UNIVERSITY OF SARGODHA, SARGODHA

NOTIFICATION

No.UOS/Acad/ 2319

Dated: 06.08.2010

The Syndicate in its 2/2010 meeting held on 08.07.2010-ha approved the schemes of studies and course contents of followin programs for implementation from the sessions mentioned agains each:-

i) *Scheme of Studies / Syllabus of BS (4-year) program i Mathematics for implantation w.e.f the academic sessio 2010-11(annexed-* ***'A'****).*

ii) *Scheme of studies / Syllabus of M.Phil program in Mathematics for implementation w.e.f spring semester 2009 (annexed-* ***'B'****).*

(Ch. FAROOQ AHMAD)
Assistant Registrar (Acad)
for Registrar

Distribution:-

- Chairperson
  Department of Mathematics
- Controller of Examinations
- Notification file

C.C:

- Dean, Faculty of Science
- Secretary to the Vice-Chancellor
- P.A. to Registrar

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Annexure-II

Scheme of Studies
BS - 4 years program
Session (From 2010)

Total Semesters:-08
Duration of each Semester: -18 weeks

1st Semester

Course Code	Course Title	Cr. Hrs.
MATH-101	Calculus-I	3+0
MATH-103	Number Theory	3+0
PHY-101	Mechanics-I	3+1
ENG -101	Study Skills	3+0
PKS-101	Pak Studies	2+0
MATH-105	Introduction to Computers	3+0
	Total Cr. Hrs.	18

2nd Semester

Course Code	Course Title	Cr. Hrs.
MATH-102	Calculus-II	3+0
MATH-104	Probability Theory	3+0
PHY-102	Electricity and Magnetism	3+1
ENG - 102	Functional Grammar	3+0
ISL-102	Islamic Studies	2+0
Math-106	Programming Languages for Mathematicians	3+0
	Total Cr. Hrs.	18

3rd Semester

Course Code	Course Title	Cr. Hrs.
MATH-201	Calculus-III	3+0
MATH-203	Vector Analysis & Mechanics	3+0
PHY-201	Mechanics-II	3+1
ENG - 203	Advanced Reading Skills	3+0
BUS - 231	Principles of Management	3+0
	Total Cr. Hrs.	16

4th Semester

Course Code	Course Title	Cr. Hrs.
MATH-202	Algebra-I	3+0
MATH-204	Ordinary Differential Equations	3+0
PHY-202	Thermodynamics and Statistical Mechanics	3+1
ENG - 204	Communication Skills	3+0
PSY - 202	Social Psychology	3+0
	Total Cr. Hrs.	16

5th Semester

Course Code	Course Title	Cr. Hrs.
ATH-301	Complex Analysis	3+0
TH-303	Algebra-II	3+0
H-305	Real Analysis-I	3+0
-307	Classical Mechanics	3+0
309	Topology	3+0
11	Differential Geometry	3+0
	Total Cr. Hrs.	18

6th Semester

Course Code	Course Title	Cr. Hrs.
SW - 204	Logic and Reasoning	3+0
MATH-302	Numerical Analysis	3+0
MATH-304	Algebra-III	3+0
MATH-306	Real Analysis-II	3+0
MATH-308	Partial Differential Equations	3+0
MATH-310	Functional Analysis	3+0
	Total Cr. Hrs.	18

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7th Semester			8th Semester		
Course Code	Course Title	Cr. Hrs.	Course Code	Course Title	Cr. Hrs.
MATH-401	Statistics	3+0	Econ-101	Principles of Economics	3+0
MATH-425	*Fluid Dynamics-I	3+0	MATH-426	*Fluid Dynamics-II	3+0
MATH-433	Integral Equations	3+0	MATH-434	*Special Relativity	3+0
MATH-439	*Remanian Geometry	3+0	MATH-450	**Special Functions	3+0
MATH-449	**Measure Theory	3+0	MATH-454	***Project	3+0
	Total Cr. Hrs.	15+0		Total Cr. Hrs.	15+0

Total Numbers of Credit Hours=134

* These four courses are optional and can be selected either from list A or B but can not be mixed from both.
**Any two courses can be selected from list C.
*** In lieu of dissertation a course can be selected from list C.

Note

These courses will be offered by the department from the lists of concentration elective courses and free elective courses as per availability of the resources.

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Concentration Elective Courses in Pure Mathematics					
Course Code	Course Title	Cr. Hrs.	Course Code	Course Title	Cr. Hrs.
MATH-413	Advanced Group Theory-I	3+0	MATH-414	Advanced Group Theory-II	3+0
MATH-415	Modern Algebra-I	3+0	MATH-416	Modern Algebra-II	3+0
MATH-417	Algebraic Topology-I	3+0	MATH-418	Algebraic Topology-II	3+0
MATH-419	Advanced Functional Analysis	3+0	MATH-420	Theory of Modules	3+0

List B

Concentration Elective Courses in Applied Mathematics

MATH-421	Astronomy-I	3+0	MATH-422	Astronomy-II	3+0
MATH-423	Electromagnetism-I	3+0	MATH-424	Electromagnetism-II	3+0
MATH-425	Fluid Dynamics-I	3+0	MATH-426	Fluid Dynamics-II	3+0
MATH-429	Operations Research-I	3+0	MATH-430	Operations Research-II	3+0
MATH-431	Quantum Mechanics-I	3+0	MATH-432	Quantum Mechanics-II	3+0
MATH-439	Riemannian Geometry	3+0	MATH-434	Special Relativity	3+0

List of Concentration Elective Courses

A student must satisfactorily complete 12 credit hours of any one of the following concentration groups of Elective Courses namely, Pure or Applied Mathematics.

List A

List C List of Free Elective Courses A student must also satisfactorily complete 06 credits of any one of the following free Elective Courses in Applied & Pure Mathematics					
MATH-441	Numerical Solution of Partial differential equations	3+0	MATH-442	Elasticity Theory	3+0
MATH-443	History of Mathematics	3+0	MATH-444	Heat Transfer	3+0
MATH-445	Projective Geometry-I	3+0	MATH-446	Projective Geometry-II	3+0
MATH-447	Methods of Optimization-I	3+0	MATH-448	Methods of Optimization-II	3+0
MATH-449	Measure Theory	3+0	MATH-450	Special Functions	3+0
MATH-453	Theory of Splines-I	3+0	MATH-454	Theory of Splines-II	3+0

SYLLABUS
BS 4 years in Mathematics

Course contents for the mathematics courses are given below semester wise.

SEMESTER-I

Course Code: MATH-101
Calculus-I
Prerequisite(s): None
Credit Hours: 3+0
Objectives of the course:
This is the first course of the sequence, Calculus-I, II and III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. Calculus I and II focus on the stu dy of functions of a single variable.
Contents:
Limits and continuity; derivative of a function and its applications; optimization problems; mean value theorem (Taylor's theorem and the infinite Taylor series with applications) and curve sketching; integrals; definite integral, the fundamental theorem of calculus; indefinite integrals, substitution rule, inverse functions (Chapters 1-6 of the text)
Recommended Books
1. Anton H., 1999.Calculus: *A New Horizon.* 6th ed. NY: John Wiley.
2. Stewart J., 1995. *Calculus*. 3rd ed. Brooks/Cole (suggested text).
3. Thomas G.B., Finney A.R., 2002. *Calculus.* 10th ed. USA:Addison-Wesley.

Course Code: MATH-103
Number Theory
Prerequisite(s): None
Credit Hours: 3+0

Objectives of the course:
This course shall assume no experience of background in number theory of theoretical mathematics. The course introduces various strategies for composing mathematical proofs.

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Course Contents:
Number systems: natural numbers, integers, rational numbers, real numbers, complex numbers, the equivalence and the difference of cardinality between them, de Morvie's theorem with application, hyperbolic ad logarithmic functions, introduction to number theory including divisibility, the Euclidean algorithm, GCD and LCM of 2 integers, fundamental theorem of arithmetic (UFT), properties of prime numbers, congruencies with applications, arithmetic functions, quadratic residues

Recommended Books:

1. Rosen K.H.,2000. *Elementary Number theory and its Applications.* 4th ed. USA:Addison-Wesley.
2. Apostal T.M., 2010. Introduction to Analytic Number Theory. 3rd ed. NY: Springer.
3. Griffin H., 1954. Elementary Theory of Numbers. 1st ed. NY Mc Graw Hill.

Course Code: PHY-101
Physics-I
Cr. Hours 3+1
Course Contents:
Vector Analysis, Particle Dynamics, Work, Power and Energy, System of Particles, Collissions, Waves and Oscillations, Harmonic Oscillations, Waves in Physical Media, Sound Light Interface, Diffraction, Polarization.

Lab-I

1. Modulus of rigidity by static and dynamic method (Maxwell's needle, Barton's Apparatus).
2. Determination of moment of inertia of a solid/hollow cylinder and a sphere etc.
3. To study the conservation of energy (Hook's Law)

Recommended Books:

1. Giancoli, Douglas C.,1988. Physics for Scientist and Engineers with Modern Physics. 2nd ed. Prentice Hall Inc.
2. Beiser A.,1987. Concepts of Modern Physics. 4th ed. McGraw-Hill Book Co.
3. Sear and Zemansky. 2008. University Physics with Modern Physics, 12th ed. Pearson

Course Code: ENG-101
English-I
Cr. Hours: 03+0
Course contents attached as Annexure III

Course Code: PKS-101
Pakistan Studies
Cr. Hours: 02+0

Objectives of the course
The objectives of this course are to acquaint the students with Ideological, Political and economic development of Pakistan. Diplomatic interaction of Pakistan with other countries of the world.

Contents:
Two nation theory and ideology of Pakistan: Historical background of the creation of Pakistan, Two-nation theory in its historical context, definition and interpretations, Quaid-I-Azam and his political ideas, Political Dynamics of Pakistan, Constitution

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development in Pakistan(1947-73), Salient features of 1973 constitution of Pakistan, Institutions of Pakistan: political parties, bureaucracy, army, and judiciary and media, Problems of Pakistan as a federal state. Socio-Economic issues of Pakistan: Economical problems, Social and demographic issues. Diplomatic dynamics of Pakistan: Determinants and objectives of Pakistan's foreign policy, Pakistan's relations with its neighboring country, Pakistan and the Muslim world(Comprehensive review of foreign policy of Pakistan)

Recommended Books:

1. Sheikh J.A., 2004. *Pakistan's Political, economic, and diplomatic dynamics. 2nd ed. Lahore:* Kitabistan Paper Products.
2. Other relevant readings for the individual subjects shall be recommended by the teacher during the course.

