Proposed Scheme of Programme for
Dual Degree B.Sc. (Hons) Mathematics – M.Sc. Mathematics
under Choice Based Credit System (w.e.f. 2016-2017)

Semester-I

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Marks		
					External	Internal	Total
Ability Enhancement Compulsory Course-I	BXL 101	English	2	2	70	30	100
Ability Enhancement Compulsory Course-II	BXL 102	Environmental Sciences	2	2	70	30	100
Bridge Course-I	BML 101	Elementary Mathematics - I	4	4	70	30	100
Core Course-I	BML 102	Mathematics – I: Basic Algebra	4	4	70	30	100
Generic Elective-I	BPL 101	Physics-I: Mechanics	4	4	70	30	100
Generic Elective-II	BCL 101	Chemistry-I	4	4	70	30	100
Generic Elective-III	BBL 101	Elementary Biology-I	4	4	70	30	100
Generic Elective Practical-I	BPP 101	Physics Lab-I	2	4	70	30	100
Generic Elective Practical-II	BCP 101	Chemistry lab-I	2	4	70	30	100
Generic Elective Practical-III	BBP 101	Biology Lab	2	4	70	30	100
Total Credits = 26, Total hours =32							

Note: (i) Students, who have not studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 101 and students, who have studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 102.

(ii)   Paper code BML 101 is offered by the Dept. of Mathematics for the students of other Departments.

(iii)   Semesters I and II will be common for all the four programmes.

Semester-II

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	Internal	Total
Ability Enhancement Compulsory Course-III	BXL 201	Hindi	2	2	70	30	100
Bridge Course-II	BML 201	Elementary Mathematics – II	4	4	70	30	100
Core Course-II	BML 202	Mathematics-II: Calculus	4	4	70	30	100
Generic Elective-IV	BPL 201	Physics –II: Waves and Optics	4	4	70	30	100
Generic Elective-V	BCL 201	Chemistry – II	4	4	70	30	100
Generic Elective- VI	BBL 201	Elementary Biology - II	4	4	70	30	100
Generic Elective-VII	BXL 202	Computer Science	2	2	70	30	100
Generic Elective Practical- IV	BPP 201	Physics Lab - II	2	4	70	30	100
Generic Elective Practical- V	BCP 201	Chemistry Lab - II	2	4	70	30	100
Generic Elective Practical- VI	BXP 201	Computer Science-Lab	2	4	70	30	100
Total Credits = 26, Total hours = 32							

Note: (i) Students, who have not studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 201 and students, who have studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 202.

(ii) Paper code BML 201 is offered by the Dept. of Mathematics for the students of other Departments.

Semester-III

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	Internal	Total
Core Course- III	BML 301	Number Theory and Trigonometry	5	5	70	30	100
Core Course -IV	BML 302	Ordinary Differential Equations	5	5	70	30	100
Core Course- V	BML 303	Advanced Calculus	5	5	70	30	100
Core Course -VI	BML 304	Vector Calculus	5	5	70	30	100
Core Course- VII	BML 305	Mathematical Statistics	5	5	70	30	100
Skill Enhancement Course- I	BML 306	Special Functions-I	2	2	36	14	50
Total Credits = 27, Total hours = 27							

Semester-IV

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	**Internal**	**Total**
Core Course -VIII	BML 401	Solid Geometry	5	5	70	30	100
Core Course- IX	BML 402	Transform Techniques	5	5	70	30	100
Core Course- X	BML 403	Elementary Partial Differential Equations	5	5	70	30	100
Core Course- XI	BML 404	Statics	5	5	70	30	100
Core Course- XII	BML 405	Operations Research-I	5	5	70	30	100
Skill Enhancement Course- II	BML 406	Special Functions-II	2	2	36	14	50
Total Credits = 27, Total hours = 27.							

Semester-V

Course Opted	Paper Code	Nomenclature	Credit	Hours /Week	Max. Marks		
					External	**Internal**	**Total**
Core Course- XIII	BML 501	Real Analysis	5	5	70	30	100
Core Course- XIV	BML 502	Groups and Rings	5	5	70	30	100
Core Course- XV	BML 503	Programming in C & Numerical Methods	5	5	70	30	100
Core Course Practical- XV	BMP 504	Programming in C & Numerical Methods - Lab	2	4	35	15	50
Discipline Specific Elective -I	BML 505	Sequences and Series	5	5	70	30	100
Discipline Specific Elective- II	BML 506	Operations Research-II	5	5	70	30	100
Total Credits = 27, Total hours = 29							

Semester-VI

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	**Internal**	**Total**
Core Course -XVI	BML 601	Real and Complex Analysis	5	5	70	30	100
Core Course -XVII	BML 602	Linear Algebra	5	5	70	30	100
Core Course -XVIII	BML 603	Numerical Analysis	5	5	70	30	100
Core Course Practical-XVIII	BMP 604	Numerical Analysis - Lab	2	4	35	15	50
Discipline Specific Elective -III	BML 605	Dynamics	5	5	70	30	100
Discipline Specific Elective -IV	BML 606	Mathematical Modeling	5	5	70	30	100
Total Credits = 27, Total Hours = 29.							

Paper Code	Nomenclature	No. of Credits	External Marks	Internal Marks	Total Marks
Semester VII					
MAL 511	Algebra	5 credits (5-0-0)	70	30	100
MAL 512	Real Analysis	5 credits (5-0-0)	70	30	100
MAL 513	Mechanics	5 credits (5-0-0)	70	30	100
MAL 514	Ordinary Differential Equations-I	5 credits (5-0-0)	70	30	100
MAL 515	Complex Analysis-I	5 credits (5-0-0)	70	30	100
MAL 516	Programming with FORTRAN (Theory)	5 credits (5-0-0)	70	30	100
MAP 517	Programming with FORTRAN (Practical)	1.5 credits (0-0-3)	70	30	100
	Total Credits	**31.5 credits**			
Semester VIII					
MAL 521	Abstract Algebra	5 credits (5-0-0)	70	30	100
MAL 522	Measure & Integration Theory	5 credits (5-0-0)	70	30	100
MAL 523	Methods of Applied Mathematics	5 credits (5-0-0)	70	30	100
MAL 524	Ordinary Differential Equations-II	5 credits (5-0-0)	70	30	100
MAL 525	Complex Analysis-II	5 credits (5-0-0)	70	30	100
MAL 526	Programming in C (Theory)	5 credits (5-0-0)	70	30	100
MAP 527	Computing Lab-I	1.5 credits (0-0-3)	70	30	100
	Total Credits	**31.5 credits**			
Semester IX					
MAL 631	Topology	5 credits (5-0-0)	70	30	100
MAL 632	Partial Differential Equations	5 credits (5-0-0)	70	30	100
MAL 633	Mechanics of Solids-I	5 credits (5-0-0)	70	30	100
MAP 634	Computing Lab-II	1.5 credits (0-0-3)	70	30	100
Programme Elective-I		5 credits (5-0-0)	70	30	100
Programme Elective-2		5 credits (5-0-0)	70	30	100
Open Elective		4 credits (4-0-0)	70	30	100
	Total Credits	**30.5 credits**			
Semester X					
MAL 641	Functional Analysis	5 credits (5-0-0)	70	30	100
MAL 642	Differential Geometry	5 credits (5-0-0)	70	30	100
MAL 643	Mechanics of Solids-II	5 credits (5-0-0)	70	30	100
Programme Elective-3		5 credits (5-0-0)	70	30	100
Programme Elective-4		5 credits (5-0-0)	70	30	100
MAP 648	Computing Lab-3	1.5 credits (0-0-3)	70	30	100
	Total Credits	**26.5 credits**			

*Programme Electives

Paper Code	Nomenclature	No. of Credits	External Marks	Internal Marks	Total Marks
Semester-IX					
MAL 635	Analytic Number Theory	5 credits (5-0-0)	70	30	100
MAL 636	Fluid Mechanics	5 credits (5-0-0)	70	30	100
MAL 637	Advanced Discrete Mathematics	5 credits (5-0-0)	70	30	100
MAL 638	Difference Equations	5 credits (5-0-0)	70	30	100
MAO 630	Open Elective	4 credits (4-0-0)	70	30	100
Semester-X					
MAL 644	Integral Equations	5 credits (5-0-0)	70	30	100
MAL 645	Advanced Fluid Mechanics	5 credits (5-0-0)	70	30	100
MAL 646	Bio-Mechanics	5 credits (5-0-0)	70	30	100
MAL 647	Algebraic Coding Theory	5 credits (5-0-0)	70	30	100

*Programme/ open electives can be offered subject to availability of requisite resources/faculty in the department.

