Bangamata Sheikh Fojilatunnesa Mujib Science And Technology University

Jamalpur-2000, Bangladesh.

Syllabus for B.Sc. (Hon's)

Faculty of Science

Department of Mathematics

Academic Session: 2018-2019

Vision Statement

The Department of Mathematics aspires to reach in the country's centre of excellence for quality education and research.

Mission Statement

The mission statements of the department of mathematics are to:
□ Conduct research which would have local and global impact and recognition;
□ Provide learning opportunities of mathematics;
□ Produce skilled mathematics graduates to serve the needs of national and international communities; and
□ Undertake educational outreach and community engagement that increases mathematical, rational and computing literacy nationally and globally.

Program Education Objectives (PEOs)

The program education objectives of the department of mathematics take into consideration of the university mission and the constituents' needs by producing graduates few years after their graduation, will be able to

PEO1 Enrich in their careers, adapting to new situations and emerging problems through the application of general purpose mathematics as knowledge, skills and the core technical disciplines, analytical procedures, and design practices in the profession mathematics ;

PEO2 Function ethically in a variety of professional roles as a graduate of mathematics through sustainable approach;

PEO3 Utilize modern tools, professional skills such as effective communication, team-work, and leadership; and able to demonstrate entrepreneurship skills and recognize the need of life-long learning for advancement of successful career.

PEO4 Demonstrate an understanding of the critical role play in the working place, industry as well as society with respect to health, safety, and the environment in tangible ways such as achieving professional excellence.

Program Outcomes (POs)

The Program Outcomes (POs) of B.Sc. (Honours) in Mathematics are:

PO1. **Subjective knowledge** (Cognitive): Acquire and apply the knowledge of mathematics, science, fundamentals and specialization to the solution of complex mathematics related problems;

PO2. **Problem analysis** (Cognitive): Identify, formulate, research and analyse complex mathematical problems and provide creative, innovative and effective solution to reach substantiated conclusion using the principles of mathematics, natural science and statistic;

PO3. **Design/development of solution** (Cognitive, Affective): Design solutions for complex mathematical problems and design system components/processes to meet the specified needs with appropriate consideration for public health and safety of cultural, societal and environmental concerns;

PO4. **Investigation** (Cognitive, Psychomotor): Investigation of complex problems considering experimental design, data analysis and interpretation and information synthesis to provide valid conclusions;

PO5. **Modern tool usage** (Psychomotor, Cognitive): Create, select and apply appropriate techniques, resources and modern IT tools including prediction and modelling to complex mathematical problems in the society, scientific activities with understanding of their limitations;

PO6. **The profession and society** (Affective): Apply reasoning information by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional practice;

PO7. **Environment and sustainability** (Affective, Cognitive): Understand the impact of problems and solutions in societal and environmental contexts and demonstrate the knowledge and need for sustainable development;

PO8. **Ethics** (Affective): Apply ethical principles and commitment to the professional ethics, responsibilities;

PO9. **Individual work and teamwork** (Psychomotor, Affective): Function effectively as an individual and as a member or leader of diverse team of multidisciplinary settings;

PO10. **Communication** (Psychomotor, Affective): Communicate effectively about activities with the expert and professional community; and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentation and give and receive clear instructions;

PO11. **Project management and finance** (Cognitive, Psychomotor): Demonstrate knowledge and understanding management principles and apply these to one's work as a team member or a leader to manage project in multidisciplinary environment;

PO12. **Life-long learning** (Affective, Psychomotor): Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological and theoretical change.

Contents

Year and semester wise course distribution

Distribution of total 154 credits.

1st Year, 1st Semester			
Sl	Course Code	Course Title	Credit
1	MAT 1111	Fundamentals of Mathematics	3
2	MAT 1121	Geometry of Two Dimensions	3
3	MAT 1131	Differential Calculus	3
4	PHY 1141	Mechanics, Properties of Matter, Wave and Sound	3
5	STA 1151	Pinciples of Statistics	3
6	ENG 1161	Functional English	2
7	CSE 1172	Computer Fundamentals Lab	2
8	MAT 1180	Viva-Voce	1
		Total	20

1st Year, 2nd Semester			
Sl	Course Code	Course Title	Credit
1	MAT 1211	Algebra and Trigonometry	3
1	MAT 1221	Geometry of Three Dimensions	3
2	MAT 1231	Integral Calculus	3
3	GED 1241	Bangladesh Studies	3
4	STA 1251	Probability and Probability Distribution	2
5	CSE 1261	Structured and Object Oriented Programming	2
6	CSE 1262	Structured and Object Oriented Programming Lab	2
7	MAT 1270	Viva-Voce	1
		Total	19

2nd Year, 1st Semester			
Sl	Course Code	Course Title	Credit
1	MAT 2111	Matrix and Linear Algebra	3
2	MAT 2121	Advanced Calculus	3
3	MAT 2131	Ordinary Differential Equations	3
4	PHY 2141	Heat,Thermodynamics and Optics	3
5	ECO 2151	Principles of Economics	2
6	ENG 2161	Analytical writing and verbal reasioning	2
7	MAT 2172	Mathematics Lab Using Matlab	2
8	MAT 2180	Viva-Voce	1
		Total	19

2nd Year, 2nd Semester			
Sl	Course Code	Course Title	Credit
1	MAT 2211	Vector Calculus	3
2	MAT 2221	Tensor Analysis	2
3	MAT 2231	Real Analysis-I	3
4	PHY 2241	Electromagnetism and Modern Physics	3
5	PHY 2242	Physics Lab	1
6	STA 2251	Mathematical Statistics	2
7	STA 2252	Statistical package Lab (R/SAS/STATA/Eviews)	2
8	ACT 2261	Principles of Accounting	2
9	MAT 2270	Viva-Voce	1
		Total	19

3rd Year, 1st Semester			
Sl	Course Code	Course Title	Credit
1	MAT 3111	Real Analysis-II	3
2	MAT 3121	Complex Analysis	3
3	MAT 3131	Mechanics	3
4	MAT 3141	Partial Differential Equations	3
5	MAT 3151	Mathematical Methods-I	2
6	CSE 3161	Relational Database Management System (RDBMS)	2
7	CSE 3162	RDBMS Lab (Oracle/ MySQL/ SQL Server/ and PL SQL)	2
8	MAT 3170	Viva-Voce	1
		Total	19

3rd Year, 2nd Semester			
Sl	Course Code	Course Title	Credit
1	MAT 3211	Mathematical Methods - II	2
2	MAT 3221	Discrete Mathematics and Graph theory	3
3	MAT 3231	Numerical Analysis	3
4	MAT 3241	Abstract Algebra	3
5	MAT 3251	Classical Mechanics	3
6	FIN 3261	Mathematical Finance	2
7	MAT 3272	Numerical Simulation Lab Using Matlab/C++/Pvthon	2
8	MAT 3280	Viva-Voce	1
		Total	19

4th Year, 1st Semester			
Sl	Course Code	Course Title	Credit
1	MAT 4111	Hydrodynamics	3
2	MAT 4121	Quantum Mechanics	3
3	MAT 4131	Differential Geometry	3
4	MAT 4141	Integral Equations	3
5	MAT 4151	Topology	3
6	MAT 4161	FORTRAN Programming	2
7	MAT 4162	FORTRAN Programming LAB	2
8	MAT 4180	Viva-Voce	1
		Total	20

4th Year, 2nd Semester			
Sl	Course Code	Course Title	Credit
1	MAT 4211	Operations Research	3
2	MAT 4221	Astronomy	3
3	MAT 4231	Special Theory of Relativity	3
4	MAT 4241	Theory of Numbers	3
5	MAT 4251	Quantitative reasoning	2
6	MAT 4263	Project in Mathematics	4
7	MAT 4270	Viva-Voce	1
		Total	19

1 1st year 1st semester

1.1 MAT 1111 : Fundamentals of Mathematics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Notion of sets, finite and infinite sets, equality of sets, null set, subsets, proper subsets, sets of sets, universal set, power set, disjoint set, Venn-Euler diagrams, union and intersection of sets, difference, complement, operations on comparable sets.
2. Natural numbers, Set of integers and rational numbers, the real number system, geometric representation of real numbers, absolute value and distance, intervals and bounded sets of real numbers, the division algorithm, fundamental theorem of arithmetic, modulus and their properties.
3. Cardinal numbers: denumerable and countable sets, cardinal number, ordering of cardinal number, cardinal arithmetic, Cantor's theorem, addition and multiplication of cardinal number.
4. Partially and totally ordered set: partially ordered set, totally ordered set, subset of ordered set, totally ordered subsets, first and last elements, maximal and minimal elements, upper and lower bound, supremum and infimum.
5. Functions: Definition of function, domain and range of functions, one-one function, onto function, invertible functions, set functions, associativity and product of functions, identity and inverse function, theorems on the inverse functions.
6. Product sets and graphs of functions: Ordered pair, product sets, coordinate diagram, graph of a function, graphs of coordinate diagram, product set in general.
7. Relations: Product set, solution sets and graphs of relations, inverse relations, reflexive relations, symmetric relations, anti-symmetric relations, transitive relations, equivalence relation.
8. Proposition and compound propositions, Basic logical operations, truth tables, tautologies and contradictions, logical equivalence, algebra of propositions, conditional and biconditional statements, arguments, logical implication, propositional functions and quantifiers, negation of quantified statements.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Set Theory and related topics : Seymour Lipschutz, Schaum's Outline Series
2. Set Theory and Number Systems : R. S. Agarwal
3. Discrete Mathematics and Its Applications : Kenneth H. Rosen
4. Discrete Mathematical Structures : Koleman & Busby

1.2 MAT 1121 : Geometry of Two Dimensions

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Transformation of coordinates: Coordinate and origin, Different type of coordinates, Rectangular System/Axes, Oblique System/Axes, Relation among/between coordinate system, Rotation of rectangular Axes, Transformation of origin, Removal of first degree terms, Removal of xy (Product of x and y) terms, Theory of invariant, some applications of coordinate transformation.
2. Pair of Straight lines: Equation of pair of straight lines, General equation of second degree and its condition, Equation of bisectors.
3. Circles: Definition of Circle, General equation of circle, Condition of tangency, Pole and polar, Chord of contact, Conjugate points and lines, Common tangents, Equation of chord, Equation of chord in terms of its middle point, some applications.
4. System of Circles: Angle of intersection of two circles, Radial axes and properties of radical axes, Co-axial circles, Point circles, Limiting points and properties of limiting point, some examples.
5. Parabola: Standard equation of parabola, Tangent, Normal, Diameter.
6. Ellipse: Standard Equation, Equation of normal and properties, Condition of tangency, Director circle, Focal distance, Eccentric angle, Conjugate diameters and properties, some applications.
7. Hyperbola: Standard Equation, Equation of tangent and properties, Asymptotes, Rectangular hyperbola, Conjugate diameters and properties, Conjugate hyperbola, some examples.
8. Conic section: The general equation of second degree in x and y, Identification of conics and reduction to standard forms.

Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Analytic Geometry of Conic Sections by J. M. Kar
2. Analytic Geometry of Conic Sections by Askwith H.H.
3. Analytic Coordinate Geometry Loney S. L.
4. Analytic Geometry of Conic Sections by Smith C

1.3 MAT 1131 : Differential Calculus

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Limit, continuity and differentiability, indeterminate forms, L, Hospital,s rule, Basic theorems and computation of limit, continuity and differentiability.
2. Differentiation: Definition of derivative, Rules of Differentiation, Successive differentiations, Leibnitz theorem and applications.
3. Expansions of functions: Rolle's theorem, Mean value theorem, Taylor's and Maclaurin's theorem.
4. Maxima and Minima of functions of one variable: Increasing and decreasing functions, Condition for extreme values of a function, Determination of maxima and minima, inflexion points and applications.
5. Partial differentiations: Partial differentiation, Euler's theorem and application.
6. Tangents and normals, asymptotes.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Differential Calculus by Das and Mukherjee
2. Calculus by Howard Anton
3. Differential Calculus by J. Edwards
4. Calculus by F. Ayres
5. Calculus and analytical Geometry by G. B. Topmas and R. L.
Finny
6. Calculus and analytical Geometry by S.K.Stein and A.Barcellos
7. Advanced Calculus by M. R. Spigel

1.4 PHY 1141 : Mechanics, Properties of Matter, Wave & Sound

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Vector Analysis: Vectors and Scalars, Addition and multiplication of vectors, triple scalar and vector product, derivatives of vectors. Gradient, divergence, and curl their physical significance.
2. Conservation of Energy and Linear Momentum: Conservative and non-conservative forces and systems, conservation of energy and momentum, Center of mass, collision problem.
3. Rotational Motions: Rotational variable, rotation with constant angular acceleration, torque on a particle, angular moment of inertia, combined translational and rotational motion of rigid body, conservation of angular momentum.
4. Oscillatory Motions: Hook's law and vibration, simple harmonic motion, combination of harmonic motions, damped harmonic motion, forced oscillation and resonance.
5. Gravitation: Center of gravity of extended bodies, gravitational field and potential their calculations, determination of gravitational constant and gravity, compound and Kater's pendulum, motion of planets and satellites, escape velocity.
6. Surface Tension: Surface tension as a molecular phenomenon, surface tension and surface energy, capillary rise or fall of liquids, pressure on a curved membrane due to surface tension, determination of surface tension of water, mercury and soap solution, effect of temperature.
7. Elasticity: (a) Moduli of elasticity, Poisson's rations, relations between elastic constants and their determination, cantilever, flat spiral spring. (b) Fluid Dynamics: Viscosity and coefficient of viscosity Poiseuille's equation, determination of the coefficient of viscosity of liquid by Stock's method, Bernoulli's theorem and its applications, Torrcelli's theorem, venturimeter.

8. Wave in Elastic Media: Mechanical waves, types of waves, Superposition principle, wave velocity, power and intensity in wave motion, interference of waves, complex waves, Standing waves and resonance. Sound Waves: Audible, Ultrasonic, and infrasonic, waves, propagation and speed of longitudinal waves, vibrating systems and source of sound, beats, Doppler Elects.

Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.

Seven questions of equal value will be set, of which five are to be answered.

Recommended Books:

1. Halliday and Resnick : Physics (1 and 2)
2. Bandopadhya and Ghose : Padartha Bidya (Bengali)
3. Emran, et. al. : General Properties of Matter
4. Ahmed and Nath : Mechanics properties of Matter
5. Emran : Text Book of Sound
6. Saha : Text Book of Sound
9. Williamson : Integral Calculus

1.5 STA 1151 : Principles of Statistics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:

1. Statistics: History, Definition, Scope and Classification of Statistics, its Relation With Mathematics, Limitations, Uses, Misuses of Statistics.
2. Processing of Data: Variables and Attributes, Types of Variables, Population and sample, Different Scales: Nominal, Ordinal, interval, Ratio, Sources of Data, Classification and Tabulation of Data, Frequency Distribution, Graphical Representation of Data, Stem and Leaf Display, dot Plot.
3. Measures of Central Tendency: Mean, Median, Mode, Quartile, Decile, Percentile with their properties and Application of Measures of Central Tendency.
4. Measures of Dispersion: Absolute and Relative Measures of Variability, Application of Different Measures of Dispersion.
5. Moments and Shapes Characteristics of Distribution: Moments, Sheppard's Corrections for Grouping Error, Skewness and Kurtosis, Box-Plot.
6. Simple Correlation and regression: Bivariate Data, Scatter Diagram, Simple Correlation, Correlation ratio, Rank Correlation, Simple Linear Regression Analysis.
7. Index Number: Basic concepts, Problem of Index Number, Different types of Indexes, Errors in Index numbers, Different formulae, Tests of Index Numbers, Cost of Living Index.
8. Time Series: Meaning of Time Series, Component of Time Series, Secular Trend, Cyclical Variation, Seasonal Variation, Irregular Variation.
9. Hypothesis: Basic Concept of Hypothesis, Type I and Type II Error, Level of Significance, P- value, Power of the Test.

Recommended Books:

1. Yule and Kendal : An Introduction to the theory of Statistics
2. Lind, A. D., Marchal, W. and Wathen : Statistical Techniques in Business and Economics
3. Bhuyan, K.C : Methods of Statistics

1.6 ENG 1161 : Functional English

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Grammar: Parts of Speech, sentence, appropriate preposition, tense, use of voice, phrase & clause, conditional sentences, infinitive, participle & gerunds, correction of sentence.
2. Developing vocabulary: suffixes, prefixes, synonyms and antonyms, conversion of words.
3. Situational writing: Posters, notices, slogans, memos, advertisements, press releases, report writing, resume/curriculum vitae, paragraph writing.
4. Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, extempore speech.
5. Translation: Translation from Bengali to English and English to Bengali.
6. Scientific writing for experiments and projects: Distinctive features of scientific writing (figures, tables, equations, captions numbering, title and section headings), professional research reporting.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Swales, J : Writing Scientific English
2. Hornby, As :The Teaching of Structural Words and Sentence Patterns (stages 1&2), (stages)
3. Ahmed, S : Learning English Grammar
4. Thomson, AJ and Martinet, AV : A Practical English Grammar

1.7 CSE 1172 : Computer Fundamentals Lab

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Syllabus:
1. Computer system Hardware and Software 2. Microsoft Office Word. 3. Microsoft Office Excel. 4. Microsoft Office Access. 5. Microsoft Office Power Point. 6. Latex 7. Photoshop illustrators.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. E Balaguruswami : Computer Fundamentals

2 1st year 2nd semester

2.1 MAT 1211 : Algebra and Trigonometry

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Inequalities: Weierstrass's Cauchy's and Chebyshev's inequalities, Arithmetic, Geometric and Harmonic means 2. Difference equations, Summation of series. 3. Theory of equations: Fundamental theorem of algebra, Relation between roots and coefficients. Descarte's rule of signs. 4. Solutions of cubic and biquadratic equations. 5. Complex number, De-Moivre's theorem and its applications. 6. Functions of complex arguments, Gragory's series. 7. Summation of trigonometric series. 8. Hyperbolic functions.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1 Bernard and Child : Higher Algebra
2 Barnside and Panton : Theory of equations
3 Hall and Knight : Higher Algebra
4 Das and Mukherjee : Higher Trigonometry
5 S.A. Sattar : Higher Trigonometry

2.2 MAT 1221 : Geometry of Three Dimension

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Direction-cosines and direction-ratios: Definition, Direction-cosines of a line joining two points, The angle between two directed lines, Projection of the joining of two points on a line.
2. The plane: Definition, Derivation of the general equation of a plane, Different forms of the equation of plane, Angle between two planes, Bisecting planes, Combined equation of two planes, Projection on a plane.
3. Straight lines: Definition, The equation of a line, Symmetrical form of equations, Condition for a line to lie in a plane, Plane through a given line, Foot of perpendicular from a point to a line, Projection of a line on a plane, Coplanar lines, Line intersecting two given lines, Distance of a point from a line, Intersection of three planes.
4. Shortest distance: Definition, The derivation of shortest distance between two given lines and also the equation of shortest distance, The coplanar condition and related problems.
5. Sphere: Definition, various forms of the equation of a sphere, Plane section of a sphere, Tangents plane of a sphere, Polar plane, Orthogonal intersection of two spheres, Radical plane and Coaxial spheres.
6. Cone and cylinder: Definition, The general equation of cone, Condition of tangency, Cone with vertex at origin, Tangent plane, Angle between the lines of sections, Three mutually perpendicular generators.
7. The general equation of second degree: Centre of the surface, Discriminating cubic, Nature of the conicoid, Elliptic or hyperbolic paraboloid, Elliptic or hyperbolic cylinder, Pair of planes, Ellipsoid, hyperboloid or paraboloid of revolution, Parabolic cylinder or pair of parallel planes.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Bell, J. T : A Treatise on Three dimensional Geometry
2. Loney S. L. : Analytic Coordinate Geometry
3. Smith, C : An Elementary Trealises on Solid Geometry
4. B. D. Sharma : Solid Geometry 5. M. L. Khanna : Solid Geometry

2.3 MAT 1231 : Integral Calculus

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Indefinite integrals: Definition and fundamental properties, Standard form of integration.
2. Techniques of integration: Method of substitutions, Integration by parts, Special trigonometric functions and rational fractions.
3. Fundamental theorem of calculus. Basic properties of integration. Reduction formulae, Integration by reduction.
4. Definite integrals: Definition, General Properties of definite integrals, Evaluations of definite integrals, Summation of series by definite integral.
5. Application of integration: Plane areas, Solids of revolution. Volumes by cylindrical shells. Volumes by cross-sections. Arc length and surface of revolution.
5. Infinite or Improper Integrals and Integration of Infinite Series, Gamma and Beta functions.
6. Graphing in polar coordinates coordinates. Tangents to polar curves. Area and arc length in polar coordinates.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Das and Mukherjee : Integral Calculus 2. Howard Anton : Calculus 3. F. Ayres : Calculus
4. G. B. Topmas and R. L. Finny : Calculus and analytical Geometry
5. S.K.Stein and A.Barcellos : Calculus and analytical Geometry 6. M. R. Spigel : Advanced Calculus
7. Williamson : Integral Calculus

2.4 GED 1241 : Bangladesh Studies

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:

1. Geography and Demographic features of Bangladesh:

(a) Geography of Bangladesh: Origin of the name of Bangladesh, Geographical location and area, river, weather, culture, Flora and Fauna.

(b) Demographic features: Ethnic and cultural diversity; society, religions and believes, arts, literature and culture of Bangladesh

2.The Liberation War of Bangladesh and its Background: Participation of Indian subcontinent, Two nation theory, Language Movement 1952, 1954 Election, Education movement 1962,Six-Point Movement, 1966, Mass Upsurge 1968-69, General Elections 1970, Non-cooperation Movement, 1971, Bangabandhu's Historic Speech of 7th March and declaration of independence of Bangladesh. Formation and Functions of Mujibnagar government, Role of Major Powers and of the UN, Surrender of Pakistani Army, Bangabandhu?s return to liberated Bangladesh. Withdrawal of Indian armed forces from Bangladesh.

