RAJIV GANDHI UNIVERSITY OF KNOWLEDGE TECHNOLOGIES BASAR

B.Tech in Mechanical Engineering

COURSE STRUCTURE& SYLLABUS

I Year – I Semester

S.No.	Subject Code	Subject Name	L	T	P/D	C
1	MA1101	Mathematics-1	4	0	---	4
2	CY1001	Engineering Chemistry	4	0	---	4
3	CS1101	Programming in C	4	0	---	4
4	ME1101	Engineering Drawing and Computer Drafting-I	1	---	3	4
5	ME1001	Engineering Mechanics	3	1	---	4
6	HS1101	Communication Skills-I	2	0	0	1
7	CY1601	Engineering Chemistry Lab	---	---	3	2
8	CS1701	Programming in C Lab	---	---	3	2
		Total	**18**	**1**	**9**	**25**

MA1101 **MATHEMATICS-I**

Externals: 60Marks **L-T-P-C***

Internals: 40Marks **4-0-0-4**

Objectives:

- To give a thorough explanation of real sequences and series.
- To introduce the concepts of Euclidean space and the behavior of functions in them.
- To emphasize the applications of differentiation on real functions and their geometrical inferences.
- Introduction to Numerical analysis.
- To Introduce Fourier series and it's applications.

UNIT-I

Sequence: Definition of sequence, convergence, limit of a sequence, divergence, oscillation, bounded and monotonic sequences, Bounded sequences, Sandwich theorem, Algebra of limits, L'Hospital Rule in sequences, subsequences and its limit.

Series: Infinite series, partial sum, convergence, divergence, oscillation, Geometric series, Telescoping series, Algebra of Limits, n^{th}- term test, Comparison test, Comparison test (Limit Form), Integral test, D'Alembert's Ratio test, Cauchy's Root test, Alternating series, Leibnitz's Rule, Absolute convergence, Conditional convergence, Power series, Radius of convergence for a power series.

UNIT-II

Differential calculus: Rolle's theorem, Lagrange's mean value theorem, Cauchy's Mean-value theorem, Taylor's Theorem and Expansion, Maclaurin's Theorem and Expansion, Indeterminate forms and application of L'Hospital Rule. Radius of curvature, Envelope, Increasing and decreasing functions, concavity, convexity and point of inflexion, Asymptotes-Curve Tracing(Sketching)

UNIT-III

Functions of Several Variable Calculus:

Definition of continuity and differentiability in single variable, n-dimensional Euclidean space, Neighborhood of a point in n-dimensional Euclidean space, Functions in n-variables, Functions in 2 & 3 variables, Interior points, Boundary points, open and closed regions, Limit and continuity, Two-path test, Discontinuities, Partial Differentiation, Clairaut's theorem(for mixed Partial Derivatives), Laplace equation, Homogeneous functions , Euler's theorem for Homogeneous functions, Differentials and derivatives, Derivatives of composite functions, Chain Rule, Jacobians, Taylor's Theorem, Maxima and minima, Lagrange's method of multipliers.

UNIT-IV:

Fourier Series:
Definition of Fourier Series, Fourier Series representation of function, Limit of Convergence of Fourier Series, Even & Odd functions, Gibb's Phenomenon, Sine and Cosine Series, Limit of Convergence of Sine & Cosine Series. Integration and Differentiation of Fourier Series, Bessel's Inequalities, Parseval's Theorem.

UNIT-V

Numerical Methods:
Introduction: True value, Approximate Value, Error, Error percentage, Application of Numerical Analysis in various fields.

Numerical Analysis in solving Algebraic equations: Algebraic equations, Transcendental equations, Bisection Method, Regula -Falsi Method, Newton-Raphson Method.

Numerical Integration: Trapezoidal Rule, Simpson $\frac{1}{3}$ Rule, Simpson $\frac{3}{8}$ Rule

Text Books:

1. Thomas Calculus, Maurice D.Wier, Joel Hass Eleventh Edition, Pearson Education ,2008
2. R.K. Jain & S.R.K.Iyengar, Advanced Engineering Mathematics, Third Edition, Narosa publications, 2007.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley & Sons Ltd 2006.