Total Credits: 120 +160 = 280

Semester-I

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Marks		
					External	**Internal**	**Total**
Ability Enhancement Compulsory Course-I	BXL 101	English	2	2	70	30	100
Ability Enhancement Compulsory Course-II	BXL 102	Environmental Sciences	2	2	70	30	100
Bridge Course-I	BML 101	Elementary Mathematics - I	4	4	70	30	100
Core Course-I	BML 102	Mathematics – I: Basic Algebra	4	4	70	30	100
Generic Elective-I	BPL 101	Physics-I: Mechanics	4	4	70	30	100
Generic Elective-II	BCL 101	Chemistry-I	4	4	70	30	100
Generic Elective-III	BBL 101	Elementary Biology-I	4	4	70	30	100
Generic Elective Practical-I	BPP 101	Physics Lab-I	2	4	70	30	100
Generic Elective Practical-II	BCP 101	Chemistry lab-I	2	4	70	30	100
Generic Elective Practical-III	BBP 101	Biology Lab	2	4	70	30	100
Total Credits = 26, Total hours =32							

Note: (i) Students, who have not studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 101 and students, who have studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 102.

(ii)   Paper code BML 101 is offered by the Dept. of Mathematics for the students of other Departments.

(iii)   Semesters I and II will be common for all the four programmes.

BXL 101: English

Marks (Theory) : 70 **Marks(Total) : 100**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

Unit-I

Syntax **7Hrs**
Sentence structures, Verb patterns and their usage

Unit-II

Phonetics **8Hrs**
Basic Concepts – Vowels, Consonants, Phonemes, Syllables; Articulation of Speech Sounds – Place and Manner of Articulation; Transcription of words and simple sentences, using International Phonetic Alphabet.

Unit-III

Comprehension **7Hrs**

Listening and Reading comprehension – Note taking, Reviewing, Summarizing, Interpreting, Paraphrasing and Précis Writing.

Unit-IV

Composition **8Hrs**
Descriptive, Explanatory, Analytical and Argumentative Writing - description of simple objects like instruments, appliances, places, persons, principles; description and explanation of processes and operations; analysis and arguments in the form of debate and group discussion.

BOOKS SUGGESTED:

1. Roy A. & Sharma P.L. English for Students of Science, Orient Longman.
2. Spoken English for India by R.K. Bansal and J.B. Harrison, Orient Longman.
3. Tickoo M.L. & Subramanian A.E. Intermediate Grammar, Usage and Composition, Orient Longman.
4. Pink M.A. & Thomas S.E. English Grammar, Composition and Correspondence, S. Chand and Sons Pvt.Ltd.,Delhi.
5. Thomson & Martinet A Practical English Grammar, OUP, Delhi.
6. Hornby A.S Guide to Patterns and Usage in English, OUP, Delhi.
7. Balasubramanian T. A Textbook of English Phonetics for Indian Students, MacMillan, Chennai.
8. O"Connor J.D. Better English Pronunciation, Cambridge Univ. Press, London.
9. McCarthy English Vocabulary in Use, Foundation Books (Cambridge University Press), Delhi.
10. Buck,Assessing Listening, Foundation Books (Cambridge University Press), Delhi.

BXL 102 : Environmental Science

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

Unit-I

The Multidisciplinary nature of environmental studies   **8Hrs**
Definition, scope and importance, Need for public awareness. Natural resources: Renewable and non-renewable resources. Natural resources and associated problems.
a) Forest resources: Use and over-exploitation, deforestration
b) Water resources: Use and over-utilization of surface and ground water, floods and drought.
c) Mineral resources: Use and exploitation, environmental effects of extrading.
d) Food resources: World food problems, changes caused by agriculture, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.
e) Energy Resources: Growing energy needs, renewable and non renewable energy sources use of alternative energy sources.
f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

Unit-II

Ecosystems   **7Hrs**
Concept of an ecosystem, Structure and function of an ecosystem, Procedures, consumers and decomposers, Energy flow in the ecosystem, Ecological succession & Food chains, food webs and ecological pyramids.
Biodiversity and its conservation: Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, National and local levels, India as a megadiversity nation.

Unit-III

Environmental Pollution   **7Hrs**
Definition, Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution & Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Unit-IV

Social Issues and the Environment   **8Hrs**

From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation, Consumerism and waste products, environment Protection Act, Air (Prevention and Control of Pollution) Act, Water(Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environment legislation & Public awareness.

BOOKS SUGGESTED:
1. De A. K. Environmental Chemistry, Wiley Eastern Ltd, 1999.
2. Bharucha E. Text book of Environmental studies, University press, Hydrabad 2005.
3. Cunningham W P., Cooper T H. Gorhani E. Hepworth M T, Environmental Enclopedia, Jaico publication House, Mumbai, 2001.
4. Miller T G. Environmental Science Wadsworth publishing corp, 2000.

BML 101 : Elementary Mathematics-I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Sets, Relations and Functions : Sets and their Representations, The Empty Set, Finite and Infinite Sets, Equal Sets, Subsets, Universal Set, Venn Diagrams, Operations on Sets, Complement of a Set, Practical Problems on Union and Intersection of Two Sets, Cartesian Product of Sets, Relations, Functions.
Sequences and Series : Sequences, Series, Arithmetic Progression (A.P.), Geometric Progression (G.P.), Relationship Between A.M. and G.M.

Section – II

Straight Lines : Introduction, Slope of a Line, Various Forms of the Equation of a Line, General Equation of a Line, Distance of a Point From a Line.
Trigonometric Functions : Angles, Trigonometric Functions, Trigonometric Functions of Sum and Difference of Two Angles, Trigonometric Equations.

Section – III

Permutations and Combinations : Fundamental Principle of Counting, Permutations, Combinations.
Binomial Theorem : Introduction, Binomial Theorem for Positive Integral Indices, General and Middle Terms.

Section – IV

Linear Inequalities : Inequalities, Algebraic Solutions of Linear Inequalities in One Variable and their Graphical Representation, Graphical Solution of Linear Inequalities in Two Variables, Solution of System of Linear Inequalities in Two Variables.

Probability : Introduction, Random Experiments, Event, Axiomatic Approach to Probability, Addition Theorems on Probability, Conditional Probability, Multiplicative Law of Probability.

Books Recommended:

1. Mathematics Text Book for Class XI, National Council of Educational Research and Training.
2. R.S. Verma and K.S. Sukla, Text Book on Trigonometry, Pothishala Pvt. Ltd, Allahabad.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, S. Chand & Sons.
4. Ivo Duntsch and Gunther Gediga, Set, Relations, Functions, Methodos Publishers.

BML 102

Mathematics-I : Basic Algebra

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

 <u>Note:</u> Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Section – II

Applications of matrices to a system of linear (both homogeneous and non–homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Section – III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Section – IV

Nature of the roots of an equation, Descarte's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Books Recommended :

1. H.S. Hall and S.R. Knight, Higher Algebra, H.M. Publications 1994.
2. Shanti Narayan, A Text Books of Matrices.
3. Chandrika Prasad, Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.

BPL 101: PHYSICS - I: Mechanics

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT – 1

Fundamentals of Dynamics: Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse.

Work and Energy: Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy.

Collisions: Elastic and inelastic collisions between particles. Centre of Mass and Laboratory frames.

UNIT - 2

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation.

Elasticity: Relation between Elastic constants. Twisting torque on a Cylinder or Wire.

Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube.

UNIT – 3

Gravitation and Central Force Motion: Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).

Oscillations: SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor.

UNIT - 4

Non-Inertial Systems: Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Special Theory of Relativity: Michelson-Morley Experiment and its outcome. Postulates of Special Theory of Relativity. Lorentz Transformations. Simultaneity and order of events. Lorentz contraction. Time dilation. Relativistic transformation of velocity, frequency and wave number. Relativistic addition of velocities. Variation of mass with velocity. Massless Particles. Mass-energy Equivalence. Relativistic Doppler effect. Relativistic Kinematics. Transformation of Energy and Momentum.

Reference Books:
1. An introduction to mechanics, D. Kleppner, R.J. Kolenkow, 1973, McGraw-Hill.
2. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker 8/e. 2008, Wiley.
4. Analytical Mechanics, G.R. Fowles and G.L. Cassiday. 2005, Cengage Learning.
5. Feynman Lectures, Vol. I, R.P.Feynman, R.B.Leighton, M.Sands, 2008, Pearson Education
6. Introduction to Special Relativity, R. Resnick, 2005, John Wiley and Sons.
7. University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

   Additional Books for Reference

1) Mechanics, D.S. Mathur, S. Chand and Company Limited, 2000
2) University Physics. F.W Sears, M.W Zemansky, H.D Young 13/e, 1986, Addison Wesley
3) Physics for scientists and Engineers with Modern Phys., J.W. Jewett, R.A. Serway, 2010, Cengage Learning
4) Theoretical Mechanics, M.R. Spiegel, 2006, Tata McGraw Hill.

