COURSE SCHEME AND SYLLABUS

FOR

B.E. (COE)

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

2024

SEMESTER-I

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCB009	Chemistry	BSC	3	0	2	**4**
2.	UES103	Programming for Problem Solving	ESC	3	0	2	**4**
3.	UES013	Electrical & Electronics Engineering	ESC	3	1	2	**4.5**
4.	UEN008	Energy and Environment	OTH	2	0	0	**2**
5.	UMA022	Calculus for Engineers	BSC	3	1	0	**3.5**
		TOTAL					**18**

SEMESTER-II

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UPH013	Physics	BSC	3	1	2	**4.5**
2.	UES101	Engineering Drawing	ESC	2	4	0	**4**
3.	UHU003	Professional Communication	HSS	2	0	2	**3**
4.	UES102	Manufacturing Processes	ESC	2	0	2	**3**
5.	UMA023	Differential Equations and Linear Algebra	BSC	3	1	0	**3.5**
		TOTAL					**18**

SEMESTER-III

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCS303	Operating System	PCC	3	0	2	**4**
2.	UTA018	Object Oriented Programming	PCC	3	0	2	**4**
3.	UCS301	Data Structures	PCC	3	0	2	**4**
4.	UCS405	Discrete Mathematical Structures	PCC	3	1	0	**3.5**
5.	UTA016	Engineering Design Project I (2 self-effort hours)	ESC	1	0	2	**3**
6.	UMA021	Numerical Linear Algebra	BSC	3	0	2	**4**
7.	UHU050	Evolutionary Psychology (1 Self Effort Hour)	HSS	1*	0	0	**1**
		TOTAL					**23.5**

Note: *Alternate week

SEMESTER-IV

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCS415	Design and Analysis of Algorithms	PCC	3	0	2	**4**
2.	UCS310	Database Management Systems	PCC	3	0	2	**4**
3.	UES021	Engineering Materials	ESC	2	0	2	**3**
4.	UCS411	Artificial Intelligence	PCC	3	0	2	**4**
5.	UMA401	Probability and Statistics	BSC	3	0	2	**4**
6.	UTA024	Engineering Design Project II	PCC	1	0	4	**3**
7.	UTD003	Aptitude Skills Building	HSS	2	0	0	**2**
		TOTAL					**24**

SEMESTER I

UCB009: Chemistry

L	T	P	Cr
3	0	2	4.0

Course Objective: The course aims at elucidating principles of applied chemistry in industrial systems, water treatment, engineering materials, computational and analytical techniques.

Syllabus

Atomic and Molecular spectroscopy: Introduction to spectroscopy, principles of atomic absorption, flame emission spectrophotometry and ICP-AES (Inductively Coupled Plasma- Atomic Emission Spectroscopy), Quantification by calibration method, Jablonski diagram, fluorescence and phosphorescence, Beer-Lambert's Law, principle and applications of UV-Vis and IR spectroscopy.

Electrochemistry: Background of electrochemistry, Ionic mobility, Conductometric titrations, Modern Batteries: Pb-acid and Li ion battery, Corrosion and its protection.

Water Treatment and Analysis: Physiochemical parameters of water quality, External and internal methods of Softening of water: carbonate, phosphate, calgon and colloidal conditioning, Zeolite process, Ion exchange process, treatment of water for domestic use, Desalination of brackish water: Reverse osmosis & Electrodialysis.

Fuels: Classification of fuels, Calorific value, Cetane and Octane number, alternative fuels: biodiesel, Power alcohol, synthetic petrol, Fuel cells: H2 production and storage, Water splitting, Rocket propellant.

Chemistry of Polymers: Classification of polymers, tacticity of polymers, molecular weight calculations, Polymers in daily life, conducting, inorganic and biodegradable polymers.

Computers in Chemistry: Introduction to SMILES (Simplified Molecular Input Line-Entry System): Methodology and encoding rules, SMILES notation-chemical structure interconversions and its applications.

Laboratory Work

Electrochemical measurements: Experiments involving use of pH meter, conductivity meter, potentiometer, Spectroscopic technique, Volumetric titrations: Determination of mixture of bases, hardness, alkalinity, chloride and iron content, Application of polymers and SMILES Language.

Course Learning Objectives (CLO)

The students will be able to:

1. Rrecognize principles and applications of atomic and molecular spectroscopy.
2. Explain the concepts of conductometric titrations, modern batteries and corrosion.
3. Apply and execute water quality parameter and treatment methods.
4. Discuss the concept of alternative fuels, application of polymers and SMILES.

5. Execute laboratory techniques like pH metry, potentiometry, spectrophotometry, conductometry, and volumetry.

Text Books

1. Engineering Chemistry, S. Vairam and S. Ramesh, Wiley India 1st ed, 2014.
2. Engineering Chemistry, K. S. Maheswaramma, and M. Chugh. Pearson, 2016.

Reference Books

1. Engineering Chemistry, B. Sivasankar, Tata McGraw-Hill Pub. Co. Ltd, New Delhi, 2008.
2. Engineering Chemistry, M.J. Shulz, Cengage Learnings, 2007.
3. J. Chem. Inf. Comput. Sci., D. Weininger, Vol. 28, 1988, 31-36.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UES103: Programming for Problem Solving

	L	T	P	Cr
	3	0	2	4.0

Course Objectives: This course is designed to solve and explore the problems using the art of computer programming with the help of C Language. Students will be able to apply these problem solving concepts in real life applications.

Syllabus

Introduction to Computer Fundamentals- Computer Memory Hierarchy, Types of Software Binary number system, Algorithm, Flowchart, Formulate simple algorithms for logical and arithmetic problems.

Basics of C Programming: Structure and Life cycle of a C Program, Data types, Identifiers, Variables, Keywords, Constants, input/output statements, Operators, Type conversion and type casting. Translate the algorithms to code snippets.

Decision Making and Iterative Statements-Decision making- if, if-else, Nested if-else, Multiple if, else if, switch, Ternary Operator, **Loops-** (while, do-while, for), Nesting of Loops, break, continue and goto. Implement the switch () to solve the basic functions of scientific calculator.

Functions: Function prototype, Definition and Call, Type of Functions, Scope of variables in (Block, Function, Program, File), Storage classes (Auto, Register, Static and Extern), Recursion (with the introduction of Stack), Implementation of recursion to solve the problem of Tower of Hanoi.

Arrays and Strings- One-dimensional array its operations (Traversal, Linear Search, Insertion, Deletion, Bubble Sort), Two-dimensional and its operations (Addition, Transpose and Multiplication), Passing of array into a function (row and entire array), Input and output of a string, string inbuilt functions, 2-D Character array.

Pointers: Introduction to Pointers, Pointer arithmetic, Passing arguments to a function using pointer (understanding of call by value and call by reference), Accessing arrays using pointers Dynamic memory allocation (malloc(), calloc(), realloc() and free()), Pointer and Functions.

Structures and Union: Structure declaration, Initialization of structures, Structure variables, Accessing structure elements using (.) operator, Array of structure variables, Passing structure variable to a function (individual and entire structure), Structure pointer, Comparison of Structure and Union.

File Handling: Introduction of Files (streams in C), using File (Declaring, Opening and

Closing), Operations on File (Reading, Writing and appending), and Random Access of a file, command line argument.

Laboratory Work

To implement programs for various kinds of real life applications in C Language.

Course Learning Outcomes (CLOs) /Course Objectives (COs):

On completion of this course, the students will be able to:

1. Comprehend and analyze the concepts of number system, memory, compilation and debugging of the programs in C language.
2. Analyze the control & iterative statements to solve the problems with C language source codes.
3. Design and create programs for problem solving involving arrays, strings and pointers.
4. Evaluateandanalyzetheprogrammingconceptsbasedonuserdefinedatatypesandfilehandlingusing C language.

Text Books

1. CProgrammingLanguage, BrianW.KernighanDennisM. Ritchie,2nded,2012.
2. ProgramminginANSIC, BalagurusamyG., 8thed., 2019

Reference Books

1. LetUs C, KanetkarY.,16th ed.,2017
2. Programming with C, Byron S Gottfried,McGraw Hill Education, Forth edition, 2018

UES013: Electrical and Electronics Engineering

L	T	P	Cr
3	1	2	4.5

Course Objective: To introduce the basic concepts of electrical and electronics engineering.

Syllabus

DC Circuits: Introduction to circuit elements; rms and average values for different wave shapes, independent and dependent current and voltage sources; Kirchhoff's laws; mesh and node analysis; source transformations; network theorems: Superposition theorem, Thevenin's and Norton's theorem, Maximum power transfer theorem; star-delta transformation; steady state and transient response of R-L and R-C and R-L-C circuits.
AC Circuits: Concept of phasor, phasor representation of circuit elements; analysis of series and parallel AC circuits; concept of real, reactive and apparent powers; resonance in RLC series and parallel circuits; balanced three phase circuits: voltage, current and power relations for star and delta arrangement; analysis of balanced and unbalanced circuits; three phase power measurement using two-wattmeter and one-wattmeter methods.
Magnetic circuits: analogy between electric and magnetic circuits; series and parallel magnetic circuits; operating principles of electrical appliances: single-phase transformer and rotating machines; tests and performance of single-phase transformer.

