Bangamata Sheikh Fojilatunnesa Mujib Science & Technology University

Jamalpur-2000, Bangladesh.

Syllabus for B.Sc. (Hon's)

Faculty of Science

Department of Mathematics

Academic Session: 2019-2020

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 C	Course Title	Credit
1	MAT 1111	Fundamentals of Mathematics	3
2	MAT 1121	Two Dimensional Geometry	3
3	MAT 1131	Differential Calculus	3
4	STA 1141	Pinciples of Statistics	3
5	GED 1151	Bangladesh Studies	3
6	CSE 1161	Fundamental of Computer Science	2
7	CSE 1162	Computer Fundamentals Lab	1
8	MAT 1170	Viva-Voce	1
		Total	**19**

1st Year, 2nd Semester

Sl	Course C	Course Title	Credit
1	MAT 1211	Algebra and Trigonometry	3
2	MAT 1221	Three Dimensional Geometry	3
3	MAT 1231	Integral Calculus	3
4	PHY 1241	Mechanics, Properties of Matter, Wave and Sound	3
5	ENG 1251	Functional English	3
6	STA 1261	Probability and Probability Distribution	2
7	CSE 1272	Structured Programming Lab using C++	2
8	MAT 1280	Viva-Voce	1
		Total	**20**

2nd Year, 1st Semester

Sl	Course C	Course Title	Credit
1	MAT 2111	Theory of Matrices	2
2	MAT 2121	Linear Algebra	2
3	MAT 2131	Advanced Calculus	3
4	MAT 2141	Ordinary Differential Equation	3
5	PHY 2151	Heat,Thermodynamics and Optics	3
6	ECO 2161	Principles of Economics	3
7	MAT 2172	Object Oriented Programing Lab	2
8	MAT 2180	Viva-Voce	1
		Total	**19**

2nd Year, 2nd Semester

Sl	Course C	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	3
7	STA 2252	Statistical package Lab (R/SAS/STATA/Eviews	2
8	ACT 2261	Accounting, Business and Entrepreneurship	3
9	MAT 2270	Viva-Voce	1
		Total	**21**

3rd Year, 1st Semester

Sl	ourse Coc	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 Equation	3
5	MAT 3151	Mathematical Method-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	ourse Cod	Course Title	Credit
1	MAT 3211	Mathematical Method - 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	Managerial Finance	3
7	MAT 3272	Numerical Simulation Lab Using Matlab/ Python	2
8	MAT 3280	Viva-Voce	1
		Total	**20**

4th Year, 1st Semester

Sl	ourse Coc	Course Title	Credit
1	MAT 4111	Hydrodynamics	3
2	MAT 4121	Quantum Mechanics	3
3	MAT 4131	Differential Geometry	3
4	MAT 4141	Integral Equation	3
5	MAT 4151	Topology	3
6	MAT 4162	Mathematical Modeling Lab using FORTRAN/ Matlab	2
7	MAT 4170	Viva-Voce	1
		Total	**18**

4th Year, 2nd Semester

Sl	ourse Cod	Course Title	Credit
1	MAT 4211	Operation Research	3
2	MAT 4221	Astronomy	3
3	MAT 4231	Special Theory of Relativity	3
4	MAT 4241	Theory of Number	3
5	MAT 4242	Operation Research and Cryptography Lab	2
6	MAT 4253	Project in Mathematics	3
7	MAT 4260	Viva-Voce	1
		Total	**18**

1 1st year 1st semester

1.1 MAT 1111 : Fundamentals of Mathematics

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

Course Content

1. Notion of set, finite and infinite set, equality of set, null set, subset, proper subset, set of sets, universal set, power set, disjoint set, Venn-Euler diagram, union and intersection of sets, difference, complement, operations on comparable set.
2. Natural number, Set of integers and rational numbers, the real number system, geometric representation of real number, absolute value and distance, interval and bounded sets of real number, the division algorithm, fundamental theorem of arithmetic, modulus and their properties.
3. Cardinal number: 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 subset, first and last elements, maximal and minimal elements, upper and lower bound, supremum and infimum.
5. Function: Definition of function, domain and range of function, one-one function, onto function, invertible function, set function, associativity and product of function, identity and inverse function, theorems on the inverse function.
6. Product set and graph of function: Ordered pair, product set, coordinate diagram, graph of a function, graph of coordinate diagram, product set in general.
7. Relation: Product set, solution set and graph of relation, inverse relation, reflexive relation, symmetric relation, anti-symmetric relation, transitive relation, equivalence relation.
8. Proposition and compound proposition, Basic logical operation, truth table, tautologies and contradiction, logical equivalence, algebra of proposition, conditional and biconditional statement, argument, logical implication, propositional function and quantifier, negation of quantified statement.

