Syllabus for 4 Year B. Tech Course in Computer Science and Engineering (Artificial Intelligence)

Second Semester

Career Advancement & Skill Development – II: Communication Skill (TIU-UEN-S102)
Contact Hours/Week: 2–0–0 (L–T–P)
Credit: 2

Course Outcome

CO1	Apply common rules of English grammar in analyzing sentence structure
CO2	Read, understand and evaluate a text intrinsically as well as extrinsically.
CO3	Articulate one's ideas and thoughts in grammatically correct and culturally appropriate language in a variety of academic and professional writings.
CO4	Apply the strategies and techniques learnt in carrying out conversations across different contexts
CO5	Create presentations to address general as well as technical audiences

The aim of this foundational course is to help the second language learners acquire fluency in both spoken and written English to communicate messages with clarity, precision and confidence in the workplace. The course will have three components: Language, Speaking and Writing. The skills required in these areas will be imparted through Lectures and Sessional. While lectures will introduce learners to the basic concepts in communication, sessional will provide hands-on experience. It is hoped that after commanding the skills required in spoken and written English, learners will be able to communicate better.

- Advanced Grammar
- Formal Writing: Meetings, Agenda, Minutes,
- Poster presentations, Multimedia Presentations, Press Releases, Technical documents, Presentation for Meeting.
- Report, Proposal, Presentations
- Similes, idioms, and anecdotes
- People's skills
- Stress Management
- Time Management
- Analytical Reading
- Grooming and Employability skills

Recommended Books:

Main Reading:

1. Rizvi Ashraf, Effective Technical Communication, Tata McGraw-Hill.
2. Lata, Pushp, Communication Skills, Oxford University Press.
3. Wren & Martin, High School Grammar & Composition, S. Chand and Sons

4. David Holmes, Communication Theory, SAGE Publications Ltd.

Supplementary Reading:

1. Viswamohan Aysha, English for Technical Communication, Tata McGraw-Hill.
2. Gregory Bassham, William Irwin, Henry Nardone & James M. Wallace. Critical Thinking: A Student's Introduction, Tata McGraw Hill.
3. CIEFL, Hyderabad, Exercises in Spoken English. Parts.I-III.. Oxford University Press
4. Robin Torres- Gouzerh. Intermediate English Grammar for ESL Learners. Tata McGraw Hill.
5. Christopher Davies. Divided by a Common Language. Houghton Mifflin Company.

Mathematics-II (TIU-UMA-T102)

Contact Hours/Week: 3–1–0 (L–T–P)
Credit: 4

Course Outcome

CO1	To learn fundamentals of complex functions, analyticity, calculus of residue, etc. and its applications in engineering
CO2	To develop a basic understanding of vector spaces, linear transformations and orthogonalization
CO3	To solve ordinary differential equations using series solution
CO4	To study special functions, namely, Legendre and Bessel functions
CO5	To develop an understanding of Integral calculus and its applications such as determining the area between two curves, the surface of revolution etc.

Course Content

Module-1
Complex analysis: Limit, continuity, differentiability and analyticity of functions, Cauchy Riemann equations, line integrals, Cauchy Goursat theorem (statement only), independence of path, Complex integration over a contour, Cauchy's integral formula, derivatives of analytic functions, Taylor's series, Laurent's series, Zeros and singularities, Residue theorem, evaluation of real integrals by contour integration.

Module-2
Linear Algebra: Vector spaces over any arbitrary field, linear combination, linear dependence and independence, basis and dimension, linear transformations, matrix representation of linear transformations, linear functional, dual spaces, Inner product spaces, norms, Gram Schmidt process, orthonormal bases, projections and least squares approximation.

Module-3
Series solution of ODE: Review of power series, Ordinary point, regular and irregular singular point, series solution near ordinary and regular singular point. Legendre's equation and Legendre polynomials, Bessel's equation and Bessel's functions.

Module-4

Riemann Integral, fundamental theorem of integral calculus, applications of definite integrals, improper integrals, Beta and Gamma functions, reduction formulae. Double and triple integration, change in order of integration, Jacobian and change of variables formula. Parametrization of curves and surfaces.