Suggested References:

1. B.S. Grewal and J.S. Grewal, "Higher Engineering Mathematics",(40th Edition), Khanna Publishers,2007
2. S.S. Sastry ,Introductory Methods of Numerical Analysis ,Third Edition, Prentice Hall India

*L-T-P-C stands for number of lectures, tutorials, practices and credits

CY1001 **ENGINEERING CHEMISTRY**

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **4-0-0-4**

Objectives:

1. To understand the basic organic reactions and their mechnisms with examples
2. To understand the importance of the spectroscopy in determining the structures of chemical compounds
3. To understand the importance of electrochemistry in technical filed
4. To undertand the rates of some of the reactions and derivation of their rate laws
5. To understand the phase rule with some examples

Unit1: Organic reactions and Mechanisms

Elimination reactions: types of elimination reactions. α-eliminations with examples, Reimer-Tiemann reaction and its mechanism, β-eliminations with examples, Hofmann elimination and Saytzeff elimination reactions and their mechanisms, Classification of β-eliminations into E1 and E2 reactions with examples, γ-elimination reactions with examples, Aldol condensation with mechanism.

Addition and Substitution reactions: Classification of addition reactions into electrophilic, nucleophilic and free radical addition reactions with examples and their mechanisms, Markonikov's law, anti-Markonikov's rule and Kharasch effect, Michael reaction, Skraup synthesis, Polyvinyl chloride synthesis and their mechanisms. Classification of substitution reactions into electrophilic, nucleophilic and free radical substitutions with examples and their mechanisms, S_N^1 and S_N^2 reactions with examples, S_E^1 and S_E^2 reactions with examples.

Bio-organic Reactions: amino acids and proteins, peptide bond formation and examples, methods of representing a peptide bond and its synthesis, Lipids, functions of lipids, classification of lipids, lipid metabolism, occurrence of lipids, properties of lipids, analysis of fats and oils.

Polymerization reactions: classification of polymerization, detailed reaction mechanism of free radical polymerization with examples, condensation polymerization reaction with mechanism, ionic polymerization with examples, classification of ionic polymerization into cationic and anionic polymerization.

Mechanism of catalytic reactions: catalyst definition, characteristics and types of catalysis, theories of catalysis, intermediate compound formation theory with examples and mechanism, drawbacks of intermediate compound formation theory, adsorption or contact theory with examples and mechanisms, enzyme catalysis, characteristics and mechanism of enzyme catalysis.

Unit 2: Spectroscopy

Introduction to spectroscopy, electromagnetic radiations, different types of spectroscopy, principle of spectroscopy, spectrophotometer

Microwave spectroscopy: principle, microwave spectra of diatomic molecules, selection rules for microwave spectra, applications of microwave spectroscopy: determination of bond length, dipolemoment measurement, determination of isotopic mass of an element.

Infrared spectroscopy: introduction and principles of IR, types of vibrations: bending and stretching, Hooke's law for stretching vibrations, characteristic frequencies of common functional groups, IR instrumentation, interpretation and applications of IR spectrum with examples.
Ultra-violet spectroscopy: Introduction and principle of UV spectroscopy, color interpretation with VBT and MOT, types of electronic transitions, selection rules, chromophores and auxochromes with examples, conjugation effect, absorption and intensity shifts, applications of UV spectroscopy.

Unit 3: Electrochemistry

Types of electrodes: introduction, metal-metal ion electrodes, metal-insoluble salt-anion electrodes, calomel electrode, gas-ion electrodes, hydrogen and chlorine electrodes, oxidation-reduction electrodes, amalgam electrodes.
Types of cells: classification into chemical and concentration cells, chemical cells with transference and without transference, classification of concentration cells into electrolyte and electrode concentration cells, electrolyte concentration cells with and without transference, amalgam and gas concentration cells, examples for these cells.
EMF and applications of EMF: determination of pH, determination of the valency of the ions, potentiometric titrations.
Thermodynamic data: enthalpy and entropy of cell reactions, Gibbs-Helmholtz equation and applications.
Activity coefficients: fugacity and activity, their derivations, determination of activity and activity coefficients from cell potentials, ionic strength and its determination.
Solubility product: solubility and solubility product definitions, determination of solubility product using potentiometric and conductometric methods.
pH: definition of pH and determination of pH by various methods, acid-base titrations.
Corrosion: introduction, causes of corrosion, factors affecting the corrosion: nature of the metal and nature of the environment, thermodynamics of the corrosion, theories of corrosion: electrochemical/wet/immersion theory and chemical/dry/direct chemical attack theory.
Prevention of corrosion: protective coating - metal and nonmetal coatings, cathodic and anodic protection and their limitations, corrosion inhibitors – organic and inorganic inhibitors with examples.

