



University of Poonch
Rawalakot
Department of
Mathematics

Course Breakup

MATH-3101		Calculus-I	Credit Hrs. 3(3-0)
Week	Topics		
Week 1-2	Pre-Calculus Review. Functions and their graphs, domain and range. Operations on functions. Trigonometric, exponential, and logarithmic functions.		
Week 3-4	Limits and Continuity. The concept of a limit, calculating limits using limit laws, the Squeeze Theorem. Continuity, types of discontinuities, the Intermediate Value Theorem.		
Week 5-6	The Derivative. The derivative as the slope of a tangent line and as a rate of change. The limit definition of the derivative. Differentiability and continuity.		
Week 7	Differentiation Rules. The power, product, and quotient rules. Derivatives of trigonometric functions. The chain rule.		
Week 8	(Mid-Term)		
Week 9-10	Advanced Differentiation. Implicit differentiation. Derivatives of exponential and logarithmic functions. Derivatives of inverse trigonometric functions.		
Week 11-12	Applications of Differentiation. Related rates. Finding absolute and local extrema. The Mean Value Theorem and Rolle's Theorem.		
Week 13-14	Further Applications. The first and second derivative tests for curve sketching (concavity, points of inflection). L'Hopital's Rule. Optimization problems.		
Week 15-16	Antiderivatives and Introduction to Integration. Antiderivatives, indefinite integrals. Introduction to the definite integral and the Fundamental Theorem of Calculus.		
Week 17	Terminal Exam		

IDC-3102 Introduction to Programming Credit Hrs. 3(2-1)	
Week	Topics
Week 1-2	Introduction to Computing. Algorithms, flowcharts, pseudo-code. Introduction to the programming environment. Basic syntax, "Hello World" program.
Week 3-4	Variables and Data Types. Primitive data types (integers, floats, strings, booleans). Variable declaration and assignment. Basic input/output operations.
Week 5-6	Operators and Expressions. Arithmetic, relational, and logical operators. Operator precedence. Type casting.
Week 7	Control Structures I. Conditional statements: if, if-else, if-elif-else. Nested conditionals.
Week 8	(Mid-Term)
Week 9-10	Control Structures II. Iteration and loops: for loops, while loops. Loop control statements (break, continue).
Week 11-12	Functions. Defining and calling functions. Parameters and return values. Scope of variables (local and global).
Week 13	Data Structures. Introduction to lists (arrays) and strings. Basic operations: indexing, slicing, iteration.
Week 14	File Handling and Exception Handling. Reading from and writing to text files. Introduction to error handling with try-except blocks.
Week 15-16	Introduction to Object-Oriented Programming. Concepts of classes and objects. Final project development and submission.
Week 17	Terminal Exam

GEN-3103		Quantitative Reasoning-I	Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz	
Week 1	<ul style="list-style-type: none"> • Number systems and basic arithmetic operations 		
Week 2	<ul style="list-style-type: none"> • Units, unit conversions, dimensions 		
Week 3	<ul style="list-style-type: none"> • Area, perimeter, and volume calculations 		
Week 4	<ul style="list-style-type: none"> • Rates, ratios, proportions, and percentages 	Assignment#1	
Week 5	<ul style="list-style-type: none"> • Types and sources of data; measurement scales 		
Week 6	<ul style="list-style-type: none"> • Tabular and graphical presentation of data; exercises on number knowledge 	Quiz #1	
Week 7	<ul style="list-style-type: none"> • Basics of geometry: lines, angles, circles 		
Week 8	Midterm		
Week 9	<ul style="list-style-type: none"> • Basics of geometry: polygons and their properties 	Assignment#2	
Week 10	<ul style="list-style-type: none"> • Sets and set operations • Relations, functions, and their graphs 		
Week 11	<ul style="list-style-type: none"> • Exponents, factoring, and simplifying algebraic expressions 	Quiz #2	
Week 12	<ul style="list-style-type: none"> • Population, sample, measures of central tendency 		
Week 13	<ul style="list-style-type: none"> • Measures of dispersion and data interpretation 		
Week 14	<ul style="list-style-type: none"> • Rules of counting: multiplication principle, permutations, combinations 		
Week 15	<ul style="list-style-type: none"> • Basic probability theory and examples 		
Week 16	<ul style="list-style-type: none"> • Introduction to random variables and their probability distributions 		
Week 17	Terminal Examination		

GEN-3104		General Physics	Credit Hrs. 3(2-1)
Week	Topics		
Week 1-2	Introduction. Physics and measurement, standards of length, mass, and time. Dimensional analysis. Introduction to vectors.		
Week 3-4	Motion in One Dimension. Position, velocity, and speed. Instantaneous velocity and speed. Acceleration. Motion with constant acceleration. Freely falling objects.		
Week 5-6	Motion in Two Dimensions. Position, velocity, and acceleration vectors. Projectile motion. Uniform circular motion.		
Week 7	The Laws of Motion. Newton's First, Second, and Third Laws. The gravitational force and weight. Forces of friction.		
Week 8	(Mid-Term)		
Week 9-10	Applications of Newton's Laws. Objects in equilibrium. Objects experiencing a net force. Uniform circular motion and its applications.		
Week 11-12	Energy and Energy Transfer. Work done by a constant force. The scalar product of two vectors. Work done by a varying force. Kinetic energy and the work-kinetic energy theorem. Potential energy. Conservative and non-conservative forces.		
Week 13-14	Conservation of Energy. Conservation of mechanical energy. Relationship between conservative forces and potential energy. Conservation of total energy. Power.		
Week 15-16	Linear Momentum and Collisions. Linear momentum and its conservation. Impulse and momentum. Collisions in one and two dimensions (elastic and inelastic).		
Week 17	Terminal Exam		