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 :Two Dimensional Geometry

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

Course Content

1. Transformation of coordinates: Coordinate and origin, Different types of coordinate, 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, Invariance Theory, some applications of coordinate transformation.
2. Pair of Straight line: Equation of pair of straight line, General equation of second degree and its condition, Equation of bisectors.
3. Circle: Definition of Circle, General equation of circle, Condition of tangency, Pole and polar, Chord of contact, Conjugate point and line, Common tangent, Equation of chord, Equation of chord in terms of its middle point, some applications.
4. System of Circle: Angle of intersection of two circles, Radial axes and properties of radical axes, Co-axial circle, Point circle, Limiting point 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 diameter 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 conic and reduction to standard form.

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)**

Course Content
1. Limit, continuity and differentiability, indeterminate form, L,Hospital,s rule, Basic theorems and computation of limit, continuity and differentiability.
2. Differentiation: Definition of derivative, Rules of Differentiation, Successive differentiation, Leibnitz theorem and applications.
3. Expansion of function: 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 value of a function, Determination of maxima and minima, inflexion point and applications.
5. Partial differentiation: Partial differentiation, Euler's theorem and application.
6. Tangent and normal, 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 STA 1141 : Principles of Statistics

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

Course Content
1. Statistics: Definition, Scope and Classification of Statistics, its Relation With Mathematics, Limitations, Uses, Misuses of Statistics.
2. Processing of Data: Variable and Attribute, Types of Variable, 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,Box 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. Moment and Shape Characteristics of Distribution: Moment, Sheppard's Correction 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 Index, Error in Index number, Test of Index Number, Cost of Living Index.
8. Time Series: Meaning of Time Series, Component of Time Series, Secular Trend, Cyclical flactuation, Seasonal Variation, Irregular Variation.
9. Sample Surveys: Basic Concepts of Sample Survey, 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.

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

1.5 GED 1151 : Bangladesh Studies

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

Course Content

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, population by age group, economic divident, 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.

1.6 CSE 1161 : Fundamental of Computer Science

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

Course Content

Introduction: Brief history, Introduction to Computer Systems, Types and Generation of Computers; Basic Organization and Functional Units, Application.

Digital System: Number system, binary, octal, hexadecimal and BCD. Data representation. Logic gates and Boolean algebra: Combinational circuits. Circuit design using logic gates. Circuit and expression minimization: Karnaugh map and Quine-McCluskey. Basic flip-flops (FF), Design of half and full adder. Basic counters and register. Basic decoders, encoders, multiplexers and demultiplexers. ADC and DAC circuits. PLA design, Pulse mode and fundamental mode logic, Pulse & switching units, Newtrivibrations , Digital LC: DTL, TTL, III, CMOS MOS gates, Memory system, LED, LCD applications of Op-Amps. Cooparators.

Computer organization and architecture: Fundamentals of computer design. Processor and ALU design. Control design: Hardware control and micro-programmed control. Caches Memory organization. Exceptions System organization Bus and hazards I/O subsystem and I/O processor. Parallel processing: Concept, pipeline processors. Interrupts systolic arrays and fault-tolerant computers.

Hardware and Devices: Basic Units of Computer Hardware; Processor; Input, Output and Memory Devices; Keyboard; Mouse; OMR; OCR; MICR; CD-ROM; Printers; CRT; LCD; LED; Microfilm; Floppy, Scanner, Plotter, Typical Computer specifications.

Software and Software Engineering: Types of Software; System Software and Operating System: Familiarization with Various Operating Systems (Windows, DOS, UNIX, Android, IOS Etc.); Application Software: Text Processing (MS-WORD); Spreadsheet (MS-EXCEL); Presentation program (MS-POWERPOINT), Computer Virus. Language: Machine Language; Assembly Language; High Level Language; Assembler; Translator; Interpreter and Compiler.

Software Engineering: Introduction, Software process. Project management. Requirements engineering processes. System models: Context, data, behavioral and object models. Object oriented design techniques. Real-time software design. System design with reuse. Critical system design dependability, software maintenance, critical system specification and development Verification and validation. Software testing. Software cost estimation: COCOMO model Halstead formula, Graph: Cel analysis of complexity measures, software reliability and availability, Quality assurance.

Data Processing: Introduction of Data, Information and Management; Studying various data management tools like MySQL, MS Access, Oracle; Mathematical and Simulation (Matlab).

Computer Network and Internet: Introduction and network types, LAN, MAN, WAN. Topologies: Star, switched, bus, ring. Ethernet LAN standards. Internetworking: Network interconnection, bridges, routers. Network layer protocols: IP, ARJP, ICMP, IP addresses. Unicast and multicast routing protocols. IPV6 congestion control, Transport layer protocol: TCP and UDP. Introduction to wireless LAN, VSAT, analog and digital cellular system. Network security: Types of attack, encryption techniques and digital signatures. ATM switches, ATM protocol; DNS, HTTP, Email.

Programming Basics: Overview of C language, C Program structure, Compiler, Interpreter, Application, C Tokens, Keywords, Identifiers, Data types, Constants, Operators, Statements, Conditional Statements, If and Loops: for, while and do-while.

