Department of Computer Science and Engineering

CURRICULUM AND SYLLABUS

(2021-2025)

B.Tech. CSBS

Computer Science and Engineering

B.Tech. (CSBS)

CURRICULUM AND SYLLABUS

Vision Statement of University

Be an internationally acclaimed University recognised for its excellent teaching, research, innovation, outreach and creating top class technocrats and professionals who can serve the mankind as multi skilled global citizen.

Mission Statement of University

- Establish state-of-the-art facilities for world class education and research.

- Conduct scholarly research and creative endeavours that impact quality of life.

- Attract quality staff and students to cater for diverse needs and preferences and widen participation.

- Build a foundation for students to be successful at all levels through high-quality, innovative programs.

- Collaborate with institute, industry, and society to address current issues through research and align curriculum.

- Involve in societal outreach programs to identify concerns and provide sustainable ethical solutions.

- Encourage life-long learning and team-based problem solving through an enabling environment.

Vision of the Department:

Inculcate the innovative thinking in Computer Science and Engineering graduates with domain knowledge and skills to address contemporary industrial and social requirements.

Mission of the Department:

1. Provide an environment to the students to learn with passion and equip with proper skill set to address current problems.

2. Provide maximum exposure to innovative techniques available to cater industrial needs by maintain the best Industry- Academia relation.

3. Imparting best problem-solving strategies in students to work in a team.

4. Develop leadership qualities in Computer Science graduates to work for the society.

5. Attract experienced and expert faculty members and create an enthusiastic academic environment.

Department of Computer Science and Engineering

Program Education Objectives (PEOs)

PEO$_{01}$ Provide the fundamental knowledge of basic sciences, mathematics, Computer Science and Business systems for the applications relevant to various streams of Engineering and Technology.

PEO$_{02}$ Provide the knowledge of computer science and Data analytics tools to store, retrieve, implement and analyse data in the context of business enterprise.

PEO$_{03}$ Provide the facility and establish themselves as professionals by applying their technical skills and leadership qualities to solve real world problems and meet the diversified needs of industry, academia and research.

PEO$_{04}$ Provide the opportunities to learn entrepreneurial skills and qualities which help them to perceive the functioning of business, diagnose business problems, explore the entrepreneurial opportunities and prepare them to manage business efficiently.

Department of Computer Science and Engineering

PROGRAMME OUTCOMES (POs)

PO01
    Engineering knowledge: Apply the knowledge of mathematics, science, engineering, fundamentals, and an engineering specialization to the solution of

PO02 **Problem analysis:** Identify, formulate, review, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO03 **Design / development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO04 **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO05 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO06 **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO07 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO08 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO09 **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO₁₀   **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able

to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO₁₁   **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO₁₂   **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Department of Computer Science and Engineering

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO$_{01}$ Ability to create, select, and apply appropriate techniques, resources, modern engineering and business tools including prediction and data analytics to complex engineering activities and business solutions.

PSO$_{02}$ Ability for effective decision making in several critical problem domains of the real world.

PSO$_{03}$ Ability to apply entrepreneurial skills and management tools for identifying, analysing and creating business opportunities with smart business ideas.

PSO$_{04}$ Ability to manage complex IT projects with consideration of the human, financial, ethical and environmental factors and an understanding of risk management processes, and operational and policy implications.

Medi-Caps University Indore (M.P.)
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
Scheme (B.Tech- Computer Science & Business Systems (CSBS)) Batch 2021

SEMESTER I

ID	Course Code	Course	L	T	P	Credit
1	EN3BS06	Discrete Mathematics	3	0	0	3
2	EN3BS07	Introductory Topics in Statistics, Probability and Calculus	3	0	0	3
3	EN3ES09	Fundamentals of Computer Science	3	0	2	4
4	EN3ES11	Principles of Electrical Engineering	3	0	2	4
5	EN3BS10	Physics for Computing Science	3	0	2	4
6	EN3HS05	Business Communication & Value Science - I	2	0	2	3
		Total	**17**	**0**	**8**	**21**
				25 Hrs		

SEMESTER II

ID	Course Code	Course	L	T	P	Credit
1	EN3BS08	Linear Algebra	3	1	0	4
2	EN3ES10	Statistical Methods	3	1	0	4
3	CB3CO01	Data Structures & Algorithms	2	1	2	4
4	EN3ES12	Principles of Electronics	3	0	2	4
5	CB3CO02	Fundamentals of Economics	2	0	0	2
6	EN3HS06	Business Communication & Value Science – II	2	0	2	3
7	EN3MC12	Environmental Sciences	3	0	0	3
		Total	**18**	**3**	**6**	**24**
				27 Hrs		

SEMESTER III

ID	Course Code	Course	L	T	P	Credit
1	CB3CO22	Formal Language and Automata Theory	3	0	0	3
2	EN3ES14	Computer Organization & Architecture	3	0	2	4
3	CB3CO04	Object Oriented Programming	3	0	2	4
4	EN3BS09	Computational Statistics	3	0	2	4
5	CB3CO07	Database Management Systems	3	0	2	4
6	CB3NG02	Open Learning Course	1	0	0	1
7	CB3NG03	Indian Constitution	2	0	0	2
		Total	**18**	**0**	**8**	**22**
				26 Hrs		

SEMESTER IV

ID	Course Code	Course	L	T	P	Credit
1	CB3CO06	Operating Systems	3	0	2	4
2	CB3CO23	Design And Analysis of Algorithms	3	0	2	4
3	CB3CO24	Software Engineering	3	0	2	4
4	CB3NG04	Introduction to Innovation, IP Management & Entrepreneurship	2	0	0	2
5	EN3ES13	Design Thinking	2	0	2	3
6	EN3ES15	Operations Research	3	0	2	4
7	OE00092	Marketing Research & Marketing Management	2	0	0	2
8	CB3NG05	Essence of Indian Traditional Knowledge	2	0	0	2
		Total	**20**	**0**	**10**	**25**
				30 Hrs		

SEMESTER V

ID	Course Code	Course	L	T	P	Credit
1	CB3CO25	Software Design with UML	3	0	2	4
2	CB3CO10	Compiler Design	3	0	2	4
3	CB3NG06	Fundamentals of Management	2	0	0	2
4	OE00090	Business Strategy	2	0	0	2
5	EN3HS07	Business Communication & Value Science – III	2	0	2	3
6	CB3EL01	Elective I : Machine Learning	3	0	2	4
7	CB3EL13	Elective II: Cryptology	3	0	2	4
8	CB3PC04	Mini Project	0	0	2	1
		Total	**18**	**0**	**12**	**24**
				30 Hrs		

SEMESTER VI

ID	Course Code	Course	L	T	P	Credit
1	CB3CO12	Computer Networks	3	0	2	4
2	CB3CO29	Usability Design of Software Applications	2	0	2	3
3	CB3CO14	Artificial Intelligence	3	0	2	4
4	OE00086	Financial & Cost Accounting	2	0	2	3
5	CB3CO27	IT Workshop Scilab / MATLAB	2	0	2	3
6	CB3EL08	Elective III: Data Mining and Analytics	3	0	2	4
7	CB3EL04	Elective IV: Advance Finance	3	0	0	3
		Total	**18**	**0**	**12**	**24**

						30 Hrs	

Industrial Project (6-8 weeks)

SEMESTER VII

ID	Course Code	Course	L	T	P	Credit
1	EN3HS11	Business Communication & Value Science-IV	2	0	0	2
2	OE00087	Financial Management	2	0	0	2
3	OE00091	Human Resource Management	2	0	0	2
4	CB3EL02	Elective V: Industrial Psychology	3	0	0	3
5	CB3EL11	Elective VI: Advanced Social, Text and Media	3	0	2	4
6	CB3CO19	Services Science & Service Operational Management	3	0	0	3
7	CB3PC06	Industrial Training	0	2	0	2
8	CB3PC05	Minor Project	0	0	8	4
		Total	**15**	**2**	**10**	**22**
				27 Hrs		

SEMESTER VIII

ID	Course Code	Course	L	T	P	Credit
1	CB3PC07	Major Project	0	0	20	10
		Total	**0**	**0**	**20**	**10**
				20 Hrs		

Total Credit   **172**

S.No.	Course Work	Total Credits	Credits as per Model scheme
1	Basic Sciences (BS)	18	10-15% (16-24)
2	Engineering Sciences (ES)	27	15-20% (24-32)
3	Humanities and Social Sciences (HS)	11	5-10% (8-16)
4	Professional Subjects-Core (CO)	54	30-40%(48-64)
5	Professional Subjects – Electives (EL)	22	10-15%(16-24)
6	Open Subjects- Electives (OE)	11	5-10%(8-16)
7	Project Work, Industrial Training(PC)	17	10-15%(16-24)
8	Non Grading(NG)	12	(11-16)
		172	

SEMESTER I

ID	Course Code	Course	L	T	P	Credit
1	EN3BS06	Discrete Mathematics	3	0	0	3
2	EN3BS07	Introductory Topics in Statistics, Probability and Calculus	3	0	0	3
3	EN3ES09	Fundamentals of Computer Science	3	0	2	4
4	EN3ES11	Principles of Electrical Engineering	3	0	2	4
5	EN3BS10	Physics for Computing Science	3	0	2	4
6	EN3HS05	Business Communication & Value Science - I	2	0	2	3
		Total	**17**	**0**	**8**	**21**
				25 Hrs		

Course Code	Course Name	Hours Per Week				
		L	**T**	**P**	**Hrs**	**Credits**
EN3BS06	Discrete Mathematics	3	0	0		3

Course Learning Objectives (CLOs):

CLO01 Understand the fundamental concepts of abstract algebra, including sets, relations, functions, and posets.

CLO02 Comprehend Boolean algebra and its applications in logic gates, truth tables, and Karnaugh maps.

CLO03 Develop proficiency in combinatorics, including counting principles, generating functions, and recurrence relations.

CLO04 Explore graph theory, covering graph properties, Eulerian paths, Hamiltonian circuits, planar graphs, and the Four-color theorem.

CLO05 Gain knowledge of propositional calculus and logic, including truth assignments, normal forms, formal reducibility, and soundness and completeness.

UNIT I Abstract algebra:
Set, Different types of sets, Operation on sets, Relation, Binary Relation, Equivalence relation, Functions: Partial order relation, Posset, least upper bound, greatest lower bound, maximal, and minimal elements of a posset.

UNIT II Boolean algebra:
Group, Finite and Infinite group, Ring, Polynomial ring, Field, Subfield, Skew field. Lattices, Distributive laws in lattices Complemented lattices, 1 Introduction of Boolean algebra, truth table, basic logic gate, basic postulates of Boolean algebra, principle of duality, canonical form, Karnaugh map.

UNIT III Combinatorics:
Basic counting, balls, and bins problems, generating functions, recurrence relations. Proof techniques, principle of mathematical induction, pigeonhole principle.

UNIT IV Graph Theory:
Graphs and digraphs, complement, isomorphism, connectedness and reachability, adjacency matrix, Eulerian paths and circuits in graphs and digraphs, Hamiltonian paths and circuits in graphs and tournaments, trees; Planar graphs, Euler's formula, dual of a planer graph, independence number and clique number, chromatic number, statement of Four colour theorem.

UNIT V Logic:

Propositional calculus - propositions and connectives, syntax; Semantics- truth assignments and truth tables, validity and satisfiability, tautology; Adequate set of connectives; Equivalence and normal forms; Compactness and resolution; Formal reducibility natural deduction system and axiom system; Soundness and completeness.

Text books:
   1. Liu and Mohapatra, Elements of Discrete Mathematics, McGraw Hill
   2. 'Kenneth H. Rosen, Discrete Mathematics and Its Applications, McGraw Hill
   3. M. Morris Mano, Digital Logic & Computer Design, Pearson.
   4. N. Deo, Graph Theory with Applications to Engineering and Computer Science, Prentic Hall, Englewood Cliffs.

References:
   1. J.P. Tremblay and R. Manohar Discréte Mathematical Structures with Applications to "Computer Science, McGraw Hill
   2. 'R. A. Brualdi Introductory Combinatorics, North-Holland, New York.
   3. J. A. Bondy and U. S. R. Murty, Graph Theory with Applications, Macmillan Press, London.
   4. L.Zhongwan, Mathematical Logic for Computer Science, World Scientific, Singapore.
   5. E. Mendelsohn, Introduction to Mathematical Logic, (Second Edition), Van-Nostrand London.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO_{01} Ability to apply abstract algebra concepts to solve problems related to sets, relations, and functions.