GEN-3105		Functional English	Credit Hrs. 3(3-0)
Week	Lecture	Topics	Activity
Week 1	Lecture 1	Introduction To Grammar: Role of Grammar in Communication, Course Overview	
	Lecture 2	Sentence Elements: Subject, Verb, Object, Complement, Predicate, Sentence Agreement	
	Lecture 3	Parts of Speech: Noun, Pronoun, Verb, Adjective, Adverb, Conjunction, Interjection, Preposition Noun: Proper Noun, Common Noun, Abstract Noun, Concrete Noun, Collective Noun, Compound Noun, Countable Noun, Uncountable Noun	
Week 2	Lecture 1	Pronoun: Personal Pronoun, Possessive Pronoun, Indefinite Pronoun, Relative Pronoun, Intensive Pronoun, Demonstrative Pronoun, Interrogative Pronoun, Reflexive Pronoun	
	Lecture 2	Adjective: Descriptive, Demonstrative, Possessive, Interrogative, Indefinite, Compound Adjectives, Adjectives of Number or Adjectives Of Quantity (Definite Numeral Adjectives, Indefinite Numeral Adjectives, Distributive Numeral Adjectives) Verb: Action Verb, Compound Verb, Transitive and Intransitive Verb, Auxiliary Verb, Modal Verb, Phrasal Verb, Regular, Irregular Verbs	
	Lecture 3	Adverb: Adverb of Manner, Adverb of Time, Adverb of Place Prepositions: Types of Preposition (Functional Types: Preposition of Time, Preposition of Place, Preposition of Direction/Movement) Types of Preposition (on the Basis of Structure): Double Prepositions, Compound Prepositions, Participle Prepositions, Phrase Prepositions	
Week 3	Lecture 1	Conjunction: Coordinating Conjunction, Correlative Conjunction, Subordinating Conjunction	
	Lecture 2	Interjection: Emotive Interjection, Volitive Interjection, Cognitive Interjection	
	Lecture 3	Articles: Definite and Indefinite, Usage Rules, Exceptions Parts of Speech: Practice- Identification, Correction Exercises	
Week 4	Lecture 1	Sentence Structure: Sentence Basics (Simple, Negative, Interrogative); Types By Structure: Simple, Compound, Complex, Compound-Complex; Types by Function: Declarative, Interrogative, Imperative, Exclamatory	Assignment#1
	Lecture 2	Tenses: Present, Past and Future Tense: Rules and Exercises	

	Lecture 3	Voice: Active and Passive: Introduction, Definition of Voice, Transformation Rules for all Tenses, Passive of Imperatives	
Week 5	Lecture 1	Voice Practice: Conversion Exercises, Correcting Passive Misuse	
	Lecture 2	Unified Sentences in English: Definition, Coherence, Unity, Logical Flow	
	Lecture 3	Unified Sentences (Continued): Use Of Transitional Devices, Maintaining Paragraph Unity	
Week 6	Lecture 1	Phrases: Introduction, Structure and Types: Noun, Verb, Adjective, Adverb, Prepositional Phrases Phrase Practice: Usage in Writing, Combining Phrases	Quiz #1
	Lecture 2	Clauses: Introduction Difference between Clause and Phrase	
	Lecture 3	Types of Clause: Independent Clause, Dependent Clause Types Of Dependent Clauses: Noun, Adjective, Adverb Clauses with Examples	
Week 7	Lecture 1	Punctuation (Basics): Full Stop, Comma, Question Mark, Exclamation Mark	
	Lecture 2	Advanced Punctuation: Semicolon, Colon, Apostrophe, Quotation Marks, Parentheses	
	Lecture 3	Advanced Punctuation (Continued): Brackets, Braces, Dash, Hyphen, Ellipsis	
Week 8	Midterm		
Week 9	Lecture 1	Spelling Rules: Common Spelling Rules (E.G., -Ie/-Ei, Silent Letters, Homophones), Doubling Consonants, Silent Letters (Kn, Wr, Gh)	
	Lecture 2	Spelling Rules (Continued): Suffixes (-Ing, -Ed, -Able), Confusing Pairs (Their/There/They Are, Affect/Effect)	Assignment#2
	Lecture 3	Reading Comprehension: Definition, Levels of Comprehension, Principles/Rules of Comprehension	
Week 10	Lecture 1	Reading Comprehension (Continued): Literal, Inferential	
	Lecture 2	Reading Comprehension (Continued): Evaluative Reading; Skimming and Scanning Techniques	
	Lecture 3	Comprehension Practice: Exercises On Reading between and Beyond the Lines, Answering Questions	
Week 11	Lecture 1	Discussion Skills: Introduction and Importance	
	Lecture 2	Discussion Skills (Continued): Strategies-Turn-Taking, Active Listening, Using Transitions, Asking Clarifying Questions,	Quiz #2