Digital Logic Design: Digital signals, Number systems, Positive and negative representation of numbers, Signed-number representation, Binary arithmetic, Postulates and theorems of Boolean Algebra**,** Algebraic simplification, Sum of products and product of sums formulations (SOP and POS), Gate primitives, Logic Gates and Universal Gates, Minimization of logic functions, Karnaugh Maps, Logic implementation using Gates, Decoder, MUX, Flip-Flops, Asynchronous up/down counters.

Electronic Devices: p- n junction diode: V-I characteristics of diode, Operation of Bipolar Junction Transistor, CB and CE configuration, Transistor as a switch, Operation of SCR, DIAC and TRIAC.

Operational Amplifier Circuits: The ideal operational amplifier, the inverting, non-inverting amplifiers, Op-Amp Characteristics, Applications of Op-amp: summing amplifier, differentiator and integrator.

Laboratory Work: Kirchhoff's laws, network theorems, ac series and parallel circuit, three phase power measurement, magnetic circuit, tests on transformer, resonance in AC circuit, combinational circuits, flip flops, shift register and binary counters, asynchronous and synchronous up/down counters, BJT characteristics.

Course Learning Objectives (CLO)
The students will be able to:

1. Apply various networks laws and theorems to solve dc circuits
2. Compute different ac quantities with phasor representation
3. Comprehend the operation in magnetic circuits, single phase transformer and rotating machines
4. Recognize and apply the number systems and Boolean algebra.

5. Reduce and simplify Boolean expressions and implement them with logic gates.
6. Discuss and explain the working of diode, transistor and operational amplifier, their configurations and applications.

Text Books

1. Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (2008) 10th ed.
2. Nagrath, I.J. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).
3. Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).
4. Mano M. M. and Ciletti, M.D., Digital Design, Pearson, Prentice Hall, (2013).

Reference Books

1. Chakraborti, A., Basic Electrical Engineering, Tata McGraw−Hill (2008).
2. Del Toro, V., Electrical Engineering Fundamentals, Prentice−Hall of India Private Limited (2004).
3. David Bell, Electronics Devices and Circuits, Oxford Publications (2009).

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UEN008: Energy and Environment

L	T	P	Cr
2	0	0	2.0

Course Objective: The exposure to this course would facilitate the students in understanding the terms, definitions and scope of environmental and energy issues pertaining to current global scenario; understanding the need of sustainability in addressing the current environmental & energy challenges.

Syllabus

Introduction: Concept of sustainability and sustainable use of natural resources, Climate Change & its related aspects.

Air Pollution: Origin, Sources and effects of air pollution; Primary and secondary meteorological parameters; wind roses; Atmospheric stability; Source reduction and Air Pollution Control Devices for particulates and gaseous pollutants in stationary sources.

Water Pollution: Origin, Sources of water pollution, Category of water pollutants, Physicochemical characteristics, Components of wastewater treatment systems.

Solid waste management: Introduction to solid waste management, Sources, characteristics of municipal solid waste, Solid waste management methods: Incineration, composting, landfilling.

Energy Resources: Classification of Energy Resources; Non-conventional energy resources- Biomass energy, Thermo-chemical conversion and biochemical conversion route; Solar energy-active and passive solar energy absorption systems; Type of collectors; Thermal and photo conversion applications.

Course Learning Objectives (CLO)
The students will be able to:

1. Comprehend the interdisciplinary context of environmental issues with reference to sustainability
2. Assess the impact of anthropogenic activities on the various elements of environment and apply suitable techniques to mitigate their impact.
3. Demonstrate the application of technology in real time assessment and control of pollutants.
4. Correlate environmental concerns with the conventional energy sources associated and assess the uses and limitations of non-conventional energy technologies

Text Books

1. Moaveni, S., Energy, Environment and Sustainability, Cengage (2018)
2. Rajagopalan, R., Environmental Studies, Oxford University Press (2018)
3. O'Callagan, P.W., Energy Management, McGraw Hill Book Co. Ltd. (1993).

Reference Books

1. Peavy H.S., Rowe D.S., and Tchobanoglous, G. (2013) Environmental Engineering, McGraw Hill.
2. Rao, M.N. and Rao, H.V.N. (2014) Air Pollution, McGraw Hill.
3. Metcalf and Eddy. (2003) Wastewater Engineering: Treatment and Reuse, Fourth Edition, McGraw Hill.
4. Rai, G.D. (2014) Non-conventional Energy Resources, Khanna Publishers.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UMA022: Calculus for Engineers

L	T	P	Cr
3	1	0	3.5

Course Objective: To provide students with skills and knowledge in sequence and series, advanced calculus, calculus of several variables and complex analysis which would enable them to devise solutions for given situations they may encounter in their engineering profession.

Syllabus

Sequences and Series: Introduction to sequences and infinite series, Tests for convergence/divergence, Limit comparison test, Ratio test, Root test, Cauchy integral test, Alternating series, Absolute convergence, and conditional convergence.

Series Expansions: Power series, Taylor series, Convergence of Taylor series, Error estimates, Term by term differentiation and integration.

Partial Differentiation: Functions of several variables, Limits and continuity, Chain rule, Change of variables, Partial differentiation of implicit functions, Directional derivatives and its properties, Maxima and minima by using second order derivatives.

Multiple Integrals: Double integral (Cartesian), Change of order of integration in double integral, Polar coordinates, Graphing of polar curves, Change of variables (Cartesian to polar), Applications of double integrals to areas and volumes, Evaluation of triple integral (Cartesian).

Complex analysis: Introduction to complex numbers, Geometrical interpretation, Functions of complex variables, Examples of elementary functions like exponential, trigonometric and hyperbolic functions, Elementary calculus on the complex plane (limits, continuity, differentiability), Cauchy – Riemann equations, Analytic functions, Harmonic functions.

Course Learning Objectives (CLO)

The students will be able to:

1. Determine the convergence/divergence of infinite series, approximation of functions using power and Taylor's series expansion and error estimation.
2. Examine functions of several variables, define and compute partial derivatives, directional derivatives, and their use in finding maxima and minima in some engineering problems.
3. Evaluate multiple integrals in Cartesian and Polar coordinates, and their applications to engineering problems.
4. Represent complex numbers in Cartesian and Polar forms and test the analyticity of complex functions by using Cauchy – Riemann equations.

Text Books

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007), 9th ed.
2. Stewart James, Essential Calculus; Thomson Publishers (2007), 6th ed.
3. Kasana, H.S., Complex Variables: Theory and Applications, Prentice Hall India, 2005 (2nd edition).

Reference Books

1. Wider David V, Advanced Calculus: Early Transcendentals, Cengage Learning (2007).
2. Apostol Tom M, Calculus, Vol I and II, John Wiley (2003).
3. Brown J.W and Churchill R.V, Complex variables and applications, McGraw Hill, (7th edition)

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

SEMESTER II

UPH013: Physics

L	T	P	Cr
3	1	2	4.5

Course Objective: To introduce the student to the basic physical laws of oscillators, acoustics of buildings, ultrasonics, electromagnetic waves, wave optics, lasers, and quantum mechanics and demonstrate their applications in technology. To introduce the student to measurement principles and their application to investigate physical phenomena

Syllabus

Oscillations and Waves: Oscillatory motion and damping, Applications - Electromagnetic damping – eddy current; ***Acoustics:*** Reverberation time, absorption coefficient, Sabine's and Eyring's formulae (Qualitative idea), Applications - Designing of hall for speech, concert, and opera; ***Ultrasonics:*** Production and Detection of Ultrasonic waves, Applications - green energy, sound signaling, dispersion of fog, remote sensing, Car's airbag sensor.

Electromagnetic Waves: Scalar and vector fields; Gradient, divergence, and curl; Stokes' and Green's theorems; Concept of Displacement current; Maxwell's equations; Electromagnetic wave equations in free space and conducting media, Application - skin depth.

Optics: ***Interference:*** Parallel and wedge-shaped thin films, Newton rings, Applications as Non-reflecting coatings, Measurement of wavelength and refractive index. ***Diffraction:*** Single and Double slit diffraction, and Diffraction grating, Applications - Dispersive and Resolving Powers. ***Polarization:*** Production, detection, Applications – Anti-glare automobile headlights, Adjustable tint windows. ***Lasers:*** Basic concepts, Laser properties, Ruby, HeNe, and Semiconductor lasers, Applications – Optical communication and Optical alignment.

Quantum Mechanics: Wave function, Steady State Schrodinger wave equation, Expectation value, Infinite potential well, Tunneling effect (Qualitative idea), Application - Quantum computing.

Laboratory Work

1. Determination of damping effect on oscillatory motion due to various media.
2. Determination of velocity of ultrasonic waves in liquids by stationary wave method.
3. Determination of wavelength of sodium light using Newton's rings method.
4. Determination of dispersive power of sodium-D lines using diffraction grating.
5. Determination of specific rotation of cane sugar solution.
6. Study and proof of Malus' law in polarization.