CO_{02} Proficiency in analyzing Boolean algebra and utilizing logic gates and truth tables for solving logical problems.

CO_{03} Capability to use combinatorial techniques to solve counting and recurrence problems.

CO_{04} Competence in analyzing graph properties and applying graph theory principles to solve graph-related problems.

CO_{05} Aptitude to apply propositional calculus in logical reasoning, evaluate truth values, and construct formal proofs using natural deduction and axiom systems.

Course Code	Course Name	Hours Per Week				
	Introductory Topics in Statistics Probability and Calculus	**L**	**T**	**P**		**Credits**
EN3BS07		3	0	0		3

Course Learning Objectives (CLOs):

CLO01 Understand the fundamental concepts of statistics, including its definition, objectives, and applications in various scientific fields.

CLO02 Develop proficiency in collecting and distinguishing between internal and external data, primary and secondary data, and understanding the concepts of population and sample.

CLO03 Comprehend the principles of descriptive statistics, including classifying, tabulating, and graphically representing univariate data, along with calculating measures of central tendency and dispersion.

CLO04 Gain knowledge of the theory of probability, including the concept of experiments, sample space, events, and the application of probability in real-world scenarios.

CLO05 Acquire a basic understanding of differential and integral calculus and its applications, including solving problems using double and triple integrals

UNIT 1 Introduction to Statistics

Definition of Statistics. Basic objectives. Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary Data. Population and sample

UNIT II Descriptive Statistics

Classification 2nd tabulation of univariate data, graphical representation, Frequency curves. Descriptive measures - central tendency and dispersion. Bivariate data. Summarization, marginal 2nd conditions frequency distribution.

UNIT III Theory of Probability. Expected values and Moments.

Concept of experiments. sample space. event. Definition of Combination 121 Probability, Bayes Theorem. Mathematical expectation and its properties, Moments (including variance) and their properties. interpretation Moment generating function.all Probability.

UNIT IV Probability Distribution

Discrete and continuous distributions, Binomial. Poisson and Geometric distributions, Uniform, Exponential. Normal. Chi-square, t, F distributions.

UNIT IV Calculus

Basic concepts of Differential and integral calculus, application of double and triple integral.

Text books:

1. Introduction of Probability Models, S.M. Ross, Academic Press, N.Y.
2. Fundamentals of Statistics, vol. I & II. A. Goon, M. Gupta and B. Dasgupta, World Press.
3. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication, Delhi.

References:

1. A first course in Probability, S.M. Ross, Prentice Hall.
2. Probability and Statistics for Engineers, (Fourth Edition), LR. Miller, J.E. Freund and R_ Johnson, PHIL.
2. Introduction to the Theory of Statistics, A.M. Mood, F.A. Graybill and D.C. Boas. McGraw Hill Education.
4. Advanced Engineering Mathematics, (Seventh Edition), Peter V. O'Neil, Thomson Leaming.
5. Advanced Engineering Mathematics, (Second Edition) M. D. Greenberg, Pearson Education.
6. Applied Mathematics, Vol. I & II, P. N. Waurika and). N. Wanker, VidvarthiPrakashan.

Web Source:
1. https://nptel.ac.in/course. php

Open Learning Source:
l. https://swayam.gov.in/courses/public

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO$_{01}$ Ability to apply statistical techniques to analyse and interpret data effectively across different scientific fields.

CO$_{02}$ Proficiency in summarizing and presenting data using appropriate graphical representations and statistical measures.

CO$_{03}$ Competence in utilizing probability theory to model and analyse uncertain events and make informed decisions based on probabilities.

CO$_{04}$ Capability to work with various probability distributions and understand their properties and applications in real-world situations.

CO$_{05}$ Aptitude to apply calculus concepts to solve mathematical and statistical problems, enhancing problem-solving skills in diverse scenarios.

Course Code	Course Name	Hours Per Week				Credit
	Fundamental of Computer Science	L	T	P		
EN3ES09		3	0	2		4

Course Learning Objectives (CLOs):

CLO01 Understand algorithm development and problem-solving techniques using flowcharts and structured logic structures.

CLO02 Comprehend the syntax and constructs of the ANSI C programming language, including data types, operators, and variable naming conventions.

CLO03 Gain proficiency in utilizing control flow structures like if-else, switch, and loops (while, do, for) to create structured programming solutions.

CLO04 Acquire knowledge of functions, their parameter passing mechanisms, scope rules, and the use of standard library functions in C programming.

CLO05 Learn about pointers, arrays, structures, and file handling in C, enabling the implementation of complex data structures and input/output operations.

UNIT I
Algorithm, and Flowchart for problem solving with Sequential Logic Structure, Decisions and Loops. Introduction to imperative language; syntax and constructs of a specific language (ANSI C) Types Operator and Expressions with discussion of variable naming and Hungarian Notation: Variable Names, Data Type and Sizes (Little Endian Big Endian), Constants, Declarations,

UNIT II
Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation, Control Flow with discussion on structured and unstructured programming: Statements and Blocks, If-Else-If, Switch, Loops – while do, for, break and continue, got labels, structured and un- structured programming.

UNIT III
Functions and Program Structure with discussion on standard library: Basics of functions, parameter passing and returning type, C main return as integer, External, Auto, Local, Static, Register Variables, Scope Rules, Block structure, Initialisation, Recursion, Pre-processor, Standard Library Functions and return types**.**

UNIT IV

Pointers and address, Pointers and Function Arguments, Pointers and Arrays, Address Arithmetic, character Pointers and Functions, Pointer Arrays, Pointer to Pointer, Multi-dimensional array and Row/column major formats, Initialization of Pointer Arrays, Command line arguments: Pointer to functions, complicated declarations and how they are evaluated. Structures: Basic Structures, Structures and Functions, Array of structures, Pointer of structures, Self-referral structures, Table look up, typedef, unions, Bit-fields.

UNIT V

Input and Output: Standard 1/0, Formatted Output — print, Formatted Input — scanf, Variable length argument list, file access including FILE structure, open, stdin, stout and stderr, Error Handling including exit, error and error's, Line 1/0, related miscellaneous functions. Unix system Interface: File Descriptor, Low level 1/0 — read and write, open, create, close and Function, make file utility.

Textbooks:
1. The C Programming Language, (Second Edition) B. W. Kernighan and D. M. Ritchi, PHI.
2. Programming in C, (Second Edition) B. Gottfried, Schaum Outline Series.

Reference Books:
1. C: The Complete Reference, (Fourth Edition), Herbert Schildt, McGraw Hill.
2. Let Us C.YashavantKanetkar, BPI Publications.

Practical: -
1. Algorithm and flowcharts of small problems like GCD
2. Structured code writing with:
   i. Small but tricky codes
   ii. Proper parameter passing.
   iii. Command line Arguments
   iv. Variable parameter
   v. Pointer to functions
   vi. User defined header
   vii. Make file utility.
   viii. ~~ Multi file program and user defined libraries
   ix. Interesting substring matching / searching programs.
   x. Parsing related assignments

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to develop efficient algorithms and represent them using flowcharts for problem-solving.

CO02 Proficiency in writing C programs, employing different data types, operators, and expressions effectively.

CO₀₃ Competence in using control flow structures to create structured and organized programs.

CO₀₄ Capability to design functions, handle pointers, arrays, and structures, and use standard library functions for efficient program development.

CO₀₅ Aptitude to implement input/output operations and handle file operations, making the students adept in file handling and Unix system interfaces.

Course Code	Course Name	Hours Per Week				
	Principles of Electrical Engineering	**L**	**T**	**P**		**Credit**
EN3ES11		3	0	2		4

Course Learning Objectives (CLOs):

CLO₀₁   Understand the fundamental concepts of electric circuits, potential difference, voltage, current, and the functional relations of linear passive and active elements.

CLO₀₂   Comprehend the terminology and symbols used to describe electric networks, as well as the properties of voltage and current sources, and their application in network analysis using Kirchhoff's laws.

CLO₀₃   Gain proficiency in analyzing DC circuits using techniques like Thevenin's theorem, Norton's theorem, and series-parallel simplifications.

CLO₀₄   Acquire knowledge of AC circuits, including waveform definitions, phasor representation, impedance, power concepts, and analysis of R-L, R-C, and RLC series and parallel circuits.

CLO₀₅   Learn about electrostatics, electromechanics, and energy conversion, including capacitors, magnetic fields, inductance, transformers, and electromechanical energy conversion principles.

UNIT 1
Introduction: Concept of Potential difference, voltage, current, Fundamental linear passive and active elements to their functional current-voltage relation, Terminology, and symbols in order to describe electric networks, voltage source and current sources, ideal and practical sources, concept of dependent and independent sources, Kirchhoff-s laws, and applications to network solutions using mesh and nodal analysis, Concept of work, power, energy, and conversion of energy.

UNIT II
DC Circuits: Current-voltage relations of the electric network by mathematical equations to analyse the network (Thevenin's theorem, Norton's Theorem, theorem) Simplifications of networks using series-parallel, Star/Delta transformation. Superposition theorem.

UNIT III
AC Circuits: AC waveform definitions, form factor, peak factor, study of R-L, R-C, RLC series circuit, R-L-C parallel circuit, phasor representation in polar and rectangular form,

concept of impedance, admittance, active, reactive, apparent and complex power, power factor, 3 phase. Balanced AC Circuits (A-A & A-A). |

UNIT IV
Electrostatics and Electro-Mechanics: Electrostatic field, electric field strength, concept of permittivity in dielectrics, capacitor composite, dielectric capacitors, capacitors in series and parallel, energy stored in capacitors, charging, and discharging of capacitors, Electricity and Magnetism, magnetic field and Faraday's law, self and mutual inductance, Ampere's law, Magnetic circuit, Single phase transformer, principle of operation, EMF equation, voltage ratio, current ratio, KVA rating, efficiency and regulation, Electromechanical energy conversion.

UNIT V
Measurements and Sensors: Introduction to measuring devices/sensors and transducers. (Piezoelectric and thermo-couple) related to electrical signals, Elementary methods for the measurement of electrical quantities in DC and AC systems (Current & Single-phase power). Electrical Wiring and Illumination system: Basic layout of the distribution system, Types of Wiring System & Wiring Accessories, Necessity of earthing, Types of earthing, Safety devices & system.

For Additional Further Reading Only Principle of batteries, types, construction, and application, Magnetic material and B-H Curve, Basic concept of indicating and integrating instruments.

Text books:
1. Electric Machinery. (Sixth Edition) A. E. Fitzgerald, Kingsley Jr Charles, D. Umans Stephen, Tata McGraw Hill.
2. 'A Textbook of Electrical Technology, (vol. 1), B. L. Theraja, Chand and Company Ltd.
3. Basic Electrical Engineering, V. K. Mehta, S. Chand and Company Ltd., New Delhi.
4. Theory and problems of Basic Electrical Engineering, (Second Edition), J. Nagrath and ' Kothari, Prentice Hall of India Pvt. Ltd.

References:
1. Basic of Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press.
2. Introduction to Electrodynamics, D. J. Griffiths, (Fourth Edition), Cambridge Universit Press.
3. Engineering Gjircuit Analysis, William H. Hayt & Jack E. Kemmerly, McGraw-Hill Book Company Inc.
4. Fundamentals] of Electrical and Electronics Engineering, Smarjith Ghosh, Prentice Hall (India) Pvt. Ltd.
5. T. K. Nagsarkar and M. S. Sukhija, Basic of Electrical Engineering, Oxford University Press, 2011.

List of Practical's:
1. Familiarization of electrical Elements, sources, measuring devices and transducers related to electrical circuits.

2. To verify KCL and KVL.
3. To verify Maximum power transfer theorem.
4. To verify Thevenin's theorem.
5. To verify Norton's theorem.
6. To verify Superposition theorem.
7. Simulation of time response of series RC circuit.
8. Simulation of R-L-C series circuits for $Xi > Xc$, $Xi < Xe$.
9. Demonstration of measurement of electrical quantities (single-phase power & current) in RL, RIC & R-L-C circuit.
10. To verify relation in between voltage and current in three-phase balanced star and delta connected load.
11. Determination of resistance temperature coefficient.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01   Ability to analyze electric circuits using Kirchhoff's laws, mesh and nodal analysis, and simplify complex circuits using network theorems.

CO02   Proficiency in solving DC circuit problems, determining current-voltage relationships, and applying Thevenin's theorem and other techniques for circuit analysis..

CO03   Competence in understanding AC circuit behavior, calculating impedance, power factors, and analyzing balanced AC circuits.

CO04   Capability to comprehend the principles of electromechanical energy conversion, magnetic fields, inductance, and transformers, and evaluate their efficiency and regulation.