Unit 4: Chemical kinetics

Complex reactions: definition and classification of complex reactions, definition of reversible reactions with examples, rate law derivation for reversible reactions.
Consecutive reactions: definition, rate law derivation and examples of consecutive reactions.
Parallel reactions: definition, rate law derivation and examples of parallel reactions.
Steady-state approximation: introduction, kinetic rate law derivation by applying steady state approximation in case of the oxidation of NO and pyrolysis of methane.
Chain reactions: introduction, types and mechanism of chain reactions, stationary and non-stationary chain reactions with examples, deriving the kinetic rate equation using a general chain reaction. Photochemical reactions: introduction, Stark-Einstein law of photochemical equivalence, photophysical processes: IC, ISC, fluorescence and phosphorescence with examples, kinetic rate law derivation incase of photochemical decomposition of HI and photochemical combination of H_2 and Br_2.

Unit 5: Phase and reaction equilibrium

Phase equilibrium: introduction, definition of phase equilibrium, phase rule, definition and explanation of the terms used in the phase equilibrium: phase, components, degrees of freedom with examples, Lead – silver system.

Chemical equilibrium in mixture: energy changes, degree of advancement of reaction, effect of adding an inert gas on equilibrium.

Reference books:

1. Applied Chemistry – A textbook for engineers and technologist by H.D. Gesser
2. Engineering Chemistry: by P C Jain & Monika Jain
3. A Text Book of Engineering Chemistry: by Shashi Chawla
4. Fundamental of Organic Spectroscopy by Y. R. Sharma
5. Introduction to spectroscopy by Pavia, Lampman, Kriz

CS1101 **PROGRAMMING IN C**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **4-0-0-4**

Prerequisites

1. No prerequisites
2. Requires analytical skills and logical reasoning.

Objectives

This course starts from the basics of computers and program development

 It covers various concepts of C programming language

 To learn how to write modular and readable C Programs

 To learn to write programs (using structured programming approach) in C to solve problems.

 To introduce the students to basic data structures

Outcomes

1.Develop C programs for computing and real life applications using basic elements like control statements, arrays, functions, pointers and strings and Implement searching and sorting algorithms

UNIT – I

Introduction to Computer Programming: Computing Environments, Computer Languages, Creating and Running Programs. Algorithms and Flow charts : Definition of Algorithms, examples, Symbols used in Flow chart, examples. Introduction to C Language - Background, C Identifiers, Data Types, Operators, Variables, Constants, Input / Output, Expressions, C Programs, Precedence and Associativity, Evaluating Expressions, Type Conversion, Statements, Bitwise Operators.

UNIT-II

Selection: Logical Data and Operators, if-else, switch Statements, Standard Functions. Repetition: loops, while, for, do-while statements, Loop examples, break, continue, go to. Arrays - Concepts, Using Arrays in C, Array Applications, Two- Dimensional Arrays, Multidimensional Arrays, Linear and Binary Search, Selection, Bubble, Insertion Sorts.

UNIT – III

Functions: Designing Structured Programs, Functions Basics, User Defined Functions, Inter Function Communication, Standard Functions, Scope, Storage Classes-auto, Register, Static, Extern, Scope Rules, and Type Qualifiers. Recursion- Recursive Functions, Preprocessor Commands. Strings - Concepts, C Strings, String Input / Output Functions, Arrays of Strings, String Manipulation Functions.

UNIT – IV

Pointers - Introduction, Pointers to Pointers, Compatibility, void Pointers, Arrays and Pointers, Pointer constants, Pointers and Strings, Pointers to Functions, Point ers to Constant Objects, Constant Pointers, Pointer Arithmetic.Call-by-reference: Pointers for Inter-Function Communication, Passing Arrays to a Function.Dynamic Memory Allocation: Memory Allocation Functions, Programming Applications, Command-line Arguments.

UNIT – V

The Type Definition (type def), Enumerated Types Structure: Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self Referential Structures, Unions. Input and Output: Files, Streams, Standard library Input Output Functions, Character Input Output Functions.