Course Code: MATH-105
Course Title: Introduction to Computers
Cr. Hours: 3+0

Fundamental concepts of computers Systems: basic computer organization, number systems and codes, processor and memory, secondary storages, input(output) units, computer softwares, internet basics, history and classification of computers, practically using windows, practically using software packages (MS Word and MS excell), practically using some computer algebra system CAS (Matlab\Maple etc).

Recommended Books:

1. Sinha P.K., 2003. Computer Fundamentals. 3rd ed. PBS Publication
2. Gilat A., 2008. An Introducton with Applicaton. 3rd ed. NY: John Wiley.
4. Lafore R., 1993. Programming using Turbo C++. 2nd ed. The Waite Group.
5. Kuo S.S., 1972. Computer Applications of Numerical Methods. 1st ed. NY: Assison Wesley.

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SEMESTER-II

Course Code: MATH-102
Calculus-II
Prerequisite(s): Calculus-I
Credit Hours: 4+0
Objectives of the course:

This is the second course of the basic sequence CalculusI, II and III, serving as the foundation of advanced subjects in all areas of mathematics. The sequence, equally, emphasizes basic concepts and skills needed for mathematical manipulation. As continuation of Calculus-I, it focuses on the study of functions of a single variable.

Course Contents:

Continuation of Calculus-I: techniques of integration; further applications of integration; parametric equations and polar coordinates; conic sections; sequences and series; power series representation of functions (Chapters 7-10 of the text)

Recommended Books

1. Anton H, 1999. *Calculus*: *A New Horizon.* 6th ed. NY:John Wiley.
2. Stewart J,1995. *Calculus*. 3rd ed. Brooks/Cole (suggested text).
3. Thomas G.B, Finney A.R, 2002. *Calculus.* 10th ed. USA:Addison-Wesley.

Course Code: MATH-104
Probability Theory
Prerequisite(s): Calculus-I
Credit Hours: 4+0
Objectives of the course:
This course is designed to teach the students how to handle data numerically and graphically. If data are influenced by chance effect, the concepts and rules of probability theory may be employed, being the theoretical counterpart of the observable reality, whenever chance is at work.
Course Contents:
Statistical measures, statistical description and graphical representation of data. sets; introduction probability theory; permutations and combinations; random variables; probability distributions, mean, standard deviation, variance and expectation.
Binomial, poisson, hypergeometric and normal distribution; normal approximation to binomial distribution; of several random variables.

Recommended Books:
1.Degroot M.H., Schervish M.J., 2002. *Probability and Statistics.* 3rd ed. USA:Addison- Wesley. (suggested Text).
2. Papoulis A, 1991. *Probability, Random Variables*, and Stochastic Processes. 3rd ed. NY:Mcgraw Hill.
3. Sincich T, 1990. *Statistics by Examples*. 4th ed. Dellen Publishing Company.

Course Code: PHY-102
Physics-II
Prerequisites: Physics-I
Cr. Hours 3+1
Course Contents:
Electric Field, Electric Potential, Capacitors and Dielectrics, DC Circuits, Magnetic Field Effects and Magnetic Properties of Matter, Electronics

Lab-II

1. To determine Horizontal/Vertical distance by Sextant.
2. The determination of wavelength of Sodium –D lines by Newton's ring.
3. The determination of wavelength of light/laser by diffraction grating.
4. To study the laws of vibration of stretched string-using sonometer.
5. To determine the stopping potential by photocell.

Recommended Books:
1. Beiser A., 1987. Concepts of Modern Physics. 4th ed. McGraw-Hill Book Co.
12. Grobe, 1993. Basic Electronics. 7th ed. McGraw Hill Book Co.
23. Reitz, John R. and Milford Fredrick, J., 1970. Foundations to Electromagnetic
3 Theory. 2nd ed. Addison-Wesley Publishing Co.
4. Sear and Zemansky. 2008. University Physics with Modern Physics. 12th ed. Pearson

Course Code: ENG-102
English-II
Prerequisites: English-I
Cr. Hours: 03+0

Course contents attached as Annexure III

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Course Code: ISL-101
Islamic Studies
Credit Hours: 2+0

Course Contents provided as Annexure II

Course Code: MATH-106
Course Title: Programming Languages for Mathematicians
Credit Hours: 3+0

Objectives of the course:
The purpose of this course is to introduce students to operating systems and environments
Course Contents: Introduction to operating systems, C language, building blocks, variables, input/output, loops (FOR, WHILE, DO), decisions (IF, IF ELSE, ELSE IF) construct switch statement, conditional statement, function hat returns a value using argument to pass data to another function, external variable, arrays and strings, pointers, structure, files and introduction to C++

Recommended Books:
1. Aho A.V. , Ulman J.D., 1995. Foundation of Computer Science. 1st ed. NY: Computer Science Press, WH Freeman.
2. Hein J.L., 1996. Theory of Computation: An Introduction. 1st ed. Boston: Jones and Bartlett.

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SEMESTER-III

Course Code: MATH-201
Calculus-III
Prerequisite(s): Calculus-II
Credit Hours: 3+0
Objectives of the course:
This is the third course of the basic sequence Calculus-1, II and III, serving as the foundation of advanced subjects in all areas of mathematics.
Course Contents:
This course covers vectors and analytic geometry of 2 and 3 dimensional spaces, vector-valued functions and space curves, functions of several variables; limits and continuity, partial derivatives, the chain rule; double and triple integrals with application, line integrals; the Green's theorem; surface area and surface integrals, the Green's, the divergence and the stokes theorems with applications (Chapters 11-14 of the text)
Recommended Books
1. Anton H., 1999. *Calculus*: *A New Horizon.* 6th ed. NY: John Wiley.
2. Stewart J.,1995. *Calculus*. 3rd ed. Brooks/Cole (suggested text).
3. Thomas G.B., Finney A.R., 2002. *Calculus.* 10th ed. NY: Addison-Wesley

Course Code: MATH-203
Vector Analysis and Mechanics
Prerequisite(s): Calculus-I and Calculus-II
Credit Hours: 3+0

Objectives of the course:
This course shall assume background in calculus. It covers basic principles of vector analysis, which are used in mechanics

Vector Analysis:
Scalar and vector triple product, differentiation and integration of vector functions. gradient, divergence, and curl of vector point functions.

Mechanics:
Composition and resolution of co-planar forces. moments, couples and conditions of equilibrium under the action of co-planar forces, frictional forces, laws of friction, equilibrium of bodies on rough surfaces, principle of virtual work and related problems, center of gravity, center of mass of various bodies, kinematics of a particle in Cartesian and polar co-ordinates, linear and angular velocity, rectilinear motion with uniform and variable acceleration, simple harmonic motion, projectile motion, motion along horizontal and vertical circles, orbital motion, planetary motion and keplar' laws, conservative forces, damped and forced vibrations.

Recommended Books:

1. Munawar H., Saeed S.M. Ahmed C.B. Elementary Vector Analysis. 1st ed. Lahore:The Caravan Book House.
2. Yousuf S.M. Vector analysis. Lahore: Ilmi Ketab Khana.
3. Ashraf M. Vector analysis. Lahore: Ilmi Ketab Khana.
4. Ghori Q.K., Mechanics. Lahore: West Pakistan Publishing Company.
6. Mir K.L. Mechanics. Lahore: Ilmi Ketab Khana.

Course Code: PHY-201
Physics-III
Prerequisites: Physics-II
Cr. Hours 3+1

Course Contents:
Rotational Dynamics, Angular Momentum, Gravitation, Bulk Properties of Matters, Special Theory of Relativity, Inductance, Alternating Current Circuits, Electro-Magnetic Waves (Maxwell's Equations)

Lab-III

1. Measurement of resistance using a Neon flash bulb and condenser
2. Conversion of a galvanometer into voltmeter & an ammeter
3. Measurement of low resistance coil by a Carey Foster Bridge.
4. Resonance frequency of an acceptor circuit
5. Resonance frequency of a Rejecter Circuit.
6. Study of the parameter of wave i.e. amplitude, phase and time period of a complex signal by CRO.

Recommended Books:

1. A. Beiser,1987. Concepts of Modern Physics. 4th ed. McGraw-Hill Book Co.s
2. Giancoli, Douglas, C.,1988. Physics for Scientist and Engineers with Modern Physics. 2nd ed. Prentice Hall Inc.
3. Sear and Zemansky. 2008. University Physics with Modern Physics. 12th ed. Pearson.

Course Code: ENG-203

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English-III
Prerequisite: English-II
Cr. Hours: 03+0

Course contents attached as Annexure III

Course Code: BUS-231
Principles of Management:
Prerequisite(s): Eng-IV
Credit Hours: 3+0
Course objectives:
This is a rudimentary course for the students of business administration. The focus of attention will be given to learning fundamental principles of management and of managing people and organization in a historical as well as contemporary world. Students are expected to develop analytical and conceptual framework of how people are managed in small, medium and large public and private national and international organizations.
Course Contents:
Introduction, overview and scope of discipline, the evolution and emergence of management thought, management functions, planning concepts, objectives, strategies and policies, decision making, organizing; departmentalization, line/staff authority, commitments and group, decision making, staffing: principles of selection, performance, career planning, leading: motivation, leadership, communication, controlling: the system and process and techniques of controlling, management and society: future system and process and techniques of controlling, management and society: future perspective.
Recommended Books:
1. Stephen P. R., Coutler M., 2004. Management. 8th ed. Prentice Hall.
2. Koontz H. O., Weihrich H., 1980. Management. 7th ed. NY: McGraw Hill.
3. Farland M. 1979. Management: Foundation And Practices. 8th ed. Wiley.
4. Fulmer M.R., 1987. The New Management. 1st ed. Macmillan Pub Co.

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SEMESTER-IV

Course Code: MATH-202
Algebra-I
Prerequisite(s): None
Credit Hours: 3+0
Objectives of the course:
This is the first course in groups, matrices and linear algebra, which provides basic background needed for all mathematics majors, a prerequisite for many courses. Many concepts presented in the course are based on the familiar setting of plane and are real three-space, and are developed with an awareness of how linear algebra is applied.

Course Contents:
Group theory: basic axioms of a group with examples, subgroups, order of a group, subgroups generated by subset of a group, system of generators, cyclic groups, cosets, Lagrange's theorem, introduction to permutations, even and odd permutations, cycles, lengths of cycles, transpositions, symmetric group, alternating groups, rings, fields (definitions and examples), vector spaces, subspaces, linear dependence and

independence, linear span of a subset of a vector space, bases and dimensions of vector space.