CO05   Aptitude to use measuring devices and sensors for electrical quantity measurements, understand electrical wiring systems, and apply safety measures in electrical installations.

Course Code	Course Name	Hours Per Week				
		L	**T**	**P**	**Hrs.**	**Credits**
EN3BS10	Physics for Computing Science	3	0	2	5	4

Course Learning Objectives (CLOs):

CLO01 Understand Einstein's theory of matter radiation interaction and A and B coefficients in laser and fiber optics.

CLO02 Describe the principles of population inversion and amplification of light in different types of lasers.

CLO03 Explain the properties of laser beams, including monochromaticity, coherence, directionality, and brightness.

CLO04 Analyze the phenomenon of laser speckles and explore the engineering applications of lasers.

CLO05 Identify and categorize various types of optical fibers used in fiber optics and their applications.

UNIT 1

Laser and Fiber optics: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: Ruby Laser, CO2, and Neodymium lasers; Properties of laser beams: mono chromaticity coherence directionality and brightness, laser speckles, applications of lasers in engineering   Fiber optics and Applications, Types of optical fibres.

UNIT 2

Interference-principle of superposition-young's experiment: Theory of interference fringes-types of interference-Fresnel's prism-Newton's rings, Dill action=Two kinds of diffraction-Difference between interference and diffraction=Fresnel's half period zone and zone plate-Fraunhofer diffraction at single slit-plane diffraction grating. 'Temporal and Spatial Coherence.
Polarization of light: Polarization - Concept of production of polarized beam of light from two SHM acting at right angle; plane, elliptical und circularly polarized light, Brewster's law, double refraction.

UNIT 3

Quantum Mechanics: Introduction - Planck's quantum theory- Matter waves, de-Broglie wavelength, Heisenberg's Uncertainty principle, time independent and time dependent Schrodinger's wave equation, Physical significance of wave function, Particle in a one dimensional potential box, Heisenberg Picture.

Crystallography: Basic terms-types of crystal systems, Bravais lattices, miller indices, d spacing, Atomic packing factor for SC, BCC, FCC, and HCP structures.

UNIT 4

Oscillation: Periodic motion-simple harmonic motion-characteristics of simple harmonic motion-vibration of simple spring mass system. Resonance-definition., damped harmonic oscillator — heavy, critical, and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators.

Basic Idea of Electromagnetisms: Continuity equation for current densities, Maxwell's equation in vacuum and non-conducting medium.

UNIT 5

Semiconductor Physics: Conductor, Semiconductor, and Insulator; Basic concept of Band theory. Lodi

Thermodynamics: Zeroth law of thermodynamics, first law of thermodynamics, brief discussion on application of Its law, second law of thermodynamics and concept of Engine, entropy, change in entropy in reversible and irreversible processes.

Textbooks:
1. Concepts of Modern Physics, (Fifth Edition) A Beiser, McGraw Hill International.
2. Fundamentals of Physics, David Halliday, Robert Resnick and Jearl Walker, Wileyplus.

References:
1. Optics, (Fifth Edition) Ajoy Ghatak, Tata McGraw Hill.
2. Sears & Zemansky University Physics, Addison-Wesley.
3. Fundamentals of Optics, (Third Edition) Jenkins and White, McGraw-Hill.

List of Practical:
1. To study the Hall effect experiment and find the Hall coefficient, carrier density and carrier mobility of a given semiconductor crystal.
2. To determine the radius of curvature of Plano convex lens using Newton's ring experiment.
3. To measure the Beam divergence and Beam waist of a Laser beam.
4. To determine wavelength of spectral lines of mercury vapor lamp with the help of grating and spectrometer.
5. To measure the numerical aperture of an optical fibre by scanning Method.
6. Determination of Planck's constant (1) using light emitting diode (LED) of various colours.
7. To determine the heating efficiency of an electric kettle with varying voltages.
8. To determine the specific optical rotation of sugar solution by biquartz Polarimeter.
9. To determine the value of acceleration due to gravity (g) using compound pendulum.
10. To determine the Standard deviation of any one of the following, by algebraic formula
    i. Thickness of the given scale by Vernier callipers
    ii Diameter of the wire by Screw gauge.
11. Mini Project(compulsory).

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01   Apply the principles of laser technology to analyze and design engineering applications.

CO02   Demonstrate an understanding of interference, diffraction, and polarization phenomena in light waves.

CO03   Apply quantum mechanics principles to analyze the behavior of matter waves and the physical significance of wave functions.

CO04   Identify and describe the crystal structures and properties of materials using crystallography concepts.

CO05   Analyze the behavior of oscillating systems and their resonance characteristics, as well as the fundamentals of electromagnetism and its relevance in non-conducting media and vacuum.

Course Code	Course Name	Hours Per Week				Credit
EN3HS05	Business Communication & Value Science- I	**L**	**T**	**P**		
		2	0	2		3

Course Learning Objectives (CLOs):

CLO01 Develop self-awareness and self-work skills by engaging in activities that involve interviewing and understanding the values that drive individuals from diverse backgrounds

CLO02 Improve grammar and language skills, including parts of speech, tenses, sentence formation, common errors, and use of voices in both general and technical contexts.

CLO03 Enhance vocabulary enrichment by learning words from various lists and sources and using them effectively in group discussions and written communication.

CLO04 Acquire essential communication skills, including email writing (both formal and informal), verbal communication, listening skills, and expressing oneself effectively through role-play and activities.

CLO05 Cultivate life skills such as stress management, teamwork, leadership, embracing diversity, and appreciating different intelligences through movie-based learning, trekking experiences, and real-life scenarios.

UNIT 1
Overview of LOL (include activity on introducing self)
Self-work with immersion — interview a maid, watchman, sweeper, cab driver, beggar and narrate what you think are the values that drive them.
Overview of business communication, **Self-awareness** — identity, body awareness, stress management

UNIT II
Essential Grammar — I: Refresher on Parts of Speech — Listen to an audio clip and note down. the different parts of speech followed by discussion.
Tenses: Applications of tenses in Functional Grammar — Take a quiz and then discuss Sentence formation (general & Technical), Common errors, Voices. Show sequence from film where a character uses wrong sentence structure (e.g., Zindagi Na Milegi Dobara where the characters use 'the' before every word).

UNIT III

Vocabulary Enrichment: Exposure to words from General Service List (GSL) by West, Academic word list (AWL) technical specific terms related to the field of technology, phrases, idioms, significant abbreviations formal business vocabulary — Read Economic Times, Reader's Digest, National Geographic and take part in a GD, using the words you learnt/liked. from the articles. Group discussion using words learnt.

UNIT IV

Email writing: Formal and informal emails, activity. **Verbal communication**: Pronunciation, clarity of speech **Communication Skills:** Overview of Communication Skills Barriers of communication, Effective communication. **Types of communication-** verbal and non — verbal — Role-play based learning. **Importance of Questioning Listening Skills:** Law of nature- Importance of listening skills, Difference between listening and hearing, Types of listening,

Expressing self, connecting with emotions, visualizing, and experiencing purpose

Written Communication: Summary writing, story writing

Build your CV — start writing your comprehensive CV including every achievement in your life, no format, no page limit

Life skill: Stress management, working with rhythm and balance, teamwork.

UNIT V

Understanding Life Skills: Movie based learning — **Pursuit of Happiness.** What are the skills? and values you can identify, what can you relate to?

Introduction to life skills What are the critical life skills **Multiple Intelligences?**

Embracing diversity — Activity on appreciation of diversity

Life skill: Join a trek — Values to be learned: Leadership, teamwork, dealing with ambiguity, managing stress, motivating people, creativity, result orientation
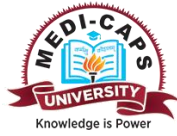
Text Books:
 There are no prescribed texts for Semester 1 — there will be handouts and reference links. shared.

References:
1. English vocabulary in use — Alan McCarthy and O'Dell
2. APAART: Speak Well | (English language and communication)
3. APAART: Speak Well 2 (Soft Skills)
4. Business Communication — Dr. Saroj Hiremath

Web References:
1. Train your mind to perform under pressure- Simon sinek
    https://curiosity.com/videos/simon-sinek-on-training-your-mind-to-perform-

underpressure-capture-your-flag/
2. Brilliant way one CEO rallied his team in the middle of layoffs
https://www.inc.com/video/simon-sinek-explains-why-you-should-put-people-
beforenumbers.html
3. Will Smith's Top Ten rules for success
https://www.youtube.com/watch?v=bBsT9omTeh0

Online Resources:
1. https://www.coursera.org/learn/learning-how-to-learn
2. https://www.coursera.org/specializations/effective-business-communication

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to demonstrate self-awareness and understanding of values, enhancing empathy and interpersonal skills.

CO02 Proficiency in using correct grammar, tenses, and sentence structures to improve written and verbal communication.

CO03 Competence in enriching vocabulary and applying new words in various contexts, fostering effective communication.

CO04 Capability to utilize email writing techniques and effective verbal communication to convey messages clearly and professionally.

CO05 Aptitude to demonstrate life skills such as stress management, teamwork, leadership, and embracing diversity in various situations, leading to personal and professional growth.

SEMESTER II

ID	Course Code	Course	L	T	P	Credit
1	EN3BS08	Linear Algebra	3	1	0	4
2	EN3ES10	Statistical Methods	3	1	0	4
3	CB3CO01	Data Structures & Algorithms	2	1	2	4
4	EN3ES12	Principles of Electronics	3	0	2	4
5	CB3CO02	Fundamentals of Economics	2	0	0	2
6	EN3HS06	Business Communication & Value Science – II	2	0	2	3
7	EN3MC12	Environmental Sciences	3	0	0	3
		Total	**18**	**3**	**6**	**24**
			27 Hrs			

Course Code	Course Name	Hour Per Week			Credit
		L	**T**	**P**	
EN3BS08	Linear Algebra	3	1	0	4

Course Learning Objectives (CLOs):

CLO$_{01}$ Understand the concepts of matrices and determinants, including types of matrices, positive definite matrices, and their properties.

CLO$_{02}$ Acquire knowledge of methods to solve systems of linear equations, such as Cramer's rule and the inverse matrix method.

CLO$_{03}$ Learn about matrix rank, linear combinations, Gaussian elimination, and LU decomposition for solving linear equations.

CLO$_{04}$ Comprehend the concepts of vector spaces, subspaces, linear combinations, linear span, linear independence, and basis of a vector space.

CLO$_{05}$ Gain insight into linear transformations, inner product spaces, orthogonal vectors, projections, and the Gram-Schmidt orthogonalization process.

UNIT I
Introduction to Matrices and Determinants; Types of Matrices, Positive Definite Matrices, Hermitian and Unitary Matrices; Solution of Linear Equations: Cramer's rule; Inverse Matrix Method.

UNIT II
Rank of the Matrix; Linear Combination; Gaussian elimination; LU Decomposition for Solving Systems of Linear Equations using the tools of Matrices; Eigenvalues and Eigenvectors of the matrix.

UNIT III
Definition of Vector spaces and Vector Sub Space (Some Important result on vector sub space only statement); Linear combination of Vector space; Linear Span of a set only definition (statements of some important result); Linear dependent and independent vectors; Some important Deductions ; Definition of Basis of a Vectors Space and Problems on basis of a vector space; Dimension of vector space and dimension theorem (only statement).

UNIT IV
Linear Transformation (zero transformation, identity transformation, negative transformation); (Def. Properties and Problems); Definition of Inner Product Space; Orthogonal Vector; Projections; Gram-Schmidt Orthogonalization process, Projection and QR decomposition.

UNIT V

Singular value decomposition and Principal component analysis; Introduction to their applications in Image Processing and Machine Learning.

Text Books:
1. B.S. Grewal, *Higher Engineering Mathematics*, Edition-43, Khanna Publishers, New Delhi, 2014.
2. B.V. Ramana, *Higher Engineering Mathematics,* Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.

References:
1. Michael. D. Greenberg, *Advanced Engineering Mathematics*, (Second Edition), Pearson.
2. Gilbert Strang, *Introduction to linear algebra*, (Fifth Edition), Wellesley-Cambridge Press.
3. R C Gonzalez and R E Woods, *Digital Image Processing*, Pearson.

Web Source:
1. https://machinelearningmastery.com/introduction-matrices-machine-learning/
2. https://nptel.ac.in/courses/111101115/
3. https://nptel.ac.in/courses/111108066/

Open Learning Source:
1. https://swayam.gov.in/courses/public
2. http://nptel.ac.in/course.php

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to apply matrix operations and determinants to solve systems of linear equations effectively.