Artificial Intelligence: Overview of AI. General concepts of knowledge. Introduction to PROLOG. Knowledge representation. Intelligent agents. First order logic. Knowledge organization and manipulation: Search strategies, matching techniques and game planning. Natural language processing, Probabilities reasoning, expert

systems and computer vision, Knowledge acquisition: Learning in symbolic and non-symbolic representation.
Recommended Books:
1. Peter Norton : Introduction to Computer, McGraw-hill Publishers
2. J. Stanley Warford : Computer Systems, Jones & Bartlett Publishers
3. P. Norton : Inside the PC, Sam Publishers
4. L. Rosch : Hardware Bible, Braddy Publishing, Indianapolis
5. Subramanian : Introduction to Computers, Mcgraw-hill Inc.

1.7 CSE 1162 : Computer Fundamentals Lab

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

Course Content
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. 8. Computer Programming with C: Simple input and output. Addition, Subtraction, Multiplication, Division, Finding the value of different functions.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination: 50 marks.
Recommended Books:
1. E Balaguruswami : Computer Fundamentals

1.8 MAT 1170 : Viva-Voce

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

Course Content
Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.
A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

2 1st year 2nd semester

2.1 MAT 1211 : Algebra and Trigonometry

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

Course Content
1. Inequalities: Weierstrass's Cauchy's and Chebyshev's inequalities, Example with Arithmetic, Geometric and Harmonic means 2. Difference equation, Summation of series. 3. Theory of equation: Fundamental theorem of algebra, Relation between roots and coefficients. Descarte's rule of sign. 4. Solution of cubic and biquadratic equation. 5. Complex number, De-Moivre's theorem and its application. 6. Function of complex argument, Gragory's series. 7. Summation of trigonometric series. 8. Hyperbolic function.
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 :Three Dimensional Geometry

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

Course Content
1. Direction-cosine and direction-ratio: Definition, Direction-cosine 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 plane, Combined equation of two planes, Projection on a plane.
3. Straight line: Definition, The equation of a line, Symmetrical form of equation, 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 line, 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, Tangent plane of a sphere, Polar plane, Orthogonal intersection of two spheres, Radical plane and Coaxial sphere.
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 section, 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)**

Course Content
1. Indefinite integral: Definition and fundamental properties, Standard form of integration.
2. Techniques of integration: Method of substitution, Integration by parts, Special trigonometric function and rational fraction.

3. Fundamental theorem of calculus. Basic properties of integration. Reduction formulae, Integration by reduction.
4. Definite integral: Definition, General Properties of definite integral, Evaluation of definite integral, Summation of series by definite integral.
5. Application of integration: Plane area, Solids of revolution. Volume by cylindrical shell. Volume by cross-section. Arc length and surface of revolution.
6. Infinite or Improper Integrals and Integration of Infinite Series, Gamma and Beta function.
7. Graphing in polar coordinates. Tangent to polar curve. Area and arc length in polar coordinate.
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 PHY 1241 : Mechanics, Properties of Matter, Wave & Sound

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

Course Content
1. Vector Analysis: Vector and Scalar, Addition and multiplication of vectors, triple scalar and vector product, derivative of vector. Gradient, divergence, and curl their physical significance.
2. Conservation of Energy and Linear Momentum: Conservative and non-conservative force and system, conservation of energy and momentum, Center of mass, collision problem.
3. Rotational Motion: 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 Motion: Hook's law and vibration, simple harmonic motion, combination of harmonic motion, damped harmonic motion, forced oscillation and resonance.
5. Gravitation: Center of gravity of extended bodies, gravitational field and potential their calculation, determination of gravitational constant and gravity, compound and Kater's pendulum, motion of planets and satellite, escape velocity.
6. Surface Tension: Surface tension as a molecular phenomenon, surface tension and surface energy, capillary rise or fall of liquid, 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 ratio, relation between elastic constant 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 wave, types of wave, Superposition principle, wave velocity, power and intensity in wave motion, interference of wave, complex wave, Standing wave and resonance. Sound Wave: Audible, Ultrasonic, and infrasonic, wave, propagation and speed of longitudinal wave, vibrating system and source of sound, beat, Doppler Elect.
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

2.5 ENG 1251 : Functional English

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

Course Content

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: press releases, resume/curriculum vitae, paragraph writing, composition/essay.
4. Spoken English: Introduction to phonetic symbols, dialogue, responding to particular situations, presentations.
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.
7. Reading : reading strategies(scanning and skiming), paraphrasing and summarising, reading of selected texts, thematic writing.

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
5. Maugham, WS : The Lotus Eater
6. Desai, A: Games at Twilight
7. Richards, JC and Rogers, TS: Approaches and Methods in Language Teaching
8. Roach, PJ: English Phonetics and Phonology

2.6 STA 1261 : Probability and Probability Distribution

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

Course Content

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, Central Limit Theorem.
2. Random Variable: Concept of Random Variable, Discrete and Continuous Random Variables, Probability Function, Distribution Function, Function of Random Variable and its Distribution, Joint, Marginal and Conditional Distribution, Independence of Random Variables.
3. Expectation: Meaning of Expectation and Conditional Expectation, Mean, Expectation of a Function of a Random Variable, Variance, Conditional Mean and Conditional Variance, Moments, Covariance and Correlation Coefficient, Expectation of Sum and Product 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 Distribution: 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
6. W.Feller : Introduction to probability theory and its application