		Agreeing/Disagreeing Politely	
	Lecture 3	Discussion Practice-Topics: Narrating Past Events, Comparing Ideas, Expressing Opinions	
Week 12	Lecture 1	Listening Skills: Introduction, Types of Listening: Active, Reflective, Critical, Appreciative, Empathetic; Common Listening Barriers	
	Lecture 2	Listening Practice: Note-Taking, Summarizing Audio/Video Clips, Identifying Key Ideas	
	Lecture 3	Listening Practice: Listening to Documentaries for Main Ideas	
Week 13	Lecture 1	Translation Skills: Introduction Types of Translation: Literal, Contextual, Idiomatic, Communicative	
	Lecture 2	Translation Skill: Basic Rules for Urdu to English Translation and Sentence Structure	
	Lecture 3	Translation Practice: Urdu To English Sentence and Paragraph Translation	
Week 14	Lecture 1	Paragraph Writing: Introduction, Parts of a Paragraph: Topic Sentence, Supporting Details, Coherence, Conclusion	
	Lecture 2	Paragraph Practice: Descriptive, Narrative, Argumentative Paragraphs with Transitions	
	Lecture 3	Presentation Skills: Introduction, Types of Presentations: Informative, Persuasive, Demonstrative	
Week 15	Lecture 1	Types of Presentations (Continued): Motivational, Instructional, Impromptu	
	Lecture 2	Structure and Tips For Effective Presentations	
	Lecture 3	Presentation Techniques: Verbal/Non-Verbal Communication, Visual Aids	
Week 16	Lecture 1	Presentation Techniques (Continued): Slide Design, Tone, Pace	
	Lecture 2	Student Presentations (Prepared): Delivering Informative or Persuasive Talks with Feedback	
	Lecture 3	Student Presentations (Impromptu): On-The-Spot Speaking, Timing, Confidence-Building	
Week 17		Terminal Examination	

GEN-3106 Application of Information and Communication Technology Credit Hrs. 3(2-1)			
Week	Topics (Theory)	Practical Work	Assignment/ Quiz
Week 1	Introduction to ICT, Scope, and Components (hardware, software, networks, cloud storage)	Basic computer usage, file management (creating folders, naming conventions)	
Week 2	ICT in Daily Life: Use in education, business, governance, healthcare, etc.	Cloud storage: Google Drive, Dropbox, OneDrive – uploading, organizing, and sharing files	
Week 3	Emerging technologies and future trends	Web exploration: Effective searching using Google, Bing (search operators, filters)	
Week 4	Formal Communication Tools: Gmail, Outlook & Netiquette	Send professional emails, attach files, apply formatting, set auto-reply	Assignment #1
Week 5	MS Word: Basics, formatting, document creation	Hands-on with MS Word: Create letter, resume, formatted report	
Week 6	MS Excel: Data entry, formulas, functions, charts	Hands-on with MS Excel: Budget sheet, formulas, basic chart creation	Quiz #1
Week 7	MS PowerPoint: Slide design, presentation techniques	Create a presentation on ICT tools in education (insert media, animations)	
Week 8	Midterm		
Week 9	Google Workspace: Docs, Sheets, Slides overview	Create a document using Google Docs, collaborate in real-time	Assignment#2
Week 10	Evernote & OneNote: Note-taking and organization tools	Use OneNote/Evernote to create categorized notes, to-do lists	
Week 11	Video Conferencing Tools: Zoom, Meet, Teams	Setup a meeting, share screen, chat, use breakout rooms	Quiz #2
Week 12	LMS and Online Education: Moodle, Google Classroom, Coursera	Practice logging in, submitting assignments, participating in discussion forums	
Week 13	ICT in Health: Fitness apps and Telemedicine	Explore Google Fit or Samsung Health; simulate booking on Sehat Kahani	
Week 14	Online Banking & E-Commerce	Simulate wallet setup (JazzCash), explore Daraz.pk features	
Week 15	Digital Citizenship, Cyberbullying, Intellectual Property	Group discussion & case study on online harassment and plagiarism	
Week 16	Ethics in ICT, Content Authenticity, and Misinformation	Final practical assessment: Document + presentation + cloud storage submission	
Week 17	Terminal Examination		

