMESTER	**IV**	**CREDITS**	**3**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**3**

Objective: To carry out numerical computations and analyses

Unit – 1 (Solution of Algebraic and Transcendental Equations)

Bisection method – method of false position – method of successive approximation – Newton Raphson method – secant method – Graeffe's root squaring method. (1+7+1 hrs)

Unit – 2 (System of Linear Algebraic Equations)

Direct methods – indirect methods – Eigen value problems (1+7+1 hrs)

Unit – 3 (Interpolation)

Lagrange's interpolation – interpolation for equally spaced points – interpolation using central differences.(1+7+1 hrs)

Unit – 4 (Numerical Differentiation and Integration)

Derivatives for equally spaced data – Newton Cote General Integration Formula – Rhomberg's rule– Gaussian quadrature. (1+7+1 hrs)

Unit – 5 (Numerical Solutions of ordinary differential equations)

Euler's method – Taylor's series method – Picard's method of successive approximations – Runge Kutta methods – predictor corrector methods – solution of Boundary value problems. (1+7+1 hrs)

Note: C++ programs to be developed for all possible methods in all units.

Books for Study:

1. RM Somasundaram and RM Chandrasekaran, Numerical Methods using C++ programming, Prentice Hall of India private limited, New Delhi, 2005. [Chapters 1, 2, 3, 6, 7 & 8].
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fourth Edition, PHI Learning Pvt. Limited., New Delhi, 2005.

Books for Reference:

1. S. Balachandra Rao, C K Shantha, Numerical

Methods with programs in Basic Fortran and C++, Universal Press, New Delhi, 2008.

2. Steven Chopra C, Raymonds Canale, Numerical Methods for Engineers, Tata McGraw Hill Publications, New Delhi, 2002.
3. Orteq a, James M., Grimshaw, Andrews, An Introduction to C++ and Numerical Methods 1st edition, e-Book, 1998;
4. Oliver Aberth, Precise Numerical. Methods using C++ Academic Press Inc, e-Book, 1998,

16PMT4MC03 NUMERICAL METHODS USING C++ - LAB

SEMESTER	**IV**	**CREDITS**	**2**
CATEGORY	**MC(L)**	**NO.OF HOURS/ WEEK**	**3**

Objective: To carry out numerical computations and analyses

Solution of Algebraic and Transcendental Equations
Computing and implementation of function pointers

- Bisection Method
- Method of false position
- Newton Raphson – Method
- Graffe's root squaring method

System of Linear Algebraic Equations
Computing

- Direct Methods
- Indirect Methods
- Eigen Value problems

Interpolation

- Lagrange's Interpolation
- Interpolation for equally spaced points
- Interpolation using central differences

Numerical Differentiation and Integration

- Newton Cote General Integration Formula
- Rhomberg's rule

- Gaussian quadrature

Numerical Solutions of ordinary differential equations

- Euler's Methods
- Taylor's series method
- Runge Kutta methods
- Solution of Boundary Value problems

Books for Study:

1. RM Somasundaram and RM Chandrasekaran, Numerical Methods using C++ programming, Prentice Hall of India private limited, New Delhi, 2005. [Chapters 1, 2, 3, 6, 7 & 8].
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fourth Edition, PHI Learning Pvt. Limited., New Delhi, 2005.

Books for Reference:

1. S. Balachandra Rao, C K Shantha, Numerical Methods with programs in Basic Fortran and C++, Universal Press, New Delhi, 2008.
2. Oliver Aberth, Precise Numerical Methods Using C++, Academic Press Inc, e – book, 1998.
3. Ortega, James M., Grimshaw, Andrew S, An Introduction to C++ and Numerical Methods 1st edition, e – book, 1998.
4. Steven Chopra C, Raymonds Canale, Numerical Methods for Engineers, Tata McGraw Hill Publications, New Delhi, 2002

16PMT4MC04 CALCULUS OF VARIATIONS AND INTEGRAL EQUATIONS

SEMESTER	**IV**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objective: To study equations involving integrals and to introduce the concept of variational problems in calculus

Unit 1: Integral Equations – Linear and Non-Linear Integral Equations – Fredholm Integral Equation Volterra Integral Equation – Singular Integral Equations – Special Kinds of Kernels – Iterated Kernel – Resolvent Kernel – Characteristic Values and Characteristic Functions – Solution of an Integral Equation - Solved Example – Method of converting an initial value problem into a Volterra Integral Equation – Method of converting a boundary value problem into a Fredholm Integral Equation. (2+15+1 hrs)

Unit 2: Characteristic Values and Characteristic Functions – Solution of Homogeneous Fredholm Integral Equation of Second Kind with Separable Kernel – Solved Examples - Solution of Fredholm Integral Equation of Second Kind with Separable Kernel – Solved Examples - Fredholm Alternative Solved Examples. (1+16+1 hrs)

Unit 3: Iterated Kernel – Resolvent Kernel – Solution of Fredholm Integral Equation of Second Kind by Successive Subsititutions – Solution of Volterra Integral Equation of Second kind by Successive Subsititutions – Solution of Fredholm Integral Equation of Second Kind of Successive Approximations – Some Important Theorem – Solved Examples based on Solutions of Fredholm Integral Equation of Second Kind by Successive Approximations – Solution of Volterra Integral Equation of Second kind by Successive Approximations – Solved Examples based on solutions of Volterra Integral Equation of second kind by Successive Approximations – Symmetric Kernels – Hilbert Schimdt Theorem. (1+16+1 hrs)