2.7 CSE 1262 : Structured Programming Lab Using C++

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

Course Content

Lab of this course shall be based on programming with Object Oriented Concept (Involving Class, Object, Member Functions, 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, prism, etc.
3. Sum of first n-natural number, prime number. Sum of series: $sin(x)$, $cos(x)$, $tan(x)$, $log(x)$, and e^x.
4. Prime number, factorial of a number and Fibonacci number.
5. One dimensional array: Sorting, searching, highest and lowest value, mean, variance
6. Calculation of interest rate, income tax, annuity, telephone bill, electric bill and grading system.
7. Matrix operation addition, subtraction, scalar multiplication, matrix multiplication, determinant of a matrix, inverse matrix and eigenvalue.
8. 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++

2.8 MAT 1280 : Viva-Voce

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

Course Content

Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.

A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

3 2nd year 1st semester

3.1 MAT 2111 : Theory of Matrices

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

Course Content
Matrix Algebra:
1. Matrix: Definition, Different types of matrices and their properties. 2. Adjoint, inverse, block matrix with properties. Theory and properties of determinant, higher order determinant, solution of system of equations by determinant. 3. Matrix Decomposition or matrix factorization: LU, Rank factorization, Cholesky decomposition, QR decomposition,Schur decomposition,QZ decomposition, Singular value decomposition. 4. Elementary transformation, ranks of a matrix, echelon, canonical and normal form, rank of a matrix. 5. System of linear equations, solution of homogenous and non-homogenous system by Matrix method and reduction to equivalent system. 6. Eigen value, Eigen vector, Cayley-Hamilton theorem and its application, Matrix Diagonalization. 7. Bilinear and Hermitian form. Quadratic form, Definite and semi-definite forms of Matrices. Generalized Inverse/ G-Inverse.

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. L. Khanna : Matrices
2. F. Ayres : Theory of Matrices
3. C. C. Mcduffe : Theory of Matrices

3.2 MAT 2121: Linear Algebra

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

Course Content
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 mapping. 6. Linear functional and Dual vector spaces, Annihilators. 7. Inner Product Spaces. 8. Bilinear, Quadratic and Hermition forms 9. Orthogonalization.
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

3.3 MAT 2131: Advanced Calculus

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

Course Content
1. Function of several variables: Partial differentiation, total differentiation, differentials, Euler's theorem of homogeneous function, Taylor's series for function of several variables, Jacobian, Heissen matrix. 2. Maxima and Minima of function of several variables and applications. 3. Curvature of plane curve, Concave and convex curve, Node, cusp, conjugate point, the point of inflexion. 4. Curve tracing. 5. Definite integration: Integration under the sign of differentiation and integration, Improper integral, Theorem of Frullani, Applications of definite integral. 6. Multiple integral: Double integration, triple integration, Diritchlet's Theorem, Change of order of integration, 7. Determination of arc length, 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

3.4 MAT 2141 : Ordinary Differential Equation

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

Course Content
1. Origin of differential equation, Classification of differential equation and solution, construction of differential equation. Initial value problem, Boundary value problem, Basic existence and uniqueness theorem (statement & applications only). 2. First order equations for which exact solutions are obtainable, Separable equation and equation reducible to this form, Exact equation and integrating factor, Special integrating factor and transformation. 3. Trajectories, Linear equation, Bernoulli's equation. 4. Higher order linear homogeneous equation with constant coefficient, Reduction of order, Basic theorem, application of second order linear differential equation. 5. Linear non-homogeneous equation with constant coefficient's, Method of undetermined coefficient, operator method and method of variation of parameter. 6. Linear equation with variable coefficient: Cauchy-Euler equation, Legendre equation, Operational factoring, exact equation. 7. Series solution of linear differential equation, Taylor series method, Frobenius method. 8. System of linear differential equation, 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

3.5 PHY 2151 : Heat,Thermodynamics and Optics

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

Course Content
1. Thermometry: Gas thermometer and their correction, measurement of low and high temperature, Platinum resistance thermometer thermocouple. 2. Kinetic Theory of gas: Kinetic theory of gas, Deduction of Boyle's, Charle's and Avogardo's Laws, determination of gas constant, mean force path. 3. Equation of state for gas: Equation of state for a perfect gas its experimental study, vander waal's equation deduction: physical significance of 'a' and 'b' defect. 4. Liquefaction of gase: Different methods of liquefaction of air nitrogen, refrigeration. 5. Thermal conduction: Thermal conductivity, Fourier's equation of heat flow thermal conductivitie of good and bad conductor. 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 heat of perfect gase, Ratio of Cp to Cv, Isothermal and adiabatic expansion. 8. Second law of Thermodynamics and entropy: Reversible and irreversible processes, carnot cycle, efficiency of heat engine, absolute scale of temperature Clausius and Claperon's theorem, Change of entropy in reversible and irreversible processes. Thermodynamics Potential at constant volume and pressure, Maxwell's thermodynamics relation, specific heat equation, joule Thomson effect, production of low temperature. 9. Geometrical Optics: Fermat's principle, theory of equivalent lense; Defect of image, Optical instruments, Dispersion, Rainbow. 10. Nature and propagation light: Properties of light, wave theory and Huygen's principle, theory of light. 11. Interference: Young's experiment, Biprism, Colour of thin film, Newton's ring, Michelson and Fabry-peret interferometer.
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