Linear Algebra: Algebra of matrices, determinants, matrix of a linear transformation, row and column operations, rank, inverse of matrices, solution of homogeneous and non-homogeneous equations, orthogonal transformation, eigen value problem with physical significance

Recommended Books:

1. Anton H.,2000. *Linear Algebra with Application*. 8th ed. NY:John Wiley.
2. Herstein I.N, 1995. *Topics in Algebra with Application.* 3rd ed. Books/Cole.
3. Leon S.j., 2002. *Linear Algebra with Applications*. 6th ed. NJ:Prentice Hall.
4. Nicholson W.K., 1994. *Elementary Linear Algebra with Applications.* 2nd ed. PWS Publishing Co.

Course Code: MATH-204
Ordinary Differential Equations
Prerequisite(s): Calculus-III
Credit Hours: 3+0
Objectives of the course:

This course provides the foundation of all advanced subjects in Mathematics. Strong foundation and applications of Ordinary Differential Equations is the goal of the course.

Course Contents:

Introduction; mathematical modeling of first and second order differential equations; solution and applications of first-order-differential equation; formation and solution of higher-order-linear-differential equations; differential equations with variable co-efficients; Sturm-Liouville (S-L) system and boundary-value problems; series solution and its limitations; the Frobenius method, solution for the Bessel, the hypergeometric, the Legendre and the Hermite equations; properties of the Bessel, the Legendre and the Hermite functions.

Recommended Books:

1. Zill D.G, Cullen M.R, 1997. *Differential Equations with boundary-value problems*. 3rd ed. PWS Publishing Co.

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Course Code: PHY-202
Thermodynamics and Statistical Mechanics
Prerequisites: Physics-III
Cr. Hours 3+1
Course Contents:

Statistical Mechanics, Temperature, Thermodynamics, Origin in Quantum Theory, Wave nature of matter, Atomic Physics, Quantum Mechanics, Nuclear Physics, Nuclear Reaction, Introduction to Quantum Optics (laser) and Pleasma Physics.

Lab-IV

1. Determination of ionization potential of mercury.
2. Characteristics of a semiconductor diode (Compare Si with Ge diode)
3. Setting up of half & full wave rectifier & study of following factors
   i. Smoothing effect of a capacitor
   ii. Ripple factor & its variation with load.
   iii. Study of regulation of output voltage with load.
4. To set up a single stage amplifier & measure its voltage gain and bandwidth.

5. To set up and study various logic gates (AND, OR, NAND etc) using diode and to develop their truth table.

Books Recommended

1. Giancoli, Douglas, C., 1988. Physics for Scientist and Engineers with Modern Physics. 2nd ed. Prentice Hall Inc.
2. Murray S. R., 1959. Outline of Theory and Problems of Vector Analysis and Introduction to Tensor Analysis. McGraw Hill.
3. Beiser A., 1987. Concepts of Modern Physics. 4th ed. McGraw-Hill Book Co.
44. Grobe, 1993. Basic Electronics. 7th ed. McGraw Hill Book Co.
55. Reitz, John R. and Milford Fredrick, J., 1970. Foundations to Electromagnetic Theory. 2nd ed. Addison-Wesley Publishing Co.
66. Paul L. & Corson, 1970. Waves. 2nd ed. Freeman and Co.
7. Marker, Zemausty, Heat and Thermodynamics, 5th ed. McGraw Hill Inc.
8. Hugh & Young, University Physics, 5th Ed. Addison, Wesley Pub. Co.
9. Sear and Zemansky. 2008. University Physics with Modern Physics. 12th ed. Pearson

Course Code: ENG-204
English-IV
Prerequisites: English-III Sem 4
Cr. Hours: 03+0

Course contents attached as Annexure III

Course Code: PSY-202
Social Psychology
Cr. Hours: 03+0

Objectives of the course:

Social Psychology is the study of social interaction and social influence. As such, it remains one of the most comprehensive and personally relevant areas within the field of psychology.To review theory and research in social psychology and to apply its major principles to situations encountered in everyday life. To investigate the manner in which, the behavior of one individual is influenced or determined by the behavior/characteristics of others.

Course Contents:

Introduction: Nature And Scope of Social Psychology:Understanding social behavior; social psychology: a working definition, origins & development of social psychology, how social psychology attains knowledge?
Social Perceptions: Knowing Others:Nonverbal communication: the unspoken language, attribution, Understanding the causes of others' behavior, impression formation and Impression management: combining and using social information.
Social Cognition: Understanding The Social World, Schemes and their effects; the Heuristics; mental shortcuts; potential sources of error; why total rationality is so rate? the interplay of affect and cognition.Attitudes: Evaluating The Social World :Forming attitudes; how do we develop the views we hold? persuasion; using messages to change attitudes; cognitive dissonance; when our behavior affects our attitudes?
Social Influence; Changing Others Behavior: Conformity; group influence in action; compliance; obedience; social influence by demand. Groups And Individuals; The Consequences Of Belonging .Groups; their nature and function; groups and task

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performance; decision making by groups; leadership patterns of influence within groups.

Books Recommended:

1. Baron, R.A., Byrene, D. & Johnson, B.T., 1998. *Exploring Social Psychology. 4th ed* .London: Ayllon & Bacon.
2. Callon V.J., Gallois C., Noller & Kashima Y., 1991. *Social Psychology. 2nd ed* . Australia: Harcourt.
3. Myers G.R., 2003. *Social Psychology. 6th ed.* New York; Prentice Hall.

SEMESTER-V

Course Code: MATH-301
Complex Analysis
Prerequisite(s): Calculus-II
Credit Hours: 3+0
Objectives of the course:

This is an introductory course in complex analysis, giving the basics of the theory along with applications, with an emphasis on applications of complex analysis and especially conformal mappings. Students should have a background in real analysis (as in the course Real Analysis I), including the ability to write a simple proof in an analysis context.

Course Contents:

The concept of analytic functions: the complex numbers and the complex plane, functions of a complex variable, general properties of analytic functions, linear transformations, basic properties of linear transformation, mapping for problems, stereographic projections, basic concepts of conformal mapping, the exponential and the logarithmic functions, the trigonometric functions, Taylor's series, Laurent's series, infinite series with complex terms, power series, infinite products.

Integration in the Complex Domain: Cauchy's theorem, Cauchy's integral formula and its applications, Laurent's expansion, isolated singularities of analytic functions, the residue theorem and its applications.

Contour Integration: definite integrals, partial fraction, expansion of Cot 2z,

The arguments principle theorem and its applications: Rouche's theorem,

Analytic Continuation: the principle of analytic continuation.

Books Recommended:

1. Kaplan W., 1966. Introduction to Analytic Function. 1st ed. Addison-Wesley.
2. Pennissi L.L., 1966. Introduction to Complex Variables. 1st ed. Holt Rinehart.
3. Churchil R.V., 2004. Complex Variables and its Applications.7th ed. McGraw Hill.
4. Mathews J.H. and Howell R.W., 2000. Complex Analysis for Mathematical Engineering. 4th ed. Boston MA.
6. Rudin W., 1987. Real and Complex Analysis. 3rd ed. McGraw-Hill International Editions: Mathematics Walter Rudin Series.

Course Code: MATH-303
Algebra-II
Prerequisite(s): Algebra-I
Credit Hours: 3+0
Objectives of the course:

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This is a course in advanced abstract algebra, which builds on the concepts learnt in Algebra I.

Course Contents:

Groups theory: normalizers and centralizers of a subset of a group, congruence classes of a group , normal subgroup, quotient groups, conjugacy relation between elements and subgroups, homomorphism and isomorphism between groups, Homomorphism and isomorphism theorems, finite p-groups, automorphisms, group automorphisms, derived group.

Ring theory: types of rings, matrix rings, rings of endomorphism, polynomial rings, integral domain, characteristic of ring, ideal, types of ideals, quotient rings, homomorphism of rings, fundamental theorem of homomorphism of rings.

Recommended Books:

1. Allenby R.B.J.T., Arnold E., 1983. *Rings, Fields and Groups*: *An Introduction to Abstract Algebra*. 1st ed. Prentice Hall.
2. Farleigh J.B., 2003. *A First Course In Abstract Algebra*. 7th ed. NY:Addison-Wesley.
3. Macdonald I.D., 1975. *The Theory Of Groups*. 1st ed. USA:Oxford Clarendon Press.

Course Code: MATH-305
Course Title: Real Analysis-I
Credit Hours: 3+0

Objectives of the course:

This is the first rigorous course in analysis and has a theoretical emphasis. It tegorously develops the fundamental ideas of calculus and is aimed to develop the students' ability to deal with abstract mathematics and mathematical proofs

Course Contents:

Real Number System: Ordered fields, The field of Reals, The extended real number system, Euclidean space.

Numerical Sequences and Series: Limit of a sequence, Bounded sequence, Monotone sequences, Limit superior and inferior, Subsequences, Infinite series of constants, Test for convergence of series, Absolute and conditional convergence.

Continuity: Limit of a function and continuous function, Continuity and compactness, Continuity and connectedness, Uniform continuity, Kind of discontinuities.

Differentiation: The derivative of a real function, Mean value theorems, The continuity of derivatives, Taylor's theorem.

Riemann Stieltjes Integral: Definition of Riemann Integral, Upper and lower sums, Integrability criterion, Classes of integrable functions, Properties of the Riemann Integral.

Books Recommended:

1. Rudin W. 1976. Principles of Mathematical Analysis. 3rd ed. MCGraw Hill.
2. Apostal T.M., 1974. Mathematical Analysis. 2nd ed. Addison Wesley.
3. Kaplan W., 1973. Advanced calculus. 2nd ed. Addison Wesley.
4. Rabenstein R.L.,1984. Elements of Ordinary differential equations. 1st ed. Academic Press.
5. Bartle R,G, Donald R.S., 1999. Introduction to Real Analysis. 3rd ed. Wiley.
6. Royden H. 1988. Real Analysis. 3rd ed. Prentice Hall/ Pearson Edition.

Course Code: MATH-307
Classical Mechanics
Prerequisite(s): Vector Analysis and Mechanics
Credit Hours: 3+0

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Objectives of the course:
This course builds grounding in principles of classical mechanics, which are to be used while studying quantum mechanics, statistical mechanics, electromagnetism, fluid dynamics, space-flight dynamics, astrodynamics and continuum mechanics.
Course Contents:
Vector Analysis
Differential operators, application to vector analysis, expansion formulas, curvilinear coordinates, line, surface and volume integrals, Gauss's, Green's, and Stokes's theorems.
Mechanics:
General motion of a rigid body, Euler's theorem and Chasles theorem Euler angles, moments and products of inertia, inertia tensor, principal axes and principal moments of inertia, kinetic energy and angular momentum of a rigid body, momental ellipsoiled and eqimomental system, Euler's dynamical equations and their solution in special cases, heavy symmetrical top, equilibrium of a rigid body, general conditions of equilibrium and deduction of conditions in special cases.
Books Recommended:
1-Synge & Griffith, 1959. Principles Of Mechanics. 3rd ed. NY: Mcgraw Hill.
2- Greenwood D.T., 1988.Principles Of Dynamics. 2nd ed. NJ: Prentice Hall.
3- Hauser W., 1965. Introduction To Principles Of Mechanics. 2nd ed. NY: Addison Wesley.
4- Becker R.A., 1954. Introduction To Theoretical Mechanics. 1st ed. NY:McGraw Hill.