3rd Semester

GEN-4301 Application of Information and Communication Technology Credit Hrs. 3(2-1)			
Week	Topics (Theory)	Practical Work	Assignment/ Quiz
Week 1	Introduction to ICT, Scope, and Components (hardware, software, networks, cloud storage)	Basic computer usage, file management (creating folders, naming conventions)	
Week 2	ICT in Daily Life: Use in education, business, governance, healthcare, etc.	Cloud storage: Google Drive, Dropbox, OneDrive – uploading, organizing, and sharing files	
Week 3	Emerging technologies and future trends	Web exploration: Effective searching using Google, Bing (search operators, filters)	
Week 4	Formal Communication Tools: Gmail, Outlook & Netiquette	Send professional emails, attach files, apply formatting, set auto-reply	Assignment #1
Week 5	MS Word: Basics, formatting, document creation	Hands-on with MS Word: Create letter, resume, formatted report	
Week 6	MS Excel: Data entry, formulas, functions, charts	Hands-on with MS Excel: Budget sheet, formulas, basic chart creation	Quiz #1
Week 7	MS PowerPoint: Slide design, presentation techniques	Create a presentation on ICT tools in education (insert media, animations)	
Week 8	Midterm		
Week 9	Google Workspace: Docs, Sheets, Slides overview	Create a document using Google Docs, collaborate in real-time	Assignment#2
Week 10	Evernote & OneNote: Note-taking and organization tools	Use OneNote/Evernote to create categorized notes, to-do lists	
Week 11	Video Conferencing Tools: Zoom, Meet, Teams	Setup a meeting, share screen, chat, use breakout rooms	Quiz #2
Week 12	LMS and Online Education: Moodle, Google Classroom, Coursera	Practice logging in, submitting assignments, participating in discussion forums	
Week 13	ICT in Health: Fitness apps and Telemedicine	Explore Google Fit or Samsung Health; simulate booking on Sehat Kahani	
Week 14	Online Banking & E-Commerce	Simulate wallet setup (JazzCash), explore Daraz.pk features	
Week 15	Digital Citizenship, Cyberbullying, Intellectual Property	Group discussion & case study on online harassment and plagiarism	
Week 16	Ethics in ICT, Content Authenticity, and Misinformation	Final practical assessment: Document + presentation + cloud storage submission	
Week 17	Terminal Examination		

GEN-4302 Quantitative Reasoning-II		Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz
Week 1	<ul style="list-style-type: none"> • Introduction to logic; importance of logical reasoning 	
Week 2	<ul style="list-style-type: none"> • Inductive, deductive, and abductive reasoning approaches 	
Week 3	<ul style="list-style-type: none"> • Propositions, arguments (valid and invalid) 	
Week 4	<ul style="list-style-type: none"> • Logical connectives, truth tables 	Assignment#1
Week 5	<ul style="list-style-type: none"> • Propositional equivalences and logical fallacies 	
Week 6	<ul style="list-style-type: none"> • Venn diagrams; predicates and quantifiers; reasoning exercises 	Quiz #1
Week 7	<ul style="list-style-type: none"> • Introduction to deterministic models 	
Week 8	<ul style="list-style-type: none"> • Midterm 	
Week 9	<ul style="list-style-type: none"> • Using linear functions for real-world modeling 	Assignment#2
Week 10	<ul style="list-style-type: none"> • Modeling with systems of linear equations and solutions 	
Week 11	<ul style="list-style-type: none"> • Elementary introduction to derivatives in modeling 	Quiz #2
Week 12	<ul style="list-style-type: none"> • Linear growth and decay models • Exponential growth and decay models 	
Week 13	<ul style="list-style-type: none"> • Introduction to probabilistic models; bivariate analysis and scatter plots 	
Week 14	<ul style="list-style-type: none"> • Simple linear regression model and correlation analysis 	
Week 15	<ul style="list-style-type: none"> • Basics of estimation and confidence intervals • Hypothesis testing: z-test and t-test basics 	
Week 16	<ul style="list-style-type: none"> • Statistical inference in decision making 	
Week 17	<ul style="list-style-type: none"> • Terminal Examination 	

GEN-4303 Civics and Community Engagement		Credit Hrs. 2(2-0)
Week	Topics (Theory)	Assignment/Quiz
Week 1	<ol style="list-style-type: none"> 1. Civics and Citizenship: <ul style="list-style-type: none"> • Concepts of civics, citizenship, and civic engagement. • Foundations of modern society and citizenship. 	
Week 2	<ul style="list-style-type: none"> • Types of citizenship: active, participatory, digital, etc. <ol style="list-style-type: none"> 2. State, Government and Civil Society: <ul style="list-style-type: none"> • Structure and functions of government in Pakistan. 	
Week 3	<ul style="list-style-type: none"> • The relationship between democracy and civil society. • Right to vote and importance of political participation and representation. 	
Week 4	<ol style="list-style-type: none"> 3. Rights and Responsibilities: <ul style="list-style-type: none"> • Overview of fundamental rights and liberties of citizens under Constitution of Pakistan 1973. • Civic responsibilities and duties. 	Assignment#1
Week 5	<ul style="list-style-type: none"> • Ethical considerations in civic engagement (accountability, non-violence, peaceful dialogue, civility, etc.) <ol style="list-style-type: none"> 4 Community Engagement: <ul style="list-style-type: none"> • Concept, nature and characteristics of community. • Community development and social cohesion. 	
Week 6	<ul style="list-style-type: none"> • Approaches to effective community engagement. • Case studies of successful community driven initiatives 	Quiz #1
Week 7	Midterm Exam	
Week 8	<ol style="list-style-type: none"> 5 Advocacy and Activism: <ul style="list-style-type: none"> ▪ Public discourse and public opinion. 	
Week 9	<ul style="list-style-type: none"> ▪ Role of advocacy in addressing social issues. ▪ Social action movements 	Assignment#2
Week 10	<ol style="list-style-type: none"> 6 Digital Citizenship and Technology: <ul style="list-style-type: none"> ▪ The use of digital platforms for civic engagement. 	
Week 11	<ul style="list-style-type: none"> • Cyber ethics and responsible use of social media. 	Quiz #2
Week 12	<ul style="list-style-type: none"> • Digital divides and disparities (access, usage, socioeconomic, geographic, etc.) and their impacts on citizenship 	
Week 13	<ol style="list-style-type: none"> 7 <u>Diversity, Inclusion and Social Justice:</u> <ul style="list-style-type: none"> • Understanding diversity in society (ethnic, cultural, economic, political etc.). 	
Week 14	<ul style="list-style-type: none"> • Youth, women and minorities' engagement in social development. 	
Week 15	<ul style="list-style-type: none"> • Addressing social inequalities and injustices in Pakistan. 	
Week 16	<ul style="list-style-type: none"> • Promoting inclusive citizenship and equal rights for societal harmony and peaceful co- existence. 	
Week17	Terminal Examination	