7. Determination of beam divergence and beam intensity of a given laser.

8. Determination of displacement and conducting currents through a dielectric.
9. Determination of Planck's constant.

Micro Project:
Students will be given physics-based projects/assignments using computer simulations, etc.

Course Learning Objectives (CLO)
The students will be able to:

1. Understand damped and simple harmonic motion, the role of reverberation in designing a hall and generation and detection of ultrasonic waves.
2. Use Maxwell's equations to describe propagation of EM waves in a medium.
3. Demonstrate interference, diffraction and polarization of light.
4. Explain the working principle of Lasers.
5. Use the concept of wave function to find probability of a particle confined in a box.
6. Perform an experiment, collect data, tabulate and report them and interpret the results with error analysis.

Text Books
1. Beiser, A., Concept of Modern Physics, Tata McGraw Hill (2007) 6th ed.
2. Griffiths, D.J., Introduction to Electrodynamics, Prentice Hall of India (1999) 3rd ed.
3. Jenkins, F.A. and White, H.E., Fundamentals of Optics, McGraw Hill (2001) 4th ed.

Reference Books
1. Wehr, M.R, Richards, J.A., Adair, T.W., Physics of The Atom, Narosa Publishing House (1990) 4th ed.
2. Verma, N.K., Physics for Engineers, Prentice Hall of India (2014)1st ed.
3. Pedrotti, Frank L., Pedrotti, Leno S., and Pedrotti, Leno M., Introduction to Optics, Pearson Prentice HallTM (2008) 3rd ed.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UES101: Engineering Drawing

L	T	P	Cr
2	4	0	4.0

Course Objective: This module is dedicated to graphics and includes two sections: 2D drafting and 3D modelling of solid objects. This course is aimed at making the student understand the concepts of projection systems, learn how to create projections of solid objects using first and third angle orthographic projection as well as isometric and auxiliary projection, concept of sectioning, to interpret the meaning and intent of toleranced dimensions and to create/edit drawings using drafting software. In addition, this course shall give an insight on the basic 3D modelling concepts like extrude, revolve, sweep, construction of complex solids.

Syllabus

Engineering Drawing Concepts

1. Introduction to Engineering Drawing
2. Projection systems: First angle and third angle projection system
3. Orthographic Projection: Points, Lines, Solid objects
4. Isometric Projections
5. Auxiliary Projections
6. Development of surfaces
7. Section of solids
8. Limits, fits and tolerances

2D Drafting

1. Management of screen menus commands
2. Creating basic drawing entities
3. Co-ordinate systems: Cartesian, polar and relative coordinates
4. Drawing limits, units of measurement and scale
5. Layering: organizing and maintaining the integrity of drawings
6. Design of prototype drawings as templates.
7. Editing/modifying drawing entities: selection of objects, object snap modes, editing commands,
8. Dimensioning: use of annotations, dimension types, properties and placement, adding text to
drawing

3D Modelling

1. Management of screen menus commands
2. Introduction to basic 3D modelling commands such as extrude, revolve, sweep etc.
3. Creation of 2D drawings from a 3D model

Micro Projects /Assignments:

1. Completing the views - Identification and drawing of missing lines and views in the projection of objects

2. Projects related to orthographic and isometric projections Using wax blocks/soap bars/any soft material to develop three dimensional object from given orthographic projections

3. a. 3D modelling of complex machine components
   b. Development of production drawings of individual components from the model

Course Learning Objectives (CLO)
The students will be able to:

1. Creatively comprehend the geometrical details of common engineering objects
2. Draw dimensioned orthographic and isometric projections of simple engineering objects
3. Interpret the meaning and intent of limits, fits and tolerances in the drawing
4. Create/edit the engineering drawings for simple engineering objects using 2D drafting software
5. Create/edit 3D models of engineering components using 3D modelling software

Text Books
1. Jolhe, D.A., Engineering Drawing, Tata McGraw Hill, 2008
2. Davies, B. L., Yarwood, A., Engineering Drawing and Computer Graphics, Van Nostrand Reinhold (UK), 1986

Reference Books
1. Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons, Delhi (2008).
2. Gill, P.S., Machine Drawings, S.K. Kataria & Sons, Delhi (2013).
3. Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd, Delhi (2002).
4. French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company, New Delhi (1986).
5. Rowan, J. and Sidwell , E. H., Graphics for Engineers, Edward Arnold, London (1968).
6. Mastering AutoCAD 2021 and AutoCAD LT 2021, Brian C. Benton, George Omura, Sybex - John Wiley and Sons, Indiana (2021).

Evaluation Scheme

Course Component	**Weightage**
AutoCAD tutorials/SolidWorks/Project work*	35
MST (1.5 hours-CAD based)**	20
EST (2 hours-CAD based)**	45

***Students are required to bring their personal computers for the** tutorial work.*
**Availability of institute server resources for sharing the software licences with the student community.*
***Institute computational resources in collaboration with other academic units / departments for conducting the mid semester and end semester test.*

UHU003: Professional Communication

L T P Cr
2 0 2 3

Course Objective: The course is designed to develop the interpersonal, written, and oral as well as the non- verbal communication skills of the students. The course begins by building up on the theoretical concepts and then practicing on the applicability of the various elements. Since the course has very high applicability content, the students are advised to practice in class as well as off class. A very high level of interaction is expected of the students in the class.

Syllabus

Fundamentals of Communication: Meaning, Types and Characteristics of communication, Applicability of Transactional Analysis and Johari Window for enhancing interpersonal communication skills. Seven Cs of Effective Communication, Barriers to Effective Communication.

Effective Oral Communication: Understanding Principles of Oral communication, Formal and Informal Oral Communication, Oral Communication and Behavioral Patterns, Advantages and Disadvantages of Oral Communication.

Effective Listening: Listening vs Hearing, Active Listening techniques, Barriers to Listening.

Effective non-verbal communication: Meaning and Importance of Non-Verbal Communication, Different Types of Non-verbal Communication, Interpretation of Non-verbal Cues.

Effective written Communication: Characteristics of Good Writing, Choice of Words, Sentence Construction, Paragraph development, Forms of writing.

Business Communication: Technical Report Writing, Designing Resumes and Cover Letters for effective job application, E-mail writing and e-mail etiquette.

Organizational Communication: Directional communication: Downward, Upward and Horizontal Communication, Grapevine.

Reading: The following texts (one from each of the two categories listed below) are required to be read by the students in the semester:
Category 1: Animal Farm by George Orwell, Lord of the Flies by William Golding, Life of Pi by Yann Martel
Category 2: The Namesake by Jhumpa Lahiri, The God of Small Things by Arundhati Roy, Q&A by Vikas Swarup

Laboratory Work

1. Needs-assessment of spoken and written communication with feedback.
2. Training for Group Discussions through simulations and role plays.
3. Technical report writing on survey-based projects.
4. Project-based team presentations.

Course Learning Objectives (CLO)

The students will be able to:

1. Apply communication concepts for effective interpersonal communication.
2. Speak assertively and effectively.
3. Interpret non-verbal cues in professional communication.
4. Write objectively, purposefully and effectively.
5. Design effective resumes and reports.

Text Books

1. Mukherjee H.S..Business Communication: Connecting at Work. Oxford University Press.(2013)
2. Lesikar R.V, and Flately M.E., Basic Business Communication Skills for empowering the internet generation.(2006)
3. Raman, M.,and Singh ,P, Business Communication . Oxford . University Press (2008).

Reference Books

1. Riordan, G.R. Technical Communication. Cengage Learning India Private Ltd. (2012)
2. Butterfield, Jeff., Soft Skills for everyone, Cengage Learning New Delhi, (2013).
3. Robbins, S.P., & Hunsaker, P.L., Training in Interpersonal Skills, Prentice Hall of India, New Delhi, (2008).
4. Orwell, G., Animal Farm, Fingerprint Publishing, New Delhi, (2017).
5. Golding, W, Lord of the Flies, Faber & Faber; Export edition (1999)
6. Martel,Y., Life of Pi, RHC, New Delhi, (2012).
7. Lahiri,J., The Namesake, Harpercollins (2007)
8. Arundhati Roy,A., The God of Small Things, Penguin India, (2002).
9. Swarup,V., Q&A, Black Swan,(2009).

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)

1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UES102: Manufacturing Processes

L	T	P	Cr
2	0	2	3.0

Course Objective: This course introduces the basic concepts of manufacturing via machining, forming, casting and joining, enabling the students to develop a basic knowledge of the mechanics, operation and limitations of basic machining tools along with metrology and measurement of parts. The course also introduces the concept of smart manufacturing.

Syllabus

Machining Processes: Principles of metal cutting, Cutting tools, Cutting tool materials and applications, Geometry of single point cutting tool, Introduction to computerized numerical control (CNC) machines, G and M code programming for simple turning and milling operations, introduction of canned cycles.