3. Economy of Bangladesh: Economy with particular emphasis on developments including Poverty Alleviation, GNP, NNP, GDP, SDG, etc. after the emergence of the country.

4. Environment, Nature and Natural resources:

(a) Bangladesh?s environment and nature and challenges and prospects with particular emphasis on conservation, preservation and sustainability.

(b) Natural resources of Bangladesh with focus on their sustainable harnessing and management.

5. The Constitution of the People's Republic of Bangladesh: Preamble, Features, Directive Principles of State Policy, Constitutional Amendments.

6. Forms of Government and its Organ: Types of government, government from liberation war to recent time.

(a) **Legislature:** Representation, Law-making, Financial and Oversight functions; Rules of Procedure, Gender Issues, Caucuses, Parliament Secretariat.

(b) **Executive:** Chief and Real executive e.g., President and Prime Minister, Powers and Functions; Cabinet, Council of Ministers, Rules of Business, Bureaucracy, Secretariat, Law enforcing agencies; Administrative setup-National and Local Government structures, Decentralization Programmes and Local Level Planning.

(c) **Judiciary:** Structure: Supreme, High and other Subordinate Courts, Organization, Powers and functions of the Supreme Court, Appointment, Tenure and Removal of Judges, Organization of Sub-ordinate Courts, Separation of Judiciary from the Executive, Judicial Review, Adjudication, Gram Adalat, Alternative Dispute Resolution (ADR).

7. Foreign Policy and External Relations of Bangladesh: Goals, Determinants and policy formulation process; Factors of National Power; Security Strategies; Geo-Politics and Environment Issues; Economic Diplomacy; Man-power exploitation, Participation in International Organizations; UNO and UN Peace Keeping Missions, NAM, SAARC, OIC, BIMSTEC, D-8 etc, and International Economic Institutions, Foreign Aid, International Trade.

8. Political Parties of Bangladesh: Historical development; Leadership; Social Bases; Structure; Ideology and Programmes; Factionalism; Politics of Alliances; Inter and Intra-Party Relations; Electoral Behaviour; Parties in Government and Opposition.

9. Trade, Globalization and Bangladesh: Economic and Political Dimensions; Roles of the WTO, World Bank, IMF, ADB, IDB and other development partners and Multi-National Corporations (MNCs).

Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.

Seven questions of equal value will be set, of which five are to be answered.

Recommended Books:

1. A History of Bangladesh- William Van Schendel, Cambridge University Press 2009
2. History of Bangladesh (1704-1971), Vol-1, Sirajul Islam (Edited), Asiatic Society of Bangladesh.
3. Social History of the Muslims of Bengal (English & Bangla Version)-Abdul Karim
4. Bangladesh National Culture and Heritage- A F Salahuddin Ahmed, BazlulMobinChowdhury (Edited), An Introductory Reader, Independent University Bangladesh.
5. Social & Cultural History of Bengal, Vol-2 (English & Bangla Version)- M.A. Rahim
6. History of Ancient Bengal (In Bangla)- Ramesh Chandra Majumdar.
7. Rise and Decline of the Economy of Bengal- SalauddinAhamed.
8. Social History of Bangladesh, Vol. 3- Sirajul Islam.
9. A Brief History of Bangladesh With Essays on Bangladesh Studies by Dr. S M A Mamun Chowdhury
10. A.M.A Muhit, Bangladesh Emargence of Nation
11. Talukdar Muniruzzaman ?The Politics of development; The case of Pakistan

12. Harun-or-Rashid, The Foreshadowing of Bangladesh; Bengal Muslim League and Muslim Politic, 1906-1947, The University Press Ltd. Dhaka-2012
13. Rounak Jahan, Pakistan; Failure in National Integration, The University Press Ltd. Dhaka-1977
14. Talukder Manurizzaman, Radical Politics and Emergence of Bangladesh, Mowla, Brotheres Dhaka-2003.

2.5 STA 1251 : Probability and Probability Distribution

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Basic Concept of Probability: Sample Space, Event, Event Space and Different Types of Events, Classical, Empirical, Geometric, Relative Frequency and Axiomatic Methodsof Probability, Odds Ratio, Probability Measures and Probability Space, Total Probability, Tree Diagrams and Compound Probability, Conditional Probability, Prior and Posterior Probability, Bayes, Theorem.
2. Random Variable: Probability Space, Concept of Random Variable, Discrete and Continuous Random Variables, Probability Function, Distribution Function, Function of Random Variable and its Distribution, Joint, Marginal and Conditional Distributions, Independence of Random Variables.
3. Expectation: Meaning of Expectation and Conditional Expectation, Mean, Expectation of a Function ofaRandom Variable, Variance, Conditional Mean and Conditional Variance, Moments, Covariance and Correlation Coefficient, Expectation of Sums and Products of Random Variables, Chebyshev's Inequality.
4. Generating Function: Moment Generating Function, Characteristic Function, Probability Generating Function, Cumulant Generating Function and Their Properties, Inversion Theorem, Convolution.
5. Probability Distributions: Bernoulli, Binomial, Poison, Exponential, Uniform, Normal distribution and Bivariate Normal distribution.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Hogg R V & Craig A T : Introduction to Mathematical Statistics
2. Mood, Graybill & Boes : Introduction to the Theory of Statistics
3. Roy, M.K. : Probability and Probability Distribution 4. Mosteller, Rourke & Thomas : Probability with Statistical Applications
5. Ross S M : A first Course in Probability

2.6 CSE 1261 : Structured and Object Oriented Programming

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Basic Knowledge of C++ Language: Rules of Identifiers, Variables and Keywords, C++ Console I/O, C++ Comments.
2. Conditional Statement, Looping.
3. Arrays & Functions.
4. Objects Oriented Programming Concepts: Features of OOP, Classes, Objects, Access Specifiers, Member Function, Constructor, Destructor, Friend Function, Inline Function and Automatic Inline Function.
5. Pointer and References: Using Pointer to Object, This Pointer, Using new and Delete, References, Passing References to Objects, Returning References.
6. Polymorphism (Function & Operator Overloading): Overloading Constructor functions, Creating Copy Constructor, Overloading and Ambiguity.
7. Operator Overloading (Binary, Relational, Logical and Unary operators).
8. Inheritance and Virtual Function: Constructor, Destructor and Inheritance, Multiple Inheritance, Pointer to Derive Classes, Applying Polymorphism.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. E Balagurusamy : Object Oriented Programming with C
2. John R Hubbard : Schaum's outline series: Programming with C++
3. Joyce Farrell : Object Oriented Programming using C++
4. Herbert Schildt : Teach yourself C++

2.7 CSE 1262 : Structured and Object Oriented Programming Lab

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Syllabus:
Lab of this course shall be based on programing with Object Oriented Concept (Involving Class, Object, Member Functons, etc).
1. Determination the value of any functions in the form of $y = f(x), y = f(x_1, x_2, \ldots x_n)$. Solution of quadratic equation using if else statement, switch statement.
2. Area and perimeter of circle, triangle, quadrangle. Surface area and volume of sphare, cone, cube, prisom, etc.
3. Sum of first n-natural numbers, prime numbers. Sum of some series: $sin(x)$, $cos(x)$, $tan(x)$, $log(x)$, and e^x.
4. Prime numbers, factorial of a number and Fibonacci numbers.
5. One dimensional array: Sorting, searching, highest and lowest values, mean, variance
6. Calculation of interest rate, income tax, annuity, telephone bill, electric bill and grading system.
6. Matrix operations addition, subtraction, scalar multiplication, matrix multiplication, determinant of a matrix, inverse matrix and eigenvalue.
7. Creation of Class that involves various objects and functions based on mathematical operations.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. E Balagurusamy : Object Oriented Programming with C++
2. John R Hubbard : Schaum's outline series: Programming with C++
3. Joyce Farrell : Object Oriented Programming using C++
4. Herbert Schildt : Teach yourself C++

3 2nd year 1st semester

3.1 MAT 2111 : Matrix and Linear Algebra

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
Matrix Algebra:
1. Matrices: Definition, Different types and kinds of matrices, properties. 2. Adjoint, inverse, block matrix, properties. The theory and properties of determinants, higher order determinants, solution of systems of equations by determinant. 3. Elementary transformation, ranks of a matrix, echelon, canonical and normal forms, ranks of a matrix, matrix decomposition, diagonalization, generalized inverse. 4. System of linear equations, solution of homogenous and non-homogenous system by Matrix method and reduction to equivalent system. 5. Eigen values, Eigen vectors, Cayley-Hamilton theorem and its application. 6. Bilinear and Hermitian forms. Quadratic forms, Definite and semi-definite forms of Matrices.
Linear Algebra: 1. Vector Space and Sub Space. 2. Linear Combination, Linear dependence and independence. 3. Generators, Basis and Dimension. 4. Linear transformation. 5. Matrix representation of a linear operator. Change of basis, Similarity, Matrices and Linear mappings. 6. Eigen values and Eigen vectors. 7. Cayley-Hamilton Theorem. 8. Linear functional and Dual vector spaces, Annihilators. 9. Inner Product Spaces. 10. Orthogonalizations.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Lipschutz, S : Linear Algebra
2. Hamilton, A.G. : Linear Algebra
3. Hardly, G. : Linear Algebra
4. Anton, H. & Rorres, C. : Elementary Linear Algebra
5. M. L. Khanna : Matrices
6. F. Ayres : Theory of Matrices
7. C. C. Mcduffe : Theory of Matrices

3.2 MAT 2121: Advanced Calculus

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Functions of several variables: Partial differentiation, total differentiation, differentials, Euler's theorem of homogeneous function, Taylor's series for functions of several variables, Jacobians, Heissen matrix. 2. Maxima and Minima of functions of several variables and applications. 3. Curvature of plane curves, Concave and convex curves, Node, cusp, conjugate points, the point of inflexion. 4. Curve tracing. 5. Definite integration: Integration under the sign of differentiation and integration, Improper integrals, Theorem of Frullani, Applications of definite integrals. 6. Multiple integrals: Double integration, triple integration, Diritchlet's Theorem, Change of order of integration, 7. Determinations of arc lengths, areas and volume using multiple integral.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. M. R. Spiegel : Advanced Calculus
2. Williamson : Integral Calculus
3. Edwards J. : Differential Calculus
4. Wider : Advanced Calculus