MATH-4304		Calculus-III	Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz	
Week 1	Sequences, Monotone Sequences		
Week 2	Infinite Series, Convergence Tests		
Week 3	The Comparison, Ratio, and Root Tests		
Week 4	Alternating Series, Absolute and Conditional Convergence	Assignment #1	
Week 5	Maclaurin and Taylor Polynomials		
Week 6	Maclaurin and Taylor Series; Power Series	Quiz #1	
Week 7	Convergence of Taylor Series, Modeling with Taylor Series		
Week 8	Midterm Examination		
Week 9	Parametric Equations, Tangent Lines and Arc Length for Curves	Assignment#2	
Week 10	Polar Coordinates, Tangent Lines, Arc Length, and Area for Polar Curves		
Week 11	Conic Sections, Rotation of Axes, Second-Degree Equations	Quiz #2	
Week 12	Rectangular Coordinates in 3-Space, Spheres, Cylindrical Surfaces, Parametric Equations of Lines, Planes in 3-Space, Quadric Surfaces		
Week 13	Functions of Two or More Variables, Limits and Continuity		
Week 14	Partial Derivatives, Differentiability, Differentials, and Local Linearity The Chain Rule		
Week 15	Directional Derivatives and Gradients, Tangent Planes and Normal Vectors, Maxima and Minima of Functions of Two Variables, Lagrange Multipliers		
Week 16	Cylindrical and Spherical Coordinates, Double Integrals, Double Integrals over Nonrectangular Regions, Double Integrals in Polar Coordinates, Surface Area, Parametric Surfaces, Triple Integrals, Change of Variables in Multiple Integrals, Jacobians		
Week 17	Terminal Examination		

Note: Topics such as Conic Sections in Polar Coordinates have been integrated logically into Weeks 10, 12, 14, and 16 for coherence and flow.

MATH-4305 Numerical Analysis-I		Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz
Week 1	Introduction to Numerical Analysis: Overview of numerical methods and their significance	
Week 2	Sources of error in numerical computations, Root Finding and Nonlinear Equations: Bisection method	
Week 3	False position method, Newton-Raphson method	
Week 4	Secant method, Fixed point iteration method, Convergence and stopping criteria	Assignment#1
Week 5	Interpolation and Polynomial Approximation: Lagrange interpolation	
Week 6	Interpolation and Polynomial Approximation: Newton's divided-difference interpolation	Quiz #1
Week 7	Interpolation and Polynomial Approximation: Hermit interpolation, Polynomial interpolation error	
Week 8	Midterm	
Week 9	Numerical Differentiation, and Integration: Forward, backward, and central difference approximations	Assignment#2
Week 10	Numerical Differentiation, and Integration: Forward, backward, and central difference approximations	
Week 11	Numerical integration: trapezoidal rule, Simpson's rule	Quiz #2
Week 12	Error analysis for differentiation and integration, Systems of Linear Equations: Gaussian elimination methods	
Week 13	Systems of Linear Equations: Gauss Jordan method, matrix inversion	
Week 14	Systems of Linear Equations: LU decomposition,	
Week 15	Iterative methods: Jacobi, Gauss-Seidel, SOR.	
Week 16	Review and Final Assessment	
Week 17	Terminal Examination	

PHY-4306 Waves & Oscillation, Thermodynamics		Credit Hrs. 3(3-0)
Week	Teaching Activities	Assignment/Quiz
01	Simple harmonic motion (SHM), Obtaining and solving the basic equations of motion $x(t)$, $v(t)$, $a(t)$	
02	Longitudinal and transverse Oscillations, and Energy considerations in SHM. Application of SHM, Torsional oscillator, Physical pendulum, simple pendulum,	
03	SHM, and uniform circular motion, Combinations of harmonic motions, Lissajous patterns	
04	Damped harmonic motion, Equation of damped harmonic motion, Quality factor, discussion of its solution	Assignment #1
05	Forced oscillations and resonances, the Equation of forced oscillation, Discussion of its solution, Natural frequency, Resonance, Examples of resonance	
06	Mechanical waves, Travelling waves, Phase velocity of traveling waves, Sinusoidal waves, Group speed and dispersion, Wave speed, Mechanical analysis	Quiz #1
07	Wave equation, Discussion of solution, Power, and intensity in wave motion, Derivation & discussion, Principle of superposition (basic ideas), Interference of waves	
08	Midterm	
09	Standing waves. Phase changes on reflection, Beats Phenomenon, Analytical treatment, Electromagnetic Spectrum, Doppler Effect	Assignment #2
10	Reflection and Refraction of light waves, Total internal reflection, Plane and Spherical Mirrors	
11	Double slit Interference, Michelson and Fabry- Perot Interferometers	Quiz #2
12	Review of previous concepts. The first law of thermodynamics and its applications to adiabatic, isothermal, cyclic, and free expansion	
13	Reversible and irreversible processes, the Second Law of thermodynamics, Carnot theorem	
14	Carnot engines. Heat engine, Refrigerators, Calculation of efficiency of heat engines	