Metal Casting: Introduction & Principles of sand casting, Requisites of a sound casting, Permanent mold casting processes, casting defects

Metal Forming: Hot & cold metal working, Forging, Rolling, Sheet Metal operations.

Joining Processes: Method of joining, type of electric arc welding processes, Methods of shielding, Power source characteristics, Resistance welding, Soldering, Brazing.

Smart Manufacturing: IoT and ML in manufacturing, Introduction to Additive Manufacturing, Robotics and Automation in manufacturing.

Laboratory Work

Relevant shop floor exercises involving practices in Sand casting, Machining, Welding, Sheet metal fabrication techniques, CNC turning and milling exercises, Experiments on basic engineering metrology and measurements to include measurements for circularity, ovality, linear dimensions, profiles, radius, angular measurements, measurement of threads, surface roughness.

Basic knowledge and derivations related to above measurements, uncertainties, statistical approaches to estimate uncertainties, Line fitting, static and dynamic characteristics of instruments will be discussed in laboratory classes.

Assignments: Assignments for this course will include the topics: Manufacturing of micro-chips used in IT and electronics industry and use of touch screens. Another assignment will be given to practice numerical exercises on topics listed in the syllabus. Case study related to smart manufacturing.

Micro Project: Fabrication of multi-operational jobs using the above processes as per requirement by teams consisting of 4 -6 members. Quality check should be using the equipment available in metrology lab.

Course Learning Objectives (CLO)
The students will be able to:

1. identify & analyse various machining processes/operations for manufacturing of industrial components
2. apply the basic principle of bulk and sheet metal forming operations
3. apply the knowledge of metal casting for different requirements.
4. identify and analyse the requirements to for achieving a sound welded joint apply the concept of smart manufacturing

Text Books

1. Degarmo, E. P., Kohser, Ronald A. and Black, J. T., Materials and Processes in Manufacturing, Prentice Hall of India (2008) 8th ed.
2. Kalpakjian, S. and Schmid, S. R., Manufacturing Processes for Engineering Materials, Dorling Kingsley (2006) 4th ed.

Reference Books

1. Martin, S.I., Chapman, W.A.J., Workshop Technology, Vol.1 & II, Viva Books (2006) 4th ed.
2. Zimmer, E.W. and Groover, M.P., CAD/CAM - Computer Aided Designing and Manufacturing, Dorling Kingsley (2008).
3. Pandey, P.C. and Shan, H. S., Modern Machining Processes, Tata McGraw Hill (2008).
4. Mishra, P. K., Non-Conventional Machining, Narosa Publications (2006).
5. Campbell, J.S., Principles of Manufacturing, Materials and Processes, Tata McGraw Hill Company (1999).
6. Lindberg, Roy A., Processes and Materials of Manufacture, Prentice Hall of India (2008) 4th ed.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UMA023: Differential Equations and Linear Algebra

L	T	P	Cr
3	1	0	3.5

Course Objective: To introduce students the theory and concepts of differential equations, linear algebra, Laplace transformations and Fourier series which will equip them with adequate knowledge of mathematics to formulate and solve problems analytically.

Syllabus

Ordinary Differential Equations: Review of first order differential equations, Exact differential equations, Second and higher order differential equations, Solution techniques using one known solution, Cauchy - Euler equation, Method of undetermined coefficients, Variation of parameters method, Engineering applications of differential equations.

Laplace Transform: Definition and existence of Laplace transforms and its inverse, Properties of the Laplace transforms, Unit step function, Impulse function, Applications to solve initial and boundary value problems.

Fourier Series: Introduction, Fourier series on arbitrary intervals, Half range expansions, Applications of Fourier series to solve wave equation and heat equation.

Linear Algebra: Row reduced echelon form, Solution of system of linear equations, Matrix inversion, Linear spaces, Subspaces, Basis and dimension, Linear transformation and its matrix representation, Eigen-values, Eigen-vectors and Diagonalisation, Inner product spaces and Gram-Schmidt orthogonalisation process.

Course Learning Objectives (CLO)
The students will be able to:

1. Solve the differential equations of first and 2nd order and basic application problems described by these equations.
2. Find the Laplace transformations and inverse Laplace transformations for various functions. Using the concept of Laplace transform students will be able to solve the initia value and boundary value problems.
3. Find the Fourier series expansions of periodic functions and subsequently will be able to solve heat and wave equations.
4. Solve systems of linear equations by using elementary row operations.
5. Identify the vector spaces/subspaces and to compute their bases/orthonormal bases. Further, students will be able to express linear transformation in terms of matrix and find the eigenvalues and eigenvectors.

Text Books

1. Simmons, G.F., Differential Equations (With Applications and Historical Notes), Tata McGraw Hill (2009).
2. Krishnamurthy, V.K., Mainra, V.P. and Arora, J.L., An introduction to Linear Algebra, Affiliated East West Press (1976).

Reference Books

1. Kreyszig Erwin, Advanced Engineering Mathematics, John Wiley (2006), 8th edition.
2. Jain, R.K. and Iyenger, S.R.K., Advanced Engineering Mathematics, Narosa Publishing House (2011), 4th edition.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25-30
2	EST	40-45
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

SEMESTER III

UCS303: Operating System

L	T	P	Cr
3	0	2	4.0

Course Objective: To understand the role, responsibilities, and algorithms involved for achieving various functionalities of an Operating System.

Syllabus

Introduction and Operating System Structures: Computer-System Organization, Computer-System Architecture, Operating-System Structure, Operating-System Operations, Computing Environments, Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Structure, System boot.

Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication, Overview of Threads, Multi-core Programming, Multithreading Models, CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Memory Management: Basic Hardware, Address Binding, Logical and Physical Address, Dynamic linking and loading, Shared Libraries, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table, Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing.

Storage Management: Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure; File Concept, Access Methods, Directory and Disk Structure, File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods.

Protection and Security: Principles of Protection, Domain of Protection, Access Matrix, Implementation of the Access Matrix, The Security Problem, Program Threats.

Process Synchronization: The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Overview of Monitors.

Laboratory Work

Learn and practice basic Linux/Unix commands to Create and manipulate files and directories; Explore about Vi Editor environment; Build .C program related to fork (), exec (), wait (), sleep () functions at Linux/Unix platform; Write .C program for message passing and shared memory; Simulate CPU scheduling algorithms using either C or C++

Course Learning Objectives (CLO)

The students will be able to:

1. Describe the basics of an operating system, including the kernel, system calls, and computing environments.
2. Evaluate the effectiveness and trade-offs of different models of multithreading, scheduling algorithms, and methods for handling deadlocks, such as prevention, avoidance, detection, and recovery.
3. Understand components of a memory system, virtual memory and analyze different memory management techniques.
4. Evaluate the effectiveness of different Disk Management strategies, and Critique thedesign and implementation of File System
5. Explain the basic concepts of Concurrency, Protection and Security issues in an operating system.

Text Books

1. Operating System Concepts, Silberschatz A., Galvin B. P. and Gagne G., John Wiley & Sons Inc., 9th ed, 2013.
2. Operating Systems Internals and Design Principles, Stallings W., Prentice Hall 9th ed, 2018

Reference Books

1. Understanding the Linux Kernel, Bovet P. D., Cesati M., O'Reilly Media, 3rd ed, 2006.
2. Introduction to Operating System Design and Implementation: The OSP 2 Approach, Kifer M., Smolka A. S., Springer, 2007

UTA018: Object Oriented Programming

L	T	P	Cr
3	0	2	4.0

Course Objective:To become familiar with object oriented programming concepts and be able to apply these concepts in solving diverse range of applications.

Objects and Classes: Structure in C and C++, Class specification, Objects, Namespaces, Overview of pillars of OOPS (Data Encapsulation, Data Abstraction, Inheritance, Polymorphism), Inline functions, Passing objects as arguments, Returning object from a function, Array of objects, Static keyword with data member, member function and object, Friend function, and Friend classes, Pointer to objects, this pointer, Dynamic Initialization, Dynamic memory allocation.

Constructor and Destructor: Constructors and its types, Constructor Overloading, Constructors in array of objects, Constructors with default arguments, Dynamic Constructor, Destructor, 'const' keyword with data member, member function and object.

Inheritance: Introduction to Inheritance, Forms of Inheritance (Single, Multiple, Multilevel, Hierarchical and Hybrid) with various modes (Public, Private and Protected), Inheritance with Constructor and Destructor, Benefits and Limitations of Inheritance.

Polymorphism: Classification of Polymorphism (Compile-time and Run-time), **Compile Time-**Function Overloading, Operator Overloading (Unary operator and Binary operator with member function and friend function), Data Conversion (Basic to user-defined, user-defined to basic, one user-defined to another user-defined). **Run-time-** Pointers to derived class object, Overriding member function, Virtual functions, pure virtual functions, Abstract class.

Exception Handling, Templates and Standard Template Library: Exception handling mechanism, Usage of template, Function templates, Overloading of Function templates, Class templates, Introduction to Standard Template Library and its components. Algorithms, Containers (Array, Vector, Stack, List and Queue) and Iterators.