Course Code: MATH-309
Course Title: Topology
Credit Hours: 3+0
Topological spaces, bases and sub-bases, first and second axiom of countability, separability, continuous functions and homeomorphism, finite product space.
Separation axioms (T_0, T_1, T_2), Techonoff space, Regular spaces, completely regular spaces, normal spaces, compact spaces, connected spaces.
Books Recommended:
1. Sheldon W. D., 2005. Topology. 1st ed. NY: McGraw Hill.
2. Lipschutz S. 1968. General Topology, Schaum's outline series. NY:McGraw Hill.
3. Munkers J.R., 2006.Topology. 2nd ed. NJ: Pearson Prentice Hall.
4. Simon G.F. 1963.Introduction to Topology and Modern Analysis. 1st ed. NY: McGraw Hill.
5. J. Willard,1970. General Topology. 1st ed. NY:Addison-Wesley.
6. Armstrong M.A., 1979. Basic Topology. 1st ed. NY: McGraw Hill.

Course Code: MATH-311
Course Title: Differential Geometry
Credit Hours: 3+0
Objectives of the course:
The course provides a foundation to solve partial differential equations with special emphasis on wave, heat and laplace equations. Formulation and some theory of these equations are also intended.
Course Contents:
Space Curves: Arc length, Tangent, Normal and Binormal, Curvature and Torsion of a Curve, Tangent Surface, Spherical Indicatrix, Involutes and Evolutes, Envelopes, Existence Theorem for a Space Curve, Helices, Curves on Surfaces, Surfaces of

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Revolution, Helicoids, Families of Curves, Developable associated with Space Curves, Developable associated with Curves on Surfaces, The First and Second Fundamental form, Principle Curvatures, Lines of Curvature, Geodesics.

Books Recommended:

1- Millman R.S. and Parker G.D.,1997. Elements of Differential Geometry. 2nd ed. NJ:Prentice Hall.
2- Wilmore T.J.,1959. An Introduction to Differential Geometry. 1st ed. Oxford Calarendo Press.
3- Weatherburn C.E., 1961. Differential Geometry. 1st ed. Cambridge University Press.
4- Pressley A., 2001. Elementary Differential Geometry, 1st ed. Springer Verlag.
5- Somasundaran D., 2005 . Differential Geometry. 1st ed. New Delhi: Narosa Publishing House.

SEMESTER-VI

Course Code: SW-204
LOGIC & REASONING
Cr. Hours: 3+0
Objectives of the Course

The course is designed to give the students the background of philosophical thinking. To make them aware of logical thinking and clear communication; To acquaint them with the fountainhead of all sciences. To give them the insight and vision to understand the human wisdom.

Course Outlines:

What Philosophy Is And Why It Is Worth Studying. Logic: Definition and scope of logic, Proposition. The Laws Of Logic:The law of identity,The law of non contradiction, The law of excluded middle, The law of sufficient reason. Deductive reasoning: Inference, Immediate inference, Mediate inference (Syllogism). Inductive reasoning: Kinds of induction, Enumeration, Analogy, Parity of reasoning, Colligation of facts. Generalization:Scientific generalization, Empirical generalization, The basis of generalization, Hypothesis.

Books Recommended:

1. Deduction By Karamat Hussain.
2. Induction By Karamat Hussain.

Course Code: MATH-302
Numerical Analysis
Credit Hours: 3+0
Objectives of the course:

This course is designed to teach the students about numerical methods and their theoretical bases. The students are expected to know computer programming to be able to write program for each numerical method. Knowledge of calculus and linear algebra would help in learning these methods

Course Contents:

Computer arithmetic, approximations and errors; methods for the solution of nonlinear equations and their convergence: bisection method, regular falsi method, fixed point iteration method, Newton-Rephson method, secant method; error analysis for iterative method, interpolation and polynomial approximation: Lagrange interpolation, Newton's divided difference, forward-difference and back ward-difference formulae, Hermite interpolation, numerical integration and error estimates: rectangular rule, trapezoidal

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rule, Simpson's one-third and three-eighth rules, numerical solution of systems of algebraic linear equation, Gauss-elimination method, Gauss-Jordan method, matrix inversion, LU-factorization, Doolittle's, Crount's, Cholesk's methods, Gauss-Seidel and Jacobi methods, matrix norms, method of least square, eigenvalues and eigenvectors, inclusion methods, power method.

Recommended Books:

1. Atkenson K.E.,1989. *An introduction to Numerical Analysis.* 2nd ed.NY: John Wiley.
2. Burden R.L., faires J.D., 1993, *Numerical Analysis.* 5th ed. PWS Publishing Company.
3. Chapra S.C., Canale R.P., 1988. *Numerical Methods for Engineers*. 2nd ed. NY:Graw Hill.
4. Sankara K. 2005. Numerical Methods for Scientists and Engineers. 2nd ed. New Delhi: Prentice Hall.

Course Code: MATH-304
Algebra-III
Prerequisite(s): Algebra-II
Credit Hours: 3+0
Objectives of the course:

This is a course in abstract linear algebra. The majority of follow up courses in both pure and applied mathematics assume the material covered in this course.

Course Contents:

Vector spaces; sums and direct sums of subspaces of a finite dimensional vector space, dimension theorem, linear transformation, null space, image space of linear transformation, rank and nullity of a linear transformation, relation between rank, nullity and dimension of the domain of a linear transformation, matrix of linear transformation change of basis, inner product spaces, projection of vector along another vector, norm of a vector, Cauchy Schwartz inequality, orthogonal and orthonormal basis, similar matrices and diagonalization of matrix, Hom (V,W), dimension and basis of Hom (V,W), dual space and dual basis, annihilators.

Recommended Books

1-Axle S.J., 1996. *Linear Algebra Done Right, Undergraduate Texts in Mathematics*. 1st ed. NY:Springer.
2-Birkhoff G, Maclane S., 1995. *A Survey Of Modern Algebra.* 4thed. AKP Classics.
3-Perry W.L., 1988. *Elementary Linear Algebra*, 2nd ed. NY: McGraw-Hill.

Course Code: MATH-306
Real Analysis-II
Prerequisite(s): Real Analysis-I
Credit Hours: 3+0
Objectives of the course:

A continuation of real analysis-I, This course rigorously develops integration theory. Like Real Analysis-I, Real Analysis-II emphasizes on proofs.

Course Contents:

Real Valued Functions of Several Variables: continuous real valued functions, partial derivatives and differentials, geometric interpretation of differentiability, chain rule, Taylor's theorem. maxima and minima, vector valued functions of several variables , linear transformations and matrices, continuous and differentiable transformations, chain rule for transformations, inverse function theorem, implicit function theorem, Jacobians, method of Lagrange multipliers.

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Sequences and Series of Functions: point-wise and uniform convergence, uniform convergence and continuity/integration/differentiation, test for uniform convergence of series, power series, radius of convergence, Taylor series, arithmetic operations with power series and test for convergence.
Improper Integrals: improper integral of 1st and 2nd kind, test for convergence of improper integrals, absolute and conditional Integrability, ordinary integrals involving parameter, uniform convergence of improper integral, test for uniform convergence of improper integrals, Fourier series.

Books Recommended:

1. Rudin W. 1976. Principles of Mathematical Analysis. 3rd ed. MCGraw Hill.
2. Apostal T.M., 1974. Mathematical Analysis. 2nd ed. Addison Wesley.
3. W.Kaplan, 1973. Advanced calculus. 2nd ed. Addison Wesley.
4. Rabenstein R.L.,1984. Elements of Ordinary differential equations. 1st ed. Academic Press.
5. Bartle R,G, Donald R.S., 1999. Introduction to Real Analysis, 3rd ed. Wiley.
6. Royden H. 1988. Real Analysis. 3rd ed. Prentice Hall/ Pearson Edition.

Course Code: MATH-308
Partial Differential Equations
Prerequisite(s): Real Analysis-I, Ordinary-Differential Equations
Credit Hours: 3+0
Objectives of the course:
The course provides a foundation to solve partial differential equations with special emphasis on wave, heat and laplace equations. Formulation and some theory of these equations are also intended.
Course Contents:
First-order-partial-differential equations; classification of second-order P. D. E; canoical form for second-order equations; wave, heat and the Laplace equation in Cartesian, cylindrical and spherical-polar coordinates; solution of partial differential equation by the method of: separation of variables; the Fourier, the Laplace and the Hankel transforms, non-homogeneous-partial-differential equations.
Recommended Books:

1. Myint U.T., 1987. *Partial Differential Equations For Scientists And Engineers.* 3rd ed. North Holland.

Course Code: MATH-310
Functional Analysis
Prerequisite(s): Complex Analysis
Credit Hours: 3+0
Objectives of the course:
This course extends methods of linear algebra and analysis to spaces of functions, in which the interaction between algebra and analysis allows powerful methods to be developed. The course will be mathematically sophisticated and will use ideas both from linear algebra and analysis.
Course Contents:
Metric Spaces: A quick review, completeness and convergence, completion, Normed Spaces: linear spaces, normed spaces, difference between a metric and a normed space, banach spaces, bounded and continuous linear operators and functionals, dual spaces, finite dimensional spaces, F. Riesz Lemma, the Hahn-Banach theorem, the HB theorem for complex spaces, The HB theorem for normed spaces, the open

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mapping theorem, the closed graph theorem uniform bounded-ness principle and its applications.

Banach-Fixed-Point Theorem: Applications in differential and integral equations

Inner-Product Spaces: Inner-Product space, Hilbert Space, orthogonal and orthonormal sets, orthogonal complements, Gram-Schmidt orthogonalization process, representation of functionals, Reiz-representation theorem, and weak* convergence.

Recommended Books:

1.Curtain R.F., Pritchard A.J., 1977. *Functional Analysis in Modern Applied Mathematics*, 1st ed. NY: Academic Press.