15	Thermodynamic temperature scale: Absolute zero: Entropy	
16	Entropy in a reversible process, Entropy in an irreversible process. Entropy & second law. Entropy & probability	
17	Terminal	

5th Semester

MAT-5101		Real Analysis-I		Credit Hrs. 3(3-0)	
No of Weeks	Topic	Activity			
1 st	Introduction				
2 nd	Ordered Properties plus examples				
3 rd	Suprimum and Infimum Plus examples				
4 th	Completeness Properties of Real Numbers plus theorems	Assignment			
5 th	Limits of Numerical sequences				
6 th	Sequences Plus examples Some important theorems plus Exercise	Quiz			
7 th	Bounded Sequence plus theorem's plus examples. Convergent sequence plus theorem's plus examples.				
8 th	MIDterm				
9 th	Recurrence relation, subsequence ,Cauchy convergence criterion.	Assignment			
10 th	Nested Intervals plus theorem, Bolzano Weierstrass theorem, Limit inferior and limit superior of the sequence examples				
11 th	Infinite series plus theorem, General principle of convergence Comparison test plus examples	Quiz			
12 th	Cauchy condensation test plus examples				
	Alternating series plus examples plus theorems				
	Ratio test plus examples plus theorem				
13 th	Limit of the function plus example plus theorem				
	Examples and Exercise				
	Sandwich theorem plus examples				
14 th	Continuity plus examples				
	Theorem plus exercise				
	Intermediate value theorem				
15 th	Uniform continuity plus exercise				
	Discontinuity plus theorems				
	Differentiation plus examples				
16 th	Derivative of the function plus examples plus exercise theorems plus examples.				
	Chain rule examples Mean value theorem plus examples				
	Lagrange mean value theorem plus exercise				
17 th	Terminal examination				

MAT-5102 Differential Geometry-I		Credit Hrs.
3(3-0)		
Weeks	Topic of Lectures	Assignment/Quiz
1 st	Historical background, Motivation and application, Index notation and summation convention.	
2 nd	Space curve, Plane curve, Tangent, Arc, Chord, Principal normal, Binormal, Torsion, Curvature.	
3 rd	Osculating, normal and the rectifying planes.	
4 th	Reparametrization, Arc length.	Assignment#1
5 th	Sample problems related to arc length.	
6 th	Frenet-Serret Theorem and its applications.	
7 th	Circle of curvature, Locus of centre of curvature, Radius of torsion.	Quiz#1
8 th	Mid Term Examination	
9 th	Helix, Fundamental theorem for space curves, Spherical indicatrices of tangent of a curve and its curvature and torsion.	
10 th	Skew curvature, Involute and evolute of a curve, Surface, Equation of tangent and normal plane to a surface, Curvilinear coordinates.	
11 th	Metric on a surface, First fundamental form for a surface, Second order magnitude of surface.	Assignment#2
12 th	Weingarten Equations, Meunier's Theorem and its applications.	
13 th	Principal directions and principal curvatures, Differential equation for principal directions, First curvature and second curvature.	
14 th	Euler's theorem and its applications.	Quiz#2
15 th	Surface of revolution, Normal surface, Geodesic curvature	
16 th	Christoffel symbols of first and second kind.	
17 th	Terminal Exam	

MAT-5103 Algebra-I Credit Hrs. 3(3-0)		
Weeks	Topics	
1 st	Introductory class, Definition of binary operation with examples, Definition of group, Different Examples of Groups,	
2 nd	Order of a Group. Order of an element of the Group, Basic Results about Groups, Definition of a Subgroup,	
3 rd	Some results related to subgroups. Left and Right cosets of a subgroup, Cosets and equivalence relation modulo subgroup H,	
4 th	Lagrange Theorem, Some consequence of Lagrange's Theorem, Cyclic groups with examples, Some results about cyclic groups	Assignment#1
5 th	Normalizer, Centralizer and Centre of Group, Some examples and related theorems, Some exercise problems	
6 th	Definition of normal subgroups and simple groups, related examples and results, Quotient groups and related results.	
7 th	Conjugate elements and conjugate subgroups, definition, examples and related results.	Quiz #1
8 th	Midterm	
9 th	Definition Homomorphisms, automorphisms and isomorphisms, Discussion with examples, related theorems	Assignment#2
10 th	1 st , 2 nd and 3 rd isomorphism theorems	
11 th	Discussion of commutators with examples, Definition of permutations with examples, Cyclic permutations, order of a permutation and related results.	Quiz #2
12 th	Cayley's theorem, Symmetric groups, even and odd permutations, alternating groups, order of alternating group,	
13 th	Finite p-groups and related results, Direct products, internal direct product and external direct product.	
14 th	Some results related to direct products. Group action on sets, Definition examples and related results.	
15 th	Definition of Sylow p-subgroups with examples, Some results related to Sylow p-subgroups	
16 th	Isotropy subgroups, orbits and 1 st Sylow theorem.	
17 th	2 nd and 3 rd Sylow theorems.	