CO02 Proficiency in finding the rank of matrices and using LU decomposition to solve linear equations.

CO03 Competence in analyzing vector spaces, subspaces, and linear independence, and determining the basis of a vector space.

CO04 Capability to apply linear transformations, inner product spaces, and orthogonalization techniques to solve problems in vector spaces.

CO05 Aptitude to understand and utilize singular value decomposition and principal component analysis in the context of applications in image processing and machine learning.

Course Code	Course Name	Hour Per Week			Credit
		L	**T**	**P**	
EN3ES10	Statistical Methods	3	1	0	4

Course Learning Objectives (CLOs):

CLO01   Understand various sampling techniques, including random sampling, stratified random sampling, and their applications to finite and infinite populations.

CLO02   Gain knowledge of linear statistical models, correlation, regression analysis, and curve fitting for different types of functions.

CLO03   Learn about estimation techniques, point estimation, and criteria for good estimates such as unbiasedness and consistency.

CLO04   Acquire proficiency in hypothesis testing, including concepts of Type I and Type II errors and the formulation of test procedures.

CLO05   Comprehend non-parametric inference methods, order statistics, and tests like the Sign test, Wilcoxon signed rank test, Mann-Whitney test, and Kolmogorov-Smirnov test.

UNIT I
Sampling Techniques: Random sampling. Sampling from finite and infinite populations, Estimates and standard error (sampling with replacement and sampling without replacement), Sampling distribution of sample mean, stratified random sampling.

UNIT II
Linear Statistical Models: Scatter diagram, correlation, types of correlation, range of correlation coefficient, Karl Pearson coefficient of correlation, Regression, Line of Regression, Regression coefficient , Property of Regression Coefficient ,Principle of Least squares method, Curve Fitting for (Straight line, Parabola , Hyperbola), Rank correlation, Spearman's Rank Correlation Coefficient , Multiple Regression Coefficient for three variable, Partial regression and Partial correlation, Partial Correlation coefficient for three variable.

UNIT III
Estimation: Point estimation, criteria for good estimates (un-biasedness, consistency), Methods of estimation including maximum likelihood estimation.
Sufficient Statistic: Concept and examples, complete sufficiency, their application in estimation. **Test of hypothesis**: Concept and formulation, Type I and Type II errors, Nyman Pearson lemma, Procedures of testing.

UNIT IV

Non-parametric Inference: Comparison with parametric inference, Use of order statistics, Sign test, Wilcoxon signed rank test, Mann-Whitney test, Run test, Kolmogorov-Smirnov test. Spearman's and Kendall's test. Tolerance region.

UNIT V

Basics of Time Series Analysis and Forecasting: Stationary, ARIMA Models: Identification, Estimation and Forecasting.

Analysis of variance: One way and two way Classification with as well as without interaction.

Text Books:
1. S.P. Gupta, *Statistical Methods*.
2. S.C Gupta and V.K Kapoor ,fundamentals of mathematical statistics.

References:
1. I.R. Johnson *, Probability and Statistics for Engineers* (Fourth Edition), , Prentice Hall India Learning private limited.
2. Goon, M. Gupta and B.Dasgupta *,Fundamentals of Statistics* (vol. I &vol. II),World Private Limited.
3. *The Analysis of Time Series: An Introduction*, Chris Chatfield, Chapman & Hall/C

Data Source:
1. www.rbi.org.in

Web Source:
1. nptel.ac.in/courses/111103021/15
2. nptel.ac.in/courses/111105035/22
3. nptel.ac.in/courses/117101055/34
4. nptel.ac.in/courses/115101005/3

Open Learning Source:
1. https://swayam.gov.in/courses/public
2. http://nptel.ac.in/course.php

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to select appropriate sampling techniques and analyze samples from finite and infinite populations.

CO02 Proficiency in interpreting and applying linear statistical models, correlation, and regression for data analysis and curve fitting.

CO03 Competence in estimating population parameters and understanding the properties of good estimates.

CO04 Capability to formulate and conduct hypothesis tests with a clear understanding of Type

I and Type II errors.

CO₀₅   Aptitude to apply non-parametric inference techniques and perform time series analysis and forecasting using ARIMA models. Additionally, proficiency in analyzing variance and performing classification with or without interaction in two-way analysis of variance.

Course Code	Course Name	Hour Per Week			Credit
		L	**T**	**P**	
CB3CO01	Data Structures and Algorithms	2	1	2	4

Course Learning Objectives (CLOs):

CLO$_{01}$ Understand the basic terminologies of algorithms and data organization, including recursion, performance analysis, and asymptotic notations (Big-O, Omega, Theta).

CLO$_{02}$ Comprehend programming styles and the refinement of coding, considering time-space trade-offs and the importance of testing in software development.

CLO$_{03}$ Gain knowledge of linear data structures such as arrays, stacks, queues, and linked lists, along with their various representations, operations, and applications.

CLO$_{04}$ Analyze non-linear data structures like trees (binary tree, threaded binary tree, binary search tree, B & B+ tree, AVL tree, splay tree) and their applications.

CLO$_{05}$ Learn about graph data structures, including basic terminologies, representations (directed and undirected), operations, and graph search algorithms, along with file organization and accessing schemes.

UNIT I Basic Terminologies and Introduction to Algorithm & Data Organization: Algorithm specification, Recursion, Performance analysis, Asymptotic Notation - The Big-O, Omega and Theta notation, Programming Style, Refinement of Coding - Time-Space Trade Off, Testing, Data Abstraction

UNIT II Linear Data Structure: Array, Stack, Queue, Linked-list and its types, Various Representations, Operations & Applications of Linear Data Structures

UNIT III Non-linear Data Structure-Trees: (Binary Tree, Threaded Binary Tree, Binary Search Tree, B & B+ Tree, AVL Tree, Splay Tree) and & Applications.

UNIT IV Non-linear Data Structure-Graph: Basic Terminologies and Representations Graphs (Directed, Undirected), Various Representations, Operations, Graph search and traversal algorithms and complexity analysis. Applications.
File: Organisation (Sequential, Direct, Indexed Sequential, Hashed) and various types of accessing schemes.

UNIT V Searching and Sorting on Various Data Structures: Sequential Search, Binary Search, Comparison Trees, Insertion Sort, Selection Sort, Shell Sort, Divide and Conquer Sort, Merge Sort, Quick Sort, Heapsort, Introduction to Hashing

Laboratory
1. Towers of Hanoi using user defined stacks.
2. Reading, writing, and addition of polynomials.
3. Line editors with line count, word count showing on the screen.
4. Trees with all operations.
5. All graph algorithms.
6. Saving / retrieving non-linear data structure in/from a file

Text Books:
1. Fundamentals of Data Structures, E. Horowitz, S. Sahni, S. A-Freed, Universities Press.
2. Data Structures and Algorithms, A. V. Aho, J. E. Hopperoft, J. D. UIlman, Pearson.

References:
1. The Art of Computer Programming: Volume 1: Fundamental Algorithms, Donald E. Knuth.
2. Introduction to Algorithms, Thomas, H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, The MIT Press.
3. *Open Data Structures: An Introduction (Open Paths to Enriched Learning)*, (Thirty First Edition), Pat Morin, UBC Press.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to design and analyse algorithms using recursion and understand their performance using asymptotic notations.

CO02 Proficiency in developing efficient programming styles and refining code to optimize time and space complexities, while incorporating testing for robust software development.

CO03 Competence in implementing and utilizing linear data structures to solve various computational problems.

CO04 Capability to implement and apply non-linear data structures like trees for organizing and managing data effectively.

CO05 Aptitude to apply searching and sorting algorithms on different data structures, understanding their complexities and applications, and comprehend file organization and accessing schemes in practical scenarios.

Course Code	Course Name	Hour Per Week			Credit
		L	**T**	**P**	
EN3ES12	Principles of Electronics	3	0	2	4

Course Learning Objectives (CLOs):

CLO$_{01}$ Understand the properties of crystalline materials, energy band theory, and Fermi levels, distinguishing between conductors, semiconductors, and insulators based on their electrical properties.

CLO$_{02}$ Comprehend the characteristics and behavior of diodes and diode circuits, including formation of P-N junctions, energy band diagrams, and V-I characteristics under different biasing conditions

CLO$_{03}$ Gain knowledge of bipolar junction transistors, their configurations, and characteristics, analyzing cut-off, active, and saturation modes, as well as the calculation of bias stability.

CLO$_{04}$ Explore field-effect transistors, their types, structures, and characteristics, including JFET and MOSFET, and understand their applications in CS, CG, and CD configurations, including CMOS principles.

CLO$_{05}$ Learn about feedback amplifiers, oscillators, and operational amplifiers, analyzing their properties, feedback factors, and topologies, and explore the concepts of integrated circuits and operational amplifier applications.

UNIT I Semiconductors:

Crystalline material: Mechanical properties, Energy band theory, Fermi levels; Conductors, Semiconductors & Insulators: electrical properties, band diagrams. Semiconductors: intrinsic & extrinsic, energy band diagram, P&N-type semiconductors, drift & diffusion carriers.

UNIT II Diodes and Diode Circuits:

Formation of P-N junction, energy band diagram, built-in-potential, forward and reverse biased P-N junction, formation of depletion zone, V-I characteristics, Zener breakdown, Avalanche breakdown and its reverse characteristics; Junction capacitance and Varactor diode. Simple diode circuits, load line, linear piecewise model; Rectifier circuits: half wave, full wave, PIV, DC voltage and current, ripple factor, efficiency, idea of regulation.

UNIT III Bipolar Junction Transistors:

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of transistors, CE, CB, CC configuration, transistor characteristics: cut-off active and saturation mode, transistor action, injection efficiency, base transport factor and current amplification factors for CB and CE modes. Biasing and Bias stability: calculation of stability factor

UNIT IV Field Effect Transistors:

Concept of Field Effect Transistors (channel width modulation), Gate isolation types, JFET Structure and characteristics, MOSFET Structure and characteristics, depletion and enhancement type; CS, CG, CD configurations; CMOS: Basic Principles

UNIT V Feed Back Amplifier, Oscillators and Operational Amplifiers:

Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors; topologies of feedback amplifier; effect of feedback on gain, output impedance, input impedance, sensitivities (qualitative), bandwidth stability; effect of positive feedback: instability and oscillation, condition of oscillation, Barkhausen criteria. Introduction to integrated circuits, operational amplified and its terminal properties; Application of operational amplifier; inverting and non-inverting mode of operation, Adders, Subtractors, Constant-gain multiplier, Voltage follower, Comparator, Integrator, Differentiator

Digital Electronics Fundamentals: Difference between analog and digital signals, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters.

Text Books:
1. Microelectronics Circuits, Adel S. Sedra and Kenneth Carless Smith, Oxford University Press.
2. Millman's Integrated Electronics, Jacob Millman, Christos Halkias, Chetan Parikh, McGraw Hill Education.
3. Digital Logic & Computer Design, M. Morris Mano, Pearson

References:
1. Electronic Devices and Circuit Theory,Robert L. Boylestad, Louis Nashelsky.
2. Solid State Electronic Devices,6th Edition, Ben Streetman, Sanjay Banerjee
3. Electronic Principle, Albert Paul Malvino.
4. Electronics Circuits: Discrete & Integrated, D Schilling C Belove TApelewiczRSaccardi.
5. Microelectronics, Jacob Millman, Arvin Grabel.
6. Electronics Devices & Circuits,S. Salivahanan, N. Suresh Kumar,A. Vallavaraj
7. Electronic Devices & Circuit Theory, 11th Edition, Robert L. Boylestad,Louis Nashelsky.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to analyse and describe the electrical properties and energy band diagrams of conductors, semiconductors, and insulators..

CO02 Proficiency in understanding diode behaviour under different biasing conditions and the

characteristics of rectifier circuits, calculating their efficiency and ripple factor.

CO03 Competence in analysing bipolar junction transistors and their configurations, evaluating bias stability, and understanding transistor action and amplification factors.

CO04 Capability to comprehend the principles and characteristics of field-effect transistors, including JFET and MOSFET, and their applications in different configurations.

CO05 Aptitude to design and analyse feedback amplifiers and oscillators, explore the terminal properties of operational amplifiers, and apply them in various configurations, such as adders, subtractors, voltage followers, and integrators.

Course Code	Course Name	Hour Per Week			Credit
		L	T	P	
CB3CO02	Fundamentals of Economics	2	0	0	2

Course Learning Objectives (CLOs):

CLO01   Understand the principles of demand and supply in microeconomics, including the concepts of elasticity and equilibrium.