3.3 MAT 2131 : Ordinary Differential Equations

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Origin of differential equations, Classification of differential equations and solution, construction of differential equations. Initial value problems, Boundary value problems, Basic existence and uniqueness theorems (statement & applications only). 2. First order equations for which exact solutions are obtainable, Separable equations and equations reducible to this form, Exact equations and integrating factors, Special integrating factors and transformations. 3. Trajectories, Linear equation, Bernoulli's equation. 4. Higher order linear homogeneous equation with constant coefficients, Reduction of order, Basic theorems, application of second order linear differential equation. 5. Linear nonhomogeneous equation with constant coefficient's, Method of undetermined coefficients, operator method and method of variations of parameters. 6. Linear equation with variable coefficients: Cauchy-Euler equation, Legendre equation, Operational factoring, exact equation. 7. Series solutions of linear differential equations, Taylor series method, Frobenius method. 8. Systems of linear differential equations, Method of elimination, Euler's method, matrix method, Elimination method.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Robert L. Borrelli and Courtney S. Coleman : Differential equations: A Modeling Perspective
2. S. L. Ross : Differential Equations 3. G. F. Simmors : Differential Equations 4. Frank Ayres : Differential Equations
5. B. D. Sharma : Differential Equations 6. M. A. Ansary : Ordinary Differential Equations
7. H. T. Piaggio : Differential equations and their applications

3.4 PHY 2141 : Heat,Thermodynamics and Optics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Thermometry: Gas thermometers and their corrections, measurement of low and high temperatures, Platinum resistance thermometer thermocouple. 2. Kinetic Theory of gases: Kinetic theory of gas, Deduction of Boyle's, Charle's and Avogardo's Laws, determination of gas constants, mean force path. 3. Equation of states for gases: Equation of state for a perfect gas its experimental study, vander waal's equation deduction: physical significance of 'a' and 'b' defects. 4. Liquefaction of gases: Different methods of liquefaction of air nitrogen, refrigeration. 5. Thermal conduction: Thermal conductivity, Fourier's equations of heat flow thermal conductivities of good and bad conductors. 6. Radiation: Radiation pressure, Kirchhoffs law Black body radiation, Stefan Boltzmann's wein's law Rayleigh jean's law, Planck's Quantum law. 7. First law of Thermodynamics: Internal energy, work done by expanding fluid, Specific heats of perfect gases, Ratio of Cp to Cv, Isothermal and adiabatic expansions. 8. Second law of Thermodynamics and entropy: Reversible and irreversible processes, carnot cycle, efficiency of heat engines, absolute scale of temperature Clausius and Claperon's theorem, Change of entropy in reversible and irreversible processes. Thermodynamics Potentials at constant volume and pressure, Maxwell's thermodynamics relations, specific heat equation, joule Thomson effect, production of low temperature. 9. Geometrical Optics: Fermat's principle, theory of equivalent lenses; Defect of images, Optical instruments, Dispersion, Rainbow. 10. Nature and propagation light: Properties of light, wave theory and Huygen's principles, theories of light. 11. Interference: Young's experiment, Biprism, Colour of thin film, Newton's ring, Michelson and Fabry-peret interferometers.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Bhuiyan and Rahman : Text Book of Heat, Thermodynamics and Radiation
2. Halliday and Resniek : Physics (I and II)
3. Saha and Srivastava : A treatise on Heat
4. Leo and Sears : Thermodynamics
5. Zemansky : Heat and Thermodynamics
6. T. Hossain : Text Book of Heat

7. Haque : Text Book of Heat Thermodynamics and Radiation
8. Din : Text Book of Optics
9. Mathur : Principles of optics
10. Mazumder : Text Book of Light
11. Sears : Optics

3.5 ECO 2151 : Principles of Economics

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Introduction to Economics: Definition of economices, The Scope of Economics, Why Study Economics, Microeconomics vs. Macroeconomics, The Diverse Fields of Economics, Descriptive Economics and Economic Theory, Theories and Models, Economic Policy, The Economic Problem: Scarcity and Choice.
2. Utility Analysis and Indifference Curve Analysis: Meaning of Utility, Types and Function of Utility, Consumer?s Surplus, Indifference Curve and Maps,Budget Constraints Utility Maximization.
3. Demand, Supply and Market Equilibrium: : Concepts of Demand, Law of Demand, Determinants of Demand,Shedules, Shedules Demand Curve, Supply, The Law of Supply, Determinants of Supply, Demand and Supply Applications, Elasticity, Market Equilibrium.
4. Market Structure and Revenue: Meaning of Market,Conditions,Classification, Concepts of Tatal, Average and Marginal Revenue, Relation bewteen AR and MR Curves, Relation bewteen Different Revenue. 5. Measuring National Output and National Income: Gross Domestic Product (GDP), Calculating GDP, Nominal versus Real GDP, Limitations of the GDP Concept, GDP Deflator, GDP Growth Rate, GNP, NNP, NI, PI.
6. Money , Monetory System and Banking System: Barter System, Problems of Barter System, Defination of Money, Functions of Money, Importance of Money,Value of Money,Monetory System,Classification of Monetory System, Bank,Banking, Banker, Classification of bank,Central Bank. CLR, SLR, Repo, Reversrepo.
7. Fiscal Policy and Monetory Policy:Defination of Fiscal policy,Types of Fiscal policies, Objectives of Fiscal policy, Major Instruments of Fiscal policy, Meaning of Monetory Policy, Types of Monetory Policy, Objectives of Monetory Policy, Major Instruments of Monetory Policy, Fiscal Policy vs. Monetory Policy.
8. Budgets and Development Planning in Bangladesh : Conceptsof Budget,Classification,Income and Expenditure of Government,Need for Planning in Bangladesh, Various Five YearsPlans in Bangladesh, Development Strategies in the Five YearsPlans in Bangladesh, Millenium Development Goals, SDG's Goals.
9. International Trade: Defination of trade and International Trade, Free Trade and protection, Arguments for Protection, Arguments against Protection, Form of Protection, Balance Trade, Balance of Payment,Difference between Balance Trade and Balance of Payment, Foreign Aid, Why do Donors Give Aid, Foreign Trade vs. Aid.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. A. O. Petters and X. Dong : An Introduction to Mathematical Finance with Applications
2. Paul A. Samuelson & William D. Nordhaus : Economics 3. N Gregory Mankiew : Macroeconomics

3.6 ENG 2161 : Analytical writing and verbal reasioning

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
Vocabulary: GRE high frequency 1000 vocabulary.
Verbal Reasoning: Verbal Reasoning for identifying relationships or patterns within sentences or group of words. **Grammar:** Grammar-based questions test the candidate's capability to mark and correct grammatical errors. Grammar includes areas like use of articles, prepositions use of modifiers, subject-verb agreement, parallel construction, phrasal verbs, redundancy, Reading Comprehension, Sentence Equivalence, Text Completion.
Analytical writing: Logical writing, Critical writing, Illustrate information, writing on contemporary issues includes political, environment pollution, economic issues, scientific issues, etc.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Michal A. Pyle : TOFEL PREPARATION GUIDE
2. Barron's Publications : Barron's GRE

3.7 MAT 2172 : Mathematics Lab Using Matlab

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Syllabus:
1. Roots of Algebraic and Transcendental equations using graphs. 2. Two dimensional graphs: Lines, circle, parabola, ellipse and hyperbola. 3. Find maxima and minima. 4. Integration, arc length, area. 5. Solution of the system of linear equations. 6. Find out the determinant, addition, subtraction, multiplication, inverse, eigen values and eigenvectors etc of a square matrix.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course= 50 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Rudrapratap : MATLAB 7
2. Amos Gilat : MATLAB- An Introduction with Applications
3. Hahn, B. D. & Valentine, D.T : Essential MATLAB for Engineers and Scientists
Sergey E. Lyshevski : Engineering and Scientific computing using MATLAB

4 2nd year 2nd semester

4.1 MAT 2211 : Vector Calculus

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Vector: Vector and Scalar, Dot product, Cross product, Box product, Vector triple product and their applications. 2. Vector differentiation: Vector differential operators, gradient, divergence and curl. 3. Vector integration: Line integration, Surface integration, Volume integration, Green's theorem, Gauss's divergence theorem, Stoke's theorem and their applications. 4. Curvilinear co-ordinates
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. M. R. Spiegel : Vector and Tensor Analysis
2. D. C. Agarwal :Tensor Calculus & Riemannian Geometry
3. M.A. Sattar : Vector Analysis
4. C. Weatherburn : An Introduction to Riemannian Geometry and Tensor Analysis

4.2 MAT 2221 : Tensor Analysis

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Tensor and Co-ordinate transformations. Covariant and contravariant vectors, Mixed & invariant tensors, Addition, subtraction and multiplication of tensors, contraction, symmetric and skew- symmetric tensors, Quotient Law. 2. Line element and metric tensor. Conjugate and associated tensors. Christoffel's symbols and their transformation laws, Geodesics and Parallelism. 3. Covariant derivative of a tensor, Intrinsic derivative, Tensor form of gradient, divergence and curl. 4. Riemann Christoffel tensor, Curvature tensor, Ricci tensor, Bianchi identity, Flat space, Einstein space and Applications of tensor.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. B. Spain :Tensor Calculus
2. M. R. Spiegel : Vector and Tensor Analysis
3. D. C. Agarwal :Tensor Calculus & Riemannian Geometry
4. Synge & Schild :Tensor Calculus
5. M. A. Ansary : Tensor
6. C. Weatherburn : An Introduction to Riemannian Geometry and Tensor Analysis

4.3 MAT 2231: Real Analysis-I

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Real Number system: Notion of set, rational and irrational number, ordered set, field, ordered field, least upper bound and greatest lower-bound, least upper bound property. The existence theorem and its proof. Dedekind cut and Dedekind theorem. Dedekind theory equivalence to least upper bound property and its applications. 2. Basic Topology: Finite and infinite sets, equivalence of sets, countable sets, uncountable sets, metric space, open and closed sets, perfect sets. 3. Numerical sequence: Sequence, Subsequence, Bounded sequence, convergent sequence, Cauchy sequence, completeness of R. 4. Series: Convergent series, Cauchy's criteria for convergent series, comparison test, Cauchy's root test, Cauchy's condensation test, Ratio test, Integral test, Raabe's test, Leibnitz test. 5. Continuity: Continuous function and compactness, uniform continuity, discontinuities. 6. Differentiation: Derivative of function, Rolle's theorem, Darboux theorem, Mean value theorem, Generalized-Mean value theorem, Taylor's theorem. 7. The Riemann Stieltjes integration: Definition and existence of the integrals, properties of the integrals, Integration and differentiations.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Nisha Rani : Real Analysis
2. W. Rudin : Principles of Mathematical Analysis
3. M.H. Proter & C.B. Morey : Modern Mathematical Analysis
4. Bortle : Real Analysis
5. Royden : Mathematical Analysis
6. Apostal : Mathematical Analysis