Laboratory Work

To implement object oriented constructs using C++programming language.

Course Learning Objectives (CLO)

The students will be able to:

1. To recall the knowledge of structure and its variables to comprehend the concept of classes, objects, constructors and destructors for implementing the object oriented paradigms.

2. To apply and analyze the inheritance on real life case studies via coding competences.

3. To design and develop code snippets for polymorphism to proclaim coding potential; and management of run-time exceptions.

4. To assess and interpret the knowledge of templates to appraise the standard template libraries.

Text Books

1. C++:The Complete Reference , Schildt H., Tata McGraw Hill, 4th ed, 2003
2. C++Primer, Lippman B.S., Lajoie J., and MooE.B., , Addison-Wesley Professional, 5th ed, 2013

Reference Books

1. Object-Oriented Programming in C++, Lafore R., Pearson Education, 4th ed, 2002
2. Object Oriented Programming with C++, E Balagurusamy, 8th ed,2017
3. The C++programming language, Stroustrup B., Pearson Education India, 4th ed, 2013

UCS301: **Data Structures**

L	T	P	Cr
3	0	2	4.0

Course Objective:To become familiar with different types of data structures and their applications.

Syllabus

Analysing algorithms: Basics of algorithm and its analysis, Complexity classes, order arithmetic, Time and space trade-off in algorithms.

Linear Data Structures: Arrays, Strings and string processing, Linked lists (Singly, Doubly, Circular), Abstract data types, their implementation and applications: Stacks (using Arrays and Linked-list), Queues (using Arrays and Linked-list), Hash tables: Hash functions, collision resolution techniques, Strategies for choosing the appropriate data structure.

Searching and Sorting: Linear Search, Binary Search. Introduction to internal and external sort, Bubble Sort, Selection Sort, Insertion Sort, Shell Sort, Quick Sort, Merge Sort, Counting Sort, Radix Sort.

Trees and their applications: Introduction to binary tree, tree traversal algorithms, Binary search tree, AVL Tree, B Tree etc. and common operations on these trees. Heap, Heap Sort, Priority Queue using Heap.

Graphs and their applications: Graph Terminology and its representation, Depth and breadth first traversals, Shortest-path algorithms (Dijkstra and Floyd), Data Structures for Disjoint Sets, Minimum spanning tree (Prim and Kruskal).

Laboratory Work

Implementation of various data structures such as Arrays, Stacks, Queues, Lists, Binary tree traversals, BST, AVL trees, Graphs traversals, Sorting and Searching techniques.

Course Learning Objectives (CLO)
The students will be able to:

1. Understand the fundamental data structures, their implementation and some of their standard applications.
2. Select and implement appropriate searching and sorting techniques for solving a problem based on their characteristics.
3. Apply tree and graph data structures for specific applications.
4. Design and analyse algorithms using appropriate data structures for real-world problems.

Text Books

1. Introduction to Algorithms,Cormen H. T., Leiserson E. C., Rivest L. R., and Stein C, MIT Press,3rd ed., 2009
2. Data Structures, Algorithms and Applications in C++,Sahni S., Universities Press 2nd ed. 2005

Reference Books

1. Data Structures and Algorithms Made Easy,Karumanchi N., Career Monk Publications, 5th ed., 2017
2. Data structures and algorithms in C++, Adam Drozdek, 4th edition.

UCS405:Discrete Mathematical Structures

L	T	P	Cr
3	1	0	3.5

Course Objective:The course objective is to provide students with an overview of Discrete Mathematical Structures. Students will learn about topics such as logic and proofs, sets and functions, graph theory, boolean algebra, number theory and other important discrete math concepts.

Syllabus

Sets, Relations, and Functions: Sets: Operations on set, Inclusion-exclusion principle, Representation of Discrete Structures, Fuzzy set, Multi-set, bijective function, Inverse and Composition of functions, Floor and Ceiling functions, Growth of functions: Big-O notation, Big-Omega and Big-Theta Notations, Determining complexity of a program, Hash functions.

Relations: Different types of relation and their representation, Equivalence and partial-ordered relations, Partition and Covering of a set, N-ary relations and database, Closure of relations, Warshall's algorithm, Lexicographic ordering, Hasse diagram, Lattices, Boolean algebra.

Graphs Theory: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, Hamiltonian Paths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Application of Graph theory in real-life applications.

Basic Logic: Propositional logic, Logical connectives, Truth tables, Normal forms (conjunctive and disjunctive), Validity of well-formed formula, Propositional inference rules (concepts of modus ponens and modus tollens), Predicate logic, Universal and existential quantification, Proof Techniques.

Recurrence Relation: Solving linear recurrence relations, divide and conquer algorithms and recurrence relations.

Algebraic Structures: Group, Semi group, Monoids, Ring, Field, Homomorphism.

Number Theory: Divisibility and Modular Arithmetic, Solving Congruences, Applications of Congruences, Cryptographic applications

Laboratory Work
NA

Course Learning Objectives (CLO)
The students will be able to:

1. Perform operations on various discrete structures such as set, function, and relation.
2. Apply basic concepts of asymptotic notation in the analysis of the algorithm.
3. Illustrate the basic properties and algorithms of graphs and apply them in modelling and solving real-world problems.
4. Comprehend formal logical arguments and translate statements from a natural

language into their symbolic structures in logic.
5. Identify and prove various properties of rings, fields, and groups.
6. Illustrate and apply the division algorithm, mod function, and Congruence.

Text Books

1. Discrete Mathematics and its Applications,Rosen H. K., McGraw Hill, 7thed., 2011
2. Discrete Mathematical Structures with Applications to Computer Science, Tremblay P. J. and Manohar, R., Tata McGraw Hill, 2008.

Reference Books

1. Contemporary Abstract Algebra, Gallian A. J., Cengage Learning, 9th ed., 2017
2. Discrete Mathematics, Lipschutz S., Lipson M., McGraw-Hill, 3rd ed.,2007

UTA016: ENGINEERING DESIGN PROJECT – I
(including 2 self-effort hours)

L	T	P	Cr
1	0	2	3.0

Course Objectives: To develop design skills according to a Conceive-Design-Implement-Operate (CDIO) compliant methodology. To apply engineering sciences through learning-by-doing project work. To provide a framework to encourage creativity and innovation. To develop teamwork and communication skills through group-based activity. To foster self-directed learning and critical evaluation.

To provide a basis for the technical aspects of the project a small number of lectures are incorporated into the module. As the students would have received little in the way of formal engineering instruction at this early stage in the degree course, the level of the lectures is to be introductory with an emphasis on the physical aspects of the subject matter as applied to the 'Mangonel' project. The lecture series include subject areas such as Materials, Structures, Dynamics and Digital Electronics delivered by experts in the field.

This module is delivered using a combination of introductory lectures and participation by the students in 15 "activities". The activities are executed to support the syllabus of the course and might take place in specialised laboratories or on the open ground used for firing the Mangonel. Students work in groups throughout the semester to encourage teamwork, cooperation and to avail of the different skills of its members. In the end the students work in sub-groups to do the Mangonel throwing arm redesign project. They assemble and operate a Mangonel, based on the lectures and tutorials assignments of mechanical engineering they experiment with the working, critically analyse the effect of design changes and implement the final project in a competition. Presentation of the group assembly, redesign and individual reflection of the project is assessed in the end.

Breakup of lecture details to be taken up by MED:

Lec No.	Topic	Contents
Lec1	INTRODUCTION	The Mangonel Project, History, Spreadsheet.
Lec2	PROJECTILE MOTION	No DRAG, Design spreadsheet simulator for it.
Lec3	PROJECTILE MOTION	With DRAG, Design spreadsheet simulator for it.
Lec4	STRUCTURES FAILURE	STATIC LOADS
Lec5	STRUCTURES FAILURE	DYNAMIC LOADS
Lec6	REDESIGNING THE MANGONEL	Design constraints and limitations of materials for redesigning the Mangonel for competition as a group.
Lec7	MANUFACTURING	Manufacturing and assembling the Mangonel.
Lec8	SIMULATION IN ENGINEERING DESIGN	Simulation as an Analysis Tool in Engineering Design.
Lec9	ROLE OF MODELLING & PROTOTYPING	The Role of Modelling in Engineering Design.

Breakup of lecture details to be taken up by ECED:

Lec No.	Topic	Contents
Lec1-5	Digital Electronics	Prototype, Architecture, Using the Integrated Development Environment (IDE) to Prepare an Arduino Sketch, structuring an Arduino Program, Using Simple Primitive Types (Variables), Simple programming examples. Definition of a sensor and actuator.

Tutorial Assignment / Laboratory Work:
Associated Laboratory / Project Program: T – Mechanical Tutorial, L – Electronics Laboratory, W – Mechanical Workshop of "Mangonel" assembly, redesign, operation and reflection.