2. Friedman A., 1982.*Foundations of Modern Analysis*. 1st ed. Dover.

3.Kreyszig E., 1989. *Introductory Functional Analysis with Applications*. 1st ed. NY:John Wiley,

4. Rudin W, 1973. *Functional Analysis*. 1st ed. NY: McGraw Hill.

SEMESTER-VII

Course Code: MATH-401
Statistics
Prerequisite(s): Probability Theory
Credit Hours: 3+0
Objectives of the course:

In the course "Probability Theory" the students learnt how to set up mathematical models of processes and systems that to check these models against reality, to determine whether they are reliable/accurate enough for practical purposes or otherwise. This helps in making predictions and decisions

Course Contents:

Sampling theory: sampling distributions; sampling procedures; estimation of parameters; estimation of mean, variance; confidence intervals; decision theory: hypothesis testing and decision making; types of errors in tests; quality control; control charts for mean, standard deviation, variance, range; goodness of fit, chi-square test. Regression analysis; method of least squares; correlation analysis

Recommended Books:

1. DeGroot M.H., Schervish M.J., 2002. *Probability and Statistics*. 3rd ed.,USA: Addison- Wesley.

2. Johnson R.1994. *Probability and Statistics for Engineers*, 1st ed.USA: Prentice-Hall.

3. Papoulis A., 1991.*Probability, Random Variables, and Stochastic Processes*. 3rd ed. NY: McGraw Hill.

4. Sincich T., 1990. *Statistics by Examples*. 1st ed. Dellen Publication Company.

Course Code: MATH-433
Integral Equations
Prerequisite(s): O.D.E and Real Analysis-I
Credit Hours: 3+0
Objectives of the course:

The course provides a foundation to solve integral equations with special emphasis on Fredholm Voltara integral equations. Formulation and some theory of these equations are also intended

Course contents:

Integral equation, formulation of boundary value problems, classification of integral equations, method of successive approximation, Hilbert-Schmidt theory, Schmidt's solution of non-homogeneous integral equations, Fredholm theory, case of multiple roots of characteristic equation, degenerate kernels.

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Recommended Books:

1. Lovitt, W.V.,1950. Linear integral equations. 1st ed. Dover Publications.
2. Jerri A.J., 1985.Introduction to integral equations with applications. 1st ed. NY: Marcel Dekker

SEMESTER-VIII

Course Code: ECON-101
Principles of Economics:
Cr. Hours: 03+0
Course Outlines

Introduction to Microeconomics :Economics systems, basic functions of an economic system, Theory of the consumer behavior (cardinal and ordinal approach), Supply, Demand and the Market price determination, Concept of Elasticity (Demand and Supply), Theory of Cost (traditional theory), Theory of the firm (laws of return and law of variable proportion), Market structure, Perfect Market, Imperfect Markets (Monopoly and Monopolistic competition). Introduction to Macroeconomics: Introduction of different concepts of NATIONAL IMCOME i.e gross domestic product (GDP), Gross national product (GNP), Net National product (NNP) National Income (NI) Personal Income (PI) Personal disposable income (PDI) and measurement of GDP: product, Income and Expenditure:Circular flow of national income, Consumption and saving function, Investment and its types, Concept of multiplier and accelerator, Concept of aggregate demand and supply and their equilibrium, Monetary and fiscal polices: Inflation and unemployment (PHILLIPS CIRVE), Balance of payment (BOP) problems and remedies, Public finance: taxation, debt and expenditure.

Recommended Books:

1. Connel Mc. and Rrue S.L., 1996. *Economics-Principles, Problems And Policies.* 18th ed. McGraw-Hill, Inc.
2. Varian, H. R 1999, *Intermediate Microeconomics,* 5th Edition, NY: W.W. Norton And Company.
3. Nicholson. 1994, *Intermediate Microeconomics.* Ist ed. NY:The Drydon Press. Harcourt Brace College, Publishers.
4. Dornbusch R and Fisher S., 1998, *Macroeconomics.*7th ed. NY: Mcgraw Hill.
5. Rashid A.H. 1998. Macro Exonomics. 1st ed. Lahore: Ilmi Kitab Khana.

Contents of Pure Mathematics Concentration Elective Courses

Course Code: MATH-413
Course Title: Advanced Group Theory-I
Credit Hours: 3+0

Group of automorphisms, direct products and normal products of groups, holomorph of a group, characteristic and fully invariant subgroups, cyclic permutations and orbits, the alternating groups, generators of symmetric and alternating groups, permutation groups, Simple groups, simplicity of A_n, $n \geq 5$, series in groups, the stabilizer subgroups, Zassenhau's Lemma, normal series and their refinements, composition

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series, principal or chief series, finitely generated abelian groups, double Cosets, Sylow's theorems, applications of Sylow Theorem.

Books Recommended:

1. Rottman J.J., 1965.The Theory of Groups: An Introduction. 1st ed. Boston :Allyn & Bacon,
2. MacDonald I., 1968. The Theory of Groups. 1st ed. Oxford University Press.
3. Cohn P.M., 1974.Algebra, Vol.I, London: John Wiley.
4. Burton D., 1972.Abstract and Linear Algebra. 1st ed. Addison-Wesley.
5. Battacharya P.B., Jain S.K. and Nagpaul S.R., 1994. Basic abstract Algebra. 2nd ed. C.U.P.

Course Code: MATH-415
Course Title: Modern Algebra-I
Credit Hours: 3+0

Rings, examples and basic properties; integral domains and fields; ideals and factor rings; ring homomorphisms; polynomials; factorization of polynomials over a field; factor rings of polynomials over a field; factorization in integral domains; principal ideal domains. Ring of endomorphisms of an abelian group.

Books Recommended:

1. Nicholson. 1994, *Intermediate Microeconomics.* Ist ed. NY:The Drydon Press.
2. Ames, D.B.1968. Introduction to Abstract Algebra. 1st ed. Pennsylvania : International text book co.
3. Northcott D,D. 1973. A first course of Homological Algebra. 1st ed. Cambridge University Press.

Course Code: MATH-417
Course Title: Algebraic Topology-I
Credit Hours: 3+0

Homotopy theory, Homotopy theory of path and maps, Fundamental group of circle, Covering spaces, Lifting criterion, Loop spaces and higher homotopy group.

Homotopy Theory: Affin spaces, Singular theory, Chain complexes, Homotopy invariance of homology, Relation between n, and H,relative homology The exact homology sequence.

Books Recommended:

1. Kosniowski C. A., 1980. First course in algebraic topology. 1st ed. Cambridge University Press.
2. Greenberg M.J. & Harper J.R., 1987. Algebraic Topology, A First Course. 1st ed. The Bonjan Cunning Pub,Co.
3. Croom F.H., 1975. Basic Concept of algebraic theory. 1st ed. NY: Spinger-Verlag.

Course Code: MATH-419
Course Title: Advanced Functional Analysis
Credit Hours: 3+0

Fundamental Theorems: Zorn's lemma, statement of Hahn-Banach theorem for real vector spaces, Hahn-Banach theorem for complex vector spaces and normed spaces, Uniform boundedness theorem, Open mapping theorem, Closed graph theorem.

Spectral Theory: Spectral properties of bounded linear operations on Normed Spaces, Further properties of Resolvent and spectrum, use of complex Analysis in spectral theory, compact linear operations on Normed Spaces.

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Books Recommended:

1.Kreyszig, E., 1978. Introductory Functional Analysis with applications. 1st ed. John Wiley.
2. Brown, A.L., 1970. A , Elements of Functional Analysis. 1st ed. Von Nostrand and Reinhold Company.
3. Oden,J.T., 1979. Applied Functional Analysis. 1st ed. Prentice-Hall Inc.

Course Code: MATH-414
Course Title: Advanced Group Theory-II
Credit Hours: 3+0

Solvable groups definition and examples, theorems on solvable groups, nilpotent groups, characterization of finite nilpotent groups, upper and lower central series, the Frattini subgroups, free groups, basic theorems, definition and examples of free products of groups, linear groups, types of linear groups, representation of linear groups, group algebras and representation modules.

Books Recommended:

1. MacDonald I., 1968. The Theory of Groups. 1st ed. Oxford University Press.
2. Cohn P.M., 1974.Algebra, Vol.I, London: John Wiley.
3. Burton D., 1972.Abstract and Linear Algebra. 1st ed. Addison-Wesley.
4. Battacharya P.B., Jain S.K. and Nagpaul S.R., 1994. Basic abstract Algebra. 2nd ed. C.U.P.
5. Jacobson .N.,1989. Basic Algebra, Vol.II. 2nd ed. Freeman.

Course Code: MATH-416
Course Title: Modern Algebra-II
Credit Hours: 3+0

Finite and finitely generated obelian groups, definition and examples of solvable and nilpotent groups, fields, finite fields, field extension, Galois theory, Galois theory of equations, construction with straight-edge and compass, splitting field of polynomials, the Galio groups, some results on finite groups, symmetric group as Galois group, constructable regular n-gones, the Galois group as permutation group.

Books Recommended:

1. Nicholson, W.K., 1993. Introduction to Abstract Algebra. 1st ed. PWS-Kent Publishing Co.
2. Ames, D.B.1968. Introduction to Abstract Algebra. 1st ed. Pennsylvania : International text book co.
3. Northcott D,D. 1973. A first course of Homological Algebra. 1st ed. Cambridge University Press.
4. Jacobson N., 1985. Basic Algebra I. 1st ed. NY: Freeman and Co.

Course Code: MATH-418
Course Title: Algebraic Topology-II
Credit Hours: 3

Relative homology, The exact homology sequences, Excion theorem and application to spheres, Mayer Victoris sequences, Jordan-Brouwer separation theorem, Spherical complexes, Betti number and Euler characteristic, Cell Complexes and adjunction spaces.

Books Recommended:

1. Kosniowski C. A., 1980. First course in algebraic topology. 1st ed. Cambridge University Press.

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2. Greenberg M.J. & Harper J.R., 1987. Algebraic Topology, A First Course. 1st ed. The Bonjan Cunning Pub,Co.
3. Croom F.H., 1975. Basic Concept of algebraic theory. 1st ed. NY: Spinger-Verlag.

Course Code: MATH-420
Course Title: Theory of Modules
Credit Hours: 3+0

Elementary notions and examples, Modules, submodules, quotient modules, finitely generated and cyclic modules, exact sequences and elementary notions of homological algebra, Noetherian and Artinian rings and modules, radicals, semisimple rings and modules, tensor product of modules, bimodules, algebra and coalgebra, torsion module, primary components, invariance theorem.