3.6 ECO 2161 : Principles of Economics

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

Course Content

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, schedules of 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 between AR and MR Curves, Relation between 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 monetary Policy: Definition 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 Years Plans in Bangladesh, Development Strategies in the Five Years Plans 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. Principles of Economics, Karl E. Case, Ray C. Fair, Sharon M. Oster.
2. Paul A. Samuelson & William D. Nordhaus, Economics, (18/e), Tata McGraw Hill Publishing Company ltd., 2005.
3. David C. Colander, Economics, (6/e) McGraw-Hill.

3.7 MAT 2172 : Object Oriented Programming Lab

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

Course Content
Lab of this course shall be based on programming with Object Oriented Concept (Involving Class, Object, Member Function, etc). C++ and Java Platform shall be applied for this course.
1. Determination the value of any function 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, prism, etc.
3. Sum of first n-natural number, prime number. Sum of series: $sin(x)$, $cos(x)$, $tan(x)$, $log(x)$, and e^x.
4. Prime number, factorial of a number and Fibonacci number.
5. One dimensional array: Sorting, searching, highest and lowest value, mean, variance
6. Calculation of interest rate, income tax, annuity, telephone bill, electric bill and grading system.
7. Matrix operation: addition, subtraction, scalar multiplication, matrix multiplication, determinant of a matrix, inverse matrix and eigenvalue.
8. Creation of Class that involves various objects and functions based on mathematical operation.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (4 hours) Examination of laboratory course: 50 marks.
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++

3.8 MAT 2180 : Viva-Voce

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

Course Content
Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.
A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

4 2nd year 2nd semester

4.1 MAT 2211 : Vector Calculus

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

Course Content
1. Vector: Vector and Scalar, Dot product, Cross product, Box product, Vector triple product and their applications. 2. Vector differentiation: Vector differential operator, 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)**

Course Content
1. Tensor and Co-ordinate transformation. Covariant and contravariant vector, Mixed & invariant tensor, Addition, subtraction and multiplication of tensor, contraction, symmetric and skew- symmetric tensor, Quotient Law. 2. Line element and metric tensor. Conjugate and associated tensor. Christoffel's symbol and their transformation law, Geodesics and Parallelism. 3. Covariant derivative of a tensor, Intrinsic derivative, Tensor form a 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)**

Course Content
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 set, equivalence of set, countable set, uncountable set, metric space, open and closed set, perfect set. 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, discontinuity. 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 integral, properties of the integral, Integration and differentiation.
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)**

Course Content
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 capacitor with dielectric, dielectric constant; energy stored in an electric field. 3. Electric Current: Electron theory of conductivity: conductor, semiconductor and insulator, superconductor, 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, magnetometer. 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 field, Measurement of e/m and 'e' positive sign, thermionic emission, photoelectric emission, Bohr's atom model, Atomic spectra, X-rays, Matter wave. 7. Nature physics: Basic concept and properties of the nucleus, Nuclear size, Binding energy, Radioactivity, Elementary knowledge of fission, Fusion and reactor cosmic ray. 8. Electronics: Vacuum diodes and triodes, P-type and n-types, semiconductor, P-n junction, Transistor biasing, Transistor amplifier, Transmitter and receiver.
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)**

Course Content
Lab Course study shall be based on related theory course.
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: 3.0 **(Credit : 3.0)**

Course Content

1. 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, MLE.
2. Hypothesis Testing: Basic Concept of Hypothesis, Type I and Type II Error, Level of Significance, P- value, Power of a Test. Detail Study of λ^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 x c contingency table.
3. Multivariate Analysis: Meaning and Application of Multivariate Analysis.
4. Multivariate Normal Distribution: Meaning and form of Multivariate Normal. Properties of Multivariate Normal Distribution, Maximum Likelihood Estimator of Mean Vector and Variance Covariance Matrix and its Properties.
5. Multivariate Sampling Distributions: The Distribution of Hotelling's T2, D2 and their Properties. 6. General Linear Regression Model: Meaning, Functional form and Underlying Assumptions. Estimation of Parameter with its mean and Variance.
7. Principal Component Analysis: Introduction to the Principal Component Analysis, ML Estimator of the Principal Components and their Variances, Sampling Properties of the Sample Principal Components, Statistical Inference.
8. Factor Analysis: Definition and Purpose of Factor Analysis, Mathematical Model for Factor Structure, ML Estimators for Random Orthogonal Factors, Estimation for Fixed Factors, Factor rotation. Testing the Goodness of Fit of the Factor Model.