4.4 PHY 2241: Electromagnetism, and Modern Physics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Electrostatistics: Electric dipole, electric field due to a dipole, dipole on external electric field, Gauss's law and its applications. 2. Capacitor: parallel plate capacitors with dielectrics, dielectric constant; energy stored in an electric field. 3. Electric Current: Electron theory of conductivity: conductor, semiconductors and insulators, superconductors, current and current density, current and current density, Kirchhoffs Law and its applications. 4. Magnetism: Magnetic dipole, mutual potential energy of two small magnets: magnetic shell, energy in a magnetic field, magnetometers. 5. Electromagnetic Induction: Faraday's experiment; Faraday's law Ampere's law, motional e.m.f. self and mutual inductance; galvanomenters-moving cell ballistic and deadbeat types. 6. Atomic Physics: Motion of electronics under electric and magnetic fields, Measurement of e/m and 'e' positive sign, thermionic emission, photoelectric emission, Bohr's atom model, Atomic spectra, X-rays, Matter waves. 7. Nature physics: Basic concept and properties of the nucleus, Nuclear size, Binding energy, Radioactivity, Elementary knowledge of fission, Fusion and reactors cosmic rays. 8. Electronics: Vacuum diodes and triodes, P-type and n-types, semi-conductors, P-n junctions, Transistor biasing, Transistor amplifiers, Transmitters and receivers.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Halliday and Resnic : Physics (I and II)
2. Acharyya : Electricity and Magnetism
3. Adans and page : Principles of Electricity
4. Bandopadhyys : Padarthavidya(Bengali). Constant & GhoseTheoretical Physics
5. Din : Electricity and Magnetism
6. Emran, et al : Text Book of Magnetism, ricity and Modern Physics
7. Bandopadhya & Ghose : Padarlhavidya (Bengali)
8. Hossain T : Text Book of Heat
9. Haque : Text Book of Heat Thermodynamics and Radiation
10. V. K. Mehta : Principles of Electronics
11. Beiser : Concepts of Modern Physics
12. N. Suabrahmanyam and Brijlal : Atomic and Nuclear Physics

4.5 PHY 2242 : Physics Lab

Contact Hr/Week: 2.0 **(Credit : 1.0)**

Syllabus:
Lab Course study shall be bsed on theory. **Evaluation:** Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.

4.6 STA 2251: Mathematical Statistics

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
Sample Surveys: Basic Concepts of Sample Surveys, Preparation of questionnaire, Schedules, Instruction etc, Survey enumeration, Pilot survey, Requirement of a good sample design, Probability and non- probability sampling, Sampling with and without replacement and with equal and unequal probabilities, Sampling and non sampling errors, Bias, Accuracy and Precision. Probability Sampling: Basic concept of Probability Sampling, Simple Random Sampling, Stratified Random Sampling, Systematic Random Sampling, Cluster Sampling. Non-Probability Sampling: Basic concept of Non-Probability Sampling, Different types of Non-Probability Sampling. Estimation: Concept of Estimation, Point estimation. Characteristic of a good point estimator, methods of point estimation. Concept of interval estimation. Methods of interval estimation. Interval estimation of mean and variance of normal distribution. Test Statistic: Detail Study of χ^2, t & F Distributions, Test of significance in small and large samples. Comparison of means, proportions and variance. Test of homogeneity of variances, Test for $r \times c$ contingency tables.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Hoel P G : Introduction to Mathematical Statistics
2. Hogg and Craig : Introduction to Mathematical Statistics
3. Mood, Graybill and Boes : Introduction to the Theory of Statistics
4. Mostafa M G : Methods of Statistics

4.7 STA 2252 : Statistical package Lab (R/SAS/STATA/Eviews)

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Lab course study shall be based on theory course of STA 2251: Mathematical Statistics.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course= 50 marks.
Seven questions of equal value will be set, of which five are to be answered.

4.8 ACT 2261: Principles of Accounting

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
Introduction: Definition of Accounting and Its Functions-Users of Accounting Data-The Work of an Accountant-Ethics in Financial Reporting-Generally Accepted Accounting Principles (GAAP)- Understanding of Accounting Principles: Accounting Concepts, Assumptions and Conventions- The Basic Accounting Equation/Balance Sheet Equation-Financial Transactions and their Effect on Accounting Equation -Understanding of Different Financial Statements and Summary of the Accounting Cycle. 2. The Recording Process: The Account-Mechanics of Double-Entry Accounting-Transactions Illustrating the Rules of Debit and Credit-The Account and the Equation-Steps in the Recording Process-Meaning of Journal-Various Kinds of Journal-Journalizing Business Transactions- Meaning of Ledger, Importance of Ledger, Posting Mechanism, Accounts and their Balances- Definition of Trial Balance,Trial Balance and Accounting Accuracy-Preparation of Trial Balance. 3. Adjusting the Accounts and Preparing the Statements: Need for Adjustments at the End of Accounting Period-Accrual Vs. Cash-Basis Accounting-Recognizing Revenues and Expenses- Types of Adjusting Entries-Adjusting the Accounts-The Adjusted Trial Balance-Preparing Statements from the Adjusted Trial Balance-The Adjustment Process-Cash Flow Statement-The Classified Balance Sheet/Classification of Balance Sheet Items- Owner's Equity on the Balance Sheet. 4. Completing the Accounting Cycle: Definition of Worksheet-Steps in Preparing Worksheet- Preparing Financial Statements from Worksheet-Preparing Adjusting Entries from a Worksheet- Preparing Closing Entries-Posting Closing Entries-Preparing Post-Closing Trial Balance. 5. Accounting for Merchandising Operations: Merchandising Operations-Recording Purchases of Merchandise-Recording Sales of Merchandise-Completing the Accounting Cycle-Forms of Financial Statements: Multiple-Step and Single-Step Income Statements and Classified Balance Sheet-Determining Cost of Goods Sold Under a Periodic System-Periodic Inventory System- Classifying Inventories- Determining Inventory Quantities-Inventory Costing-Inventory Errors- Estimating Inventories-Worksheet for Merchandising Company. 6. Accounting Information Systems: Basic Concepts of Accounting Information Systems- Computerized Accounting Systems Vs. Manual Accounting Systems. 7. Accounting for Receivables: Types of Receivables-Accounts Receivables-Notes Receivables- Statement Presentation and Analysis. 8. Accounting for Plant Assets, Natural Resources, and Intangible Assets: Determining the Cost of Plant Assets-Depreciation-Depreciation Methods-Expenditures for Useful Life-Plant Assets Disposals-Exchange of Plant Assets-Natural Resources-Accounting for Intangible Assets. 9. Accounting for Current Liabilities and Payroll Accounting: Accounting for Current Liabilities- Contingent Liabilities-Payroll Accounting.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Weygandt & Kieso, Accounting Principles, (Latest edition), Wiley Publishing.
2. William W. Pyle and Kermit D. Larson, Fundamental Accounting Principles (10/e). Richard D. IRWIN. ICC. ILLINOIS.
3. Khan, Md. Muinuddin,Advanced Accounting, Vol. I, Ideal Library, Dhaka.
4. J.M. Smith Jr. and K.F. Skousen., Intermediate Accounting (Comprehensive Volume).
5. Wild, Larson, Chiappetta, Financial and Managerial Accounting, (Latest edition).
6. R.H Hermanson, J. D. Edwards and L.G. Rayburn, Financial Accounting, (Latest edition), Business Publication.Inc. Dallas.
7. R.H Hermanson, J. D. Edwards and L.G. Rayburn, Financial Accounting, (Latest edition), Business Publication.Inc. Dallas.

5 3rd year 1stsemester

5.1 MAT 3111 : Real Analysis-II

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Topology and Real numbers: Neighborhood at a point, open and closed sets, limit point, cluster points, closure, interior and boundary points. 2. Compact Sets: Compact sets, locally compact sets, K cell, and related theorems, perfect set, Continuity and compactness. 3. Connected Sets: Connected sets, locally connected sets, path wise connected sets and related theorems, Cantor set, continuity and connected sets 4. Metric Space: Definition, Metric space, norm, norm space, Euclidean norm, Cauchy Schwarz inequality, and MinKowski,s inequality. 5. Sequences and Series of Functions: Discussion about their properties and problems, Uniform convergence, Uniform convergence and continuity, Uniform convergence and Integration, Uniform convergence and Differentiation, The Stone-Weierstrass Theorem. 6. Functions of Several Variables: Limit and continuity of two variables, Differentiation, Partial differentiation, Schwarz's theorem & Young's theorem. 7. Linear Transformation, Differentials, The Inverse Function theorem, The Implicit Function theorem, The Rank theorem, Jacobian, The Contraction mapping theorem.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Rudin, W. : Principles of Mathematical Analysis
2. Royden : Mathematical Analysis
3. Apostol : Mathematical Analysis
4. Spiegel, M.R. : Real Variables

5.2 MAT 3121: Complex Analysis

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Complex number system: Complex number, polar form of complex number, complex plane, point sets. 2. Complex Function: Single and many valued function, Singularities, Riemann Surfaces, Limits and continuity. 3. Analytic functions: Derivation, Cauchy Riemann equations, orthogonal families of curves, harmonic function. 4. Complex integration: Cauchy's theorem, some consequences of Cauchy's theorem and applications. 5. Complex integration and related theorem: Cauchy,s integral formulae, maximum modulus theorem, Fundamental theorem of algebra, Rouche's theorem, Argument principle. 6. Infinite series: Series of function, power series, Taylor's theorem, Laurent's theorem, analytic continuation. 7. Calculation of Residues: Residues, Residue theorem, Evaluation of Definite integrals. 8. Conformal mapping: Some general transformations, linear transformation, Bilinear Transformations, Applications of the conformal mapping.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. B. S. Taygi : Complex Variable
2. M. R. Spiegel : Complex Variable
3. J. B. Conway : Functions of complex variables
4. L. V. : Complex Analysis
5. D. Sarason : Notes on complex function theory
6. M. L. Khanna : Complex Analysis

5.3 MAT 3131 : Mechanics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Statics: Equilibrium of coplanar forces, A static equilibrium, Stable and unstable equilibrium, General conditions of equilibrium forces. 2. Work, Virtual work. 3. Equilibrium of a string and chains: The common catenary, General conditions of equilibrium of string, Catenary of a uniform strength, String under central forces. 4. Centre of gravity: (i) Centre of gravity of an arc (ii) Centre of gravity of a plane area (iii) Centre of gravity of a solid and surface of revolution (iv) Centre of gravity of any volume. 5. Motion in a straight line, Simple harmonic motion. 6. Motion in a plane referred to a Cartesian and polar co-ordinates, Central forces, Radial and transverse velocities and accelerations, Apses and apsidal distances. 7. Motion in three dimensions, Accelerations in terms of polar and Cartesian co-ordinates. 8. Dynamics of a rigid body: a) Moments and products of inertia: The momental Ellipsoid, Equi-momental systems, principal axes. b) D' Alembert's Principle: The general equations of motion, Independence of the motions of translation and rotation, Empulsive force. 9. Generalized coordinates: Holonomic and non-holonomic systems. Lagrange's equation for holonomic and non-holonomic dynamical systems. 10. Elementary Principles: Mechanics of a particle and system of particles, constraints, D-Alembert's principle and Lagrange's equation. Simple applications of Lagrange's equation.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. S. L. Loney : An Elementary treatise on the dynamic of a particle and of Rigid Bodies
2. S. L. Loney : An Elementary treatise on statics 3. A. S. Ramsey : Dynamics 4. P. P. Gupta : Statics
5. G. S. Malik : Dynamics