Unit 4: Variational Problems with Fixed Boundaries – The Concept of Variation and its Properties – Euler's Equation - Variational Problems for Functionals Containing First Order Derivative and One Independent Variable – Functionals Dependent on Higher Order Derivatives – Functionals

Dependent on Functions of Several Independent Variables – Variational Problems in Parametric Form. (1+16+1 hrs)

Unit 5: Variational Problems with a Moving Boundary for a Functional Dependent on One and Two Functions – One Sided Variations – Sufficient Conditions for Extemum – Field of Extremals – Jacobi Condition – Wierestrass Function – Legendre Condition – Second Variation. (1+16+1 hrs)

Books for Study:

1. M. D. Raisinghania, Integral Equations and Boundary Value problems, S. Chand, New Delhi, First Edition, 2007.

   Unit 1: Chapter 1, 2 – Sections - 1.1, 1.3 – 1.8, 1.10 – 1.12, 1.17 – 1.18, 2.3, 2.6

   Unit 2: Chapter 3, 4 – Sections - 3.1 – 3.3, 4.1 – 4.4

   Unit 3: Chapter 5, 7 – Sections - 5.2 – 5.9, 5.11 – 5.13, 7.1 (a), 7.4

2. S. Gupta, Calculus of Variations with Applications, PHI Learning private Limited, New Delhi, 2014.

   Unit 4: Chapter 1 – Sections - 1.1 – 1.6

   Unit 5: Chapter 2, 3 – Sections - 2.1 – 2.3, 3.1, 3.2, 3.3, 3.4, 3.5

Books for Reference:

1. Abdul-Majid Wazwaz, A First Course in Integral Equations, , WSPC; Second Edition, e-Book, 2015.
2. I. M. Gelfand, S. V. Fomin, Calculus of Variations, Dover Publications, e-Book, 2012.
3. S. G. Mikhlin, Linear Integral equations, Hindustan publishing Corp., Delhi, 1960.
4. Kanwal P Ram, Linear Integral Equations: Theory and Technique, Birkhäuser Basel, Second Edition, 2013.
5. Lev D. Elsgolc, Calculus of Variations, Dover Publications, e-Book, 2012.

6. Naveen Kumar, An Elementary Course on Variational problems in Calculus, Alpha Science International, 2005.
7. Shanti Swarup, Integral Equations, Krishna Prakashan Media (P) Ltd, Nineteenth Edition, 2010.

16PMT4MC05 CLASSICAL MECHANICS

SEMESTER	**IV**	**CREDITS**	**5**
CATEGORY	**MC(T)**	**NO.OF HOURS/ WEEK**	**6**

Objective:

To provide the student with a thorough mastery both of the fundamentals and of significant contemporary research developments.

Unit 1: Generalised coordinates – constraints – Virtual work and D' Alembert's Principle – Lagrange's equations – Problems using Lagrange's equation – Variational Principle and Lagrange's equations. (2+15+1 hrs)

Unit 2: Hamilton's principle -Derivation of Lagrange's equation from Hamilton's principle.-Legendre transformation and the Hamilton Canonical equation of motion.-Cyclic coordinates and Routh's procedure - Conservation theorems - Derivation from variational principle. (1+16+1 hrs)

Unit 3: The principle of least action-The types of periodicity - The discussion of the motion of the Top by Lagrange's method and by Hamilton's method.-The equations of Canonical transformation - Examples – the integral invariants of Poincare'- Lagrange and Poisson brackets and Canonical invariants. (1+16+1 hrs)

Unit 4: Equation of motion in Poisson bracket -Infinitesimal contact transformation - the angular momentum Poisson brackets relations - Lioville's theorem - The Hamilton -

Jacobi equation for Hamilton's principle function.

(1+16+1 hrs)

Unit 5: The Harmonic Oscillator problem as example of Hamilton – Jacobi method Hamilton's-characheristic function – Separation of variables in Hamilton –Jacobi equation-Action angle variables – The Kepler Problems in Action-angle variables. (1+16+1 hrs)

Book for Study:

Goldstein. H, Classical Mechanics, 2nd Edition, Narosa Publishing, 1994.

Unit 1: Chapter 1- Sections- 1-4.

Unit 2: Chapter 2- Sections- 1-6.

Unit 3: Chapter 8- Sections- 2-6.

Unit 4: Chapter 9- Sections- 1, 5,6,7,9.

Unit 5: Chapter 10- Sections- 1-4, 6-8.

Books for Reference:

1. D.E.Rutherford, Classical Mechanics, Oliver Boyd, New York, 2000.
2. D.T. Greenwood, Classical Dynamics, Prentice Hall, 1979.
3. Daniel Kleppne & Robert . J. Kolenkow, An introduction to mechanics, Cambridge university press, e-Book, 2013.
4. J.L.Synge and B.A.Griffith, Principle of Mechanics, McGraw Hill, 1959.
5. Martin. W. McCall, Classical Mechanics, John Wiley & sons Ltd, first edition, e-Book, 2011.

16PMT4PJ01 PROJECT

SEMESTER	**IV**	**CREDITS**	**4**
CATEGORY	**P**	**NO.OF HOURS/ WEEK**	**6**