Books Recommended:

1. Adamson, J.,1976. Rings and modules 1st ed. NY: Chelsea.
2. Blyth, T.S., 1977. Module Theory. 1st ed. Oxford University Press.
3. Hartley, B. and Hawkes, T.O., 1980. Rings, Modules and Linear algebra. 1st ed. Chapman and Hall.
3. Herstein I.N, 1995. *Topics in Algebra with Application.* 3rd ed. Books/Cole.
5. Jacobson .N.,1989. Basic Algebra, Vol.II. 2nd ed. Freeman.

Contents of Applied Mathematics Concentration Elective Courses

Course Code: MATH-421
Course Title: Astronomy-I
Credit Hours: 3+0

Introduction, The great and small circles, spherical angle and spherical triangle, applications to the Earth, longitude and latitude, basics of spherical trigonometry, the celestial sphere, horizontal and equatorial systems of coordinates, observer's meridian and diurnal motion, circumpolar stars, right ascension, the equation of time.

Books Recommended:

1. Smart W. M., 1977. *Textbook on Spherical Astronomy*. 1st ed. Cambridge University Press.
2. Roy A. E. ,1982. *Astronomy: Principles and Practice*. 1st ed. Bristor: Adam Hilger Ltd.
3. Wooland E. W. & Clemence G. M., 1966. *Spherical Astronomy*, 1st ed. Boston: Academic Press.

Course Code: MATH-423
Course Title: Electromagnetism-I
Credit Hours: 3+0

Electrostatics: Coulomb's law, electric field and potential. lines of force and equipotential surfaces. Gauss's law and deduction. conductor condensers, dipoles, forces dipoles, dielectrics, polarization and apparent charges, electric displacement, energy of the field, minimum energy, magnetostatic field, the magnetostatic law of force. magnetic shells, force on magnetic doublets, magnetic induction, para/dia and magnitism, steady and slowly varying currents, electric current, linear conductors, conductivity. resistance, Kirchoff's laws, heat production, current density vector, magnetic field of straight and circular current, magnetic flux.

Books Recommended:

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1. Ferraro. 1956. Electromagnetic Theory. Revised ed. The Athlon Press, University of London.
2. Reitz J.R. & Milford. 1960. Foundations of Electromagnetic theory. 3rd ed. Addison-Wesley.
3. Pugh & Pugh. 1960. Electricity and Magnetism. 1st ed. Addison-Wesley.

Course Code: MATH-425
Course Title: Fluid Mechanics-I
Credit Hours: 3+0

Introduction: Definition of Fluid, basics equations, Methods of analysis, dimensions and units. Fundamental concepts, Fluid as a continuum, velocity field, stress field, viscosity, surface tension, description and classification of fluid motions.
Fluid Statics: The basic equation of fluid static, The standard atmosphere, pressure variation in a static fluid, fluid in rigid body motion. Basic equation in integral form for a control volume, basic laws for a system, relation of derivatives to the control volume formulation, conservation of mass, momentum equation for inertial control volume, momentum equation for control volume with rectilinear acceleration, momentum equation for control volume with arbitrary acceleration, the angular momentum principle, the first law of thermodynamics, the second law of thermodynamics. Introduction to differential analysis of fluid motion: conservation of mass, stream function for two dimensional incompressible flow, motion of a fluid element (kinematics), momentum equation.

Books Recommended:

1. Fox R. W. & McDonald A. T., 2004. Introduction to Fluid Mechanics 6th ed. John Wiley & Sons.
2. White F. M., 2006. Fluid Mechanics. 5th ed. Mc Graw Hill.
3. Schichting H., 1964. Boundary Layer Theory. 6th ed. Mc. Graw Hill.
4. Milne-Thomson L. M., 2006. Theoretical Hydrodynamics, 6th ed. NY: Macmillan.

Course Code: MATH-429
Course Title: Operations Research-I
Credit Hours: 3+0

Linear Programming: formulation and graphical solution, simplex method, M-technique and two-phase technique, special cases sensitivity analysis, the dual problem, primal dual relationship, the dual simplex method, sensitivity and post optimal analysis, transportation model, Northwest corner, least cost and Vogel's approximation methods, the method of multipliers, the assignment model, the transshipment model, network minimization, shortest route algorithms for variables.

Books Recommended:

1. Hamdy A. T., 2006 Operations Research an Introduction. 6th ed. NY: Macmillan
2. Gillet B.E., 1979. Introduction to Operations Research. 1st ed. New Delhi: McGraw Hill.
3. HARVY C.M., 1979.Operations Research. 1st ed. North Holland.
4. Hillier F.S. & Liebraman G.J., 2000. Operations Research. 8th ed., CBS.

Course Code: MATH-431
Course Title: Quantum Mechanics–I
Credit Hours: 3+0

Inadequacy of classical mechanics: black body radiation, photoelectric effect, compton effect, Bohr's theory of atomic structure, wave-particle duality, the de-Broglie

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postulate, the uncertainty principle, uncertainty of position and momentum, statement and proof of the uncertainty principle, energy-time uncertainty, eigenvalues and eigenfunctions, operators and eigenfunctions, linear operators, operator formalism in quantum mechanics, orthonormal systems, Hermitian operators and their properties, simultaneous eigenfunctions, parity operators, postulates of quantum mechanics, the Schrödinger wave equation.

Motion in one dimension: step potential, potential barrier, potential well, and harmonic oscillator.

Books Recommended:

1. Taylor G., 1970. Quantum Mechanics. 1st ed. George Allen and Unwin.
2. Powell T.L and Crasemann B., 1961. Quantum Mechanics. 1st ed. Addison Wesley.
3. Merzdacker E.,1988. Quantum Mechanics. 1st ed. John Wiley.
4. Eisberg R.M., 1961. Fundamental of Modern Mechanics. 1st ed. Willey.

Course Code: MATH-439
Course Title: Riemannian geometry
Credit Hours: 3+0

Definition and examples of manifolds; Submanifolds; Tangents; Coordinate vector fields; Tangent spaces; Dual spaces; Algebra of tensors; Vector fields; Tensor fields; Integral curves; Affine connections and Christoffel symbols; Covariant differentiation of tensor fields; Geodesics equations; Curve on manifold; Parallel transport; Lie transport; Lie derivatives and Lie Brackets; Geodesic deviation; Differential forms; Introduction to integration theory on manifolds; Riemannian Curvature tensor; Ricci tensor and Ricci scalar; Killing equations and Killing vector fields.

Books Recommended:

1. Bishop, R.L. and Goldberg, S.I., 1980.. Tensor Analysis on Manifolds. 1st ed. NY: Dover Publications.
2. Carmo M.P., 1992. Riemannian Geometry. 1st ed. Boston:Birkhauser.
3. Lovelock, D. and Rund, H. Tensors., Differential Forms and Variational Principles,John-Willey, 1975.
4. Langwitz, D., Differential and Riemannian Geometry, Academic Press, 1970.
5. Abraham, R., Marsden, J.E. and Ratiu, T., Manifolds, Tensor Analysis and Applications, Addison-Wesley, 1983.

Course Code: MATH-422
Course Title: Astronomy-II
Pre Requisite: Astronomy-I
Credit Hours: 3+0

Introduction to celestial navigation on earth; celestial sphere; time-keeping system; refraction; parallax and triangulation, aberration; precession, nutation; tropical measurements, magnitude systems; Naked Eye Observations; Observational techniques; optics and telescopes; Radio telescopes and Doppler imaging.

Books Recommended:

1. Roy A. E., 1982. *Astronomy: Principles and Practice*. 1st ed. Adam Hilger Ltd.
2. Roy A. E., 1989. *Astronomy: Structure of the Universe*. 1st ed. Adam Hilger Ltd., Bristol.

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Course Code: MATH-424
Course Title: Electromagnetism-II
Credit Hours: 3+0

Vector potential, forces on a circuit in magnetic field, magnetic field energy, law of electromagnetic induction, Co-efficient of self and mutual induction, alternating current and simple I.C.R circuits in series and parallel, power factor, the equations of electromagnetism, Maxwell's equations in free space and material media, solution of Maxwell's equations, plane electromagnetic waves in homogeneous and isotropic media, reflection and refraction of plane waves, wave guides Laplace' equation in plane, polar and cylindrical coordinates, simple introduction to Legendre polynomials, method of images, images in a plane, images with spheres and cylinders.

Books Recommended:

1. Ferraro. 1956. Electromagnetic Theory. Revised ed. The Athlon Press, University of London.
2. Reitz J.R. & Milford. 1960. Foundations of Electromagnetic theory. 3rd ed. Addison-Wesley.
3. Pugh & Pugh. 1960. Electricity and Magnetism. 1st ed. Addison-Wesley.

Course Code: MATH-426
Course Title: Fluid Mechanics-II
Credit Hours: 3+0

Incompressible inviscid flow, momentum equation for frictionless flow, Euler's equations, Euler's equations in streamline coordinates, Bernoulli equation- Integration of Euler's equation along a streamline for steady flow, relation between first law of thermodynamics and the Bernoulli equation, unsteady Bernoulli equation-Integration of Euler's equation along a streamline, irrotational flow. Internal incompressible viscous flow, Part-A Fully developed laminar flow, fully developed laminar flow between infinite parallel plates, fully developed laminar flow in a pipe, Part-B Flow in pipes and ducts, shear stress distribution in fully developed pipe flow, turbulent velocity profiles in fully developed pipe flow, energy consideration in pipe flow. External incompressible viscous flow, Part-A, Boundary layers, the boundary concept, boundary thickness, laminar flat plate boundary layer: exact solution, momentum, integral equation, use of momentum integral equation for flow with zero pressure gradient, pressure gradient in boundary-layer flow.

Books Recommended:

1. Fox R. W. & McDonald A. T., 2004. Introduction to Fluid Mechanics 6th ed. John Wiley & Sons.
2. White F. M., 2006. Fluid Mechanics. 5th ed. Mc Graw Hill.
3. Schichting H., 1964. Boundary Layer Theory. 6th ed. Mc. Graw Hill.
4. Milne-Thomson L. M., 2006. Theoretical Hydrodynamics, 6th ed. NY: Macmillan.cmillan.