5.4 MAT 3141 : Partial Differential Equations

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Formation of PDFs and First order linear PDEs. 2. Total Differential Equations: Integrability condition, Solution method for $Pdx+Qdy+Rdz=0$ and $dx/P=dy/Q=dz/R$ 3. First Order quasilinear and non-linear PDEs. 4. Classification of general second order PDEs and canonical forms. 5. Second Order homogeneous and non-homogeneous PDEs. 6. Second Order non-linear PDEs, Parabolic form, Elliptic form, Hyperbolic form. 7. Solutions of Laplace's equations in Cartesian, Cylindrical and Spherical coordinates. Solutions of diffusion (heat flow) equation. Solution of wave equations.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. F. Ayres : Differential Equations 2. B.D. Sharma : Partial Differential Equations
3. I.N. Sneddon : Elements of partial Differential Equations
4. R. Dennemeyer : Introduction to partial Differential Equations
5. T Myint U : Partial Differential Equations

5.5 MAT 3151 : Mathematical Methods-I

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. The Laplace Transform: Definition, existence, and basic properties, Differentiation and integration, Inverse Laplace transform and convolution, Solution of linear differential equations with constant coefficients, and linear systems. 2. Fourier series: Fourier coefficients, sine and cosine series, Diritchlet's theorem, Properties and applications. 3. Fourier transforms: Fourier sine and cosine transforms, Complex Fourier transform, convolution theorem, Applications to boundary value problems, asymptotic expansions. 4. Z-transformation: Definition, expansion, relation between Fourier Series and Z-transformation.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. D. A. Kuddus : Mathematical Methods 2. Jeffreys and Jeffreys : Methods of Mathematical Physics
3. Courant and Hilbert : Methods of Mathematical Physics 4. B.S. Rajput : Mathematical Physics

5. M R Spiezel : Laplace Transforms
6. B.D. Sharma and R.K. Gupta : Mathematical Method 7 M J Lighthill : Asymptotic Expansion
8. L A Pipes : Applied Mathematics for Engg. & Scientist

5.6 CSE 3161: Relational Database Management System (RDBMS)

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
Introduction: Database-System Applications, Purpose of Database Systems, View of Data, Database Languages, Relational Databases, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information, Retrieval, Specialty Databases, Database Users and Administrators. Introduction to the Relational Model: Structure of Relational Databases, Database Schema, Keys, Schema, Diagrams, Relational Query Languages, Relational Operations, Relational Algebra, Tuple Relational Calculus, Domain Relational Calculus. SQL: Overview of the SQL Query, Language, SQL Data Definition, Basic Structure of SQL, Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub-queries, Join Expressions, Transactions, Integrity Constraints, SQL Data Types and Schemas, Authorization, Functions and Procedures, Triggers, Recursive Queries, Advanced Aggregation Features, OLAP. Database Design and the E-R Model: Overview of the Design Process, Entity-Relationship Model, Constraints, Removing Redundant Attributes in Entity Sets, Entity-Relationship Diagrams, Reduction to Relational Schemas, Entity-Relationship Design Issues, Extended E-R Features, Alternative Notations for Modeling, Data, Other Aspects of Database Design. Relational Database Design: Features of Good Relational Designs, Atomic Domains and First Normal Form, Decomposition Using Functional Dependencies, Functional-Dependency Theory, Algorithms for Decomposition, Decomposition Using Multivalued Dependencies, More Normal Forms, Multivalued Dependencies, Domain-Key Normal Form.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. A. Silberschatz : Database System Concepts, McGraw-Hill.
2. James Martin : Principles of Database Management, Prentice-hall Of India Pvt Ltd
3. Ullman : Database Management systems, Prentice-Hall Publication.
4. Abey : Oracle 8i a Beginners Guide, McGraw Hill.

5.7 CSE 3162 : RDBMS Lab (Oracle/ MySQL/SQL Server/and PL SQL)

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Sessional based on CSE 3161 Relational Database Management System (RDBMS)
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. A. Silberschatz : Database System Concepts, McGraw-Hill.
2. James Martin : Principles of Database Management, Prentice-hall Of India Pvt Ltd
3. Ullman : Database Management systems, Prentice-Hall Publication.
4. Abey : Oracle 8i a Beginners Guide, McGraw Hill.

6 3rd year 2nd semester

6.1 MAT 3211 : Mathematical Methods - II

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Bessel's Equations: Solution, Generating function, Recurrence relation, values of Bessel function, Orthogonality, Neuman, and Hankel function, Modified Bessel function. 2. Legendre's Equation: Solution, Generating function, Recurrence relation, Rodrigue's formula and Orghogonality of Legendre polynomials. 3. (a) Hermite's Equation: Solution, Integral and Recurrence formula, Orthogonality, Differential formula. (b) Leguerre's Equation: Solution, Integral and Recurrence formula, Differential forms, Orthogonality. 4. Hypergeometric Equation: Solution, Hypergeometric function and its properties, Integral formula and linear transformations of hypergeometric functions. 5. Sturm-Lioville problem, self-adjoint differential equation, Characteristic values and characteristic function, Orthogonality, Greens's function.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. D. A. Kuddus : Mathematical Methods
2. Jeffreys and Jeffreys : Methods of Mathematical Physics
3. Courant and Hilbert : Methods of Mathematical Physics
4. B.S. Rajput : Mathematical Physics
5. M R Spiezel : Laplace Transforms
6. B.D. Sharma and R.K. Gupta : Mathematical Method
7 M J Lighthill : Asymptotic Expansion
8. L A Pipes : Applied Mathematics for Engg. & Scientist

6.2 MAT 3221 : Discrete Mathematics and Graph theory

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Graphs and planar Graphs: Introduction, Basic terminology, Multigraphs and weighted graphs, Paths and circuits, Shortest Paths in weighted graphs, rulerian Paths and circuits, Hamiltonian Path and circuits. 2. Trees and Cut Sets: Tress, Rooted trees, Path lengths in rooted trees, Binary search trees spanning trees and custsets, Minimum spanning trees. 3. Latties: Lattices and Algebraic systems, Principle of duality, Baric Properties of Algebraic system defined by lattices, Distributive and complemented lattices, Boolean lattices and Boolean algebras. 4. Boolean Algebras: Boolean functions and Boolean expressions Prepositional calculus, Design and implementation of digital Networks, Switching circuits. Boolean lattices. 5. Basic application of graph theory: In switching and coding theory, Electrical networks analysis by graph theory, graph theory in operation research.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. C. L Liu : Elements of Discrete Mathematics
2. Robert J. McElice : Introduction to Discrete Mathematics
3. Alan Doer : Applied discrete structure for computer Science
5. Berge, C : The theory of Graphs
6. Harary, F : Graph Theory
7. Parthasarathy, K. R : Basic Graph Theory

6.3 MAT 3231 : Numerical Analysis

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Roots of Algebraic and Transcendental Equation: The Bisection Method, The Iteration Method, Newton-Rapson Method, The Method of False position. 2. Finite difference, Relation between operators, Interpolation for equal interval: Newton's Formula for Interpolation, Gauss's Interpolation Formulae, Hermite Interpolation Formula, Starling Interpolation Formula, Bessel's Interpolation Formula. 3. Interpolation for unequal interval: Properties of divided differences, Newton's divided difference method, Lagrange's Interpolation Formula. 4. Curve Fitting, Cubic spline and Approximation. 5. Numerical Solutions of Linear and Non-Linear System of Equations: Gaussian Elimination Method, Iterative Methods, Method of Factorization, Newton-Raphson Method. 6. Numerical Differentiation and Integration. 7. Numerical Solutions of Ordinary Differential Equations: Solution by Taylor's series, Picard's Method of Successive Approximations, Euler's Method, Modified Euler's, Runge-Kutta method. Finite difference method, Adam Bashforth Method. 8. Numerical Solutions of Partial Differential Equations
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. S. S. Sastry : Introductory Methods of Numerical Analysis
2. A. R. Bashishtha : Numerical Analysis 3. P. Henrici : Elements of Numerical Analysis
4. Burden, Faires : Numerical Analysis 5. J. B. Scarborough Jr. : Numerical Mathematical Analysis

6.4 MAT 3241 : Abstract Algebra

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Group, quasi group, semigroup and monoid. The symmetric and alternation group, Permutation group, Cyclic groups, Lagrange's theorem. 2. Subgroup, normal subgroup, cosets and related theorems. 3. Homomorphsim, isomorphism, related theorems and Caley's theorem. 4. Rings, Subrings, Integral domain, Ideal, quotient ring, field, The Imbedding theorem, The Euclidean rings. 5. Linear transformations: Range, kernel, nullity, rank, singular and non-singular transformations, Matrix representation of linear transformation.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Aggarwal, R.S : Modern Algebra 2. Balakrishan, R. : A Text book of Modern Algebra
3. Dean, R.A. : Elements of Abstract algebra 4. Herstein, I.N. : Topics in Algebra
5. Khanna, M.L. :Abstract Algebra 6. Paley, H. & Weicheel, P.M. :A first course in Abstract Algebra

6.5 MAT 3251 : Classical Mechanics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Holonomic and Non-Holonomic system and Lagrange's equation, Simple applications of Lagrange's equation. 2. Introduction to calculus of variation, Euler-Lagrange differential equations, Aapplications. 3. Euler's dynamical equations for rigid body motion, Motion under no forces. 4. Motion in rotating frames, Motion Relative to Earth Foucault's Pendulum. 5. Generalized coordinates and Lagrange, Impulsive motion, Ignoration of coordinates. 6. Small oscillation, Constant of motion, Phase space. 7. Hamilton's equations, Hamilton's principle, Principle of least action. 8. Hamilton's principles function and Hamilton Jacobe equation. 9. Lagrange and Poisson brackets. 10. Contact transformation, Commutator.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Gupta, Kumar and Sharma : Classical Mechanics 2. Gupta, B.D. and Saha, S :Classical Mechanics
3. Goldstein, H. :Classical Mechanics 4. Rutherford :Classical Mechanics
5. Ganguli, S. :Classical Mechanics