Suggested References:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice

Hall of India.

2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.

3. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

4. Seymour Lipschutz, Data Structures, Schaum's Outlines Series, Tata McGraw-Hill.

CODE: ME1101 ENGINEERING DRAWING AND COMPUTER DRAFTING – I

Instruction	:4Hours/Week(1 Theory+3 Drawing)
Duration of External Exam	: 3 Hours
Scheme of External Exam	: 60 Marks
Scheme of Internal Exam	: 40 Marks
Credits	: 4

Objectives:

- To evaluate the language of the drawing for-geometric constructions and to understand the engineering perspective of drawings
- To understand projection of points and lines using 2-Dimensional drawing tools
- To learn the section of solids or To learn the engineering graphics through AutoCAD
- object from various views / angles etc.,

UNIT-I

Introduction to Engineering drawing: Size of Drawing Sheet, Drawing sheet format, Types of lines, lettering, types of dimensioning, Title Block, Engineering Scales. Free hand sketches: Sketch straight line, circles, arcs, and fillet.

Introduction to AutoCAD: Initial setup commands, utility commands, function keys, entity draw commands, display commands, edit commands, setting limits of sheet size, dimensioning and dimension style, Tile Block.

UNIT-II

Engineering curves: Conic sections, Cycloids, Involutes.

Projections: Elements of projections, multi view projections, principal plane of projections, Methods of projections, first angle and third angle projection methods.

Orthographic projections: Concept of quadrant, projection of point, projection of a line inclined to one plane and parallel to other plane, line inclined to both the planes, lines parallel to profile plane, Traces of line.

UNIT-III

Projection of Planes: Introduction, Types of planes, Traces of a planes, Projection of a planes parallel to one reference planes, projections of planes inclined to one reference planes and perpendicular to the other, projections of oblique planes.

Auxiliary projections: Types of auxiliary projection planes, Single and double auxiliary views.

UNIT-IV

Projection of Solids: Introduction, Types of solids, Projection of solids in simple positions, Projections of solids axes inclined to one of the reference planes and parallel to the other, Axis inclined to the V.P. and parallel to the H.P. , Axis inclined to the H.P. and parallel to the H.P. and parallel to the V.P., Transfer of point from one view to other.

UNIT-V

Sections of Solids: Introduction- Section planes, Sections, True shape of a section, Sections of Prisms, Sections of Pyramids, Sections of Cylinders, Sections of Cones and Sections of Spheres.

Suggested Reading:

1. Kulkarni, D.M., Rastogi, A.P. and Sarkar, A.K. (2013). "Engineering Graphics with AutoCAD." *PHI publications*, New Delhi.
2. Butt,N.D. (2011). " Engineering Drawing." *5th Edition, Charotar publishing house Pvt. Ltd.*
3. Sham Tickoo, and Saravanan, D. (2010). "AutoCAD 2010 for engineers and designers." *Dreamtech Press.*
4. Sham Tickoo. (2011). "AutoCAD 2011: A Problem solving approach" *Autodesk Press*, USA
5. Venugopal, K. (1998). "Engineering Drawing and Graphics + Autocad", *New Age International [P] Ltd.*, New Delhi.

CODE: ME1001 ENGINEERING MECHANICS

Instruction	:4Hours/Week(3Theory + 1 Tutorial)
Duration of External Exam	: 3 Hours
Scheme of External Exam	: 60 Marks
Scheme of Internal Exam	: 40 Marks
Credits	: 4

UNIT I–

BASIC CONCEPTS - System of forces– Moment of forces and its Application – Couples and Resultant of Force System

EQUILIBRIUM OF SYSTEM OF FORCES: Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II–

ANALYSIS OF PERFECT FRAMES: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, Tension Coefficient method and methods of sections for vertical loads, horizontal loads and inclined loads.

UNIT III–

FRICTION: Types of friction– laws of Friction–Limiting friction–Cone of limiting friction– static and Dynamic Frictions –Motion of bodies – Wedge, Screw jack and differential Screw jack.

UNIT IV–

CENTROID AND CENTER OF GRAVITY: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Centre of Gravity of Composite figures. (Simple problems only).

AREA MOMENT OF INERTIA - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures

MASS MOMENT OF INERTIA: Moment of Inertia of Simple solids, Moment of Inertia of composite masses. (Simple problems only)

UNIT V–

KINEMATICS : Rectilinear and Curve linear motion –Velocity and Acceleration – Motion of A Rigid Body – Types and their Analysis in Planar Motion.