Module-5
Vector fields, divergence and curl, Line integrals, Green's theorem, surface integral, Gauss and Stokes' theorems with applications.

Recommended Books:
Main Reading:

1. Higher Engineering Mathematics, B. S. Grewal
2. Advanced Engineering Mathematics, Kreyszig
3. A Text Book of Engineering Mathematics, Rajesh Pandey
4. Engineering Mathematics, B. K. Pal, K. Das

Chemistry (TIU-UCH-T106)

Contact Hours/Week: 3–1–0 (L–T–P)
Credit: 4

Course Outcome

CO1	To understand the basic concepts of C programming language
CO2	To develop the ability to analyze a problem, develop an algorithm to solve it
CO3	To develop the use of the C programming language to implement various algorithms
CO4	To introduce the more advanced features of the C language

Course Content

Module 1: Thermodynamics
First law of thermodynamics-system, process, Internal Energy, Enthalpy, Concept of reversible and irreversible process, mathematical form of reversible work and irreversible work, Adiabatic reversible expansion, work done in isothermal and adiabatic process, Specific heat capacity, concept of molar specific heat at constant pressure (Cp), molar heat capacity at constant volume (Cv), Relationship between CP and CV, Second law of thermodynamics-Carnot cycle, calculating efficiency of machines, entropy, free energy, Gibbs-Helmholtz equation, concept of spontaneous and non-spontaneous process, Maxwell relation, chemical equilibrium.

Module 2: Kinetics of Chemical reaction
Rate of reactions, factors affecting the rate of reaction, Rate laws, order and molecularity of a reaction, half life period, mechanism of elementary and overall reaction, reversible, consecutive, and parallel reactions, steady state approximation, variation of rate constant with temperature, Arrhenius equation, collision theory, concept of energy barrier, threshold energy, activation energy.

Module 3:

Acid-Base Equilibria: Strength of acids and bases based on their dissociation constant, Brönsted-Lowry and Lewis concept of acids and bases, Ionic product of water, pH of solutions and pH indicators, Common ion effect, Salt hydrolysis, Buffer solutions, Henderson's equation, Solubility product and its applications.

Electrochemical System: Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis, Ostwald's dilution law, Electrochemical cells, electrolytic cells, EMF of a cell, Application of EMF measurements, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and EMF of a cell, fuel cells.

Module 4: Chemical Bonding

Concept of ionic bonding, ionization enthalpy, lattice energy and electro negativity and periodic trends. Covalent bond, sigma and pi bonds: the examples of formation of ammonia, nitrogen, ethene, ethyne, and carbondioxide, Resonance, Co-ordinate or dative covalent bond: the examples of formation of oxy-acids of chlorine, Hydrogen bonding.

Valence Shell Electron Pair Repulsion Theory, Hybridization and shapes of molecules, dorbital splitting in crystal field (Oh, Td), Molecular orbital theory: Qualitative treatment of homo-nuclear diatomic molecules of first two periods, Energy level diagrams, bonding, antibonding molecular orbitals, bond order, paramagnetism of O2 molecule.

Module 5:

Isomerism and Chirality: Definition and Classification of isomerism – Structural Isomerism, Stereo Isomerism - Geometric isomerism (Cis and Trans only), Optical isomerism, CIP rules, R,S-Configuration.

Reaction Mechanism: Concept of Substitution, addition and elimination reactions, concept of homolytic and heterolytic fission, concept of electrophiles and nucleophiles. Inductive, mesomeric, electrometric effects, and hyper-conjugation, leaving group, reaction media, stereo chemical implications, free radicals and polar mechanisms, Nucleophilic substitution at the saturated carbon atom- SN1, SN2, and SNi, mechanism, elimination reaction-E1, E2, and E1CB mechanisms.

Recommended Books:

Main Reading

1. P. C. Rakshit, Physical Chemistry, Sarat Book House (7th Edition).
2. S. Glasstone, Text Book of Physical Chemistry, Macmillan India Limited.
3. S. Pahari, Physical Chemistry, New Central Book Agency.
4. P. W. Atkins, Physical Chemistry, 6th Edition, Oxford Publishers.
5. I. L. Finar, Organic Chemistry, Addison Wesley Longman, Inc.
6. Mark Loudon, Organic Chemistry, 4th Edition, Oxford Publishers.