6.6 FIN 3261 : Mathematical Finance

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Introduction: Definition of finance, Functions of finance, Goal of a firm, Profit Maximization vs. Value creation Management vs. Shareholders. Conceptual framework-Financial decision making-Role of finance in a firm-Goal of financial management of a firm-Finance as a discipline- Financial Instruments-Financial Markets-Financial and Non Financial Institutions and Financial Regulatory Bodies -Agency Theory.
2. Time Value of Money: Concept, Reasons for Time Value of Money, Discounting and Compounding, Factors considered in time value of money- Size of the cash flows, Time between the cash flows, Rate of return/Interest rate, Simple Interest, Compound Interest, Single amount, Annuity, Mixed stream, Perpetuity.
3. Cost of Capital: Concept, Importance of Cost of Capital, Cost of Long-term Debt, Cost of Preferred Stock, Cost of Common Stock, Cost of Retained Earnings, Weighted Average Cost of Capital. Determinants of Markets Interest Rate.
4. Risk and Return: Financial and business risk-Leverage and risk-Measuring risk-Expected value-Risk premium-Risk and required return- Project risk and firm portfolio risk, Managerial option to manage risk.
5. Valuation of Long Term Securities: Book Value vs. Market Value, Bond, Face value, coupon rate, bond with finite maturity, Semiannual compounding of interest, Preferred stock, and common stock valuation - Constant growth- yield to maturity (YTM) on bonds. Capital Market Theory and Portfolio Risk Measures, The Capital Market Line, CAPM Theorem, Security Market Line, Sharpe ratio, Sortino ratio, VaR.
6. Capital Budgeting: Capital budgeting and its process, Generating investment, Project proposals, Estimating project after tax incremental operating cash flow, Sunk cost and opportunity cost, Alternative methods for evaluation and selection of project, Payback period (PBP), Internal Rate of Return (IRR) under interpolation, Net present value (NPV), Profitability Index (PI).
7. Dividend Decision and Policy: Concept-Form of payments of Dividends- Dividend Policy-Types of dividend policies- Payment procedure of Dividend- Factors Affecting Dividend Policy- Relevance Concept of Dividend or the Theory of Relevance- Irrelevance Concept of Dividend or the Theory of Irrelevance.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Gitman, Lawrence J. Principles of Managerial Finance, Pearson Education Inc., New Delhi, 2003.
2. Horne, James C. Van & Wachowicz, John M. Jr., Fundamentals of Financial Management, Pearson Education Inc. (Aisa), New Delhi, 2004.
3. Weston and Brigham: Managerial Finance.
4. A. O. Petters and X. Dong, An Introduction to Mathematical Finance with Applications (Springer, New York, 2016)
5. S. Ross, An Elementary Introduction to Mathematical Finance, Third Edition (Cambrige U. Press, Cambridge, 2011)

6.7 MAT 3272 : Numerical Simulation Lab Using Matlab/C++/Python

Contact Hr/Week: 4.0 **(Credit :2.0)**

Syllabus:
1. Solution of Polynomial and transcendental equations and system of linear equations. 2. Interpolation and Polynomial Approximation. 3. Matrices and solution of systems of linear equations. 4. Numerical Differentiation and Integration. 5. Numerical Solution of ordinary Differential and system of ordinary differential equations. 6. Numerical solution of partial differential equations and Integral equations. 7. Curve fitting.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.

7 4^{th} year 1^{st} semester

7.1 MAT 4111 : Hydrodynamics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Some basic properties of the fluid. Velocity and acceleration of fluid particles. Lagrange's and Euler's method. Material and convective derivatives. Steady and unsteady flows. Uniform and non-uniform flows. 2. Streamlines, pathlines and Vortex lines. Velocity potential, vorticity vector, rotational and irrotational flows, one, two and three dimensional flows, discharge. 3. Motion in two-dimension; Stream function Physical meaning of stream function velocity in polar coordinates. Relation between stream function and velocity potential. 4. Significance of the equation of continuity. The equation of continuity. Equation of continuity in curvilinear coordinates. Equation of continuity in spherical and polar coordinates. Equation of continuity of an incompressible fluid through a channel. Boundary surface. 5. Euler's equation of motion, conservative field of force; Lamb's hydrodynamical equations of motion; Bernoulli's equation; Motion under conservative body force, Vorticity equations, Helmhomrks vorticity equation. 6. Sources, sinks and doublets, complex potential and complex velocity, stagnation points; complex potential due to a source and a doublet, Uniform stream. Image in two and three dimensions Image of a source and doublet w.r.to circle. Stokes theorem. 7. Flow and Circulation; Relation between circulation and vorticity. Kelvin's circulation theorem, Permanence of irrational motion, Equation of energy; Kelvin's minimum energy theorem. Circle's theorem, The Theorem of Blasius, the force exerted on a circular cylinder by a source, motion of a circular cylinder, pressure at points on a circular cylinder and image system for a source outside circular cylinder. 8. Vortex motion, vortex tube; strength of a vortex, vortex pair, complex potential due to vortex motion, vortex rows, Free vortex, Forced vortex, spiral vortex, compound vortex. Image of a vortex filament in a plane, Image of a vortex outside and inside a circular cylinder.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. F. Chorlton : Fluid dynamics Van-Nostrand
2. P.P. Gupta : Hydrodynamics
3. I.M. Milne Thomosn : Theoretical Hydrodynamics
4. M. D. Raishingania : Fluid Dynamics

7.2 MAT 4121 : Quantum Mechanics

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Basic Concept, Black body radiation, Planck's hypothesis, Planck's radiation law, Photo-electric effect, Einstein's Photon theory, Compton effect. 2. Wave Particle Dualism for light and matter, De Broglie wave, phase and group velocities, Wave packets, Uncertainty principle. 3. Bohr Model of the Atom, Bohr's theory of the Hydrogen Spectrum, Spectral Series of Hydrogen Atom, Energy level of Hydrogen Atom, Correspondence principle. 4. Wave Mechanical concepts, Schrodinger wave equation, Interpretation of wave function; Expectation value and Ehrenfest's theorem. 5. Energy eigen functions, One dimensional square well potential, Interpretative Postulates and energy eigen functions. 6. Momentum eigen functions, Box normalization, Dirac, function; Motion of a free wave packet, Minimum uncertainty product and minimum packet. 7. Linear harmonic oscillator. Spherically Symmetric potential in three-dimension. 8. Three-dimensional square well potential, Hydrogen atom, one-dimensional square potential barrier.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Arther Beiser : Concepts of Modern Physics
2. L. I Schiff : Quantum Mechanics
3. P. T. Mathews : Introduction of Quantum Mechanics
4. Powell and Crassmann : Quantum Mechanics
5 Gupta, Kumar and Sharma : Quantum Mechanics
6 Donald Rao : Quantum Mechanics

7.3 MAT 4131 : Differential Geometry

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Curves in space: Parametric representation, arc length, Tangent, Osculating plane, Normal, Principal normal, Binormal and fundamental planes. 2. Curves: Curvature and torsion, Serret-Frenet formula, Helics, Osculating circle, osculating sphere, Involute and Evolute. 3. Surface: Parametric equations, Parametric curves, Tangent plane, normal and envelope, two and three parameter family of surfaces. 4. First and second fundamental forms, Direction coefficients, orthogonal trajectories, Double family of curves. 5. Curves on a surface: Normal curvature and sections Meusnier,s theorem, Principal sections, Curvature and directions, Rodrigue,s formula, Euler's theorem, Minimal surface. 6. Developable surface, Monge's Theorem, Conjugate directions, Asymptotic lines, Theorem of Beltrami Enneper. 7. Ruled and skew surfaces, parallel surfaces and Bonnet's theorem isometric lines. 8. Geodesics: Definitions, Differential equation of geodesics. Canonical geodesic equation, Geodesic on a surface of revolutions, Clairaut's theorem, Gauss-Bonnet Theorem. Differential Manifolds, connection & curvature on a Manifold.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. H.Guggen, Heimer : Differential Geometry
2. D.J. Struik : Classical Differential Geometry
3. J.N. Sharma and A.R. Basishtha : Differential Geometry
4. M.L. Khanna : Differential Geometry
5. C. Weathcrburn : Differential Geometry of three Dimensions
6. T.J. Willmore : An Introduction to Differential Geometry
7. S. Stamike : Differential Geometry

7.4 MAT 4141 : Integral Equations

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Types of Integral Equations (IEs), Differentiation under an integral sign, Relation between differential and integral equations. 2. Solution of the Volterra Integral Equation (VIEs) and Fredholm Integral Equations (FIEs) of the first and second kinds. 3. Fredholm's First Second and Third fundamental theorems. 4. Applications of Fredholm's theorems,Fundamental function, 5. IEs with degenerate kernels, Eigenvalues & eigen functions. 6. Symmetric kernel, Orthogonal & Normalised systems, Schmidt,s solution of non-homogeneous IEs, Hilbert Schmidt theorem. 7. Construction of Green's function, Influence function, IE & Green's function for BVPs. 8. Singular IEs, Cauchy principal integral, Hilbert kernel & Hilbert formula. Solution of Hilbert type IEs of the first & second kinds.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Shanti Swarup Integral Equations
2. M.D. Raishinghania Linear Integral Equations
3. R.P. Kanwal Linear Integral Equations
4. T.G. Tricomi Integral Equations
5. A.R. Vashishtha Integral Equations

7.5 MAT 4151 : Topology

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Topology and Topological space: Open sets and Closed sets, Closure of a set, Interior, Exterior and Boundary, Neighborhoods and Neighborhoods systems, Weak and strong Topology 2. Topology of the real line and plane: Co-finite and Countable topology, Subspaces, Relative topology, Bases and Sub-bases for a topology, Continuity and Topological equivalence, Homeomorphism spaces 3. Metric Spaces: Metric topologies, Properties of metric spaces, and their problems 4. Metrizable Space: Convergence and Continuity in metric space, Normed spaces 5. Countability: First countable spaces, Second countable spaces and related theorems 6. Compactness: Covers, Compact sets, Subset of a compact space, Finite intersection property, Bolzano-Weierstrass theorem, locally

compact spaces, Separated sets, connected sets, connected spaces, Components, Locally connected spaces and simply connected spaces. 7. Separation axioms: T1-spaces, Hausdorff spaces, Regular spaces, Definition and properties, completely normal spaces and completely regular spaces.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. Lipschutz, S. General Topology
2. Simmons, G.F. Introduction to Topology and Modern Analysis
3. Gal, S. Point Set Topology
4. Kelley, J.L. General Topology
5. Hockling and Young Topology

7.6 MAT 4161 : FORTRAN Programming

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
1. Basic concept/ First Steps in Fortran Programming. 2. Essential Data Handling. 3. Basic Building Blocks. 4. Controlling the flow of a program. 5. Repeating parts of a program. 6. An introduction to Arrays. 7. More control over input and output. 8. Functions & Subroutines, Subfunctions.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Recommended Books:
1. M.R. Ellis,Ivor R. Philips, Thomas M. Lahey : Fortran 90 Programming
2. V. Rajaraman : Computer Programming in Fortran 90 and 95
3. Cooper Redwine : Upgrading to Fortran 90

7.7 MAT 4162 : FORTRAN Programming LAB

Contact Hr/Week: 4.0 **(Credit : 2.0)**

Syllabus:
1. Solution of quadratic equation using block if statement, case statement and subroutine. 2. Area and perimeter of circle, triangle, quadrangle. 3. Sum of some series. 4. Sum of digits, product of some factors, prime numbers, Fibonacci numbers and factorial of a number. 5. One dimensional array: Sorting, searching, highest and lowest values, mean, variance, S. D. Curve Fitting. 6. Two dimensional array: Upper & lower triangular, addition, subtraction, multiplication of matrices. 7. Program using function subprograms and subroutine subprogram.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course: 50 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Amos Gilat : MATLAB- An Introduction with Applications
2. Hahn, B. D. & Valentine, D.T : Essential MATLAB for Engineers and Scientists
3. Sergey E. Lyshevski : Engineering and Scientific computing using MATLAB