BCL 101: CHEMISTRY-I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist

of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

UNIT-I

Chemical Thermodynamics **15 Hrs**

Objectives and limitations of Chemical Thermodynamics, state functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy. First Law of Thermodynamics: First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas.Irreversible isothermal and adiabatic expansion.Enthalpy change and its measurement, standard heats of formation and absolute enthalpies.Kirchoff's equation.

Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle). Entropy: Entropy changes of an ideal gas with changes in P,V, and T. Free energy and work functions. Gibbs-Helmholtz Equation, Criteria of spontaneity in terms of changes in free energy.Introduction to Third law of thermodynamics.

UNIT-II

Conductance and Electrochemistry15 Hrs

Arrhenius theory of electrolytic dissociation.Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes.Molar conductivity at infinite dilution.Kohlrausch law of independent migration of ions.

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods.Applications of conductance to measure degree of dissociation of weak electrolytes.

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half cell potentials, application of electrolysis in metallurgy and industry.Chemical cells with examples; Standard electrode (reduction) potential.

UNIT-III

Fundamentals of Organic Chemistry **15 Hrs**

Electronic Displacements: Inductive Effect, Electromeric Effect, ResonanceandHyperconjugation.

Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles.

Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affectingpK values.

UNIT-IV

Stereochemistry **8Hrs**

Conformations with respect to ethane, butane and cyclohexane.Interconversion of WedgeFormula, Newmann, Sawhorse and Fischer representations.Concept of chirality (uptotwocarbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism,Diastereomerism and Meso compounds). Threo and erythro; D and L; *cis–trans*nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (forupto two C=C systems).

Chemistry of Biomolecules **7Hrs**

Occurrence, classification of Carbohydrates.Amino acids, peptides and their classification.α-Amino Acids.Zwitterions, pK_avalues, isoelectric point, components of nucleic acids, nucleosides and nucleotides.

BOOKSSUGGESTED:
1. Atkins, P.W. & Paula, J. *Physical Chemistry,* 10th Ed., Oxford University Press, 2014.
2. Castellan, G.W.,Physical Chemistry, Narosa Publishers
3. Morrison, R. N. & Boyd, R. N. *Organic Chemistry,* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Finar, I. L. *Organic Chemistry (Volume 1),* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. Finar, I. L. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products),* Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Eliel, E. L. &Wilen, S. H. *Stereochemistry of Organic Compounds,* Wiley: London,1994.
7. Kalsi, P. S. *Stereochemistry Conformation and Mechanism,* New Age International, 2005.
8. McMurry, J.E. *Fundamentals of Organic Chemistry,* 7th Ed. Cengage Learning India Edition, 2013.

BBL 101 : Elementary Biology-I

(Fundamentals of Biology)

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

 Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice

covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section - I

Introduction to concepts of biology
Themes in the study of biology; A closer look at ecosystem; A closer look at cell; The process of
Science; Biology and everyday life

Evolutionary history of biological diversity
Early earth and the origin of life; Major events in the history of life; Mechanism of Macroevolution; Phylogeny and the tree of life

Section - II

Classifying the diversity of life
Kingdoms of Life –Prokaryotes, Eukaryotes, Archaea

Darwinian view of life and origin of species
Darwin's theory of evolution; The evolution of populations; Concepts of species; Mechanism of speciation

Genetic approach to Biology
Patterns of inheritance and question of biology; Variation on Mendel's Law; The molecular basis of genetic information; The flow of genetic information from DNA to RNA to protein; Genetic Variation; Methodologies used to study genes and gene activities; Developmental noise; Detecting macromolecules of genetics; Model organisms for the genetic analysis; Distinction between Phenotype and Genotype.

Section - III

Chemistry of life
The constituents of matter; Structure of an atom; The energy level of electron; The formation and
function of molecules depend on chemical bonding between atoms; Chemical reaction make or break chemical bonds

Water and life
The water molecule is polar; Properties of water; Ionization of water

Carbon and life
Organic chemistry-the study of carbon compounds; what makes carbon special? Properties of organic compounds

Section – IV

Structure and function of biomolecules
Most macromolecules are Polymers; Carbohydrates act as fuel and building materials; Lipids are
group of hydrophobic molecules; Protein have diverse structures and functions; Nucleic acids store and transmit hereditary information

SUGGESTED READING/BOOKS

1. Campbell, N.A. and Reece, J. B. (2008) Biology 8th edition, Pearson Benjamin Cummings, San Francisco.
2. Raven, P.H et al (2006) Biology 7th edition Tata McGrawHill Publications, New Delhi
3. Griffiths, A.J.F et al (2008) Introduction to Genetic Analysis, 9th edition, W.H. Freeman & Co. NY

BPP-101: Physics Lab – I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

                                                         (Credits: 02)

1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the Motion of Spring and calculate (a) Spring constant, (b) **g** and (c) Modulus of rigidity.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine **g** and velocity for a freely falling body using Digital Timing Technique;
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater's Pendulum.

Reference Books

1. Advanced Practical Physics for students, B. L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, I.Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal
4. Engineering Practical Physics, S.Panigrahi & B.Mallick,2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.

BCP 101: CHEMISTRY LAB-I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

1. Preparation of reference solutions.

2. Redox titrations: Determination of Fe^{2+}, $C_2O_4^{2-}$(using $KMnO_4$, $K_2Cr_2O_7$)

3. Iodometic titrations: Determination of Cu^{2+} (using standard hypo solution).

4. To determine the surface tension of at least two liquids using stalagmometer by drop no. and drop weight methods (Use of organic solvents excluded).

5. To study the effect of surfactant on surface tension of water.

6. To determine the viscosity of at least two liquids by using Ostwald's viscometer (use of organic solvents excluded).

7. To study the process of (i) sublimation (ii) Crystallization of camphor and phthalic acid

8. Preparation and purification through crystallization or distillation and ascertaining their purity through melting point or boiling point

    (i)   Iodoform from ethanol (or acetone)

    (ii)   p-Bromoacetanilide from acetanilide

BOOKSSUGGESTED:

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G.,Vogel's Text Book of Practical Organic Chemistry,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole,2005.
3. Mann F.G., Saunders. P.C.,Practical Organic Chemistry,Pubs:Green& Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman,1978.
6. Yadav J. B., Advanced Practical physical Chemistry

BBP 101 : ELECTIVE PRACTICAL-II BIOLOGY LAB-I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

PRACTICALS

1. To learn a) use of microscope b) principles of fixation and staining.
2. Preparation of Normal, molar and standard solutions, phosphate buffers, serial dilutions
3. Use of micropipettes
4. Measurement of cell size by cytometry
5. To perform gram staining of bacteria.
6. To study the cytochemical distribution of nucleic acids and mucopolysaccharides with in cells/tissues from permanent slides.
7. To perform quantitative estimation of protein using the Lowry's method. Determine the concentration of the unknown sample using the standard curve plotted.
8. To study of plasmolysis & deplamolysis of *Rhoeo* leaf.
9. To study prokaryotic cells, Bacteria/fungi and eukaryotic cells.
10. To prepare squash from root tip of Alium cepa & study various stages of mitosis.

Semester-II

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	Internal	Total
Ability Enhancement Compulsory	BXL 201	Hindi	2	2	70	30	100

Course-III							
Bridge Course-II	BML 201	Elementary Mathematics – II	4	4	70	30	100
Core Course-II	BML 202	Mathematics-II: Calculus	4	4	70	30	100
Generic Elective-IV	BPL 201	Physics –II: Waves and Optics	4	4	70	30	100
Generic Elective-V	BCL 201	Chemistry – II	4	4	70	30	100
Generic Elective- VI	BBL 201	Elementary Biology - II	4	4	70	30	100
Generic Elective-VII	BXL 202	Computer Science	2	2	70	30	100
Generic Elective Practical- IV	BPP 201	Physics Lab - II	2	4	70	30	100
Generic Elective Practical- V	BCP 201	Chemistry Lab - II	2	4	70	30	100
Generic Elective Practical- VI	BXP 201	Computer Science-Lab	2	4	70	30	100
Total Credits = 26, Total hours = 32							

Note: (i)   Students, who have not studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 201 and students, who have studied Mathematics at 10+1 and 10+2 level, will opt the paper BML 202.

(ii) Paper code BML 201 is offered by the Dept. of Mathematics for the students of other Departments.