Title for the weekly work in 15 weeks	Code
Using a spread sheet to develop a simulator	T1
Dynamics of projectile launched by a Mangonel – No Drag	T2
Dynamics of projectile launched by a Mangonel – With Drag	T3
Design against failure under static actions	T4
Design against failure under dynamic actions	T5
Electronics hardware and Arduino controller	L1
Electronics hardware and Arduino controller	L2
Programming the Arduino Controller	L3
Programming the Arduino Controller	L4
Final project of sensors, electronics hardware and programmed Arduino controller based measurement of angular velocity of the "Mangonel" throwing arm.	L5
Assembly of the Mangonel by group	W1
Assembly of the Mangonel by group	W2
Innovative redesign of the Mangonel and its testing by group	W3
Innovative redesign of the Mangonel and its testing by group	W4
Final intergroup competition to assess best redesign and understanding of the "Mangonel".	W5

Project:
The Project will facilitate the design, construction and analysis of a "Mangonel". In addition to some introductory lectures, the content of the students' work during the semester will consist of:

1. The assembly of a Mangonel from a Bill Of Materials (BOM), detailed engineering drawings of parts, assembly instructions, and few prefabricated parts;
2. The development of a software tool to allow the trajectory of a "missile" to be studied as a function of various operating parameters in conditions of no-drag and drag due to air;
3. A structural analysis of certain key components of the Mangonel for static and dynamic stresses using values of material properties which will be experimentally determined;
4. The development of a micro-electronic system to allow the angular velocity of the throwing arm to be determined;
5. Testing the Mangonel;
6. Redesigning the throwing arm of the Mangonel to optimise for distance without compromising its structural integrity;

7. An inter-group competition at the end of the semester with evaluation of the group redesign strategies.

Course Learning Outcomes (CLOs) / Course Objectives (COs):

Upon completion of this module, students will be able to:

1. Simulate trajectories of a mass with and without aerodynamic drag using a spreadsheet based software tool to allow trajectories be optimized;
2. Perform a test to acquire an engineering material property of strength in bending and analyze the throwing arm of the "Mangonel" under conditions of static and dynamic loading;
3. Develop and test software code to process sensor data;
4. Designn, construct and test an electronic hardware solution to process sensor data;
5. Construct and operate a Roman catapult "Mangonel" using tools, materials and assembly instructions, in a group, for a competition;
6. Operate and evaluate the innovative redesign of elements of the "Mangonel" for functional and structural performance;

Text Books:

1. Michael Mc Roberts, Beginning Arduino, Technology in action publications.
2. Alan G. Smith, Introduction to Arduino: A piece of cake, Create Space Independent Publishing Platform (2011).

Reference Book:

1. John Box all, Arduino Workshop – A Hands-On Introduction with 65 Projects, No Starch Press (2013).

UMA021: Numerical Linear Algebra

L	T	P	Cr
3	0	2	4.0

Course Objectives: The goal of this course is to give students an introduction to numeric and algorithmic techniques used for the solution of a broad range of mathematical problems, with an emphasis on computational issues and linear algebra. In addition, students will become familiar with numeric programming environments Matlab.

Contents:

Roots of Non-Linear Equations: Mathematical preliminaries, bisection, fixed-point, Newton's method and its extension to system of equations.

Interpolation and Integration: Lagrange and Newton basis of polynomials and interpolation problems, divided difference interpolation, forward and backward differences, trapezoidal and Simpson's rules, method of undetermined coefficients.

Matrix Algebra: Gauss elimination method, pivoting strategies, matrix factorization, Jacobi and GaussSeidel methods, matrix norm and conditioning, linear least square problems.

Matrix Computations: Orthogonal and orthonormal basis, Gram-Schmidt process, orthogonal matrices and similarity transformations, power method for eigen-value and eigen-vector, QR algorithm, singular value decomposition.

Laboratory Work:

Lab experiments will be set in consonance with materials covered in the theory and the implementation of numerical methods will be done using MATLAB

Course Learning Outcomes (CLOs) /Course Objectives (COs):

On completion of this course, the students will be able to:

1. Make use of iterative methods to solve nonlinear equations.
2. Approximate the functions using interpolating polynomials and apply to definite integrals.
3. Evaluate solution of system of linear equations and least square problems.
4. Perform matrix computations and evaluate eigen-values and eigen-vectors.

Text Books

1. Richard L. Burden, J. Douglas Faires, and Annette Burden, Numerical Analysis, Cengage Learning, 10th edition, 2015.
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th edition, 2005.
3. J. Desmond Higham and Nicholas J. Higham, MATLAB Guide, Third Edition, Society for Industrial and Applied Mathematics, 2016.

Reference Books

1. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers,

McGraw-Hill Higher Education, 6th edition, 2010.
2. E. Ward Cheney and David R. Kincaid, Numerical Mathematics and Computing, Cengage Learning, 7th edition, 2012.
3. Endre Suli and David F. Mayers, An Introduction to Numerical Analysis, Cambridge University Press, 2003

Evaluation Scheme:

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	45
3	Sessionals (Assignments/Quizzes/Lab Evaluation)	30

SEMESTER IV

UCS415:DESIGN AND ANALYSIS OF ALGORITHMS				
	L	T	P	Cr

	3	0	2	4.0

Course Objective To provide students with the knowledge and skills necessary to design and analyse algorithms for solving computational problems.

Syllabus:

Introduction and Complexity Analysis: Analysing algorithms, Complexity classes, Time and space trade-offs in algorithms, Recurrence relations, Analysis of iterative and recursive algorithms, Amortized Analysis.

Algorithm Design Techniques and Analysis

Divide and Conquer: Fundamentals of divide and conquer strategy, Applications such as The maximum subarray problem, Strassen's algorithm for matrix multiplication, merge sort, quick sort etc.

Greedy Algorithms: Elements of greedy strategy, Applications such as activity selection, Huffman Coding, job sequencing, fractional knapsack problem, etc.

Dynamic Programming: Elements of dynamic programming, Memorization and tabulation approaches, Applications such as matrix multiplication, 0/1 knapsack, Longest common subsequence, Optimal binary search tree, etc.

Backtracking: Introduction, Applications such as N queen problem, sum of subsets, graph coloring, etc.

Branch and Bound Algorithm: General method, Applications such as0/1 knapsack problem, Traveling salesperson problem etc.

Graphs & Algorithms: Introduction to graphs, Paths and Circuits, Euler Graphs, Hamiltonian graphs,Cut-sets, Connectivity and Separability, Covering and Partitioning, Strongly connected component, Topological sort, Max flow: Ford Fulkerson algorithm, max flow- min cut.

String Matching Algorithms: Suffix arrays, Rabin-Karp, Knuth-MorrisPratt (KMP), Boyer Moore algorithm.

Problem Classes: P, NP, NP-Hard and NP-complete, deterministic and non-deterministic polynomial time algorithm approximation, Randomized algorithms.

Laboratory Work (if applicable): Implementation of various algorithmic techniques for solving common computational/engineering problems.

Course Learning Objectives (CLO)
The students will be able to:

1. Analyse the complexity of algorithms and implement it in a specific scenario.
2. Apply common algorithmic techniques such as greedy, dynamic programming etc. to standard computational problems
3. Design solutions by using appropriate data structures or applying algorithms such as string matching, randomized, approximation and graph.
4. Develop efficient algorithms for various computational challenging problems solving in computing.

Text Books

1. Cormen H. T., Leiserson E. C., Rivest L. R., and Stein C., Introduction to Algorithms, MIT Press (2009) 3rd ed.
2. Horwitz E., Sahni S., Rajasekaran S., Fundamentals of Computers Algorithms, Universities Press (2008) 2nd ed.

Reference Books

1. Levitin A., Introduction to the design and analysis of algorithms, Pearson Education (2008) 2nd ed.
2. Aho A.V., Hopcraft J. E., Dulman J. D., The Design and Analysis of Computer Algorithms, Addsion Wesley (1974) 1st ed.
3. Sedgewick R. and Wayne K., Algorithms, Addison-Wesley Professional (2011), 4th ed.

UCS310:Database Management Systems

L	T	P	Cr
3	0	2	4.0

Course Objective:Emphasis is on the need of database systems. Main focus is on E-R diagrams, relational database, concepts of normalization and de-normalization and SQL commands.

Syllabus

Introduction: Data, data processing requirement, desirable characteristics of an ideal data processing system, traditional file-based system, its drawback, concept of data dependency, Definition of database, types of database, database management system, 3-schema architecture, database terminology, benefits of DBMS.

Relational Database: Relational data model: Introduction to relational database theory: definition of relation, keys, relational model integrity rules, introduction to Relational Algebra.

Database Analysis: Conceptual data modeling using E-R data model -entities, attributes, relationships, generalization, specialization, specifying constraints, Conversion of ER Models to Tables, Practical problems based on E-R data model.

Database Design: Functional Dependency, Canonical Covers, Candidate Key Identification, Normalization- 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Concept of De-normalization and practical problems based on these forms.

Transaction Management and Concurrency control: Concept of Transaction, States of Transaction and ACID properties, Need of Concurrency control, concept of Lock, Two phase locking protocol.

Recovery Management: Need of Recovery Management, Concept of Stable Storage, Log Based Recovery Mechanism, Checkpoint.