8 4^{th} year 2^{nd} semester

8.1 MAT 4211 : Operations Research

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Basic Concepts: Introduction, The nature, Meaning, Scope and role of Operations Research. Main phases of Operations Research (OR). 2. Linear Programming: Concept and Basic elements of Linear Programming (LP), Formulation of Linear Programming Problems. Solution of Linear Programming. Problems by Graphical Method. 3. Solution of LP Problems by using Simplex Method, Reverse Simplex Method, Two phase method, Big-M method. 4. Duality in Linear Programming. Solution of LPP by Dual simplex method. 5. Transportation and Assignment problems. 6. Decision making and decision tree in Operation Research. Dynamic Programming problems. 7. Basic concepts of Game theory, two persons and n-persons zero-sum game and its solutions, Solutions of $2 \times n$ and $m \times 2$ Games using dominance and graphical methods.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Gupta, D.K. and Mohan M : Linear Programming and Theory of Games 2. Berger J.O : Statistical Decision Theory
3. Charles, A : Decision Making under Uncertainty
4. Gass, S.I. : Linear Programming
5. Hudly, G : Linear Programming
6. Lindly, D.V : Making Decision
7. Taha, H.A. : Operation Research: An Introduction
8. Vajda S. : Game Theory
9. Hira & Gupta : Operation Research

8.2 MAT 4221 : Astronomy

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Elements of Spherical trigonometry: Spherical and Polar triangles, Cosine, sine, cotangent and polar formule, Analogues of cosine formula, Napier's and Delambre's analogies.
2. Celestial Coordinate System: Different kinds of coordination system, Relation between different coordinate systems, Celestial sphere, Midnight sun, Circumpolar star, Setting, Rising and twilight.
3. Refraction: Astronomical refraction, laws of refraction, effect of refraction on celestial bodies, coefficient of refraction and its determination, Cassini's hypothesis, Bradley's formula.
4. The Solar system and Planetary motion: Main feature of the solar system, solar planet, sidereal and synodic periods of solar planet, direct and retrograde motions, elongation, phase of the moon, Bode law, Kepler's laws of planetary motion, Anomalies.
5. Time, seasons: Different kinds of times, conversion of times, year, mean sun, apparent sun, the equation of time and its measurement, equation of centre, reduction to the equator, astronomical seasons and their causes, lengths of different seasons.
6. Aberration, Precession and Nutation: Aberration, aberrational error, apex, effect of aberration on celestial bodies, effect of aberration on right ascension and declination, longitude and latitude of a star, aberrational ellipse, planetary aberration, precession and nutation of equinoxes and their causes, planetary precession, effect of precession and nutation on right ascension and declination of a star.
7. Parallax: Geocentric and heliocentric parallaxes, effect of parallaxes on heavenly bodies, parallax in the distance between two planets, annual parallaxes in longitude and latitude of a heavenly body, the paralytic ellipse, stellar parallax in right ascension and declination.
8. Eclipses: Solar and lunar eclipses, circumstances of eclipses, causes and conditions of eclipses, the ecliptic limits, calculation of solar and lunar eclipses, frequency of eclipses, the soars, the mitotic cycle.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Smart : Spherical Astronomy
2. Godtrey : Spherical trigonometry

3. J. M. Kar : Astronomy
4. Datta & Choudhary : Astronomy
5. Todhunter : Spherical trigonometry
6. Khan and Sikder : Astronomy

8.3 MAT 4231 : Special Theory of Relativity

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Experimental Background: Galilean transformation, Newtonian relativity, Relativity of electrodynamics, Michelson-Morely experiment, Attempts to preserve Ether frame, Limitation of Galilean transformation, Findings and possibilities. 2. Postulates of special relativity, Lorentz transformation and their consequences, Length contraction, Time dilation and simultaneity. 3. Relativistic addition of velocities, Transformation of velocities and accelerations, Composition of Lorentz transformations, Aberation and Doppler Effect of relativity. 4. Relativistic Dynamics: Relativistic mass, Relativistic momentum, Relativistic force law and the dynamics of a single particle, Relativistic energy and Acceleration. 5. Equivalence of mass and energy, Transformation properties of momentum, energy, mass, and force. 6. Relativity and Electromagnetism: Interdependence of electric and magnetic fields, Transformation for electric and magnetic fields, Maxwell's equations in tensor form. 7. Four-Vector Formalism, Minkowski spacetime, Time order and space separation of events, Proper time, Twin paradox, Minkowski force. 8. Principle of Least Action: The Lagrangian, Conservation of momentum four-vector and angular momentum tensor. Conservation of Energy-momentum tensor of the electromagnetic field: Poynting,s law, Energy density, Energy current density, Momentum density, Momentum current density.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. R. Resnick : Introduction to Special Relativity
2. A. Qadir : Relativity: An Introduction to the Special Theory
3. U.E. Schröder : Special Relativity
4. F.N.H. Robinson : An Introduction to Special Relativity and it applications
5. B. F. Schuttz : Geometrical Methods of Mathematical Physics

8.4 MAT 4241 : Theory of Numbers

Contact Hr/Week: 3.0 **(Credit : 3.0)**

Syllabus:
1. Basic Concepts: Mathematical Induction, The Binomial theorem, Prime number theorem. 2. Divisibility Theory: The division Algorithm, The greatest common divisor, The Euclidean Algorithm, The Diophantine equation. 3. Primes and their Distribution: The Fundamental theorem of Arithmetic, The sieve of Eratosthenes, The Goldbach conjecture. 4. The Theory of Congruence: Basic concepts, Basic properties of congruence, Special Divisibility tests, Linear congruence. 5. Factorization Method: Fermat's theorem, Fermat's factorization method. 6. The little theorem, Wilson's theorem, Fermat's last theorem (statement). 7. Number Theoretic Functions: The functions and The mobius inversion formula, The greatest integer function. 8. Euler's Generalization of Fermats Theorem: Euler's phi-Function, Euler's theorem, Properties of the phi- Function. An application to cryptography. 9. Fibonacci Numbers and Continued Fractions: The Fibonacci sequence, Fibonacci numbers, Finite continued fractions, Infinite continued fractions.
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. Burton, D.M. : Topics in Number Theory
2. Hardy, G.M. and Wright, E.M. : An Introduction to the Number Theory.
3. Apostol : Theory of Numbers
4. Chowdhury, F. : Essentials of Number Theory
5. Niven and Zucherman : Theory of Numbers
6. Hunter, J. : Number Theory

8.5 MAT 4251 : Quantitative reasoning

Contact Hr/Week: 2.0 **(Credit : 2.0)**

Syllabus:
Quantitative Reasoning: The main objective of the quantitative reasoning course is to enhance the students' problem solving skills by the knowledge of the math concepts like Arithmetic, Algebra, Data Analysis, Geometry, calculus, trigonometry, and statistics, etc.
1. Arithmetic: include properties and types of integers, arithmetic operations, exponents and roots; and concepts such as estimation, percent, ratio, rate, absolute value, the number line, decimal representation and sequences of numbers.
2. Algebra : include operations with exponents; factoring and simplifying algebraic expressions; relations, functions, equations and inequalities; solving linear and quadratic equations and inequalities; solving simultaneous equations and inequalities; and coordinate geometry.
3. Geometry: parallel and perpendicular lines, circles, triangles, quadrilaterals, other polygons, congruent and similar figures, three-dimensional figures, area, and perimeter, volume, the Pythagorean Theorem and angle measurement in degrees.
4. Data analysis : basic descriptive statistics, such as mean, median, mode, range, standard deviation, interquartile range, quartiles and percentiles; interpretation of data in tables and graphs, elementary probability, permutations and Venn diagrams.
5. Calculus : General Application of differential and integral calculus
6. Trigonometry: Problems related to trigonometry, solution of trigonometric equations
7. Sets Theory : Types of number system, different set operations, bounded set, cardinal numbers
8. Permutation & combination : application of permutations and combinations
Evaluation: Class attendance: 10 marks, Continuous assessment: 20 marks, Semester Final (3 hours) Examination: 70 marks.
Seven questions of equal value will be set, of which five are to be answered.
Recommended Books:
1. ETS: GRE The Official Guide to the Revised General
2. Barron's GRE: 21st Edition 3. KAPLAN GRE MATHS WORKBOOK

8.6 MAT 4263 : Project in Mathematics

Contact Hr/Week: 4.0 **(Credit : 4.0)**

Each student is required to work on a project and present a project report for evaluation. Such projects should be extensions or applications of materials included in different honours courses and may involve field work and use of technology. There may be group projects or individual projects.
Implementation and Evaluation of the Project:
Implementation: The Academic Committee shall appoint a project Implementation and coordination Committee (PICC) before the session begins. The PICC shall consist of a project Coordinator (PC) and such other members as the Academic Committee considers appropriate. The PC shall invite projects from the teachers before the class start. Each teacher should submit three project proposal should include a short description of the project. Such projects should be extension of applications of materials included in different honors courses, and may involve field work and use of technology. There may group projects as well as individual projects. For group projects, students will sign up with the PICC in groups of three. These may not be changed later on without approval of the PICC.
The PICC shall assign each group a project. The members of each group shall work independently on the assigned project under the supervision of the concerned teacher. The PICC shall monitor with the supervisors the progress of different projects and arrange weakly discussions on projects and materials.
Completion: The project must be completed the before the termination of the classes. Each student is required to prepare a separate report on the project. Each report should be of around 40 pages typed on one side of A4 size white paper preferable using word processors. Graphs and figures should be clearly drawn preferably using computers. Reports of different students working on the same group project should differ in some details and illustrations. The Academic Committee will fix a data for the submission of the projects to the PICC. Each student must submit three typed copies of her/his project report to the PICC on or before the date fixed for such submission.
The PICC, on receiving the reports will arrange the presentation of by individual students before the PICC. This presentation should take palace soon after the completion of the written examination. Any student who fails to submit the report on the due date or to present the thesis on the fixed date will not get any credit for

this course.
Evaluation: The distribution of marks for each project shall be as follows:

Sl.	Project Items	Marks
1	Project Report evaluation	60%
2	Project Presentation and Viva-Voce	40%
	Total	100%

Each project report shall be examined by two examiners, one of whom shall be project supervisor and the other appointed from amongst the teachers of the department of the recommendation of the PICC. In case the marks of the two examiners of a project report differ by more than 20% a third examiner for that report shall be appointed from amongst the teachers of the department on the recommendation of the PICC. In such cases the final marks shall be determined according to the usual procedure.
Each student is required to present her/his work on the project before the PICC who will evaluate the presentation. The Academic Committee may prepare additional guidelines for evaluation of the projects.
All marks on the projects shall be submitted to the Examination Committee for tabulation with copies to the Controller of Examination. The project reports shall be returned to the PICC for preservation.