BML 201 : Elementary Mathematics-II

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

 Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**)

will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Matrix Algebra : Introduction, types of matrices, addition and multiplication of matrix, transpose of matrix, concept of elementary row and column operations. Determinant and its properties, minors, cofactors. Application of determinants in finding area of triangle. Adjoint and inverse of square matrix. Solution of homogeneous and non-homogeneous linear equations and condition for solution.

Section – II

Differential Calculus : Differentiation of standard functions including function of a function (Chain rule). Differentiation of implicit functions, logarithmic differentiation, parametric differentiation, elements of successive differentiation.

Integral Calculus : Integration as inverse of differentiation, indefinite integrals of standard forms, integration by parts, partial fractions and substitution. Formal evaluation of definite integrals.

Section – III

Ordinary Differential Equations : Definition and formation of ordinary differential equations, equations of first order and first degree, variable separable, homogeneous equations, linear equations (Leibnitz form) and differential equations reducible to these types, Linear differential equation of order greater than one with constant coefficients, complementary function and particular integrals.

Section – IV

Partial Differential Equations: Introduction and formation of P.D.E., solution of P.D.E., linear equation of first order (Lagrange's Equation), Non-Linear Equation of first order.

Vector Calculus: Differentiation of vectors, scalar and vector point functions, gradient of scalar field and directional derivative, divergence and curl of vector field and their physical interpretation.

Books Recommended:

1.	Shanti Narayan	: Differential and Integral Calculus, S. Chand.
2.	S.L. Ross,	: Differential Equations, John Wiley and sons inc., Ny, 1984.
3.	Shanti Narayan	: A Textbook of Matrices, S. Chand.
4.	Ian N. Snnedon	: Elements of Partial Differential Equations, McGraw Hill.
5.	Murray R. Spiegal	: Vector Analysis Schaum Publishing Company, New York

BML 202

Mathematics-II : Calculus

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Section – II

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Section – III

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Section – IV

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Books Recommended :

1. Differential and Integral Calculus, Shanti Narayan.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov, Differential and Integral Calculus. Peace Publishers, Moscow.
4. Gorakh Prasad, Differential Calculus. Pothishasla Pvt. Ltd., Allahabad.
5. Gorakh Prasad, Integral Calculus. Pothishala Pvt. Ltd., Allahabad.

BPL-201: PHYSICS – II: Waves and Optics

Marks (Theory) : 70 **Marks(Total) : 100**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: The question paper will consist of nine questions in all. Question no. 1 will contain seven short answer type questions without any internal choice covering the entire syllabus and shall be compulsory. The remaining eight questions will be set from the four units with two questions from each unit. Candidate is required to attempt five questions in all with one compulsory question and one question from each unit.

UNIT - I

Superposition of Collinear Harmonic oscillations: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences.

Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses.

Wave Motion: Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves.

UNIT - II

Velocity of Waves: Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

Superposition of Two Harmonic Waves: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.

Wave Optics: Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence.

UNIT - III

Diffraction: Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only)

   Fraunhofer diffraction: Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating.

Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

UNIT -IV

Interference: Division of amplitude and wave front. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination

(Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index.

Interferometer: Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4) Refractive Index, and (5) Visibility of Fringes. Fabry-Perot interferometer.

Holography: Principle of Holography. Recording and Reconstruction Method. Theory of Holography as Interference between two Plane Waves. Point source holograms.

Reference Books

1. Waves: Berkeley Physics Course, vol. 3, Francis Crawford, 2007, Tata McGraw-Hill.
2. Fundamentals of Optics, F.A. Jenkins and H.E. White, 1981, McGraw-Hill
3. Principles of Optics, Max Born and Emil Wolf, 7th Edn., 1999, Pergamon Press.
4. Optics, Ajoy Ghatak, 2008, Tata McGraw Hill
5. The Physics of Vibrations and Waves, H. J. Pain, 2013, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N.K. Bajaj, 1998, Tata McGraw Hill.
7. Fundamental of Optics, A. Kumar, H.R. Gulati and D.R. Khanna, 2011, R. Chand Publications.

BCL 201- CHEMISTRY-II

Marks (Theory) : 70   **Marks(Total) : 100**

Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

UNIT-I

Chemical Bonding and Molecular Structure   **15 Hrs**

Introduction to Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy, polarizing power and polarizability

Introduction to Covalent bonding: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonalbipyramidal and octahedral arrangements.

Ionic Solids: Factors affecting the formation of ionic solids, concept of close packing, radius ratio rule and coordination number. Calculation of limiting radius ratio for tetrahedral and octahedral sites.Structures of some common ionic solids NaCl, ZnS (zinc blende and wurtzite).

UNIT-II

Acids and Bases   **8 Hrs**

Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process.

Basic Coordination Chemistry7Hrs

Coordinate Bond. Werner's coordination theory, ligands, chelates. Nomenclature of coordination compounds. Stereochemistry of different coordination numbers, isomerism. Valence-bond and crystalfield theories of bonding in complexes.Explanation of properties such as geometry colour and magnetism.

UNIT-III

Chemical Kinetics And Catalysis   **15 Hrs**

Rates of reactions, rate constant, order and molecularity of reactions. Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy.

Catalysis: Homogeneous catalysis, Acid-base catalysis and enzyme catalysis. Heterogeneous catalysis.

UNIT-IV

Basics of spectroscopy   **15 Hrs**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.Electromagnetic radiations, Introduction to ultraviolet, visible and infrared spectroscopy, electronic transitions, λ_{max}&ε_{max}, chromophore,

auxochrome, bathochromic, hypsochromic shifts.Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

BOOKS SUGGESTED:

1.Cotton F.A. and Wilkinson G., Murillo C.A., Bochmann M., Advanced Inorg. Chemistry, 6th Edition, Pubs: John Wiley & Sons. Inc., 1999.
2. Lee J.D., Concise Inorganic Chemistry, 4th edition, Pubs: ELBS,1991.
3. Huheey J.E., Keiter E.A., Keiter R.L., Inorganic Chemistry : Principles of Structures and Reactivity; 4th Edition, Pubs: Harper Collins, 1993.
4. Greenwood N.N. and Earnshaw A., Chemistry of the Elements, 2nd edition., Pubs: Butterworth/Heinemann, 1997.
5. Douglas B., Daniel D. Mc and Alexander J., Concepts of Models of Inorganic Chemistry, Pubs: John Wiley,1987.
6. Puri B.R., Sharma L. R. and Pathania M. S., Principles of Physical Chemistry, Pubs: Vishal Publishing Company, 2003.
7. Laidler K. J Chemical Kinetics, McGraw Hill.
8. Castellan G.W. Physical Chemistry, Narosa Publishers
9. Kemp W. Organic Spectroscopy

BBL 201 : ELEMENTARY BIOLOGY-II (CELL BIOLOGY)

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Cell: Introduction and classification of organisms by cell structure, cytosol, compartmentalization of eukaryotic cells, cell fractionation.
Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport.

Section – II

Membrane Vacuolar system, cytoskeleton and cell motility: Structure and function of microtubules, Microfilaments, Intermediate filaments.
Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and functions including role in protein secretion.

Section - III

Lysosomes: Vacuoles and micro bodies: Structure and functions
Ribosomes: Structures and function including role in protein synthesis.
Mitochondria: Structure and function, Genomes, biogenesis.
Chloroplasts: Structure and function, genomes, biogenesis
Nucleus: Structure and function, chromosomes and their structure.

Section – IV

Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction.
Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer.

SUGGESTED READING/BOOKS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASMPress & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

BXL 202 : Computer Science

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: The examiner is requested to set nine questions in all, selecting two questions from each unit and one compulsory question (Question No.1 based on entire syllabus will consist of seven short answer type questions each of two marks). The candidate is required to attempt five questions in all selecting one from each unit and the compulsory Question No.1.

Unit-I
An Overview of Computer System   **8Hrs**

Anatomy of a digital Computer, Memory Units, Main and Auxiliary Storage Devices, Input Devices, Output Devices, Classification of Computers. Radix number system: Decimal, Binary, Octal, Hexadecimal numbers and their inter-conversions; Representation of information inside the computers.

Unit-II
Operating System Basics   **7Hrs**

The user Interface, Running Programmes, Managing files, Introduction to PC operating Systems: Unix/Linux, DOS, Windows 2000.

Unit-III
Internet basics   **7Hrs**

Introduction to the basic concepts of Networks and Data Communications, How Internet works, Major features of internet, Emails, FTP, Using the internet.

Unit-IV
Programming Languages   **8Hrs**

Machine-, Assembly-, High Level- Language, Assembler, Compiler, Interpreter, debuggers, Programming fundamentals: problem definition, algorithms, flow charts and their symbols, introduction to compiler, interpreter, assembler, linker and loader and their inter relationship.