Database Implementation: Introduction to SQL, DDL aspect of SQL, DML aspect of SQL – update, insert, delete & various form of SELECT- simple, using special operators, aggregate functions, group by clause, sub query, joins, co-related sub query, union clause, View, exist operator. PL/SQL - cursor, stored function, stored procedure, triggers, error handling, and package.

Laboratory Work

Students will perform SQL commands to demonstrate the usage of DDL and DML, joining of tables, grouping of data and will implement PL/SQL constructs. They will also implement one project.

Project: It will contain database designing & implementation, should be given to group of 2-4 students. While doing projects emphasis should be more on back-end programming like use of SQL, concept of stored procedure, function, triggers, cursors, package etc. Project should have continuous evaluation and should be spread over different components.

Course Learning Objectives (CLO)

The students will be able to:

1. Analyze the Information Systems as socio-technical systems, its need and advantages as compared to traditional file-based systems.
2. Analyze and design database using E-R data model by identifying entities, attributes and relationships.
3. Apply and create Relational Database Design process with Normalization and Denormalization of data.
4. Comprehend the concepts of transaction management, concurrence control and recovery management.
5. Demonstrate use of SQL and PL/SQL to implementation database applications.

Text Books

1. Database System Concepts, Silverschatz A., Korth F. H. and Sudarshan S., Tata McGraw Hill, 6th ed, 2010
2. Fundamentals of Database Systems,Elmasri R. and Navathe B. S., Pearson, 7th ed, 2016

Reference Books

1. SQL, PL/SQL the Programming Language of Oracle, Bayross I., BPB Publications, 4th ed, 2009
2. Modern Database Management,Hoffer J., Venkataraman, R. and Topi, H., Pearson, 12th ed2016
3. Simplified Approach to DBMS, Parteek Bhatia and Gurvinder Singh,
4. Database management systems. Vol. 3. Raghu Ramakrishnan and Johannes Gehrke
5. FOR SQL/RA, New York: McGraw-Hill,

UES021: ENGINEERING MATERIALS

L	T	P	Cr
2	0	2	3

Course Objectives: To provide basic understanding of engineering materials, their structure and the influence of structure on mechanical, chemical, electrical and magnetic properties.

Structure of solids: Classification of engineering materials, Structure-property relationship in engineering materials, Crystalline and non-crystalline materials, Miller Indices, Crystal planes and directions, Determination of crystal structure using X-rays, Inorganic solids, Silicate structures and their applications. Defects; Point, line and surface defects.

Mechanical properties of materials: Elastic, Anelastic and Viscoelastic behaviour, Engineering stress and engineering strain relationship, True stress - true strain relationship, review of mechanical properties, Plastic deformation by twinning and slip, Movement of dislocations, Critical shear stress, Strengthening mechanism, and Creep.

Equilibrium diagram: Solids solutions and alloys, Gibbs phase rule, Unary and binary eutectic phase diagram, Examples and applications of phase diagrams like Iron - Iron carbide phase diagram.

Electrical and magnetic materials: Conducting and resister materials, and their engineering application; Semiconducting materials, their properties and applications; Magnetic materials, Soft and hard magnetic materials and applications; Superconductors; Dielectric materials, their properties and applications. Smart materials: Sensors and actuators, piezoelectric, magnetostrictive and electrostrictive materials.

Corrosion process: Corrosion, Cause of corrosion, Types of corrosion, Protection against corrosion.

Materials selection: Overview of properties of engineering materials, Selection of materials for different engineering applications.

Laboratory Work and Micro-Project:

Note: The micro-project will be assigned to the group(s) of students at the beginning of the semester. Based on the topic of the project the student will perform any of the six experiments from the following list:

1. To determine Curie temperature of a ferrite sample and to study temperature dependence of permeability in the vicinity of Curie temperature.
2. To study cooling curve of a binary alloy.
3. Determination of the elastic modulus and ultimate strength of a given fiber strand.
4. To determine the dielectric constant of a PCB laminate.
5. Detection of flaws using ultrasonic flaw detector (UFD).
6. To determine fiber and void fraction of a glass fiber reinforced composite specimen.
7. To investigate creep of a given wire at room temperature.

8. To estimate the Hall coefficient, carrier concentration and mobility in a semiconductor crystal.
9. To estimate the band-gap energy of a semiconductor using four probe technique.
10. To measure grain size and study the effect of grain size on hardness of the given metallic specimens.

Course Learning Outcomes (CLOs) / Course Objectives (COs):

Student will be able to:

1. Classify engineering materials based on its structure.
2. Draw crystallographic planes and directions.
3. Distinguish between elastic and plastic behavior of materials.
4. Distinguish between isomorphous and eutectic phase diagram.
5. Classify materials based on their electrical and magnetic properties.
6. Propose a solution to prevent corrosion.

Text Books:

1. W.D. Callister, Materials Science and Engineering; John Wiley & Sons, Singapore, 2002.
2. W.F. Smith, Principles of Materials Science and Engineering: An Introduction; Tata Mc-Graw Hill, 2008.
3. V. Raghavan, Introduction to Materials Science and Engineering; PHI, Delhi, 2005.

Reference Books:

1. S. O. Kasap, Principles of Electronic Engineering Materials; Tata Mc-Graw Hill, 2007.
2. L. H. Van Vlack, Elements of Material Science and Engineering; Thomas Press, India, 1998.
3. K. G. Budinski, Engineering Materials – Properties and selection, Prentice Hall India, 1996.

UCS411: Artificial Intelligence				
	L	T	P	Cr
	3	0	2	4.0

Course Objectives: This course introduces students to the fundamental concepts, techniques, and applications of Artificial Intelligence (AI). Students will gain theoretical knowledge and practical skills in areas such as problem-solving using search techniques, machine learning and designing intelligent agents for solving particular engineering problems.

Syllabus:

Introduction to Artificial Intelligence: Foundations, scope, types of AI, problems, and approaches of AI

Intelligent agents: Structure of agents, Types of agent programs: reflux, model-based, goal-driven, utility-driven, and learning agents

Problem spaces: State Space Representation, Representation of problems as state space, problem characteristics, sample applications

Uninformed Search Algorithms: Brute Force search, Depth-First Search, Breadth-First search, Depth-Limited Search, Uniform Cost Search, Bidirectional Search

Informed search algorithms: Heuristic Functions, Best-First search, Beam Search, Hill Climbing, A* algorithm, AO graph, stochastic search algorithms: Simulated Annealing and Genetic Algorithm

Game playing: Minimax algorithm, alpha-beta pruning, iterative deepening

Introduction to Machine Learning: Well-Posed learning problems, Basic concepts, Designing a learning system, Types of machine learning: Supervised learning, Unsupervised learning, Semi-supervised Learning and Reinforcement learning, Types of data: structured and unstructured data.

Supervised Learning: Introduction to supervised learning tasks, Tree induction algorithms: split algorithm based on Information Gain (ID3), split algorithm based on Gain Ratio (C4.5), split algorithm based on Gini Index (CART), Instance based algorithms: K-Nearest Neighbours (K-NN), Probabilistic algorithms: Naïve Bayes algorithm, Evaluation metrics.

Unsupervised Learning: Introduction to supervised learning tasks, Partitioning-based methods

Laboratory Work (if applicable): Basics of Python programming language: Data Types, Data Structures, Flow Control, Functions, Basic Data Science packages: NumPy, Pandas, SciPy

Implementing Search algorithms in C/C++/Java/Python: Depth first, Breadth first, Hill climbing, best first, A* algorithm, Implementation of games: 8-puzzle, Tic-Tac-Toe, tower of Hanoi and water jug problem using heuristic search

Implementing Machine Learning algorithms: Tree-based methods, K-NN, Naïve-Bayes algorithms, K-Means (from scratch and using sklearn library)

Course Learning Objectives (CLO)

The students will be able to:

1. Analyze methods and theories in the field of Artificial Intelligence and categorize

various problem domains.
2. Design intelligent agents for concrete computational problems.
3. Analyze and apply different problem-solving strategies and search algorithms.
4. Implement and evaluate machine learning algorithms for various real-world tasks.

Text Books

1. Russel S., Norvig P., Artificial Intelligence: A Modern Approach, Prentice Hall (2014) 3rd ed.
2. Murphy, Kevin P. Machine learning: a probabilistic perspective. MIT press, (2012) 3rd ed.

Reference Books

1. Rich E., Knight K. and Nair B. S., Artificial Intelligence, Tata McGraw Hills (2009) 3rd ed.
2. Luger F. G., Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education Asia (2009) 6th ed.

UMA401: PROBABILITY AND STATISTICS

L	T	P	Cr
3	0	2	4.0

Course Objectives: This course shall make the students familiar with the concepts of Probability and Statistics useful in implementing various computer science models. One will also be able to associate distributions with real-life variables and make decisions based on statistical methods.

Introduction to Statistics and Data Analysis: Introduction to Statistical Inference, Samples, Populations and Experimental Design, Collection of Data, Measures of location and variability, Graphical representation of data.