CLO02   Comprehend consumer behavior, choice axioms, budget constraints, and indifference curves, and analyze the effects of price changes and income substitution on demand

CLO03   Gain knowledge of the theory of production, production function, isoquants, and cost curves, and understand the equilibrium of a firm under different market structures like perfect competition, monopoly, and monopolistic competition.

CLO04   Analyze the concepts of national income, its components, consumption function, investment, and the Keynesian model of income determination in macroeconomics.

CLO05   Acquire knowledge about money, business cycles, and macroeconomic policies, including monetary and fiscal measures, and understand the classical paradigm and the concept of involuntary unemployment.

UNIT I Microeconomics:
Demand and Supply: Principles of Demand and Supply- Supply Curves of Firms – Elasticity of Supply; Demand Curves of Households- Elasticity of Demand; Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve).

UNIT II
Welfare Analysis: Consumers' and Producers' Surplus - Price Ceilings and Price Floors; Consumer Behaviour- Axioms of Choice- Budget Constraints and Indifference Curves; Consumer's Equilibrium- Effects of a Price Change, Income and Substitution Effects - Derivation of a Demand Curve; Applications- Tax and Subsidies - Intertemporal Consumption - Suppliers' Income Effect;

UNIT III
Theory of Production: Production Function and Iso-quants - Cost Minimization; Cost Curves- Total, Average and Marginal Costs - Long Run and Short Run Costs; Equilibrium of a Firm Under Perfect Competition; Monopoly and Monopolistic Competition

UNIT IV Macroeconomics:
National Income and its Components: GNP, NNP, GDP, NDP; Consumption
Function; Investment; Simple Keynesian Model of Income Determination and the Keynesian
Multiplier; Government Sector- Taxes and Subsidies; External Sector- Exports and Imports;

UNIT V
Money, Business Cycle and Macroeconomic policy: Money- Definitions; Demand for
Money-Transactionary and Speculative Demand; Supply of Money- Bank's Credit Creation
Multiplier; Integrating Money and Commodity Markets- IS, LM Model; Business Cycles and
Stabilization- Monetary and Fiscal Policy - Central Bank and the Government; The Classical
Paradigm- Price and Wage Rigidities - Voluntary and Involuntary Unemployment.

Text Books:
1. Microeconomics, Pindyck, Robert S., and Daniel L. Rubinfeld, Pearson, New Delhi.
2. Macroeconomics, Dornbusch, Fischer and Startz, TMH, New Delhi
3. Economics, Paul Anthony Samuelson, William D. Nordhaus, TMH, New Delhi.

References:
1. Intermediate Microeconomics: A Modern Approach, Hal R, Varian, Tata McGraw
   Hills, New Delhi
2. Principles of Macroeconomics, N. Gregory Mankiw, Worth Replika, New York

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to analyze market dynamics and understand the factors influencing demand and
supply in various economic scenarios.

CO02 Proficiency in applying consumer theory and equilibrium analysis to predict consumer
choices and behavior.

CO03 Competence in analyzing production processes, cost curves, and the behavior of firms
under different market conditions.

CO04 Capability to evaluate national income and its components, and understand the factors
influencing aggregate demand and supply in the macroeconomy.

CO05 Aptitude to comprehend the role of money, business cycles, and the significance of
macroeconomic policies in stabilizing the economy, and analyze the classical paradigm
in the context of price and wage rigidities.

Course Code	Course Name	Hour Per Week			Credit
		L	**T**	**P**	
EN3HS06	Business Communication and Value Science – II	2	0	2	3

Course Learning Objectives (CLOs):

CLO01   Identify and analyse social issues, conducting research and generating reports based on findings.

CLO02   Acquire effective writing techniques, avoiding common errors, and applying punctuation rules appropriately.

CLO03   Develop skills in storytelling and scriptwriting, creating skits and advertisements with compelling dialogues.

CLO04   Understand Belbin's 8 Team Roles and Lindgren's Big 5 personality traits, applying them to form effective teams and collaborations.

CLO05   Gain knowledge of diversity and inclusion, framing questions on diversity, and understanding the concepts of consequentialism and utilitarianism in ethical debates.

UNIT-I
Identification of social issues, generating a report based on the findings. Research on the social cause. Good and Bad Writing, writing techniques, Common errors, punctuation rules, use of words. SATORI –way of telling a story.

UNIT-II
Formation of an NGO. Create Vision, Mission, Value statement, tagline and Design a logo. Introduction to basic presentation skills, Speed Reading session: Introduction to skimming and scanning; reading skills activities, SQ3Rs technique.

UNIT-III
Advertisement making, Design a skit, write the script, completing dialogue. Belbin's 8 Team Roles (Shaper, Implementer, Completer / Finisher Co-ordinator Team worker, Resource Investigator, Plant Monitor / Evaluator, Specialist) and Lindgren's Big 5 personality traits (Extraversion, Introversion, openness, Conscientiousness Agreeableness) Lindgren's 8 team player Builder, Visualizer, Analyst, Controller, organizer networker, guide innovator)

UNIT-IV
Discussion on a film, key take away of the film, review of the film. Theory to connect the key take away of the film to the concept of empathy, impact of social issues on personal life.

Research on a book, incident or film based on the topic of students' respective NGO, Writing a review in a blog on the topics they are covering in their research.

UNIT-V
Session on Diversity & Inclusion- Different forms of Diversity in on society, framing questions on diversity. Definition of Consequentialism & Utilitarianism. GD and Debate skills, difference between GD and debate, Debate on the topic of diversity with an angle of ethics, morality and respect for individual. Respect for Individual and Integrity. Difference between morality and ethics. Writing Resume,

References:
1. Guiding Souls : Dialogues on the purpose of life; Dr. A.P.J Abdul Kalam ;Publishing Year-2005; Co-author--Arun Tiwari
2. The Family and the Nation; Dr. A.P.J Abdul Kalam; Publishing year: 2015; Co-author: Acharya Mahapragya
3. The Scientific India: A twenty First Century Guide to the World around Us; Dr. A.P.J Abdul Kalam; Publishing year: 2011; Co-author- Y.S.Rajan
4. Forge Your Future: Candid, Forthright, Inspiring ; Dr. A.P.J Abdul Kalam; Publishing year: 2014
5. Abundance: The Future is Better Than You Think; Peter H. Diamandis and Steven Kotler; Published: 21 Feb, 2012; Publisher: Free Press
6. Start With Why: How Great Leaders Inspire Everyone to Take Action; Simon Sinek; Published: 6 October 2011; Publisher: Penguin
7. Advertising & IMC: Principles and Practice; Sandra Moriarty, Nancy D. Mitchell, William D. Wells; Published: 15 June 2016; Publisher: Pearson Education India

Web References
1. ETHICS FUNDAMENTALS AND APPROACHES TO ETHICS https://www.eolss.net/Sample-Chapters/C14/E1-37-01-00.pdf
2. A Framework for Making Ethical Decisions https://www.brown.edu/academics/science-and-technology-studies/framework-making-ethical-decisions
3. Five Basic Approaches to Ethical Decision- http://faculty.winthrop.edu/meelerd/docs/rolos/5_Ethical_Approaches.pdf

List of Practicals
1. Preparation of Slam book by the participant to be used for capturing individual learning points and observations,
2. SATORI (join the dots with participants personal life) Participants share the personal take away acquired from working in teams, , presenting their NGOs
3. Group Discussion.
4. Plan and design an E Magazine. Apply and assimilate the knowledge gathered from Sem-1 till date. Share objective & guideline. All members to contribute an article to the magazine, trainer to evaluate the content.
5. Group to come back and share their findings from the recording. Post work- individual write up to be written and evaluated for the E- magazine
6. articulating the message of their respective NGOs. Skit time-5 minutes

7. Presentations on various issues.
8. GD, learning about presentations and understanding diversity inclusion.
9. Teams to video record interviews of people from diverse groups (Ask 5 questions). Share the recordings in FB.
10. Prepared speech- Every student will narrate the challenges faced by a member of a diverse group in 4 minutes (speech in first person), Discussion on TCS values
11. Revisit your resume Include your recent achievements in your resume.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO$_{01}$ Ability to identify and address social issues, presenting research findings effectively through reports.

CO$_{02}$ Proficiency in written communication, demonstrating improved writing techniques and enhanced punctuation skills.

CO$_{03}$ Competence in storytelling and scriptwriting, creating engaging skits and advertisements with meaningful dialogues.

CO$_{04}$ Capability to form and lead effective teams, considering different team roles and personality traits for optimal teamwork.

CO$_{05}$ Aptitude to engage in discussions and debates on topics of diversity, ethics, and morality, promoting respect for individuality and integrity, while enhancing presentation and resume-writing skills.

Course Code	Course Name	Hour Per Week			Credit
		L	T	P	
EN3MC12	Environmental Sciences	3	0	0	0

Course Learning Objectives (CLOs):

CLO01   Understand the multidisciplinary nature of environmental studies, recognizing the scope and significance of environmental education and sustainable development principles.

CLO02   Comprehend the concepts of sustainability and sustainable agriculture, along with the principles of environmental laws and their implementation in India.

CLO03   Gain knowledge of disaster management, solid waste management, deforestation, and urbanization, addressing domestic environmental concerns.

CLO04   Analyze global environmental concerns, including climate change, ozone layer depletion, and their impact on human communities and agriculture.

CLO05   Explore natural resources, their use, and overexploitation, as well as the types, causes, and control of environmental pollution in air, water, soil, and noise.

UNIT I Environmental Communication and Public Awareness
Multidisciplinary nature of environmental studies: Scope and Significance of environmental education; Concept of sustainability and sustainable development – Principles, imperatives and threats; three E's to optimize sustainable development, Sustainable Agriculture and Organic Farming.
An Introduction to Environmental laws in India: Environmental Impact Assessment and Environmental Auditing. Polices for Disaster preparedness programs, Rehabilitation measures and long-term reconstruction, Psychosocial care provision during the different phases of disaster

UNIT II Domestic and Global Environmental Concerns
Domestic environmental concerns: Disaster management – Introduction, types, disaster management cycle; Case studies of terrorist incidence, Bomb threat; Solid Waste management: Introduction, types of solid waste, methods to manage; Deforestation; Urbanization and Energy requirements
Global environmental concerns: Global Challenges - climate change and global warming, Kyoto Protocol, Greenhouse Gases, Ways to reduce Greenhouse gases emissions, Carbon Footprint, ways to reduce carbon footprint, Carbon Trading; Ozone layer depletion, Acid rain and impacts on human communities and agriculture.

UNIT III Natural resources and Environmental Pollution

Natural Resources: Land resources and land use change; Land degradation, soil erosion, salinization and desertification. Water: Use and over exploitation of surface and ground water, Forest Resources; Food resources. Case studies on natural disaster: Earthquake, floods, cyclone, volcanoes; Energy resources: Renewable and nonrenewable energy sources, use of alternate energy sources.

Environmental pollution: types, causes, effects and control of; Air, water, soil and noise pollution.

UNIT IV Ecosystem and Biodiversity

Ecosystem: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession.

Biological diversity: types of biodiversity; its significance, threats and conservation.

UNIT V Sustainable habitat and Green Technology

Sustainable Habitat: Concept of Green Building and its rating systems, Volatile Organic Compounds (VOC), Heating Ventilation and Air Conditioning (HVAC) systems.

Green Technology: Hybrid Vehicle Technology, Industrial ecology, Green Technology, Green Business, Green Computing, Green Chemistry.