MATH-5104		Probability Theory	Credit Hrs: 3(3-0)
Week	Days	Course Content	Assignment /Quiz
1	1	Introduction to Probability	
	2	Basic Concepts and Terminology	
	3	Axioms and rules of Probability	
2	1	Counting Techniques	
	2	Combinations & Permutation	
	3	Sample Space & Events	
3	1	Venn Diagrams & Set Operations	
	2	Def. & examples of discrete random variables	
	3	Probability mass function	
4	1	Cumulative Distribution function	
	2	Bernoulli Distribution	Assignment
	3	Binomial distribution	
5	1	Geometric distribution	
	2	Negative binomial distribution	
	3	Q1	
6	1	Hypergeometric distribution	Quiz
	2	Poisson distribution	
	3	Expectation variance, standard deviation	
7	1	Moment Generating function	
	2	Properties & operations of expectations & variances	
	3	Continuous random variables	
8	Mid Term		
9	1	Def. & examples of continuous random variables	Assignment
	2	Probability density function	
	3	Cumulative distribution function	
10	1	Uniform distribution	
	2	Exercise	
	3	Exponential distribution	
11	1	Exercise	Quiz
	2	E	
	3	Gamma distribution	
12	1	Exercise	
	2	EX	
	3	Normal distribution	
13	1	Exercise	
	2	EX	
	3	Expectation	
14	1	Variance of standard deviation	
	2	Moment generating function	
	3	Properties of Expectation	
15	1	Operation of expectation	
	2	Properties of variances	
	3		
16	1	Terminal	

MATH-5105		
Number Theory		Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz
Week 1	<ul style="list-style-type: none"> Divisibility, Euclidean Algorithm, GCD and LCM of integers 	
Week 2	<ul style="list-style-type: none"> Properties of prime numbers, Fundamental Theorem of Arithmetic(UFT), Examples and applications 	
Week 3	<ul style="list-style-type: none"> Introduction to congruences, Congruence relations, Modular arithmetic 	
Week 4	<ul style="list-style-type: none"> Linear congruences, Solutions using Euclidean algorithm 	Assignment#1
Week 5	<ul style="list-style-type: none"> Quadratic congruences, polynomial congruences 	
Week 6	<ul style="list-style-type: none"> Chinese Remainder Theorem, Applications 	Quiz #1
Week 7	<ul style="list-style-type: none"> Fermat's Little Theorem, examples 	
Week 8	Midterm	
Week 9	<ul style="list-style-type: none"> Wilson's theorem, Application to primes 	Assignment#2
Week 10	<ul style="list-style-type: none"> Primitive roots modulo primes, Orders and indices 	
Week 11	<ul style="list-style-type: none"> Primitive roots of composite moduli, Index computations, Using indices to solve congruences 	Quiz #2
Week 12	<ul style="list-style-type: none"> Quadratic residues, Legendre Symbol introduction 	
Week 13	<ul style="list-style-type: none"> Euler's criterion, Legendre symbol rules, Quadratic residues of primes. 	
Week 14	<ul style="list-style-type: none"> Quadratic Reciprocity Law, Applications 	
Week 15	<ul style="list-style-type: none"> Jacobi Symbol, Comparison with Legendre Symbol, Applications 	
Week 16	<ul style="list-style-type: none"> Diophantine Equations, Pythagorean triples, Integer solution to classic equations 	
Week 16	Terminal Examination	

7th Semester

MAT-6301 Partial Differential Equations		Credit Hrs. 3(3-0)
Weeks	Topic of Lectures	Assignment/Quiz
1 st	Introduction: Definition of partial differential equation, order, degree, linear and non-linear, homogeneous and non-homogeneous partial differential equations.	
2 nd	Method of forming partial differential equations by eliminating arbitrary constants and arbitrary functions.	
3 rd	Lagrange's linear equations and its solutions.	
4 th	Method of multipliers.	Assignment#1
5 th	Charpit's method, Classification of partial differential equations.	
6 th	Canonical form/normal form/standard form. Canonical form of hyperbolic equations.	
7 th	Canonical form of parabolic and elliptic type PDE's.	Quiz#1
8 th	Mid Term Examination	
9 th	Method of separation of variables(Solutions of PDE's in Cartesian coordinates).	Assignment#2
10 th	Method of separation of variables(Solution of PDE's in polar coordinates).	
11 th	Solution of wave equation by D'Alembert's method	Quiz#2
12 th	Laplace transform ad its properties, Inverse laplace transform.	
13 th	Solutions of partial differential equations by Laplace transform method.	
14 th	Fourier transform and its properties, Hankel transform.	
15 th	Solutions of partial differential equations by Fourier transform method.	
16 th	Non-homogeneous partial differential equations.	
17 th	Terminal Exam	