BOOKS SUGGESTED:

1. Goel A., Computer Fundamentals, Pearson Education, 2010.
2. Aksoy P. & DeNardis L., Introduction to Information Technology, Cengage Learning, 2006
 3. Sinha P. K. & Sinha P. Fundamentals of Computers, BPB Publishers, 2007

BPP-201: Physics Lab – II

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

(Credits: 02)

1. To determine the frequency of an electric tuning fork by Melde's experiment and verify λ^2 /T law.
2. To investigate the motion of coupled oscillators.
3. To study Lissajous Figures.
4. Familiarization with: Schuster`s focusing; determination of angle of prism.
5. To determine refractive index of the Material of a prism using sodium source.
6. To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.
7. To determine the wavelength of sodium source using Michelson's interferometer.
8. To determine wavelength of sodium light using Fresnel Biprism.
9. To determine wavelength of sodium light using Newton's Rings.
10. To determine the thickness of a thin paper by measuring the width of the interference fringes produced by a wedge-shaped Film.
11. To determine wavelength of (1) Na source and (2) spectral lines of Hg source using plane diffraction grating.
12. To determine dispersive power and resolving power of a plane diffraction grating.

Reference Books

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
2. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Ed., 2011, Kitab Mahal
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
4. A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, Vani Pub.

BCP 201: CHEMISTRY LAB-II

Marks (Theory) : 70   **Marks(Total) : 100**

Marks (Internal Assessment) : 30   **Time : 3 Hrs**

1. Complexometrictitrations: Determination of Mg^{2+}, Zn^{2+} by EDTA.

2. Paper Chromatography: Qualitative Analysis of any one of the following Inorganic cations and anions by paper chromatography (Pb^{2+}, Cu^{2+}, Ca^{2+}, Ni^{2+}, Cl^- , Br^- , I^- and PO_4^{3-} and NO_3^-).
3. To determine the specific refractivity of at least two liquids.
4. Determine rate constant of acid catalyzed hydrolysis of methyl acetate.
5. Determination of conductance of electrolytes
6. The preliminary examination of physical and chemical characteristics (physical state, colour, odour and ignition test), extra element detection (N,S,Cl, Br and I).

BOOKS SUGGESTED:

1. Vogel A. I., Tatchell A.R., Furnis B.S., Hannaford A.J., Smith P.W.G.,Vogel's Text Book of Practical Organic Chemistry,5th Edn.,Pubs: ELBS, 1989.
2. Pavia D.L., Lampanana G.M., Kriz G.S. Jr., Introduction to Organic Laboratory Techniques, 3rd Edn., Pubs: Thomson Brooks/Cole,2005.
3. Mann F.G., Saunders. P.C.,Practical Organic Chemistry,Pubs:Green& Co. Ltd., London, 1978.
4. Svehla, G., Vogel's Qualitative Inorganic Analysis (revised); 7th edition, Pubs: Orient Longman, 1996.
5. Bassett, J., Denney, R.C., Jeffery, G.H., Mendham, J., Vogel's Textbook of Quantitative Inorganic Analysis (revised); 4th edition, Pubs: Orient Longman,1978.
6. Das R.C. &Behra B. Experimental Physical Chemistry, , McGraw Hill.

7. Shoemaker &GailandExperiments in Physical Chemistry, McGraw Hill.

8. YadavJ. B. Advanced Practical physical Chemistry

BXP 201: Computer Science Lab

Marks (Theory) : 70 **Marks(Total) : 100**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

C Programming language: C fundamentals, formatted input/ output, expressions, selection statements, loops and their applications; Basic types, arrays, functions, including recursive functions, program organization: local and external variables and scope; pointers & arrays

Representative programming in C

1. Write a program to find the largest of three numbers. (if-then-else)

2. Write a program to find the largest number out of ten numbers (for-statement)

3. Write a program to find the average mail height & average female heights in the class (input is in form of sex code, height).

4. Write a program to find roots of quadratic equation using functions and switch statements.

5. Write a program to multiply two matrices

BOOKS SUGGESTED:

1. Kanetkar Y. Let Us C, BPB publication

Semester-III

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	**Internal**	**Total**
Core Course- III	BML 301	Number Theory and Trigonometry	5	5	70	30	100
Core Course -IV	BML 302	Ordinary Differential Equations	5	5	70	30	100
Core Course- V	BML 303	Advanced Calculus	5	5	70	30	100
Core Course -VI	BML 304	Vector Calculus	5	5	70	30	100
Core Course- VII	BML 305	Mathematical Statistics	5	5	70	30	100
Skill Enhancement Course- I	BML 306	Special Functions-I	2	2	36	14	50
Total Credits = 27, Total hours = 27							

BML 301: Number Theory and Trigonometry

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Divisibility, G.C.D.(greatest common divisors), L.C.M.(least common multiple)

Primes, Fundamental Theorem of Arithemetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophanatine equations in two variables

Section – II

Complete residue system and reduced residue system modulo m. Euler's ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function [x]. The number of divisors and the sum of divisors of a natural number n (The functions d(n) and σ(n)). Moebius function and Moebius inversion formula.

Section - III

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Section – IV

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Books Recommended :

1. S.L. Loney, Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Ivan Ninen and H.S. Zuckerman, An Introduction to the Theory of Numbers.

BML 302: Ordinary Differential Equations

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for *x,y,p* Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Section – II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous

Section – III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Section – IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators *(d/dx)* or *(d/dt)* etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Books Recommended :

1. D.A. Murray, Introductory Course in Differential Equations. Orient Longaman (India). 1967
2. A.R.Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd., London
3. E.A. Codington, Introduction to Differential Equations.
4. S.L.Ross, Differential Equations, John Wiley & Sons
5. B.Rai & D.P. Chaudhary, Ordinary Differential Equations, Narosa Publishing House Pvt. Ltd.

BML 303: Advanced Calculus

Marks (Theory) : 70 **Marks(Total) : 100**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Continuity, Sequential Continuity, properties of continuous functions, Uniform continuity, chain rule of differentiability. Mean value theorems; Rolle's Theorem and Lagrange's mean value theorem and their geometrical interpretations. Taylor's Theorem with various forms of remainders, Darboux intermediate value theorem for derivatives, Indeterminate forms.

Section – II

Limit and continuity of real valued functions of two variables. Partial differentiation. Total Differentials; Composite functions & implicit functions. Change of variables. Homogenous functions & Euler's theorem on homogeneous functions. Taylor's theorem for functions of two variables.

Section – III

Differentiability of real valued functions of two variables. Schwarz and Young's theorems. Implicit function theorem. Maxima, Minima and saddle points of two variables. Lagrange's method of multipliers.

Section – IV

Curves: Tangents, Principal normals, Binormals, Serret-Frenet formulae. Locus of the centre of curvature, Spherical curvature, Locus of centre of Spherical curvature, Involutes, evolutes, Bertrand Curves. Surfaces: Tangent planes, one parameter family of surfaces, Envelopes.

Books Recommended:

1. C.E. Weatherburn , Differential Geometry of three dimensions, Radhe Publishing House, Calcutta
2. Gabriel Klaumber, Mathematical analysis, Marcel Dekkar, Inc., New York, 1975
3. R.R. Goldberg , Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
4. Gorakh Prasad, Differential Calculus, Pothishala Pvt. Ltd., Allahabad
5. S.C. Malik , Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
6. Shanti Narayan, A Course in Mathemtical Analysis, S.Chand and company, New Delhi
7. Murray, R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing co., New York

BML 304: Vector Calculus

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

<u>**Note:**</u> Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Scalar and vector product of three vectors, product of four vectors. Reciprocal vectors. Vector differentiation. Scalar Valued point functions, vector valued point functions, derivative along a curve, directional derivatives

Section – II

Gradient of a scalar point function, geometrical interpretation of grad Φ , character of gradient as a point function. Divergence and curl of vector point function, characters of Div $\vec{f}$ and Curl $\vec{f}$ as point function, examples. Gradient, divergence and curl of sums and product and their related vector identities. Laplacian operator.

Section – III

Orthogonal curvilinear coordinates Conditions for orthogonality fundamental triad of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinates, Cylindrical co-ordinates and Spherical co-ordinates.

Section – IV

Vector integration; Line integral, Surface integral, Volume integral. Theorems of Gauss, Green & Stokes and problems based on these theorems.

Books Recommended:

1.   Murrary R. Spiegal, Theory and Problems of Advanced Calculus, Schaum Publishing Company, New York.
2.   Murrary R. Spiegal, Vector Analysis, Schaum Publishing Company, New York.
3.   N. Saran and S.N. Nigam, Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad.
4.   Shanti Narayna, A Text Book of Vector Calculus. S. Chand & Co., New Delhi.