Engineering Mechanics (TIU-UME-T102)

Contact Hours/Week: 3–0–0 (L–T–P)

Credit: Theory–3

Course Outcome

CO1	To understand the basics of vector mechanics and its application in engineering

	mechanics.
CO2	To understand Newton's laws of motion, frames of reference, static and dynamic equilibrium of rigid bodies.
CO3	To be able to apply the laws of static equilibrium in solving problems and performing analysis of trusses.
CO4	To understand basic principles of work, power, energy and conservation laws.
CO5	To understand basic principles of Kinematics and kinetics of particles, plane, rectilinear and curvilinear coordinate system, projectile motion, Newton's laws and conservation of momentum.
CO6	To understand basic principles of Kinematics of rigid bodies, absolute, relative velocities, accelerations, instantaneous centre of rotation.

Course Content

Module-1:
Introduction: Fundamentals of Mechanics: Introduction to mechanics; Basic concepts – mass, space, time and force; Particles and rigid bodies; Scalars and vectors; Free, sliding, fixed and unit vectors; Addition, subtraction and multiplication of two vectors; scalar triple product and vector product of 3 vectors.

Module 2:
Force systems: Introduction to different force systems; Composition of forces – triangle, parallelogram and polygon law of forces, and addition of two parallel forces; Resolution of forces; Moment of a force, Varignon's theorem; Couples; Force-couple system; Resultant of a force system Equilibrium: Force Systems & Equilibrium: Free body diagram, equilibrium conditions in 2 dimensions.

Module 3:
Plane Truss: Statically determinate trusses; Force analysis of a truss - method of joints, method of sections

Module-4:
Friction: Laws of dry friction; Co-efficient of friction; Angle and cone of friction; Angle of repose; Applications of friction—wedges and screw-jacks.

Module-5:
Distributed Forces: Line, area and volume distributions of forces; Centre of gravity; Centre of mass; Centroids of plane figures; Centroids of composite areas. Moment of Inertia: Area and mass moments of inertia; Perpendicular and Parallel axes theorems pertaining to moment of inertia; Radius of gyration.

Module-6:
Kinematics of Particles: Differential equations of kinematics – plane, rectilinear and curvilinear motions; Cartesian co-ordinate system; Normal and tangent co-ordinate system, projectile motion.

Module-7:
Kinetics of Particles: Newton's second law of motion; Work and energy principle – gravitational potential energy, elastic potential energy, kinetic energy, power, efficiency; Principle of impulse and momentum; Impact motion- direct central impact.

Module-8:
Kinematics of Rigid Bodies: Kinematics of rotation, absolute motion, relative velocity, instantaneous centre, relative acceleration, motion relative to relative axes.

Recommended Books:

Main Reading

1. Meriam and Kraige,Engineering Mechanics (Vol.1 & 2),Wiley India 2017.
2. Khurmi R.S. Khurmi N., A Textbook of Engineering Mechanics,S. Chand, 2018.

Supplementary Reading

1. Bhavikatti S. S, Engineering Mechanics, New Age International Publishers, 2021.
2. Shames I. H., Rao G. K. M., Engineering Mechanics, Pearson, 2005.

Problem Solving Techniques (TIU-UCS-T106)

Contact Hours/Week: 3–0–0 (L–T–P)

Credit: Theory–3

Course Outcome

CO1	To understand the basic concepts of C programming language
CO2	To develop the ability to analyze a problem, develop an algorithm to solve it
CO3	To develop the use of the C programming language to implement various algorithms
CO4	To introduce the more advanced features of the C language

Course Content

Module 1:
Introduction to C Language: Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple 'C' programs.
Conditional Statements and Loops: Decision making within a program Conditions, Relational Operators, Logical Connectives, if statement, if-else statement. Loops: while loop, do while, for loop, Nested loops, Infinite loops, switch statement, Structured Programming.

Module 2:
Arrays: One dimensional arrays: Array manipulation, Searching, Insertion, and Deletion of an element from an array, finding the largest/smallest element in an array; Two dimensional arrays, Addition/multiplication of two matrices, transpose of a matrix.