Text Books:
1. Environmental Science by Dr. Preeti Jain, Dr. Devaanshi Jagwani, Manthan Publications, 2016
2. Environmental Science by Dr. Surinder Deswal, Dhanpat Rai & Co. publication
3. Environmental Studies by R. Rajgopalan ,Oxford IBH Publication 2011

References:
1. Environmental Science (8 th Edition) (2010): Daniel D. Chiras, Jones & Bartlett Ltd
2. Introduction to Environmental Science and Engineering (2nd Ed.) (2004): G. M. Masters, Pearson Education Pvt. Ltd.
3. Environmental Chemistry : A. K. De, New Age International,1996
4. Environmental Science (6 th ed) (1997): Jr. G. T. Miller, Wadsworth Publishing
5. A text book of Environmental Studies.,2006. D.K.Asthana, Meera Asthana (S.Chand&Co.)
6. Environmental Law in India, Singh Gurdip, 2004, Mcmillan & Co.
7. G.J. Rau and C.D. Wee ten, "Environmental Impact Analysis" Hand book, McGraw Hill, 1980.
8. Petts Judith, 1999, Handbook of environmental impact assessment. Vol. 1, Blackwell Science
9. Carter Nick, 1991, Disaster Management: A Disaster Manager's Handbook, Asian Development Bank, Manila Phillipines Govt. of India, 2009, National Disaster Management

Web Source:
1. http://www.circularecology.com/sustainability-and-sustainable-development.html#.WwOcRkiFPIU
2. http://markdiesendorf.com/wp-content/uploads/2015/09/CorpSust2000.pdf
3. http://www.fao.org/docrep/005/v9933e/v9933e02.htm

4. http://www.yourarticlelibrary.com/essay/disaster-management-in-india-classification-policies-and-other-details/25006
5. https://ndma.gov.in/en/
6. https://www.conserve-energy-future.com/sources-effects-methods-of-solid-waste-management.php
7. https://beeindia.gov.in/sites/default/files/1Ch9.pdf
8. https://www.ugc.ac.in/oldpdf/modelcurriculum/Chapter2.pdf
9. http://download.nos.org/333courseE/10.pdf
10. http://download.nos.org/333courseE/5.pdf
11. http://www.unesco.pl/fileadmin/user_upload/pdf/BIODIVERSITY_FACTSHEET.pdf
12. http://www.nistads.res.in/images/ISTIP/report/green%20technology.pdf

Open Learning Source:
1. https://swayam.gov.in/courses/public
2. http://nptel.ac.in/course.php

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Ability to evaluate and discuss the importance of environmental education in sustainable development.

CO02 Proficiency in understanding and analyzing the principles of environmental laws and their application in addressing environmental issues in India.

CO03 Competence in dealing with disaster management, solid waste management, and deforestation, and proposing solutions to urbanization and energy requirements..

CO04 Capability to identify and assess global environmental concerns, including climate change, ozone layer depletion, and their implications..

CO05 Aptitude to comprehend ecosystem structures, energy flow, and biodiversity conservation, and explore sustainable habitat concepts and green technologies like green building, hybrid vehicle technology, and green computing.

SEMESTER III

ID	Course Code	Course	L	T	P	Credit
1	CB3CO22	Formal Language and Automata Theory	3	0	0	3
2	EN3ES14	Computer Organization & Architecture	3	0	2	4
3	CB3CO04	Object Oriented Programming	3	0	2	4
4	EN3BS09	Computational Statistics	3	0	2	4
5	CB3CO07	Database Management Systems	3	0	2	4
6	CB3NG02	Open Learning Course	1	0	0	1
7	CB3NG03	Indian Constitution	2	0	0	2
		Total	**18**	**0**	**8**	**22**
				26 Hrs		

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
CB3CO022	Formal Language & Automata Theory	3	0	0	3

Course Learning Objectives (CLOs):

CLO$_{01}$ To develop concept of formal languages, its grammar used in computation. To introduce regular language and finite state automata.

CLO$_{02}$ To make student understand and design context free grammar.

CLO$_{03}$ To make learn push down automata, LBA and its design for CFL and CSL respectively.

CLO$_{04}$ To make student understand about Turing machine, its design its ability, its relationship with modern computing device.

CLO5 To introduce computability and complexity theory.

Unit-I

Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, *Myhill-Nerode theorem and its uses,* minimization of finite automata.

Unit-II

Regular grammars and equivalence with finite automata, properties of regular languages, *Kleene's theorem,* Pumping lemma for regular languages,

Context-free languages: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, parse trees, ambiguity in CFG, pumping lemma for context-free languages, closure properties of CFLs.

Unit-III

Pushdown Automata: Deterministic and nondeterministic pushdown automata (PDA) and equivalence with CFG,

Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Unit-IV

Turing machines: The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with

deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Unit-V

Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Basic Introduction to Complexity: Introductory ideas on Time complexity of deterministic and nondeterministic Turing machines, P and NP, NP- completeness, Cook's Theorem, other NP -Complete problems.

Text Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson.
2. Peterlinz, An Introduction to Formal Languages and Automata, Jones & Bartlett

References:

1. Dexter C. Kozen, Automata and Computability,Springer.

2. John C. Martin, Introduction to Languages and the Theory of Computation, McGrawHill

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Understand classes of formal Languages and their relationship. Students will also able to understand regular language, its acceptability by automata and design of FSA for RL.

CO02   Understand grammar for Regular and context free language, designing of CFG for CFL, properties of CFL.

CO03   Understand concept of PDA for CFL, LBA for CSG designing of PDA for CFL. Student will also able to establish equivalency between CFG, CFL and PDA, equivalency between LBA and CSL.

CO04   Understand and design different types of Turing Machine and its relationship to formal language. The concept of Turing Machine as an modern computing device will also be understood by students.

CO05   Understand and recognize different types of problem like undecidable, semi decidable, different classes of problem complexity. Student will also understand the class of problem from the Turing Machine

Course Code	Course Name	Hour Per Week			Credit
		L	T	P	
EN3ES14	Computer Organization & Architecture	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Functional blocks of Computers, Instruction set architecture of a CPU, Register Transfer language, Execution of a complete instruction, Instruction Cycle, Addressing modes, Data representation.

CLO02 Computer arithmetic: Integer addition and subtraction, ripple carry adder, multiplication and division algorithms.

CLO03 Hardwired and micro-programmed design approaches, Input -Output Organization. Input-Output Interface, Modes of Transfer- Interrupt and its Priority, DMA.

CLO04 Pipelining – Basic concepts, Students will learn about Multiprocessor Architectures organization – Performance characteristics of Multiprocessors.

CLO05 Understand Storing data and Program in Memory, Memory Hierarchy in a Computer, virtual memory concept.

Unit-I

Revision of basics in Boolean logic and Combinational/Sequential Circuits. Functional blocks of a computer: CPU, memory, input-output subsystems, control unit.

Instruction set architecture of a CPU: Registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Outlining instruction sets of some common CPUs.

Data representation: Signed number representation, fixed and floating-point representations, character representation.

Unit-II

Computer arithmetic: Integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and-add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic, IEEE 754 format. Introduction to x86 architecture.

Unit-III

CPU control unit design: Hardwired and micro-programmed design approaches, design of a simple hypothetical CPU.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes – role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Unit -IV

Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

Unit-V

Memory system design: Semiconductor memory technologies, memory organization.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Text Books:

1. M. M. Mano ,Computer System Architecture:, Prentice Hall of India.
2. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface,.

References:

1. Carl Hamacher, Computer Organization and Embedded Systems, McGrawHill.
2. William Stallings, Computer Organization and Architecture: Designing for Performance, Pearson

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Student will understand the data representation, Measuring Computer, addressing modes, Instruction formats, Measuring Computer Performance.

CO$_{02}$ Students will be able solve questions on Number systems, Arithmetic operations on binary numbers, Floating Point Representation.

CO$_{03}$ Students will understand Input Output Organization, interrupt, DMA.

CO$_{04}$ Students will able to understand pipelining, vector processing, Multiprocessor Architecture organization, Performance, characteristics of Multiprocessors.

CO$_{05}$ Students will able to understand basics of Storing data and Program in Memory, Memory Hierarchy in a Computer, Semiconductor RAMs–ROMs, Cache memories, and virtual memory.

List of Experiments:

Sr. No.	Name of Experiment
1	Study of motherboard and its parts.
2	Study of computer memory, RAM and its types.
3	Assembling a PC.

4	Installation of GNUSIM 8085 microprocessor (registers, flags, memory, i/o ports) and swapping of two numbers.
5	Addition of two 8-bit numbers.
6	To study the use of lda and sta instructions and subtraction of two numbers
7	To find 1's complement of a number.
8	To find 2's complement of a number
9	To find the smallest number in an array.
10	To find the largest number in an array.
11	To find number of ones in a given data byte.
12	To find number of zeroes in a given data byte.

Course Code	Course Name	Hour Per Week			Credit
		L	T	P	
CB3CO04	Object Oriented Programming	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Understand the concepts of programming language and it's terminology.

CLO02 Understand the concepts of procedural oriented programming basics.

CLO03 Understand the concept of classes and features of Object-oriented programming language.

CLO04 Understand the concept of inheritance and polymorphism.

CLO05 Understand the concept of container classes and templates.

Unit-I

Procedural programming, An Overview of C: Types Operator and Expressions, Scope and Lifetime, Constants, Pointers, Arrays, and References, Control Flow, Functions and Program Structure, Namespaces, error handling, Input and Output (*C*-way), Library Functions (*string*, *math*, *stdlib*), Command line arguments, Pre-processor directive

Unit-II

Some difference between C and C++: Single line comments, Local variable declaration within function scope, function declaration, function overloading, stronger type checking, Reference variable, parameter passing – value vs reference, passing pointer by value or reference, #define constant vs const, Operator new and delete, the typecasting operator, Inline Functions in contrast to macro, default arguments

The Fundamentals of Object Oriented Programming: Necessity for OOP, Data Hiding, Data Abstraction, Encapsulation, Procedural Abstraction, Class and Object.

Unit-III

More extensions to C in C++ to provide OOP Facilities: Scope of Class and Scope Resolution Operator, Member Function of a Class, private, protected and public Access Specifier, this Keyword, Constructors and Destructors, friend class, error handling (exception)

Unit-IV

Essentials of Object Oriented Programming: Operator overloading, Inheritance – Single and Multiple, Class Hierarchy, Pointers to Objects, Assignment of an Object to another Object, Polymorphism through dynamic binding, Virtual Functions, Overloading, overriding and hiding, Error Handling

Unit-V

Generic Programming: Template concept, class template, function template, template specialization

Input and Output: Streams, Files, Library functions, formatted output

Object Oriented Design and Modelling: UML concept, Use case for requirement capturing, Class diagram, Activity diagram and Sequence Diagram for design, Corresponding C++ code from design

Text Books:

1. Bjarne Stroustrup , The C++ Programming Language, Addison Wesley.
2. Debasish Jana, C++ and Object-Oriented Programming Paradigm, PHI Learning Pvt. Ltd.

References:

1. Bjarne Stroustrup, Programming – Principles and Practice Using C++, Addison Wesley.
2. Bjarne Stroustrup, The Design and Evolution of C++, Addison Wesley.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$	Differentiate between OO Programming vs Procedural Programming.
CO$_{02}$	Understand the OO Programming with its properties.
CO$_{03}$	Understand the object-oriented programming paradigm specifically including abstraction, encapsulation, inheritance and polymorphism.
CO$_{04}$	Describe and explain the factors that contribute to a good object-oriented solution, reflecting in your own experiences and drawing upon accepted good practices.
CO$_{05}$	Learn the preliminaries of Object-Oriented modeling and how it helps in software development.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EN3BS09	Computational Statistics	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 To Understand Multivariate Data its distribution and Statistics analysis on it.

CLO02 To learn regression analysis on univariate data and apply on multivariate data. To create mathematical model and transform on matrix for computation using programming language.

CLO03 To understand the concept of discriminate analysis and principal component analysis, understand its mathematical model and perform computation using programming language.

CLO04 To understand the concept of factor analysis, understand its mathematical model and perform computation using programming language.

CLO05 To understand and apply Cluster Analysis on multivariate data.

Unit-I

Multivariate Normal Distribution: Multivariate Normal Distribution Functions, Conditional Distribution and its relation to regression model, Estimation of parameters.

Unit-II

Multiple Linear Regression Model: Standard multiple regression models with emphasis on detection of collinearity, outliers, non-normality and autocorrelation, Validation of model assumptions.

Multivariate Regression: Assumptions of Multivariate Regression Models, Parameter estimation, Multivariate Analysis of variance and covariance

Unit-III

Discriminant Analysis: Statistical background, linear discriminant function analysis, Estimating linear discriminant functions and their properties.

Principal Component Analysis: Principal components, Algorithm for conducting principal component analysis, deciding on how many principal components to retain, H-plot.

Unit-IV

Factor Analysis: Factor analysis model, Extracting common factors, determining number of factors, Transformation of factor analysis solutions, Factor scores.

Unit-V

Cluster Analysis: Introduction, Types of clustering, Correlations and distances, clustering by partitioning methods, hierarchical clustering, overlapping clustering, K-Means Clustering-Profiling and Interpreting Clusters.

Laboratory

Python Concepts, Data Structures, Classes: Interpreter, Program Execution, Statements, Expressions, Flow Controls, Functions, Numeric Types, Sequences and Class Definition, Constructors, Text & Binary Files - Reading and Writing

Visualization in Python: Matplotlib package, Plotting Graphs, Controlling Graph, Adding Text, More Graph Types, Getting and setting values, Patches

Multivariate data analysis: Multiple regression, multi variate regression, cluster analysis with various algorithms, factor analysis, PCA and linear discriminant analysis. Various datasets should be used for each topic

Text Books:

1. T.W. Anderson, An Introduction to Multivariate Statistical Analysis, Wiley.
2. J.D. Jobson, Applied Multivariate Data Analysis, Springer.