BML 305: Mathematical Statistics

Marks (Theory): 70   **Marks (Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Measures of Central Tendency and Location: Mean, median, mode, geometric mean, harmonic mean, partition values.
Measures of Dispersion: Absolute and relative measures of range, quartile deviation, mean deviation, standard deviation (σ), coefficient of variation.

Section – II

Moments, Skewness and Kurtosis: Moments about mean and about any point and derivation of their relationships, effect of change of origin and scale on moments, Sheppard's correction for moments (without derivation), Charlier's checks, Concepts of Skewness and Kurtosis.

Section –III

Basic concepts in Probability, Bayes' theorem and its applications.
Random Variable and Probability Functions: Definition and properties of random variables, discrete and continuous random variable, probability mass and density functions, distribution function.

Section – IV

Correlation for Bivariate Data: Concept and types of correlation, Scatter diagram, Karl Pearson Coefficient (r) of correlation and rank correlation coefficient.
Linear Regression: Concept of regression, principle of least squares and fitting of straight line, derivation of two lines of regression, properties of regression coefficients, standard error of estimate obtained from regression line, correlation coefficient between observed and estimated values. Angle between two lines of regression. Difference between correlation and regression.

Books Suggested:
1.   A.M. Mood, F.A. Graybill and D.C. Boes, Introduction to the theory of Statistics, McGraw Hill, 1974.
2.   Baisnab and M. Jas, Element of Probability and Statistics, Tata McGraw Hill.
3.   S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, 2002.
4   P.L.Meyer, Introductory Probability and Statistical Applications, Addison-Wesley Publishing Company, 1970.

BML 306: Special Functions-I

Marks (Theory) : 36   **Marks(Total) : 50**
Marks (Internal Assessment) : 14   **Time : 2 Hrs**

Note: Attempt three questions in all. The question paper will consist of **two** sections. **Question No. 1** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the two sections   (**I-II**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Series solution of differential equations – Power series method, Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties- Convergence, recurrence, Relations and generating functions, Orthogonality of Bessel functions.

Section – II

Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions. Orhogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

Books Recommended:

1. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
2. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon, Special Functions of Mathematical Physics & Chemistry. Oliver and Boyd: Interscience Publishers.
4. W.W. Bell, Special Functions for Scientists and Engineers.

Semester-IV

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	Internal	Total
Core Course -VIII	BML 401	Solid Geometry	5	5	70	30	100
Core Course- IX	BML 402	Transform Techniques	5	5	70	30	100
Core Course- X	BML 403	Elementary Partial Differential Equations	5	5	70	30	100
Core Course- XI	BML 404	Statics	5	5	70	30	100
Core Course- XII	BML 405	Operations Research-I	5	5	70	30	100
Skill Enhancement Course- II	BML 406	Special Functions-II	2	2	36	14	50
Total Credits = 27, Total hours = 27.							

BML 401: Solid Geometry

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

General equation of second degree. Tracing of conics. Tangent at any point to the conic, chord of contact, pole of line to the conic, director circle of conic. System of conics. Confocal conics. Polar equation of a conic, tangent and normal to the conic.

Section – II

Sphere: Plane section of a sphere. Sphere through a given circle. Intersection of two spheres, radical plane of two spheres. Co-axal system of spheres
Cones. Right circular cone, enveloping cone and reciprocal cone.
Cylinder: Right circular cylinder and enveloping cylinder.

Section – III

Central Conicoids: Equation of tangent plane. Director sphere. Normal to the conicoids. Polar plane of a point. Enveloping cone of a coincoid. Enveloping cylinder of a coincoid.

Section – IV

Paraboloids: Circular section, Plane sections of conicoids.
Generating lines. Confocal conicoid. Reduction of second degree equations.

Books Recommended:
1. R.J.T. Bill, Elementary Treatise on Coordinary Geometry of Three Dimensions, MacMillan India Ltd. 1994.
2. P.K. Jain and Khalil Ahmad : A Textbook of Analytical Geometry of Three Dimensions, Wiley Eastern Ltd. 1999.

BML 402: Transform Techniques

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Laplace Transform: – Existence theorem for Laplace transforms, Linearity of the Laplace transforms, Shifting theorems, Laplace transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Inverse Laplace transforms, convolution theorem, Inverse Laplace transforms of derivatives and integrals, solution of ordinary differential equations using Laplace transform.

Section – II

Finite Laplace transformation: Definition and Properties, shifting and scaling theorem. **Fourier transforms:** Linearity property, Shifting, Modulation, Convolution Theorem, Fourier Transform of Derivatives, Relations between Fourier transform and Laplace transform, Parseval's identity for Fourier transforms, solution of differential Equations using Fourier Transforms.

Section – III

Mellin Transform: Definition and Properties of Mellin transform, shifting and scaling properties, Mellin transform of derivaties and integral.

Z-Tranform:- Z-Tranform and inverse Z-Tranform of elementary function, shifting theorem, Convolution theorem, initial and final value theorem.

Section – IV

Hankel Tranform: Basic properties of Hankel transform, Basic Operational properties, Hankel transform of derivatives and some elementary functions, Relation between Fourier and Hankel transform with application to boundary value problem and PDE.

Books Recommended:

1. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999.
2. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon, The use of integral transform, McGraw Hill, 1972
5 Murray R. Spiegel, Laplace transform, Schaum's Series.

BML 403: Elementary Partial Differential Equations

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I
Partial differential equations: Formation, order and degree, Linear and Non-Linear Partial differential equations of the first order: Complete solution, singular solution, General solution, Solution of Lagrange's linear equations, Charpit's general method of solution. Compatible systems of first order equations, Jacobi's method.

Section – II
Linear partial differential equations of second and higher orders, Linear and non-linear homogeneous and non-homogeneous equations with constant coefficients, Partial differential equation with variable coefficients reducible to equations with constant coefficients, their complimentary functions and particular integrals, Equations reducible to linear equations with constant coefficients.

Section – III
Classification of linear partial differential equations of second order, hyperbolic, parabolic and elliptic types, Reduction of second order linear partial differential equations to Canonical (Normal) forms and their solutions, Solution of linear hyperbolic equations, Monge's method for partial differential equations of second order.

Section – IV
Cauchy's problem for second order partial differential equations, Characteristic equations and characteristic curves of second order partial differential equation, Method of separation of variables: Solution of Laplace's equation, Wave equation (one and two dimensions), Diffusion (Heat) equation (one and two dimension) in Cartesian Co-ordinate system.

Books Recommended:
1. D.A.Murray, Introductory Course on Differential Equations, Orient Longman, (India), 1967
2. Erwin Kreyszing, Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
3. A.R. Forsyth, A Treatise on Differential Equations, Macmillan and Co. Ltd.
4. Ian N.Sneddon, Elements of Partial Differential Equations, McGraw Hill Book Company, 1988
5. Frank Ayres, Theory and Problems of Differential Equations, McGraw Hill Book Company, 1972
6. J.N. Sharma and Kehar Singh, Partial Differential Equations

BML 404: Statics

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Composition and resolution of forces. Parallel forces. Moments and Couples.

Section – II

Analytical conditions of equilibrium of coplanar forces. Friction. Centre of Gravity.

Section – III

Virtual work. Forces in three dimensions. Poinsots central axis.

Section – IV

Wrenches. Null lines and planes. Stable and unstable equilibrium.

Books Recommended:

1. S.L. Loney, Statics, Macmillan Company, London
2. R.S. Verma, A Text Book on Statics, Pothishala Pvt. Ltd., Allahabad

BML 405: Operations Research-I

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section- I

Definition, scope, methodology and applications of OR. Types of OR models.

Concept of optimization, Linear Programming: Introduction, Formulation of a Linear Programming Problem (LPP), Requirements for an LPP, Advantages and limitations of LP. Graphical solution: Multiple, unbounded and infeasible solutions.

Section-II

Principle of simplex method: standard form, basic solution, basic feasible solution.

Computational Aspect of Simplex Method: Cases of unique feasible solution, no feasible solution, multiple solution and unbounded solution and degeneracy. Two Phase and Big- M methods.

Section-III

Duality in LPP, primal-dual relationship.Transportation Problem: Methods for finding basic feasible solution of a transportation problem, Modified distribution method for finding the optimum solution, Unbalanced and degenerate transportation problems, transhipment problem, maximization in a transportation problem.

Section-IV

Assignment Problem: Solution by Hungarian method, Unbalanced assignment problem, maximization in an assignment problem, Crew assignment and Travelling salesman problem.

Game Theory: Two person zero sum game, Game with saddle points, the rule of dominance; Algebraic, graphical and linear programming methods for solving mixed strategy games.