KINETICS : Analysis as particles and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies – Work Energy Method– Equation for Translation – Work – Energy application to Particle Motion, Connection System – Fixed axis Rotation and Plane Motion.

TEXT BOOKS:

1. Engineering Mechanics, Shames & Rao – Pearson Education.
2. Engineering Mechanics, Fedrinand L.Singer – B.S. Publishers.
3. Engineering Mechanics, Bhavikatti and Rajasekharappa

REFERENCES:

1. Engineering Mechanics-Statics and dynamics, A.Nelson, Tata McGraw-Hill Company
2. Mechanics of Materials by Timoshenko & Gere, CBS
3. Engineering Mechanics – B. Bhathacharya- Oxford University Publications
4. Mechanics of Materials - Dr. B. C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publication
5. Engineering Mechanics –Arthur P. Boresi and Richard J.Schmidt. – Brooks/Cole – Cengage Learning

HS1101 COMMUNICATION SKILLS- I

Externals: 60 **L-T-P-C***

Internals: 40 **2-0-0-1**

Objectives:

- To improve the English language learning ability of the students by emphasizing on LSRW.
- To complement the comprehensibility of the Technical subjects in a better way.

UNIT-I

Basics of Technical Communication - Introduction - Importance of Technical Communication (2hrs) - **Visual Aids in Technical Communication** - Tables - Graphs - Chart - Drawings and Diagrams - Photographs – Maps - **Non-verbal Communication** - Introduction - Kinesics - Proxemics - Chronemics - Correlating Verbal and Non-verbal Communication - Cross-cultural Variations - Significance of Understanding Culture

UNIT-II

Speaking – JAM - Dialogue conversations - Telephonic Conversations and Etiquette - Telephonic Conversation Practice – Jokes – Proverbs – Quotes

UNIT-III

Writing- Dialogue writing

Suggested References:

1. Technical Communication – Meenakshi Raman & Sangeeta Sharma

CY1601 ENGINEERING CHEMISTRY LAB

Externals: 60 Marks **L-T-P-C**
Internals: 40 Marks **0-0-3-2**

Objectives:

1. To learn the preparation of organic compounds in the laboratory
2. To estimate the hardness and alkalinity of the given sample of water
3. To understand the Job's method for determining the composition
4. Learns how to use the pH meter and polarimeter

1. **Synthesis**
   i. Synthesis of soap from cheap oil.
   ii. Synthesis of Thiokol rubber

2. **Volumetric analysis**
   i. Estimation of alkalinity of water
   ii. Estimation of total hardness of water by EDTA method

3. **Job's method**
   i. Determination of composition of Ferric-Thiocyanate complex by Job's method

4. **pH meter**
   i. Estimation of the strength of a weak acid by pH metry

5. **Polarimeter**
   i. Determination of specific rotation of sucrose by polarimeter

Reference books:

1. College Practical Chemistry by V K Ahluwalia, Sunita Dhingra, Adarsh Gulati
2. Practical Engineering Chemistry by K Mukkanti
3. A Text Book of Engineering Chemistry: by Shashi Chawla
4. Essentials of Experimental Engineering Chemistry by Shashi Chawla
5. Comprehensive Practical Organic Chemistry – Preparation and Quantitative analysis byV K Ahluwalia, Renu Aggarwal

CS1701 **PROGRAMMING IN C LAB**

Externals: 60Marks **L-T-P-C**

Internals: 40Marks **0-0-3-2**

Objectives:

1. Able to have fundamental concept on basics commands in Linux.

2. Able to write, compile and debug programs in C language.

3. Able to formulate problems and implement algorithms in C.

4. Able to effectively choose programming components that efficiently solve computing problems in real-world

Experiments:

Suggested assignments to be conducted on a 3-hour slot. It will be conducted in tandem with the theory course so that the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course should be appropriately sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:

1. Familiarization of a computer and the environment and execution of sample programs
2. Expression evaluation
3. Conditionals and branching
4. Iteration
5. Functions
6. Recursion
7. Arrays
8. Structures
9. Files

For the detailed list of programs refer the lab manual.

Note: Any experiment according to the syllabus of CS1101 can be substituted

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