References:

1. H. Kris, Statistical Tests for Multivariate Analysis, Springer.
2. Mark Lutz, Programming Python, O' Rielly.

After completion of this course the students shall be able to:

CO$_{01}$ Understand the difference between univariate and multivariate data and its normal distribution.

CO$_{02}$ Apply regression model for prediction of variable value for both univariate and multivariate data.

CO$_{03}$ Discriminant data set into two or more class and reduce dimensions of data set by applying concept of PCA and Factor analysis.

CO$_{04}$ Create cluster using various techniques.

CO$_{05}$ Apply python programming for computation of regression, Principal components, factor analysis etc.

List of Experiments (if applicable)

1. Write a Python program to calculate roots of quadratic equation.

2. Write a Python program to read more than one digit number through keyboard and claculate the sum of its number.

3. Write a Python program to determine given number is prime or non-prime.

4. Write a Python program to display all prime nubers betwwen 1 and 100.

5. Write a Python program to check year is leap or non-leap.

6. Write a Python program to print Fibonacci number upto 55.

7. Write a Python program which print sum of every fifth number from 0 to 500 (Including both 0 and 500).

8.Consider the scenario where person purchase some items every day from the shop. The price of every item is different. The person pay the bill to shop vendor at the end of every week. Develop a python program that can generate the bill.

9. Create List and perform following operations on it
   Access elemenst by index + and - index
   Slicing
   Update / Change some elemenets of List
   Apply for loop to access list elemets
   Two list L1 and L2 then L1+L2, L1*L2
   Write the use of following list functions and perform operatiion on created list.
     append(), clear(), count(), extend() , index(), insert(), pop(), remove()
      reverse() sort(), split()
10. Create tuple, dictionary and set and perform various operations on it.

11. Create function to compute factorial of given number, arithmatic opertions like addition, substarctio, multiplication, division and return all on given numbers.

12. Compute Linear regression model for following set of data. Also draw scatter plot and Regression Line on same plot.

Predictor,Z	Response Y
0	1
1	4
2	3
3	8
4	9

Predict of Response for predictor = 10.

13. Compute Linear regression model for following set of data. Also draw scatter plot and Regression Line on same plot.

Year of Experince	Salary
1.1	39343
1.3	46205
2.0	43525
3.2	54445
3.7	57289
4.0	56957
4.1	57081
5.3	83088

Predict the salary for 7 years of experice.

14. Compute Linear regression model for following set of data.

R&D spend,Profit	Administration spend	Marketing Spend,	Profit
165349.2	136897.8	471784.1	192261.83
153441.51	101145.55	407934.54	191050.39
131876.9	99814.71	362861.36	156991.12
123334.88	108679.17	304981.62	149759.96
91992.39	135495.07	252664.93	134307.35
78013.11	121597.55	264346.06	126992.93
76253.86	113867.3	298664.47	118474.03

15. Find principal components of five random variables data set whose var-cov matrix S is follows

$$
\begin{vmatrix}
4.308 & 1.683 & 1.803 & 2.155 & -.253 \\
1.683 & 1.768 & .588 & .177 & .176 \\
1.803 & .588 & .801 & 1.065 & -.158 \\
2.155 & .177 & 1.065 & 1.970 & -.357 \\
-.253 & .176 & -.158 & -.357 & .504
\end{vmatrix}
$$

Can we represent data set by one or two principal components? Also draw scree plot.

Course Code	Course Name	Hours per Week			Credit
		L	T	P	
CB3CO07	Database Management System	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Have a broad understanding of database concepts and database management system software

CLO02 Have a high-level understanding of major DBMS components and their function

CLO03 Be able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model.

CLO04 Be able to write SQL commands to create tables and indexes, insert/update/delete data, and query data in a relational DBMS.

CLO05 Be able to program a data-intensive application using DBMS APIs.

UNIT I

Introduction: Introduction to database. Hierarchical, Network and Relational database. **Database system architecture**: Data abstraction, Data independence, Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language (DCL).

UNIT II

Data Models: Entity-relationship model, Network model, Relational and Object oriented data Models, Integrity constraints, Data manipulation operations. **Relational Query Languages**: Relational algebra, Tuple and domain relational calculus. **Open source and commercial DBMS** – MySQL, Oracle, DB2, SQL server.

UNIT III

Relational database design: Domain and data dependency, Armstrong's axioms, Functional dependencies, Normal forms, Dependency preservation, Lossless design. **Query processing and optimization**: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.

UNIT IV

Storage strategies: Indices, B-trees, Hashing. **Transaction processing**: Concurrency control, ACID property, Serializability, Schedules, Locking and timestamp based schedules, Multi-version and optimistic concurrency control schemes, Database recovery.

UNIT V

Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection SQL injection. **Advanced topics**: Object oriented and object

relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts.

Reference Books:

1. J. D. Ullman., Principles of Database and Knowledge – Base Systems
2. R. Elmasri and S. Navathe , Fundamentals of Database Systems..
3. Serge Abiteboul, Richard Hull, Victor Vianu ,Foundations of Databases..

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01	Identify the basic concepts and various data model used in database design ER modelling concepts and architecture use and design queries using SQL
CO02	Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression from queries.
CO03	Recognize and identify the use of normalization and functional dependency, indexing and hashing technique used in database design.
CO04	*Recognize/ I*dentify the purpose of query processing and optimization and also demonstrate the basic of query evaluation.
CO05	*Apply* and *relate* the concept of transaction, concurrency control and recovery in database.
CO06	*Understanding* of recovery system and be familiar with introduction to web database, distribute databases, data warehousing and mining.

List of lab Practicals:

1. SQL Basics: Apply SQL SELECT statements on "Employees" table.

2. Apply Following Compound condition and use relational operators (IN, BETWEEN, LIKE, NULL, NOT NULL etc) in SQL statements on "Employees" and "Department" table.

3. Creating new tables, Adding data, updating data, altering tables, deleting data.

4. Implementation of different integrity constraints like Referential Integrity Constraint, entity integrity constraint and domain Constraints.

5. Perform operations like Natural Join, equijoin, left outer join, right outer join, full outer join, intersection, union, union all and minus on given relations.

6. Sub-queries: Single-Row Sub-queries, Multiple row Sub-queries, Scalar Sub-queries, Sub queries in other DML statements., nested queries.

7. Creating views, modifying views, dropping views, inserting and updating data using views.

8. Design a database of a car insurance company and perform the SQL queries on that database also Construct an E-R diagram for the same.

9. Evaluation Assignment-I

10. Evaluation Assignment-II

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
CB3NG03	Indian Constitution	2	0	0	0

Course Learning Objectives (CLOs):

CLO01 To learn the history of constitution & Basic concept of fundamental rights etc.

CLO02 To understand central and state relationship & the power of president

CLO03 Student have an idea about government schema and power of DM

CLO04 To Learn about the effect of the cast system pre and post-independence

CLO5 Understand the international relationship of India and its neighboring country

Unit-I: Introduction to Constitution of India

Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947, Composition of the Constituent Assembly, Functions of the Constituent Assembly, Various Committees of the Constituent Assembly, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy

Unit-II: Indian Federalism

Meaning and Definition of Federalism, Structure and Features of Indian Federalism, Centre-State Relations, Panchayat Raj Institutions Powers of Indian Parliament, Functions of Rajya Sabha, Functions of Lok Sabha, Introduction to different Bills, Powers & Functions of President, Powers & Functions of Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, The Lokpal and Lokayuktas Act 2013

Unit-III: The Welfare State

The concept of welfare state. Central and State Government's role and schemes to promote sports, entrepreneurship, Start-up and infrastructural development. An overview of Civil and Criminal codes and their discrimination/Uniformity. Functions and Powers of District Magistrate.

Unit-IV: Contemporary issues in Socio-Legal system

A General Overview of the Indian Scenario, The caste and communal issues in Pre and Post-Independence period, Mandal Commission, Terrorism and its impact. Regulatory framework for Education institutes. RTI & RTE. An overview of New Education Policy (2020) .

Unit-V: India's External Relations: Cold War & Post-Cold War Era

Foreign Policy, Basic determinants of Foreign Policy, India and its Neighbours, India's relations with the United States and Russia, India and the World Organizations, India in 21st Century

Text Books:

1. Durga Das, Introduction to the Constitution of India, Lexis Nexis
2. Madhav Khosla, The Indian Constitution, Oxford

References:

1. P. Bakshi, The Constitution of India, Lexis Nexis
2. Granville Austin, The Indian Constitution Cornerstone of a Nation, Oxford India.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01 Students can discuss the history of the Indian constitution and the concept of FR and DPSP

CO02 Students can explain basic fundamentals of central state relationship

CO03 Students will define the government schema and the role to DM

CO04 Students will observe the effect of the Indian caste system

CO05 Student observe the how effect and maintain India its relationship with neighboring countries

SEMESTER IV

ID	Course Code	Course	L	T	P	Credit
1	CB3CO06	Operating Systems	3	0	2	4
2	CB3CO23	Design And Analysis of Algorithms	3	0	2	4
3	CB3CO24	Software Engineering	3	0	2	4
4	CB3NG04	Introduction to Innovation, IP Management & Entrepreneurship	2	0	0	2
5	EN3ES13	Design Thinking	2	0	2	3
6	EN3ES15	Operations Research	3	0	2	4
7	OE00092	Marketing Research & Marketing Management	2	0	0	2
8	CB3NG05	Essence of Indian Traditional Knowledge	2	0	0	2
		Total	**20**	**0**	**10**	**25**
			30 Hrs			

Course Code	Course Name	Hours per Week			Total	
		L	T	P	Hrs.	Credits
CB3CO06	Operating System	3	0	2	5	4

Course Learning Objectives:

CLO01 To understand the fundamental operating system such as Batch, Time sharing, parallel and System software.

CLO02 Analyze important algorithm like process scheduling and to understand the deadlock management techniques.

CLO03 Categories the operating system's memory management techniques.

CLO04 To gain knowledge of virtual memory and get familiar with operating system security aspects.

CLO05 Demonstrate the significance of disk scheduling algorithm, file system and to understand the ability to perform operating system tasks.

UNIT-1

Introduction: Concept of Operating Systems (OS), Generations of OS, Types of OS, OS Services, Interrupt handling and System Calls, Basic architectural concepts of an OS, Concept of Virtual Machine, Resource Manager view, process view and hierarchical view of an OS.

UNIT-2

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching.

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads.

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

Scheduling algorithms: Pre-emptive and non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT-3

Inter-process Communication: Concurrent processes, precedence graphs, Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Semaphores, Strict Alternation, Peterson's Solution, The Producer / Consumer Problem, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, Barber's shop problem

Concurrent Programming: Critical region, conditional critical region, monitors, concurrent languages, communicating sequential process (CSP); Deadlocks - prevention, avoidance, detection and recovery.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT-4

Memory Management: Basic concept, Logical and Physical address maps, Memory allocation: Contiguous, Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page allocation, Partitioning, Paging, Page fault, Working Set, Segmentation, Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU)

UNIT- 5

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Diskreliability, Disk formatting, Boot-block, Bad blocks.

I/O Hardware: I/O devices, Device controllers, Direct Memory Access, Principles of I/O.

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed),Free-space management (bit vector, linked list, grouping), directory implementation(linear list, hash table), efficiency and performance.

Case study: UNIX OS file system, shell, filters, shell programming, programming with the standard I/O, UNIX system calls.

Text Books:

1.   Operating System Concepts Essentials.AbrahamSilberschatz, Peter Baer Galvin and Greg Gagne.

Reference Books:

Operating Systems: Internals and Design Principles. William Stallings.

Operating System: A Design-oriented Approach. Charles Patrick Crowley.

Operating Systems: A Modern Perspective. Gary J. Nutt.

Design of the Unix Operating Systems. Maurice J. Bach.

Understanding the Linux Kernel, Daniel Pierre Bovet, Marco Cesati.

Course Outcomes:

After the completion of the course, the students shall be able to:

CO01   Master the basic concept related to operating system and system software.

CO02   Analyze the basic concept of process management and evaluate performance of process scheduling algorithm and apply the concept of synchronization and Deadlock.

CO03   To apply the concept of memory management techniques.

CO04   To apply virtual memory concepts and understand the system security aspects.