Course Code: MATH-430
Course Title: Operations Research-II
Credit Hours: 3+0

Algorithm for cyclic network, maximal flow problems, matrix definition of LP- problems, revised simplex methods, bounded variables decompositions algorithm, parametric linear programming, application of integer programming, cutting plane algorithm, mixed fractional cut algorithm, branch and bound methods, zero-one implicit

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enumeration, element of dynamics programming, problems of dimensionality, solutions of linear program by dynamics programming,

Books Recommended:

1. Hamdy A. T., 2006 Operations Research an Introduction. 6th ed. NY: Macmillan
2. Gillet B.E., 1979. Introduction to Operations Research. 1st ed. New Delhi: McGraw Hill.
3. Harvy C.M., 1979.Operations Research. 1st ed. North Holland.
4. Hillier F.S. & Liebraman G.J., 2000. Operations Research. 8th ed., CBS

Course Code: MATH-432
Course Title: Quantum Mechanics–II
Credit Hours: 3+0

Motion in three dimensions, angular momentum, commutation relations between components of angular momentum, and their representation in spherical polar coordinates, simultaneous Eigen functions of Lz and L2, Spherically symmetric potential and the hydrogen atom.

Scattering Theory: The scattering cross-section, scattering amplitude, scattering equation, Born approximation, partial wave analysis.

Perturbation Theory: Time independent perturbation of non-degenerate and degenerate cases. Time-dependent perturbations.

Identical Particle: Symmetric and anti-symmetric Eigen function, The Pauli exclusion principle.

Books Recommended:

1. Taylor G., 1970. Quantum Mechanics. 1st ed. George Allen and Unwin.
2. Powell T.L and Crasemann B., 1961. Quantum Mechanics. 1st ed. Addison Wesley.
3. Merzdacker E.,1988. Quantum Mechanics. 1st ed. John Wiley.
4. Eisberg R.M., 1961. Fundamental of Modern Mechanics. 1st ed. Willey.

Course Code: MATH-434
Course Title: Special Relativity
Credit Hours: 3+0

Historical background and fundamental concepts of special theory of relativity, Galilean transformations, Lorentz transformations (for motion along one axis), length contraction, time dilation and simultaneity, velocity addition formulae.3-dimensional, Lorentz transformations, introduction to 4-vector formalism. Lorentz transformations in the 4-vector formalism, the Lorentz and Poincare groups, introduction to classical mechanics, Minkowski space-time and null cone, 4-velocity and 4-momentum and 4-force, application of special relativity to Doppler shift and Compton effect, aberration of light, particle scattering, binding energy, particle production and decay, special relativity with small acceleration.

Recommended Books:

1. Qadir, 1989. An introduction to the Special Relativity theory. 1st ed. World scientific.
2. D'Inverno R., 1992. Introducing Einstein's Relativity. 1st ed. Oxford University Press.
3. Rindler W., 1977. Essential Relativity. 2nd ed. Springer Verlag.

Course Contents of Free Elective Courses

Course Code: MATH-441
Course Title: Numerical Solutions of Partial Differential Equations
Credit Hours: 3+0

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Course Contents: Introduction and Finite-Difference Formulae, Parabolic Equations: Finite difference methods, convergence, and stability. Parabolic Equations: Alternative derivation of difference equations and miscellaneous topics. Hyperbolic equations and characteristics. Elliptic equations and systematic iterative methods.

Books Recommended:

1. Smith G.D., 1986. Numerical Solution of Partial Differential Equations: Finite Difference Methods, 3rd ed, Oxford University Press.
2. Ames, W.F., 1992. Numerical Methods for Partial Differential Equations. 3rd ed. NY: Academic Press.

Course Code: MATH-443
Course Title: History of Mathematics
Credit Hours: 3

History of numerations; Egyptian, Babylonian, Hindu and Arabic contributions. Algebra: Including the contributions of Al-Khwarzmi and Ibn Kura. Geometry: areas, the work of Al-Toussi on Euclid's axioms. Analysis: The CalculusNewton, Lebnitz, Gauss. The concept of limit: Cauchy, Laplace. An introduction to some famous old open problems.

Books Recommended:

1. Boyer C.B. and Mersbach U.V., 1989. The History of Mathematics. 2nd ed. John Wiley.

Course Code: MATH-445
Course Title: Projective Geometry-I
Credit Hours: 3
Note: Course contents will be provided later on

Course Code: MATH-447
Course Title: Methods of Optimization-I
Credit Hours: 3+0
Introduction to optimization and review of related mathematical concepts, unconstrained optimization, conditions for local minimizers, one dimensional search methods, gradient methods, Newton's method analysis and modifications, conjugate direction methods, Quasi Newton method, application to neural network, genetic algorithms.

Books Recommended

1. Sudaran R.K., 1996. A first course in optimization theory. 3rd ed. CUP.
2. Chang E.K.P and Zak, S.I.I, 2004. An Introduction to Optimization. 3nd ed. Wiley.
3. Rao S.S., 1992. Optimization Theory and Applications. 2nd ed. Wiley Eastern Ltd.

Course Code: MATH-449
Course Title: Measure Theory
Credit Hours: 3+0
Lebesgue measure: introduction, outer measure, measurable sets and Lebesgue measure, a non-measurable set. Measurable functions. Lebesgue integration: the Lebesgue integral of a non-negative function. The general Lebesgue integral; general

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measure and integration measure spaces, measurable functions, integration, general convergence theorems.

Books Recommended:

1. Roydon H.L., 1986. Real Analysis. 1st ed. NY:Collier Macmillan Co.
2. Barra G. De., 1981. Measure Theory and Integration. 1st ed. Ellis, Harwood Ltd.
3. Philip E.R., 1978. An introduction to Analysis and Integration Theory. 1st ed. USA: Intext Educational Publications.

Course Code: MATH-453
Course Title: Theory of Splines-I
Credit Hours: 3+0

Euclidean Geometry: basic concepts of Euclidean geometry, scalar and vector functions, barycentric coordinates, convex hull, matrices of affine maps, translation, rotation, scaling, reflection and shear.

Approximation *using Polynomials:* curve fitting, least squares line fitting, least squares power fit, data linearization method for exponential functions, nonlinear least-squares method for exponential functions, transformations for data linearization, linear least squares, Polynomial fitting.

Interpolation: basic concepts of interpolation, Lagrange's method, error terms and error bounds of Lagrange's method, divided differences method, Newton polynomials, error terms and error bounds of Newton polynomials, central difference interpolation formulae, Gauss's forward interpolation formula, Gauss's backward interpolation formula, Hermite's methods.

Books Recommended:

1. Sudaran R.K., 1996. A first course in optimization theory. 3rd ed. CUP.
2. Chang E.K.P and Zak, S.I.I, 2004. An Introduction to Optimization. 3nd ed. Wiley.
3. Rao S.S., 1992. Optimization Theory and Applications. 2nd ed. Wiley Eastern Ltd.

Course Code: MATH-442
Course Title: Elasticity Theory
Credit Hours: 3+0

Cartesian tensors, analysis of stress and strain, generalized Hook's law, crystalline structure, point groups of crystals, reduction in the number of elastic moduli due to crystal symmetry; equations of equilibrium, boundary conditions, compatibility equations, plane stress plane strain problems, two dimensional problems in rectangular and polar coordinates, torsion of rods and beams.

Books Recommended:

1. Sokolinikoff. 1956. Mathematical Theory of Elasticity. 2nd ed. NY:McGraw Hill.
2. Dieulesaint E. and Royer D., 1974. Elastic Waves in solids. 1st ed. NY: Wiley.
3. Funk Y. C., 1965. Foundations of Solid Mechanics. 1st ed. Prentice – Hall.

Course Code: MATH-444
Course Title: Heat Transfer
Credit Hours: 3

Introduction, Steady-State Conduction-One Dimension, Steady-State Conduction-Multiples Dimensions, Unsteady-State Conduction, Principles of Convection, Empirical and practical Relations or Forced –Convection Heat Transfer, Natural Convection Systems, Radiation Heat Transfer.

Books Recommended:

1. Holman J.P., Heat Transfer. 8th ed. McGraw Hill.

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2. Kays W.M. & Crawford, M.E., 1993. Convective Heat & Mass Transfer. 3rd ed. NY: McGraw Hill.
3. Incropera F.P. & Dewitt, D.P., 1985. Fundamentals of Heat & Mass Transfer. 2nd ed. NY: Wiley.

Course Code: MATH-446
Course Title: Projective Geometry-II
Credit Hours: 3
Note: Course contents will be provided later on.

Course Code: MATH-448
Course Title: Methods of Optimization-II
Credit Hours: 3
Problems with equality constraints Problem with inequality constraints, convex optimization problems, Algorithms for constrained optimization, Lagrange method.

Books Recommended:
1. Sudaran R.K., 1996. A first course in optimization theory. 3rd ed. CUP.
2. Chang E.K.P and Zak, S.I.I, 2004. An Introduction to Optimization. 3nd ed. Wiley.
3. Rao S.S., 1992. Optimization Theory and Applications. 2nd ed. Wiley Eastern Ltd.

Course Code:MATH 450
Course Title: Special Functions
Credit Hours:3+0

The Gamma function: definition, relations satisfied by Gamma function, Euler's constant, the order symbols o and O, asymptotic representation of the Gamma function for large O(Z), Beta function; Tye-Hypergeometric function, the function F(a,b;c;z) and F(a,b;c;I), the hypergeometric differential equation, simple transformations, a theorem due to Kummer, orthogonal polynomials, simple sets of polynomials, orthogonality, the three term recurrence relation, the Christofell-Darboux formula, normalization, Bessel's inequality, Legendere Polynomials, generating function, differential equation, the Rodrigues formula, recurrence relations, hypergeometric form of Pn(x), Some bounds on Pn(x), orthogonality, Hermite Polynomials, definition of Hn(x), recurrence relations, the Rodringues formula, the Hermite polynomials as ${}_2F^O$, orthogonality, Laguerre Polynomials, The polynomial $L_n(x)$, generating functions, Rodrigues formula, the differential equation, orthogonality.

Books Recommended:
1. Rainville, E.D., 1971.Special Functions. 2nd ed. Chelsea Publishing Co.
2. Lebedev, N.N., 1972.Special Functions and their Applications. 2nd ed. Prentice Hall,
3. Whittaker & Watson. 1978. A Course in Modern analysis. 2nd ed.Cambridge University Press.

Course Code: MATH-454
Course Title: Theory of Splines-II
Credit Hours: 3+0
Parametric curves (scalar and vector case), algebraic form, Hermite form, control point form, Bernstein Bezier form, matrix forms of parametric curves, algorithms to compute B.B. form, convex hull property, affine invariance property, variation diminishing property, rational quadratic form, rational cubic form, tensor product surface, B.B. cubic patch, quadratic by cubic B.B. patch, B.B. quartic patch.

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Spline Functions: splines, cubic splines, end conditions of cubic splines: clamped conditions, natural conditions, second derivative conditions, periodic conditions, Not a knot conditions, general splines, natural splines, periodic splines, truncated power function, representation of spline in terms of truncated power functions, odd degree interpolating splines.