Probability: Sample space, Events, Classical, relative frequency and axiomatic definitions of probability, addition rule and conditional probability, multiplication rule, total probability, Baye's Theorem.

Random Variables: Discrete, continuous and mixed random variables, probability mass, probability density and cumulative distribution functions, mathematical expectation, moments, probability and moment generating function, median and quantiles, Markov inequality, Chebyshev's inequality, Function of a random variable.

Special Distributions: Discrete uniform, binomial, geometric, negative binomial, Poisson, continuous uniform, exponential, gamma, normal, lognormal, inverse Gaussian, Cauchy, double exponential distributions, reliability of series and parallel systems.

Joint Distributions: Joint, marginal and conditional distributions, product moments, correlation and regression, independence of random variables, bivariate normal distribution.

Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions.

Estimation: Unbiasedness, consistency, the method of moments and the method of maximum likelihood estimation, confidence intervals for parameters in one sample and two sample problems of normal populations, confidence intervals for proportions.

Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance regions, two types of error, power of the test, the most powerful test and Neyman-Pearson Fundamental Lemma, tests for one sample and two sample problems for normal populations, tests for proportions, Chi-square goodness of fit test and its applications.

Laboratory Work:
Implementation of statistical techniques using statistical packages viz. SPSS/R including evaluation of statistical parameters and data interpretation, regression analysis, covariance, hypothesis testing and analysis of variance.

Course Learning Outcomes (CLOs) / Course Objectives (COs):
After completion of this course, the students will be able to:

1. Analyze the data using different descriptive measures and present graphically.
2. Compute the probabilities of events along with an understanding of the random variables.
3. Comprehend the concept of statistical distributions, their properties and relevance to real-life data.
4. Understand the estimation of mean and variance and their respective hypothesis tests.

Text Books:

1. Probability & Statistics for Engineers & Scientists by R.E. Walpole, R.H. Myers, S.L. Myers & Keying Ye, Prentice Hall, (2016), 9^{th} edition.
2. An Introduction to Probability and Statistics by V.K. Rohatgi & A.K. Md. E. Saleh, Wiley, (2008), 2^{nd} edition

Reference Books:

1. Miller and Freund's – Probability and Statistics for Engineers by R. A. Johnson, Person Education, (2017), 9^{th} edition.
2. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross, Elsevier, (2014), 4^{th} edition.

UTA024: ENGINEERING DESIGN PROJECT – II

L	T	P	Cr
1	0	4	3.0

Course Objectives: The project will introduce students to the challenge of electronic systems design & integration. The project is an example of 'hardware and software co-design' and the scale of the task is such that it will require teamwork as a co-ordinated effort.

Hardware overview of Arduino:

- Introduction to Arduino Board: Technical specifications, accessories and applications.
- Introduction to Eagle (PCB layout tool) software.

Sensors and selection criterion:

- Concepts of sensors, their technical specifications, selection criterion, working principle and applications such as IR sensors, ultrasonic sensors.

Active and passive components:

- Familiarization with hardware components, input and output devices, their technical specifications, selection criterion, working principle and applications such as-
  - Active and passive components: Transistor (MOSFET), diode (LED), LCD, potentiometer, capacitors, DC motor, Breadboard, general PCB etc.
  - Instruments: CRO, multimeter, Logic probe, solder iron, desolder iron
  - Serial communication: Concept of RS232 communication, Xbee
- Introduction of ATtiny microcontroller based PWM circuit programming.

Programming of Arduino:

- Introduction to Arduino: Setting up the programming environment and basic introduction to the Arduino micro-controller
- Programming Concepts: Understanding and Using Variables, If-Else Statement, Comparison Operators and Conditions, For Loop Iteration, Arrays, Switch Case Statement and Using a Keyboard for Data Collection, While Statement, Using Buttons, Reading Analog and Digital Pins, Serial Port Communication, Introduction programming of different type of sensors and communication modules, DC Motors controlling.

Basics of C#:

- Introduction: MS.NET Framework Introduction, Visual Studio Overview and Installation
- Programming Basics: Console programming, Variables and Expressions, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operators, Assignment Operators, Expressions, Control Structures, Characters, Strings, String Input, serial port communication: Read and write data using serial port.

- Software code optimization, software version control

Laboratory Work:
Schematic circuit drawing and PCB layout design on CAD tools, implementing hardware module of IR sensor, Transmitter and Receiver circuit on PCB.

Bronze Challenge: Single buggy around track twice in clockwise direction, under full supervisory control. Able to detect an obstacle.Parks safely. Able to communicate state of the track and buggy at each gantry stop to the console.

Silver Challenge: Two buggies, both one loop around, track in opposite directions under full supervisory, control. Able to detect an obstacle. Both park safely. Able to communicate state of the track and buggy at each gantry stop with console.

Gold Challenge: Same as silver but user must be able to enter the number of loops around the track beforehand to make the code generalized.

Course Learning Outcomes (CLOs) / Course Objectives (COs):
The student will be able to:

1. Recognize issues to be addressed in a combined hardware and software system design.
2. Draw the schematic diagram of an electronic circuit and design its PCB layout using CAD Tools.
3. Apply hands-on experience in electronic circuit implementation and its testing.
4. Demonstrate programming skills by integrating coding, optimization and debugging for different challenges.
5. Develop group working, including task sub-division and integration of individual contributions from the team.

Text Books:

1. Michael McRoberts, Beginning Arduino, Technology in action publications, 2nd Edition.
2. Alan G. Smith, Introduction to Arduino: A piece of cake, CreateSpace Independent Publishing Platform (2011).

Reference Book:

1. John Boxall, Arduino Workshop - a Hands-On Introduction with 65 Projects, No Starch Press; 1st edition (2013).

UTD003: Aptitude Skills Building

L	T	P	Cr
2	0	0	2.0

Course Objectives:

This course aims to sensitize students with the gamut of skills which facilitate them to enhance their employability quotient and do well in the professional space. These skills are imperative for students to establish a stronger connect with the environment in which they operate. An understanding of these skills will enable students to manage the placement challenges more effectively.

Emotional Intelligence: Understanding Emotional Intelligence (EI); Daniel Goleman's EI Model: Self Awareness, Self-Regulation, Internal Motivation, Empathy, Social Skills; Application of EI during Group Discussions & Personal Interview; Application of EI in personal life, student life and at the workplace

Team Dynamics & Leadership: Understanding the challenges of working within a team format in today's complex organizational environments; Stages of team formation; Appreciating forces that influence the direction of a team's behaviour and performance; Cross-functional teams; Conflict in Teams- leveraging differences to create opportunity Leadership in the team setting & energizing team efforts; Situational leadership; Application of team dynamics & collaboration in Group Discussions; Application of team dynamics at the workplace

Complex Problem Solving: Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions; Understanding a working model for complex problem solving - framing the problem, diagnosing the problem, identifying solutions & executing the solutions; Appreciation of complex problem solving at the workplace through case studies

Lateral Thinking: Understanding lateral thinking & appreciating the difference between vertical & lateral thinking, and between convergent & divergent thinking; Understanding brain storming & mind-maps; Solving of problems by an indirect and creative approach, typically through viewing the problem in a new and unusual light; Application of lateral thinking during Group Discussions & Personal Interviews; Application of lateral thinking at the workplace

Persuasion: Role of persuasion in communication; Application of ethos-pathos-logos; Using persuasive strategies to connect with individuals & teams to create competitive advantage

Quantitative Reasoning: Thinking critically and applying basic mathematics skills to interpret data, draw conclusions, and solve problems; developing proficiency in numerical reasoning; Application of quantitative reasoning in aptitude tests

Verbal Reasoning: Understanding and reasoning using concepts framed in words; Critical verbal reasoning; Reading Comprehension; Application of verbal reasoning in aptitude tests

Group Discussion (GD): Illustrating the do's and don'ts in Group Discussions; Specific thrust on types of GD topics; GD evaluation parameters; Understanding the challenge in a case discussion; SPACER model

Personal Interview (PI): Interview do's and don'ts; PI evaluation parameters; The art of introduction; Managing bouncer questions; Leading the panel in a PI

Course Learning Outcomes (CLOs):

The students will be able to

1. appreciate the various skills required for professional & personal success.
2. bridge the gap between current and expected performance benchmarks.
3. competently manage the challenges related to campus placements and perform to their utmost potential.

Recommended Books:

1. *Harvard Business Essentials; Creating Teams with an Edge; Harvard Business School Press (2004)*
2. *Edward de B., Six Thinking Hats; Penguin Life (2016)*
3. *Daniel, G., Working with Emotional Intelligence; Bantam Books (2000)*
4. *Aggarwal, R.S., Quantitative Aptitude for Competitive Examinations; S Chand (2017)*
5. *Agarwal, A., An expert guide to problem solving: with practical examples; CreateSpace Independent Publishing Platform (2016)*
6. *William, D., The Logical Thinking process; American Society for Quality (2007)*

Evaluation Scheme:

Sr. No.	Evaluation Elements	Weightage (%)
1	MST	45
2	EST	55