Strings: General concept of string, String declaration and initialization, String input and output functions, Different in-build string functions – strlen(), strcmp(), strcpy(), strcat() etc.

Module 3:
Functions: Top-down approach of problem solving; Modular programming and functions; Standard Library of C functions; Prototype of a function Formal parameter list, Return Type, Function call, Block structure; Passing arguments to a Function Call by reference, Call by value, Recursive Functions, Arrays as function arguments.

Module 4:
Structures and Unions: Structure variables, Initialization, Structure assignment, Nested structure, Structures and Functions, Structures and arrays: Arrays of structures, Structures containing arrays, Unions.

Module 5:
Pointers: Address operators, Pointer's type declaration, Pointer assignment, Pointer initialization, Pointer arithmetic, Functions and pointers, Arrays and Pointers, Pointer arrays.

Module 6:
File Processing: Concept of Files, File opening in various modes and closing of a file, reading from a file, writing onto a file.

Recommended Books:
Main Reading
1. H. Scheldt, C: The Complete Reference, 4th Edition, McGrawHill
2. B W Kernighan and D.M. Ritchie, The C Programming Language, Prentice Hall of India.

Supplementary Reading
1. Jones, Robin and Stewart, The Art of C Programming, Narosa Publishing House.
2. A Kenneth, C Problem solving and Programming, Prentice Hall International.
3. R G Dromey, how to solve it by Computer, Prentice Hall in India.
4. H. Schildt, C Made easy, McGraw Hill Book Company.
5. Kr. Venugopal and Sudeep R Prasad, Programming with C, Mc-Grow Hill

Basic Electrical & Electronics Engineering (TIU-UEE-T102)
Contact Hours/Week: 3–1–0 (L–T–P)
Credit: 4

Course Outcome

CO1	Understand the basic properties of electrical elements and analyze DC circuits.
CO2	Explain the behavior of AC circuits and series & parallel resonance.
CO3	Explain the basic properties of electromagnetic circuit & their application.

CO4	Understand basic electronic components and circuits and their applications in different areas.
CO5	Analyze diode, rectifier and transistor circuits.
CO6	Understand different biasing techniques to operate transistor, FET, MOSFET and OP-AMP in different modes.

Course Content

Module 1: Introduction
Basic electrical quantities, Voltage, Current, Power. Basic Electrical elements:
Resistance, Inductance, Capacitance. Their voltage-current relationship. Voltage and current sources.

Module 2: DC Network Analysis
KCL and KVL and their applications in purely resistive circuits. Concept of linear, bilateral networks. Source conversion,
Star-Delta conversion.

Module 3: DC Network Theorems
Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem.

Module 4: Sinusoidal Steady State Analysis
Representation of Sinusoids. Idea of reactance and impedance. Phasors for simple R-L-C combinations. Concept of power
and power factor. Resonance.

Module 5: 3-Ph circuits
Introduction to 3-Ph quantities. 3-ph star and delta connection. Phasor diagram for 3-ph system, Balanced 3-ph loads,
measurement of 3-ph power.

Module 6: Semiconductor Devices
Energy bands in solids. Intrinsic and extrinsic semiconductors. P-N junctions. Semiconductor diodes: Zener and Varactor
diodes. Bipolar transistors (operation, characteristics).

Module 7: Diode Circuits, BJT biasing & Operation of JFET, MOSFET
Rectifiers, Clippers, Clampers, DC analysis of BJT, Operation of JFET, MOSFET , CE amplifiers.

Module 8: OPAMPs
Properties of an ideal and a practical OPAMP. Block diagram. Concept of Virtual Short, Inverting and Non-inverting
amplifiers, Summing and Differencing amplifier, Differentiator and Integrator.

Module 9: 1-Ph Transformers

Faraday's Law, EMF generation (dynamic and static), B-H curve, Construction and operation of single-phase transformer:
voltage and current transformation, no-load operation, voltage regulation on resistive load.

Recommended Books:

Main Reading

1. Nagrath and Kothari, Basic Electrical and Electronics Engineering, Tata McGraw-Hill