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. Johnson, R. A. and Wichern, D. W. (2007): Applied Multivariate Statistical Analysis, 6th Edition, Pearson Education, Asia.
2. Anderson, R. A. and D. W Wichern (2002): An Introduction to Multivariate Statistical Analysis, 5th ed., Wiley, N.Y
3. Hogg, R. V and A. T. Craig (2002): Introduction to Mathematical Statistics, 5th ed., Pearson Education, Singapore.
4. Mood, A.M., F. A. Graybill and D.C. Boes (1994): Introduction to the theory of Statistics. 5th ed., McGraw-Hill, N.Y

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

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

Course Content

1. Computation of various measures of central tendency, dispersion, range, standard deviation, mean deviation, first four moments, skewness and kurtosis from ungrouped data.
2. Correlation and regression for two variables.
3. Probability Distribution: Fitting of Binomial, Poisson exponential and Normal Distribution.
4. Graph: Graphical presentation by using group and ungroup data.
5. Matrix Algebra: Transpose, Addition, Subtraction, Multiplication and Inversion.
6. Analysis of Variance: One-way classification.
7. Time series analysis: Check stationary and non-stationary data, components of time series.

4.8 ACT 2261: Accounting, Business and Entrepreneurship

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

Course Content

Accounting Principles: Accounting Fundamentals, Accounting in perspective of Software Industries, Transaction Analysis, Accounting Cycle, Principles of Journal Entries, Ledger, Trial Balance, and Adjusting Entries. **Financial Statement:** Income statement, Cash flow statement, Balance sheet, Analysis of Financial Statements for Software Industries, Ratio Analysis.

Managerial and Cost Accounting: Cost concepts; Cost of Goods Manufactured Statement **Cost-Volume-Profit analysis:** meaning breakeven analysis, contribution margin approach, sensitivity analysis, Costing for Decision making and reporting, Flexible budget and standard costing, Overhead cost: meaning and classification; Distribution; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation.

Entrepreneurship: Introduction to Entrepreneurship, Forms of Entrepreneurship, Social responsibility and Entrepreneurship Ethics, Entrepreneurship Law and Government.

Business Plan: Target Market, The Competition, Risk Assessment, Technology Plan, Exit Plan, Cash-Flow Projection, SWOT(Strengths/Weaknesses/Opportunities/Threats), covered in this course.

Valuation: Importance of company valuation, earning, growth, growth rate, different model of valuations: Asset valuation, Historic earning valuation, Relative valuation, Future earnings valuation, Discount cash flow model, Dividend discount model, Free cash flow model, WACC, Residual earning model.

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. Management, Harold Koontz, McGraw-Hill.
2. Account Principle, Weygandt,Kieso & Kimmel, John Wiley & Sons, Inc.
3. Entrepreneurship Development, Nazrul Islam and Muhammad Z Mamun, The University Press Limited.
4. Entrepreneurship Development, An Indo-German Technical Cooperation Project.
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.

4.9 MAT 2270 : Viva-Voce

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

Course Content

Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.

A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

5 3rd year 1st semester

5.1 MAT 3111 : Real Analysis-II

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

Course Content
1. Topology and Real number: Neighborhood at a point, open and closed set, limit point, cluster point, closure, interior and boundary point. 2. Compact Set: Compact set, locally compact set, K cell, and related theorems, perfect set, Continuity and compactness. 3. Connected Set: Connected set, locally connected set, path wise connected set and related theorems, Cantor set, continuity and connected set 4. Metric Space: Definition, Metric space, norm, norm space, Euclidean norm, Cauchy Schwarz inequality, and MinKowski,s inequality. 5. Sequence and Series of Function: 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. Function 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)**

Course Content
1. Complex number system: Complex number, polar form of complex number, complex plane, point set. 2. Complex Function: Single and many valued function, Singularity, Riemann Surface, Limit and continuity. 3. Analytic function: Derivation, Cauchy Riemann equation, orthogonal family 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 Residue: Residue, Residue theorem, Evaluation of Definite integral. 8. Conformal mapping: Some general transformations, linear transformation, Bilinear Transformation, 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)**

Course Content
1. Statics: Equilibrium of coplanar force, A static equilibrium, Stable and unstable equilibrium, General conditions of equilibrium forces. 2. Work, Virtual work. 3. Equilibrium of a string and chain: The common catenary, General condition 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 velocity and acceleration, Apse and apsidal distance. 7. Motion in three dimensions, Acceleration in terms of polar and Cartesian co-ordinates. 8. Dynamics of a rigid body: a) Moment and products of inertia: The momental Ellipsoid, Equi-momental systems, principal axes. b) D' Alembert's Principle: The general equation of motion, Independence of the motion of translation and rotation, Empulsive force. 9. Generalized coordinate: Holonomic and non-holonomic system. lagrange's equation for holonomic and non-holonomic dynamical systems. 10. Elementary Principle: Mechanics of a particle and system of particle, constraint, D-Alembert's principle and lagrange's equation. Simple application 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 Equation