MAT-6302` Fluid Mechanics-I		Credit Hrs. 3(3-0)
Week	Topics	Assignment/Quiz
Week 1	Introduction and overview of Fluid Mechanics, Real fluids and ideal fluids, Velocity of a fluid at a point.	
Week 2	Equation of continuity, Acceleration of fluid conditions at a rigid boundary, general analysis of fluid motion.	
Week 3	Streamlines and path lines, Steady and unsteady flows.	
Week 4	Velocity potential, Vorticity vector.	Assignment#1
Week 5	Local and particle rates of change, Boundary Conditions.	
Week 6	Boundary surface and its applications. Euler's equations of motion.	Quiz #1
Week 7	Bernoulli's equation Steady motion under conservative body forces.	
Week 8	Midterm	
Week 9	Some potential theorems. Sources sink and doublets, Images in rigid infinite plane and solid spheres.	Assignment#2
Week 10	A-symmetric flows, Stokes's stream function. Stream function.	
Week 11	Complex potential for two-dimensional, Irrotational, Incompressible flow.	Quiz #2
Week 12	Complex velocity potential for uniform stream, Line Sources and line sinks, Line doublets and line vortices.	
Week 13	Image system, Milne-Thomson circle theorem, Blasius's theorem.	
Week 14	The use of conformal transformation and the Schwarz-Christoffel transformation in solving problems, Vortex rows.	
Week 15	Kelvin's Minimum energy theorem, Uniqueness theorem, Fluids streaming past a circular cylinder.	
Week 16	Irrotational motion produced by a vortex filament, Karman's vortex-street.	
Week 17	Terminal Examination	

MAT-6305		Measure Theory	Credit Hrs. 3(3-0)
Week	Topics		
1 st	Measure Space, Examples, Definition and Examples of algebra and σ -algebra, Lemmas, Propositions		
2 nd	Basic properties of measurable spaces, Definition and examples of measure spaces and related Theorems and Propositions,		
3 rd	Outer measure, Definition, Examples and Results of Outer measure, Lebesgue measure,		
4 th	Definition, Examples and Theorems of Outer measure,		Assignment #1
5 th	Measurable sets, Definition and Examples, Propositions and Lemmas		
6 th	Complete Measure Spaces. Definition and examples and related theorems		Quiz #1
7 th	Measurable Functions, Definition, Examples and basic results		
8 th	Midterm		
9 th	Some equivalent formulations of measurable functions and relevant theorems		Assignment #2
10 th	Various characterization of measurable functions related examples and theorems		
11 th	Properties that holds almost everywhere, Examples and relevant theorems		Quiz #2
12 th	Lebesgue Integration, Definition of Lebesgue integral, Base of Lebesgue integral		
13 th	Basic properties of Lebesgue integrals and relevant theorems		
14 th	Comparison between Riemann integration and Lebesgue integration		
15 th	Convergent sequences and measurable functions, Various properties of Lebesgue integral		
16 th	L_2 -Spaces examples and relevant results, The Riesz Fischer theorem		
17	Terminal Exam		

MAT-6308 Numerical Methods for Partial Differential Equations Credit Hrs. 3(3-0)		
Weeks	Topic of Lectures	Assignment/Quiz
1 st	Introduction: Definition of ODE/PDE, order, degree, linear, nonlinear, homogeneous and nonhomogeneous PDEs, solution of a PDE, Mathematical and physical classification of PDEs, initial and boundary conditions, types of boundary conditions.	
2 nd	Analytical approach versus numerical approximation, discretization techniques, Finite difference method basics, convergence, stability, consistency, finite difference approximation to derivatives.	
3 rd	Discretization of Poisson's equation and Laplace equation, Discretization of Dirichlet problem (Poisson's and Laplace equations with Dirichlet BCs).	
4 th	Discretization of Cauchy problem (Poisson's and Laplace equations with Cauchy conditions).	Assignment#1
5 th	Discretization of PDEs (Laplace equation with irregular boundaries).	
6 th	Direct methods (Gauss's elimination method, Gauss's Jordan method), Indirect methods/iterative methods (Jacobi iterative method, Gauss Seidal iterative method, SOR(Successive Over Relaxation method)).	
7 th	Finite difference solution to elliptic PDEs (Poisson's equation) using Gauss-Seidal Iterative method.	Quiz#1
8 th	MidTerm	
9 th	Finite difference solution to Laplace's equation in polar coordinates. Finite difference solution to parabolic PDEs (heat/diffusion equation) using Time Explicit Method. Simple implicit method.	
10 th	Fourier (Von Neumann) stability analysis of various schemes, Time Explicit method, simple implicit method.	
11 th	Crank-Nicolson method, Combined method.	Assignment#2
12 th	Dufort-Frankel method. Viscous Burger's equation Parabolic partial differential equation.	
13 th	Stability of combined method for heat equation.	
14 th	Finite difference methods for one and two dimensional hyperbolic PDEs(wave equation).	Quiz#2
15 th	ADI method.	
16 th	Numerical methods for conservation laws, Advanced topics, irregular domain.	
17 th	Terminal Examination	