Books Recommended:

1. Farin G., 2002. Curves and Surfaces for Computer Aided Geometric Design A Practical Guide. 5th ed. Academic Press
2. Faux I.D. 1979.Computational Geometry for Design and Manufacture. 1st ed. Ellis Horwood
3. Bartle H.R, Beatly C.J., 2006. An Introduction to Spline for use in Computer Graphics and Geometric Modeling. 4th ed. Morgan Kaufmann.
4. Boor C.D., 2001. A Practical Guide to Splines. Revised ed. Springer Verlag.

Note: The other courses will also be offered on the availability of teachers.

The End

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Annexure – VIII

Course Code: ENG-301

English I

Semester I

Course: Foundations of English Grammar Credit Hrs 3+1

Course Aims:

This course aims at introducing basic concepts of grammar to students. This course will provide a basis for developing grammatical competence of the learners to become proficient writers and speakers of English language.

1. What is grammar?	1.1 Language and Communication 1.2 Making sense 1.3 Grammar and sense
2. Phrases and sentences	2.1 Word groups 2.2 Phrases 2.3 Sentence 2.4 Four kinds of sentences 2.5 The punctuation of written sentences
3. Subject and predicate	3.1 The two parts of the sentence 3.2 The functions of the two parts 3.3 Subject and predicate (1) 3.4 Subject and predicate (2)
4. Words in sentences	4.1 Words at work 4.2 Different work for the same word
5. An introduction to the parts of speech	5.1 Parts of speech 5.2 Nouns 5.3 Verbs 5.4 Pronouns 5.5 Adjectives 5.6 Adverbs 5.7 Prepositions 5.8 Conjunctions 5.9 Interjections 5.10 Family groups and word behaviour 5.11 The Article
6. The parts of the simple sentence	6.1 Definitions of the simple sentence 6.2 Subject and predicate 6.3 The subject and the subject word 6.4 Subject word and words qualifying subject word 6.5 Predicate: the verb and words modifying the verb 6.6 Predicate: the direct object 6.7 Predicate: the indirect object 6.8 Predicate: predicative words (or complement)
7. Finite verbs and non finite verbs	7.1 Finite verbs 7.2 Non-finite verbs 7.3 Participal phrases 7.4 Gerundive phrases 7.5 Infinitive phrases

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8. Simple sentence analysis	8.1 Tabular analysis 8.2 Descriptive analysis 8.3 Graphic analysis 8.4 Analysing phrases
9. Clauses and sentences	9.1 What is a clause? 9.2 Main clauses 9.3 Co-ordinating conjunctions 9.4 Double sentences 9.5 Multiple sentences 9.6 Complex sentences 9.7 Kinds of sentences: a checklist
10. Subordinate clauses and the work they do	10.1 Introduction 10.2 Adjective clauses 10.3 Adverb clauses 10.4 Noun Clauses
11. The analysis of complex double and multiple sentences	11.1 Method 11.2 Procedure 11.3 Notes on procedure 11.4 Worked examples: complex sentences 11.5 Double and multiple sentence analysis
12. The parts of speech: a chapter for reference	12.1 Introduction 12.2 Nouns 12.3 Pronouns 12.4 Adjectives 12.5 Verbs 12.6 Adverbs 12.7 Prepositions 12.8 Conjunctions 12.9 Interjections 12.10 'It' as a provisional subject 12.11 'There' as an introductory adverb
13. Common errors and debatable Points	13.1 Introduction 13.2 Agreement 13.3 Case 13.4 Verb-forms 13.5 The rule of proximity 13.6 Woolly use of pronouns 13.7 Defining and non-defining phrases and clauses 13.8 Chopping and changing

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Reading List:

Burton,S.H.(1984)Mastering English Language.McMillan.
Devitiis,Mariani & O'Malley (1991) English Grammar for Communication. Longman
Swan, M.and Catherine (2001) How English Works.OUP.
Burton,S.H.(1984)Mastering English Grammar.McMillan.
Hornby,A.S.(1978) The Teaching of Structural Words and Sentence Patterns.OUP.
Hornby,A.S.(1975) A Guide to Patterns and Usage in English. OUP.
Zandvoort, R.W.(1976) A Handbook of English Grammar.ELBS.

607 ENG-302
English-II

ter – II

se: Foundations of English Credit Hrs 3

rse Aims:

aim of this course is to groom the students linguistically in such a manner that they read and understand different texts written in English (academic or non academic) by plying different strategies of reading. A particular care has been taken to gratify the sthetic needs of the learners. The basic aim of this course is to develop critical reading nd critical thinking among the students. This course also aims to train students to meet he demands of other subjects written in the English language which need to be dealt with at optimal level of efficiency. The course shall enable the learners to develop vocabulary in English by reading dynamic text and understand different composition patterns in the English language.

Pootry-I

1.	To a butterfly	William Wordsworth
2.	Westminster Bridge	William Wordsworth
3.	A Divine Image	William Blake
4.	On a Dead Child	Richard Middleton
5.	The Pains of Sleep	J.J. Coleridge
6.	To Wordsworth	P.B. Shelley
7.	Siberia	James Manager
8.	After the battle	Tomas Moor

Short Stories:

1.	The Man with the Star	S. Maugham
2.	The New Constitution	Saadat Hassan Manto
3.	Breakfast	John Steinbeck

Essays-I

1.	Quid-e-Azam's Address	
2.	Seeing Life	Arnold Bennet
3.	A Visit to Swat Valley	H.P. Stewart
4.	The Unconscious Artists	Gilber Hight

Composition Skills

1. Mechanics
2. Paragraph Writing
3. Essay Writing

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Reading List:

Burton,S.H.(1984)Mastering English Language.McMillan.
Devitiis,Mariani & O'Malley (1991) English Grammar for Communication. Longman
Swan, M.and Catherine (2001) How English Works.OUP.

Gill, G. (1985) *Mastering English Literature*. McMillan
Burns & McNamara (1987) Literature: A Close Study. McMillan
Burton,S.H.(1984)Mastering English Language.McMillan.
Brooks, C. et al. (1975) An Approach to Literature. Prentice Hall
Guddon, J.A. (1991) Dictionary of Literary Terms and Literary Theory. Penguin

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Course code ENG-303
English - III

ar-II

ar-III

Foundations of English Credit Hrs 3

The Aims:
Aim of this course is to train the students in such a manner that they can comprehend and understand different English text patterns by applying different analytical strategies. A particular care has been taken to gratify the aesthetic needs of the learners. The basic aim of this course is to develop critical reading and critical thinking among the students. The course shall enable the learners to develop vocabulary in English by reading dynamic texts and understand different composition patterns in the English language. It shall also give them orientation to different literary genres so that they could themselves be able to compose variety of texts independently.

Poetry:

1.	All the world is a Stage	William Shakespeare
2.	On his Blindness	John Milton
3.	My God , My Father	John Donne
4.	Ode to Autumn	John Keats
5.	No Buyers	Thomas Hardy
6.	Law	D.H. Lawrence
7.	Prayer before birth	Louis MacNiece
8.	The Owl Critic	S.T Field

Essays:

1.	One Vote for this age of Anxiety	Margaret Mead
2.	On Babies	Jerome K.Jerome
3.	The Urdu Writers of our Time	A.S. Bokhari
4.	Islamic Culture	Muhammad Marmaduke Pickthal

Short Stories:

1.	The sound of falling Leaves	Quartulain Haider
2.	Necklace	G.D. Maupassant
3.	A Passion in the Desert	Hanore De Balac
4.	The Fly	Katherine Mansfield

One Act Plays:

1.	Even Exchange	Paul S McCoy
2.	The Master of the House	W.S. Houston
3.	The Little Man	John Galsworthy

Composition Skills

1. Precise Writing
2. Letter Writing
3. Job Application
4. C V Writing

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Reading List:

Burton,S.H.(1984)Mastering English Language.McMillan.
Devitiis,Mariani & O'Malley (1991) English Grammar for Communication. Longman
Swan, M.and Catherine (2001) How English Works.OUP.

Gill, G. (1985) *Mastering English Literature*. McMillan
Burns & McNamara (1987) Literature: A Close Study. McMillan
Burton,S.H.(1984)Mastering English Language.McMillan.
Brooks, C. et al. (1975) An Approach to Literature. Prentice Hall
Guddon, J.A. (1991) Dictionary of Literary Terms and Literary Theory. Penguin

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ster-IV

Course Code: ENG-304

rse: Foundations of English Credit Hrs 3

urse Aims:

e aim of this course is to train the students in such a manner that they can mprehend and understand different English text patterns by applying different nalytical strategies. A particular care has been taken to gratify the aesthetic eeds of the learners. The basic aim of this course is to develop critical reading and critical thinking among the students. The course shall enable the learners to develop vocabulary in English by reading dynamic texts and understand different composition patterns in the English language. I t shall also give them orientation to different literary genres so that they could themselves be able to compose variety of texts independently.

Poetry:

1.	Departure and Arrival	T.S. Eliot
2.	The Morning of Freedom	Faiz Ahmed Faiz
3.	The Road Not Taken	Robert Frost
4.	Because I could not stop for Death	Emily Dickinson
5.	Abraham Lincoln Walks In Midnight	Verchal Lindsay
6.	Say this City has Ten Million Souls	W.H.Auden
7.	The Daisy	Francis Thompson
8.	Purity	Robinder Nath Tagore

One Act Plays:

1.	The Bear	Anton Chekhov
2.	Smoke Screen	Harold Bridge house

Extracts from Shakespeare:

1. King Lear (Storm Scene)
2. Hamlet (Polonius to his Son)
3. Julius Caeser (Antony's Speech)

Essays:

1.	Work	Bertrand Russel
2.	On Fashion	William Hazlitt
3.	Three days to See	Helen Keller
4.	Spoon Feeding	W.R. Inge
5.	Gettysburg Address	Abraham Lincoln
6.	The Damned human race	Mark Twain

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Novel:

1. Jane Eyre — Charlotte Bronte

Composition Skills

Report Writing (Short Reports)

Formal Reports (Long Reports)

Reading List:

Burton,S.H.(1984)Mastering English Language.McMillan.
Devitlis,Mariani & O'Malley (1991) English Grammar for Communication. Longman
Swan, M.and Catherine (2001) How English Works.OUP.
Gill, G. (1985) *Mastering English Literature*. McMillan
Burns & McNamara (1987) Literature: A Close Study. McMillan
Burton,S.H.(1984)Mastering English Language.McMillan.
Brooks, C. et al. (1975) An Approach to Literature. Prentice Hall
Guddon, J.A. (1991)Dictionary of Literary Terms and Literary Theory. Penguin

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