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

Course Content
1. Formation of PDE and First order linear PDE. 2. Total Differential Equation: Integrability condition, Solution method for $Pdx + Qdy + Rdz = 0$ and $dx/P = dy/Q = dz/R$ 3. First Order quasilinear and non-linear PDE. 4. Classification of general second order PDE and canonical form. 5. Second Order homogeneous and non-homogeneous PDE. 6. Second Order non-linear PDE, Parabolic form, Elliptic form, Hyperbolic form. 7. Solution of Laplace's equation in Cartesian, Cylindrical and Spherical coordinate. Solution of diffusion (heat flow) equation. Solution of wave equation.
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 Method-I

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

Course Content
1. The Laplace Transform: Definition, existence, and basic properties, Differentiation and integration, Inverse Laplace transform and convolution, Solution of linear differential equation with constant coefficient, and linear system. 2. Fourier series: Fourier coefficient, sine and cosine series, Diritchlet's theorem, Properties and applications. 3. Fourier transform: Fourier sine and cosine transform, Complex Fourier transform, convolution theorem, Application to boundary value problem, asymptotic expansion. 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)**

Course Content
Introduction: Database-System Application, Purpose of Database System, View of Data, Database Languages, Relational Database, Database Design, Data Storage and Querying, Transaction Management, Database Architecture, Data Mining and Information, Retrieval, Specialty Database, Database Users and Administrators. Introduction to the Relational Model: Structure of Relational Database, 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 Operation, Null Values, Aggregate Function, Nested Sub-query, Join Expression, Transaction, Integrity Constraint, SQL Data Types and Schemas, Authorization, Function and Procedure, Trigger, Recursive Query, Advanced Aggregation Feature, OLAP. Database Design and the E-R Model: Overview of the Design Process, Entity-Relationship Model, Constraint, Removing Redundant Attributes in Entity Set, Entity-Relationship Diagram, 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 Design, Atomic Domain 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)**

Course Content
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.
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.

5.8 MAT 3170 : Viva-Voce

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

Course Content
Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.
A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

6 3rd year 2nd semester

6.1 MAT 3211 : Mathematical Method - II

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

Course Content
1. Bessel's Equation: 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 polynomial. 3. (a) Hermite's Equation: Solution, Integral and Recurrence formula, Orthogonality, Differential formula. (b) Leguerre's Equation: Solution, Integral and Recurrence formula, Differential form, Orthogonality. 4. Hypergeometric Equation: Solution, Hypergeometric function and its properties, Integral formula and linear transformation of hypergeometric function. 5. Sturm-Lioville problem, self-adjoint differential equation, Characteristic roots 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)**

Course Content
1. Graph and planar Graph: Introduction, Basic terminology, Multigraph and weighted graph, Path and circuit, Shortest Path in weighted graph, rulerian Path and circuit, Hamiltonian Path and circuit. 2. Tree and Cut Set: Tree, Rooted tree, Path length in rooted tree, Binary search tree spanning tree and custset, Minimum spanning tree. 3. Lattice: Lattice and Algebraic system, Principle of duality, Basic Properties of Algebraic system defined by lattices, Distributive and complemented lattices, Boolean lattices and Boolean algebra. 4. Boolean Algebra: Boolean function and Boolean expression Prepositional calculus, Design and implementation of digital Network, Switching circuit. Boolean lattice. 5. Basic application of graph theory: In switching and coding theory, Electrical network 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)**

Course Content

1. Roots of Algebraic and Transcendental Equation: Bisection Method, Iteration Method, Newton-Rapson Method, Method of False position. 2. Finite difference, Relation between operators, Interpolation for equal interval: Newton's Formula for Interpolation, Gauss's Interpolation Formula, 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 Solution of Linear and Non-Linear System of Equations: Gaussian Elimination Method, Iterative Method, Method of Factorization, Newton-Raphson Method. 6. Numerical Differentiation and Integration. 7. Numerical Solution of Ordinary Differential Equation: Solution by Taylor's series, Picard's Method of Successive Approximation, Euler's Method, Modified Euler's, Runge-Kutta method. Finite difference method, Adam Bashforth Method. 8. Numerical Solution of Partial Differential Equation

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)**

Course Content

1. Group, quasi group, semigroup and monoid. The symmetric and alternation group, Permutation group, Cyclic group, Lagrange's theorem. 2. Subgroup, normal subgroup, cosets and related theorems. 3. Homomorphsim, isomorphism, related theorems and Caley's theorem. 4. Ring, Subring, Integral domain, Ideal, quotient ring, field, Imbedding theorem, Euclidean ring. 5. Linear transformation: Range, kernel, nullity, rank, singular and non-singular transformation, 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)**

Course Content

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 equation with Application. 3. Euler's dynamical equation for rigid body motion, Motion under no force. 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 equation, Hamilton's principle, Principle of least action. 8. Hamilton's principle 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 : Managerial Finance

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

Course Content

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), Residual Earnings.
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)

6.7 MAT 3272 : Numerical Simulation Lab Using Matlab/Python

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

Course Content

1. Solution of Polynomial and transcendental equation and system of linear equation. 2. Interpolation and Polynomial Approximation. 3. Solution of system of linear equation. 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.