Books Recommended
1. J.K. Sharma, Mathematical Model in Operations Research, Tata McGraw Hill.
2. H.A. Taha, Operations Research – An Introduction.
3. Kanti Swarup, P.K. Gupta, and Manmohan, Operations Research.
4. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.
5. S.I. Gass, Linear Programming (3rd Edition), McGraw Hill, New York, 1985.
6. S.D. Sharma, Operations Research.
7. N.S. Kambo, Mathematical Programming.
8. G. Hadley, Linear Programming, Narosa Publishing House, 1987.

BML-406: Special Functions-II

Marks (Theory) : 36   **Marks(Total) : 50**
Marks (Internal Assessment) : 14   **Time   : 2 Hrs**

<u>**Note:**</u> Attempt three questions in all. The question paper will consist of **two** sections. **Question No. 1** will contain **six** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the two sections   (**I-II**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section-I

Laguerre Polynomials: Laguerre's equation and its solution, generating function, alternative expression for the Laguerre polynomials, explicit expressions and special values of the Laguerre polynomials, orthogonality properties of Laguerre polynomials, relation between Laguerre polynomials and their derivatives, recurrence relations, associated Laguerre polynomials, properties of the associated Laguerre polynomials.

Section-II

Hypergeometric functions: The hypergeometric series, an integral formula for the hypergeometric series, the hypergeometric equation, linear relation between the solutions of the hypergeometric equation, relation of contiguity, the confluent hypergeometric function, generalized hypergeometric series.

Books Recommended:
1. W.W. Bell, Special Functions for Scientists and Engineers, D. Van Nostrand Company Ltd., London 1968
2. I.N. Sneddon, Special Functions of Mathematical Physics and Chemistry, Interscience Publishers, Inc., New York, 161.

Semester-V

Course Opted	Paper Code	Nomenclature	Credit	Hours /Week	Max. Marks		
					External	Internal	Total
Core Course- XIII	BML 501	Real Analysis	5	5	70	30	100
Core Course- XIV	BML 502	Groups and Rings	5	5	70	30	100
Core Course- XV	BML 503	Programming in C & Numerical Methods	5	5	70	30	100
Core Course Practical- XV	BMP 504	Programming in C & Numerical Methods - Lab	2	4	35	15	50
Discipline Specific Elective -I	BML 505	Sequences and Series	5	5	70	30	100
Discipline Specific Elective- II	BML 506	Operations Research-II	5	5	70	30	100
Total Credits = 27, Total hours = 29							

BML 501: Real Analysis

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Riemann integral, Integrabililty of continuous and monotonic functions, The Fundamental theorem of integral calculus. Mean value theorems of integral calculus.

Section – II

Improper integrals and their convergence, Comparison tests, Abel's and Dirichlet's tests, Frullani's integral, Integral as a function of a parameter. Continuity, Differentiability and integrability of an integral of a function of a parameter.

Section – III

Definition and examples of metric spaces, neighborhoods, limit points, interior points, open and closed sets, closure and interior, boundary points, subspace of a metric space, equivalent metrics, Cauchy sequences, completeness, Cantor's intersection theorem, Baire's category theorem, contraction Principle

Section – IV

Continuous functions, uniform continuity, compactness for metric spaces, sequential compactness, Bolzano-Weierstrass property, total boundedness, finite intersection property, continuity in relation with compactness, connectedness , components, continuity in relation with connectedness.

Books Recommended:

1. P.K. Jain and Khalil Ahmad, Metric Spaces, 2nd Ed., Narosa, 2004
2. Babu Ram, Metric Spaces, Vinayaka Publication
3. T.M. Apostol: Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
4. R.R. Goldberg, Real Analysis, Oxford & IBH publishing Co., New Delhi, 1970
5. D. Somasundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
6. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co., New Delhi
7. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
8. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw Hill, 1963.

BML-502: Groups and Rings

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Definition of a group with example and simple properties of groups, Subgroups and Subgroup criteria, Generation of groups, cyclic groups, Cosets, Left and right cosets, Index of a sub-group Coset decomposition, Largrage's theorem and its consequences, Normal subgroups, Quotient groups,

Section – II

Homoomorphisms, isomophisms, automorphisms and inner automorphisms of a group. Automorphisms of cyclic groups, Permutations groups. Even and odd permutations. Alternating groups, Cayley's theorem, Center of a group and derived group of a group.

Section – III

Introduction to rings, subrings, integral domains and fields, Characteristics of a ring. Ring homomorphisms, ideals (principle, prime and Maximal) and Quotient rings, Field of quotients of an integral domain.

Section – IV

Euclidean rings, Polynomial rings, Polynomials over the rational field, The Eisenstein's criterion, Polynomial rings over commutative rings, Unique factorization domain, R unique factorization domain implies so is $R[X_1 , X_2,……X_n]$

Books Recommended:

1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975

2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2nd edition).

3. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House.

4. I.S. Luther and I.B.S. Passi, Algebra, Vol.-II, Narosa Publishing House.

BML 503: Programming in C and Numerical Methods

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Programmer's model of a computer, Algorithms, Flow charts, Data types, Operators and expressions, Input / Output functions.

Section – II

Decisions control structure: Decision statements, Logical and conditional statements, Implementation of Loops, Switch Statement & Case control structures. Functions, Preprocessors and Arrays.

Section – III

Strings: Character Data Type, Standard String handling Functions, Arithmetic Operations on Characters. Structures: Definition, using Structures, use of Structures in Arrays and Arrays in Structures. Pointers: Solution of Algebraic and Transcendental equations: Bisection method, Regula-Falsi method, Secant method, Newton-Raphson's method. Newton's iterative method for finding pth root of a number.

Section – IV

Simultaneous linear algebraic equations: Gauss-elimination method, Gauss-Jordan method, Triangularization method (LU decomposition method). Crout's method, Cholesky Decomposition method. Iterative method, Jacobi's method, Gauss-Seidal's method, Relaxation method.

Books Recommended:

1. B.W. Kernighan and D.M. Ritchie, The C Programming Language, 2nd Edition
2. V. Rajaraman, Programming in C, Prentice Hall of India, 1994
3. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998
4. Babu Ram, Numerical Methods, Pearson Publication.
5. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
6. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
7. E. Balagurusamy, Programming in ANSI C, Tata McGraw-Hill Publishing Co. Ltd.

BMP 504: Programming in C & Numerical Methods –Lab

Marks (Practical) : 35   **Marks(Total) : 50**
Marks (Internal Assessment) : 15

There will be a separate practical paper based on the theory paper BML 503.

BML 505: Sequences and Series

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Boundedness of the set of real numbers; least upper bound, greatest lower bound of a set, neighborhoods, interior points, isolated points, limit points, open sets, closed set, interior of a set, closure of a set in real numbers and their properties. Bolzano-Weiestrass theorem, Open covers, Compact sets and Heine-Borel Theorem.

Section – II

Sequence: Real Sequences and their convergence, Theorem on limits of sequence, Bounded and monotonic sequences, Cauchy's sequence, Cauchy general principle of convergence, Subsequences, Subsequential limits.

Infinite series: Convergence and divergence of Infinite Series, Comparison Tests of positive terms Infinite series, Cauchy's general principle of Convergence of series, Convergence and divergence of geometric series, Hyper Harmonic series or p-series.

Section – III

Infinite series: D-Alembert's ratio test, Raabe's test, Logarithmic test, de Morgan and Bertrand's test, Cauchy's nth root test, Gauss Test, Cauchy's integral test, Cauchy's condensation test.

Section – IV

Alternating series, Leibnitz's test, absolute and conditional convergence, Arbitrary series: abel's lemma, Abel's test, Dirichlet's test, Insertion and removal of parenthesis, re-arrangement of terms in a series, Dirichlet's theorem, Riemann's Re-arrangement theorem, Pringsheim's theorem (statement only), Multiplication of series, Cauchy product of series, (definitions and examples only) Convergence and absolute convergence of infinite products.

Books Recommended:

1. R.R. Goldberg , Real Analysis, Oxford & I.B.H. Publishing Co., New Delhi, 1970
2. S.C. Malik, Mathematical Analysis, Wiley Eastern Ltd., Allahabad.
3. Shanti Narayan, A Course in Mathematical Analysis, S.Chand and Company, New Delhi
4. Murray, R. Spiegel, Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York
5. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
6. Earl D. Rainville, Infinite Series, The Macmillan Co., New York

BML 506: Operations Research-II

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section- I

Inventory Control: introduction of inventory, factors affecting inventory, Inventory models, Deterministic models: Economic order quantity model when shortages are allowed/not allowed, price discounts model, multi-item inventory models.