6.8 MAT 3280 : Viva-Voce

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

Course Content

Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester. A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

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

7.1 MAT 4111 : Hydrodynamics

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

Course Content

1. Some basic properties of 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. Streamline, pathline and Vortex line. 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. 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 equation, Helmhomrks vorticity equation. 6. Source, sink and doublet, complex potential and complex velocity, stagnation point; 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)**

Course Content

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 function, One dimensional square well potential, Interpretative Postulates and energy eigen function. 6. Momentum eigen function, 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)**

Course Content

1. Curves in space: Parametric representation, arc length, Tangent, Osculating plane, Normal, Principal normal, Binormal and fundamental planes. 2. Curve: Curvature and torsion, Serret-Frenet formula, Helics, Osculating circle, osculating sphere, Involute and Evolute. 3. Surface: Parametric equation, Parametric curve, 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 section Meusnier,s theorem, Principal section, Curvature and direction, Rodrigue,s formula, Euler's theorem, Minimal surface. 6. Developable surface, Monge's Theorem, Conjugate direction, Asymptotic line, Theorem of Beltrami Enneper. 7. Ruled and skew surface, parallel surface and Bonnet's theorem isometric line. 8. Geodesic: Definition, Differential equation of geodesic. Canonical geodesic equation, Geodesic on a surface of revolution, Clairaut's theorem, Gauss-Bonnet Theorem. Differential Manifold, 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 Equation

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

Course Content

1. Types of Integral Equation (IE), Differentiation under an integral sign, Relation between differential and integral equation. 2. Solution of the Volterra Integral Equation (VIEs) and Fredholm Integral Equation (FIEs) of the first and second kinds. 3. Fredholm's First Second and Third fundamental theorem. 4. Application of Fredholm's theorems,Fundamental function, 5. IEs with degenerate kernel, Eigenvalue & eigen function. 6. Symmetric kernel, Orthogonal & Normalised system, 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)**

Course Content

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

compact space, Separated set, connected set, connected space, Component, Locally connected space and simply connected space. 7. Separation axioms: T1-space, Hausdorff space, Regular space, Definition and properties, completely normal space and completely regular space.
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 4162 : Mathematical Modeling Lab uisng FORTRAN/Matlab

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

Course Content
POPULATION DYNAMICS, SINGLE SPECIES: A single species with limited resources, deterministic approach: logistic equation, geometric approach, linearized stability analysis.
POPULATION DYNAMICS, COMPETITION OF SPECIES:Two competing species: deadly survival struggle between sheep and Rabbits, Predator-prey oscillation:LotkaVolterra equation.
Logistic map: fixed point, stability, oscillation, chaos. Why is the logistic map behavior so much richer than of the continuous logistic equation. CLIMATE:Energy balance model, greenhouse warming to snowball earth, Stochastic model of Climate variability, Thermohaline circulation.
TRAFFIC FLOW: Single-car approach, Macro approach
Diffusion equation: Derivation of the 1d and 2d diffusion equations and solution.
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (3 hours) Examination: 50 marks.
Recommended Books:
1. Adam, J. (2003). Mathematics in Nature. Princeton university press.
2. Burden, R. L. and Faires, J. D. (2004). Numerical Analysis. Brooks Cole, 8 edition.
3. Chopard, B. and Droz, M. (paperback, 2005). Cellular automata modeling of physical systems. Cambridge University Press.
4. Haberman, R. (2003). Applied Partial Differential Equations, Fourth Edition. Prentice Hall.
5. Roberts, F. S. (1976). Discrete mathematical models. Prentice-Hall.

7.7 MAT 4170 : Viva-Voce

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

Course Content
Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.
A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.

8 4th year 2nd semester

8.1 MAT 4211 : Operation Research

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

Course Content

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)**

Course Content

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)**

Course Content
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 transformation, 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 equation 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 Number

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

Course Content
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 test, 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 Function: Function and 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 Number and Continued Fraction: The Fibonacci sequence, Fibonacci number, Finite continued fraction, Infinite continued fraction.
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 4242 : Operation research and Cryptography Lab

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

Course Content
Operation research: Linear Programming, Graphical Solution, Simplex Method (Artificial Variable Techniques, Using The Dual Simplex Method), Transportation Problem, Assignment Problem, Game Theory.
Cryptography: Prime Numbers, Perfect numbers, Congruence relation, Coprime, Euler totient
Remainder theorem, RSA algorithm,Shannon's Theory
Evaluation: Class attendance: 10 marks, Continuous assessment: 40 marks, Semester Final (3 hours) Examination: 50 marks.
Recommended Books:
1. Niven and Zucherman : Theory of Numbers
2. Hudly, G : Linear Programming

8.6 MAT 4253 : 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 extension or application 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:
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 before 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.

8.7 MAT 4260 : Viva-Voce

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

Course Content

Content of the Viva-Voce shall be the contents of mathematics courses of the semester. Student will be able to define, state, explain, illustrate, simplify and apply various mathematical terms and theorems related to the courses of the semester.

A Viva-Voce will be held on at the end of the semester. Student shall be asked questions on the courses of the current semester.