Section-II

Queuing Theory : Basic characteristics of queuing system, Birth-death equations, Steady state solution of Markovian queuing models with single and multiple servers with infinite capacity (M/M/1 and M/M/c), and with limited capacity (M/M/1/K and M/M/c/K).

Section-III

Sequencing problems: Processing of n jobs through 2 machines, n jobs through 3 machines, 2 jobs through m machines, n jobs through m machines.

Replacement problems: Replacement of items whose running cost increases with time, Replacement policies for the items that fail completely - Individual and the group replacement policies.

Section-IV

PERT and CPM: Introduction of PERT and CPM, Earliest and latest times, Determination of critical path and various types of floats, Probablistic and cost considerations in project scheduling

Books Recommended:

1. J.K. Sharma, Mathematical Model in Operations Research, Tata McGraw Hill.
2. H.A. Taha, Operations Research – An Introduction.
3. Kanti Swarup, Gupta, P.K. and Manmohan. Operations Research.
4. P.K. Gupta and D.S Hira, Operations Research, S. Chand & Co.
5. S.D. Sharma, Introduction to Operations Research.

Semester-VI

Course Opted	Paper Code	Nomenclature	Credit	Hours/ Week	Max. Marks		
					External	**Internal**	**Total**
Core Course -XVI	BML 601	Real and Complex Analysis	5	5	70	30	100
Core Course -XVII	BML 602	Linear Algebra	5	5	70	30	100
Core Course -XVIII	BML 603	Numerical Analysis	5	5	70	30	100
Core Course Practical-XVIII	BMP 604	Numerical Analysis - Lab	2	4	35	15	50
Discipline Specific Elective -III	BML 605	Dynamics	5	5	70	30	100
Discipline Specific Elective -IV	BML 606	Mathematical Modeling	5	5	70	30	100
Total Credits = 27, Total Hours = 29.							

BML 601: Real and Complex Analysis

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Jacobians, Beta and Gama functions, Double and Triple integrals, Dirichlets integrals, change of order of integration in double integrals.

Section – II

Fourier's series: Fourier expansion of piecewise monotonic functions, Properties of Fourier Co-efficients, Dirichlet's conditions, Parseval's identity for Fourier series, Fourier series for even and odd functions, Half range series, Change of Intervals.

Section – III

Extended Complex Plane, Stereographic projection of complex numbers, continuity and differentiability of complex functions, Analytic functions, Cauchy-Riemann equations. Harmonic functions.

Section – IV

Mappings by elementary functions: Translation, rotation, Magnification and Inversion. Conformal Mappings, Mobius transformations. Fixed pints, Cross ratio, Inverse Points and critical mappings.

Books Recommended:

1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985
2. R.R. Goldberg, Real analysis, Oxford & IBH publishing Co., New Delhi, 1970
3. D. Somasundaram and B. Choudhary, A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997
4. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co., New Delhi
5. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw-Hill, New York, 1990
6. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.

BML 602: Linear Algebra

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Vector spaces, subspaces, Sum and Direct sum of subspaces, Linear span, Linearly Independent and dependent subsets of a vector space. Finitely generated vector space, Existence theorem for basis of a finitely generated vactor space, Finite dimensional vector spaces, Invariance of the number of elements of bases sets, Dimensions, Quotient space and its dimension.

Section – II

Homomorphism and isomorphism of vector spaces, Linear transformations and linear forms on vactor spaces, Vactor space of all the linear transformations Dual Spaces, Bidual spaces, annihilator of subspaces of finite dimentional vactor spaces, Null Space, Range space of a linear transformation, Rank and Nullity Theorem,

Section – III

Algebra of Linear Transformation, Minimal Polynomial of a linear transformation, Singular and non-singular linear transformations, Matrix of a linear Transformation, Change of basis, Eigen values and Eigen vectors of linear transformations.

Section – IV

Inner product spaces, Cauchy-Schwarz inequality, Orthogonal vectors, Orthogonal complements, Orthogonal sets and Basis, Bessel's inequality for finite dimensional vector spaces, Gram-Schmidt, Orthogonalization process, Adjoint of a linear transformation and its properties, Unitary linear transformations.

Books Recommended:

1. I.N. Herstein,: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975
2. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2nd edition).

3. Vivek Sahai and Vikas Bist, Algebra, Narosa Publishing House.

4. I.S. Luther and I.B.S. Passi, Algebra, Vol.-II, Narosa Publishing House.

BML 603: Numerical Analysis

Marks (Theory) : 70 **Marks(Total) : 100**
Marks (Internal Assessment) : 30 **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Finite Differences operators and their relations. Finding the missing terms and effect of error in a difference tabular values, Interpolation with equal intervals: Newton's forward and Newton's backward interpolation formulae. Interpolation with unequal intervals: Newton's divided difference, Lagrange's Interpolation formulae.

Section – II

Central Differences: Gauss forward and Gauss's backward interpolation formulae, Sterling, Bessel Formula. Eigen Value Problems: Power method, Jacobi's method, Given's method, House-Holder's method, QR method, Lanczos method.

Section – III

Numerical Differentiation: Derivative of a function using interpolation formulae as studied in Sections –I & II. Numerical Integration: Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's one- third and three-eighth rule, Gauss Quadrature formula.

Section – IV

Difference equation: Formation of difference equation, Linear difference equation, Difference equation reducible to linear form. Numerical solution of ordinary differential equations: Single step methods-Picard's method. Taylor's series method, Euler's method, Runge-Kutta Methods. Multiple step methods; Predictor-corrector method, Modified Euler's method, Milne-Simpson's method.

Books Recommended:

1. Babu Ram, Numerical Methods: Pearson Publication.
2. R.S. Gupta, Elements of Numerical Analysis, Macmillan's India 2010.
3. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Method, Problems and Solutions, New Age International (P) Ltd., 1996
4. M. K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Method for Scientific and Engineering Computation, New Age International (P) Ltd., 1999
5. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition).
6. Melvin J. Maaron, Numerical Analysis-A Practical Approach, Macmillan Publishing Co., Inc., New York
7. R.Y. Rubnistein, Simulation and the Monte Carlo Methods, John Wiley, 1981

BMP 604: Numerical Analysis- Lab

Marks (Practical) : 35   **Marks(Total) : 50**
Marks (Internal Assessment) : 15

There will be a separate practical paper consisting of implementation of numerical methods in C Programming Language, studied in the theory paper BML 603.

BML 605: Dynamics

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

Velocity and acceleration along radial, transverse, tangential and normal directions. Relative velocity and acceleration. Simple harmonic motion. Elastic strings.

Section – II

Mass, Momentum and Force. Newton's laws of motion. Work, Power and Energy. Definitions of Conservative forces and Impulsive forces.

Section – III

Motion on smooth and rough plane curves. Projectile motion of a particle in a plane. Vector angular velocity.

Section – IV

General motion of a rigid body. Central Orbits, Kepler laws of motion. Motion of a particle in three dimensions. Acceleration in terms of different co-ordinate systems.

Books Recommended:

1. S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and a Rigid Bodies, Cambridge University Press, 1956
2. F. Chorlton, Dynamics, CBS Publishers, New Delhi
3. A.S. Ramsey, Dynamics Part-1&2, CBS Publisher & Distributors.

BML 606: Mathematical Modeling

Marks (Theory) : 70   **Marks(Total) : 100**
Marks (Internal Assessment) : 30   **Time   : 3 Hrs**

Note: Attempt five questions in all. The question paper will consist of **four** sections. **Question No. 1** will contain **seven** short answer type questions without any internal choice covering the entire syllabus and shall be **compulsory.** Each of the four sections   (**I-IV**) will contain two questions and the students are required to attempt **one** question from each section. **All questions carry equal marks.**

Section – I

The process of Applied Mathematics: Mathematical modeling, need, techniques, classification and illustrative.

Section – II

Mathematical modeling through ordinary differential equation of first order. Mathematical modeling in population dynamics, mathematical modeling of epidemic and compartment models through system of ordinary differential equations.

Section – III

Mathematical modeling in economics, in medicine, Arms race, Battle, international trade and dynamics through ordinary differential equations. Mathematical modeling through ordinary differential equation of record order.

Section – IV

Mathematical modeling through difference equations: need, basic theory, economics and finance, population dynamics and Genetics, probability theory and examples.

Books Recommended:

1. J.N. Kapur: Mathematical modeling, Wiley Eastern limited, 1990.
2. J.N. Kapur, Mathematical Models in Biology and Medicine, Affiliated East-West Press (P) Ltd.
3. D.N. Burghes and A.D. Wood, Mathematical Models in the Social, Management and Life Science, John Wiley & Sons.
4. J.G. Andrews & R.R. Mclone, Mathematical Modeling, Butterworths (Pub.) Inc.