CO05   To analyze the techniques of disk scheduling.

| Course Code | Course Name | Hours per Week | | | Total | |
		L	T	P	Hrs.	Credits
CB3CO23	Design and Analysis of Algorithms	3	0	2	5	4

Course Learning Objectives (CLOs):

CLO01	To analyze algorithms with respect to time and space. Teach techniques for effective problem solving in computing.
CLO02	To provide detailed knowledge about divide-and-conquer technique.
CLO03	To provide detailed knowledge about greedy and dynamic programming technique.
CLO04	To provide detailed knowledge about backtracking and branch and bound technique.
CLO05	To explore the concepts of P,NP,NPC and NPH

Unit-I

Introduction: Characteristics of Algorithm. Analysis of Algorithm: Asymptotic analysis of Complexity Bounds – Best, Average and Worst-Case behavior; Performance Measurements of Algorithm, Time and Space Trade-Offs, Analysis of Recursive Algorithms through Recurrence Relations: Substitution Method, Recursion Tree Method and Masters' Theorem.

Unit-II

Divide & conquer Technique and Greedy Algorithm: Binary search, Merge Sort, Quick sort, Minimum spanning trees, Knapsack problem, Job sequencing with deadlines, Single source shortest path problem - Dijkstra's Algorithm.

Unit-III

Dynamic Programming: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Topological sorting, Dynamic Programming Methodology: Network Flow Algorithm, Bin Packing, Travelling sales men problem,0/1 Knapsack problem, multistage graph.

Unit-IV

Backtracking and Branch & Bound:

Backtracking Approach: N-Queen's problem, Hamiltonian cycle, Graph colouring problem, Sum of Subset problem. Introduction to branch & bound method, examples of branch and bound method like15 puzzle travelling salesman problem. .

Unit-V

P, NP, NP Complete and NP Hard:

An introduction to P, NP, NP Complete and NP hard problems. NP-complete problems

Cook's theorem and Reduction techniques. Standard Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE, Introduction to Quantum Algorithms.

Lab

Implementation of Different Algorithms based on various algorithmic strategies using C/C++

Text Books:

E. Horowitz and S. Sahni, Fundamental of Computer Algorithms.

A. Aho, J. Hopcroft and J. Ullman, The Design and Analysis of Computer Algorithms.

Reference Books:

T. H. Cormen, C. E. Leiserson and R. L. Rivest., Introduction to Algorithms.

S. Baase , Computer Algorithms: Introduction to Design and Analysis.

D. E. Knuth, The Art of Computer Programming.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Calculate time and space complexity of any algorithm.

CO02   Derive and solve recurrences for recursive algorithms. Apply various recurrence solving techniques depending upon specific cases

CO03   Understand the divide-and-conquer paradigm and will have knowledge, when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms and analyse them

CO04   Understanding the concept of greedy and dynamic programming, Backtracking.

CO05   Understand concept of P, NP, NP Complete and NP hard problems. Prove some problems NP complete or not.

Course Code	Course Name	Hours Per Week			
		L	T	P	Credits
CB3CO24	Software Engineering	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Knowledge of basic SW engineering methods and practices, and their appropriate application. Along with general understanding of software process models such as the waterfall and evolutionary models

CLO02 Understanding of software requirements and the SRS documents.

CLO03 Describe data models, object models, context models and behavioural models with Understanding of different software architectural styles.

CLO04 Understanding of software testing approaches such as unit testing and integration testing. Describe software measurement and software risks.

CLO05 Understanding on quality control, software metrics and how to ensure good quality software.

Unit 1

Software Engineering – Definition, Process, Evolution and Myths, Generic Process Model, Framework, Process Models – Waterfall, Incremental, Evolutionary, Spiral, Component Based Model, Rational Unified Process

Unit 2

Requirement Analysis, Stakeholders, Elicitation Techniques, Requirement Modelling - Use Cases, Activity Diagrams, Swimlane Diagrams, Data Modelling, Data Flow Diagram, Overview of Class Based Modelling, requirement Tracking

Unit 3

Principles of Software Design, Design Concepts – Abstraction, Architecture, Modularity, Relationships, Design Model, Component Design, User Interface Design, Configuration Management

Unit 4

Software Quality, Approaches for Quality Assurance, Software Testing, Verification and Validation, Types of Testing, Risk Assessment, Risk Mitigation, Monitoring and Management

Unit 5

Software Metrics, Process Metrics, Product Metrics, Function Oriented Metrics, Software Project Estimations, Function Point Based Metrics, COCOMO Models, Project Scheduling, Effort Distribution

Text Book:

1. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw-Hill.

2. Ian Sommerville, Software Engineering, Pearson Education Inc., New Delhi

References:

1. Fundamentals of Software Engineering by Rajib Mall, – PHI

Course Outcomes (COs): After completion of this course the students shall be able to:

CO01 Students will have thorough understanding of the basic structure and operation of software & various SDLC models.

CO02 Students will be able to trace out requirements of a software to be build and also learn to

prepare SRS.

CO03 They will be able to draw the different types design models (UML Diagrams).

CO04 Students will be able to understand the role & importance of SQA & software testing.

CO05 They learnt different ways of maintenance in software and measuring project.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
CB3NG04	Introduction to Innovation, IP Management & Entrepreneurship	2	0	0	2

Unit I- Introduction to Entrepreneurship

Opportunity recognition and entry strategies, Entrepreneurship as a style of management, maintaining competitive advantage – use of IPR to protect innovation. Concept, Need & process of Entrepreneurship; Factor Affecting Entrepreneurial Growth, Managerial vs. entrepreneurial approach, Entrepreneur vs. Intrapreneur, Types of Entrepreneurs, Traits/Qualities of successful entrepreneurs,

Unit: II- Creating and Starting the Venture

Business plan– Meaning, Significance, contents, formulation and presentation of Business Plan, implementing business plans. Marketing plan, Financial Planning: Financial Projections and Valuation, Stages of financing, Debt, Venture Capital and other forms of financing. and the organizational plan, Launching Formalities, Common errors in Business Plan formulation.

Unit:III-Innovation and Entrepreneurship

Concept, Importance and a core business process of Innovation, Sources of innovation, Knowledge push vs. need pull innovation, Innovation as manageable and a random gambling activity. Creating new products and services, Exploiting open innovation and collaboration, Use of innovation for starting a new venture. Innovation: Co-operative across networks vs. 'go-it-alone' approach. The Innovation Source of Innovation for Opportunities, Product life cycle, Creativity and innovation in product modification/ development.

Unit: IV- Introduction to Intellectual Property Rights

Introduction and the economics behind development of Intellectual Property Rights; Categories of Intellectual Property Rights, Rationale behind intellectual property protection, business perspective, Intellectual Property Rights in India; Genesis and Development, International Context, Concept of IP management, Use in marketing.

Unit–V:Application of Intellectual property

Types of Intellectual Property; Patent- procedure, licensing and assignment, infringement and penalty, Trademark- use in marketing; examples of trademarks, domain name, Geographical Indications: concept and protection, Copyright, Industrial Design: concept and protection, Major Court battles regarding violation of patents between corporate companies

Text Books

Harold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, TataMcGraw Hill.

Stoner, Management, PHI Learning.

Vasant Desai: Small scale Industries and Entrepreneurship, Himalaya Publishing House.

Joe Tidd, John Bessant: Managing Innovation: Technological, Market and Organizational Change.

Case Study Materials: To be distributed for class discussion

Reference Books

B. K. Mohanty Fundamentals of Entrepreneurship, PHI.

Desai Vasant, Dynamics of Entrepreneurship Development and Management, Himalaya Publishing House

Kanishka Bedi, Management and Enterpreneurship, Oxford Higher Education

Course Code	Course Name	Hours per Week			Total	Total
		L	T	P	Hrs.	Credits
EN3ES13	Design Thinking	2	0	2	4	3

Course Learning Objectives (CLOs):

CLO01 To understand the concept of design thinking, creativity, phases, tools and empathy.

CLO02 To understand and apply creative thinking, brainstorming, mind mapping, National Group Technique, Immersion, personas and Defining problem statements.

CLO03 To understand and apply the Design Ethics, Creativity and Innovation in Design Process.

CLO04 To understand and apply the Design Thinking in IT, Business Process modelling, Ideate, Prototype and Test.

CLO05 To understand and apply Design Thinking for Strategic Innovations.

Unit-I: Introduction

Introduction of Design Thinking, Need of Design Thinking, Traditional Problem Solving versus Design Thinking, Difference between innovation and creativity, phases of Design Thinking, Tools for Design Thinking, Relevance of Design and Design Thinking in business, Empathy.

Unit-II: Generating and Developing Ideas

Introduction - Create Thinking - Generating Design Ideas - Lateral Thinking – Anologies – Brainstorming - Mind mapping - National Group Technique – Synectics -Development of work - Analytical Thinking, Immersion Activity, Creating personas, Problem statements and Defining problem statements.

Unit-III: Design Ethics

Design Ethics - Design Process - Four Step – Five Step - Twelve Step - Creativity and Innovation in Design Process - Design limitation.

Unit-IV: Ideation

Design Thinking in IT – Design Thinking to Business Process modeling – Agile in Virtual collaboration environment – Scenario based Prototyping, Ideate, Prototype and Test, Testing in Design Thinking

Unit-V: Design Thinking for Strategic Innovations

DT For strategic innovations – Growth – Story telling - Predictability – Strategic Foresight - Change – Sense Making - Value redefinition - Extreme Competition - Standardization –

Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.

Text Books:

H. S. Fogler and S. E. LeBlanc, Strategies for Creative Problem Solving, 2nd edition, Pearson Education

Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press.

Reference Books:

Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons.

Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand –

Improve – Apply", Springer

Yousef Haik and Tamer M.Shahin, "Engineering Design Process", Cengage Learning.

Nir Eyal, Hooked: How to Build Habit-Forming Products, Portfolio Penguin.

Rod Judkins, The Art of Creative Thinking, Hachette Book Publishing.

Dan Senor and Saul singer, Start Up nation, HACHETTE INDIA.

Start with Why by Simon Sinek, Penguin UK.

Web References:

https://www.mindtools.com/brainstm.html

5 Stages in the Design Thinking Process | Interaction Design Foundation (IxDF) (interaction-design.org)

Design Thinking as a Strategy for Innovation %%sep%% %%sitename%% (creativityatwork.com)

Design Thinking 101 (nngroup.com)

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01	Students able to understand the concept of design thinking, creativity, phases, tools and empathy.
CO02	Students able to understand and apply creative thinking, brainstorming, mind mapping, National Group Technique, Immersion, personas and Defining problem statements.

CO03	Students able to understand and apply the Design Ethics, Creativity and Innovation in Design Process.
CO04	Students able to understand and apply the Design Thinking in IT, Business Process modelling, Ideate, Prototype and Test.
CO05	Students able to understand and apply Design Thinking for Strategic Innovations.

List of Experiments

Stories and examples will be used to introduce Design Thinking.

Products that you loved and hated: In this activity, learners will have to share about a product they like of disliked based on their experience. What would they need in a bad product to make it good?

Moccasin Walk activity for 1 hour to allow learners experience stepping into the shoes of another person. Sharing observations with the group.

Each group will need to visit any one of the following places to conduct an immersion activity. They need to interview people and fill up the DT question template:

College cafeteria.

College library.

College sports facility.

Transport facility near college.

Each group will create at least one persona based on the immersion study they conducted in the empathize stage (refer to the four question templates). The group can use A4 pages, colors and other props to create and display their respective persona.

Each group will define the key problem statements (max three) for their lead personas. Each group will present while the remaining groups will do a peer review. Finally, lecturer will moderate/validate the problem statements.

Participants will work in their assigned groups to ideate solutions for the problem statements they identified (as continuation of immersion activity) applying ideation methods discussed in the previous session. They will get scores based on how well they can apply the ideation methods. Lecturers will observe the groups separately and assign them scores based on specific rubric.

Participants will work in groups (They did immersion, persona creation, defining problem statement and ideating) to create prototypes based on the solutions they had identified.

Each group needs to test their prototype created earlier and:

Document user feedback.

Write down their inference from the feedback.

Suggest next steps (the loop that happens in DT).

Project:

Option 1: Each group needs to present a Prototype of how they can apply DT in their functional work or coding. Examples will be provided to explain what exactly they need to do.

Option 2: Each group will apply DT to create a prototype to improve any existing product or service. For both options, groups need to complete all phases of the Stanford DT model and include the outputs of each phase in their presentation.

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
EN3ES15	Operations Research	3	0	2	4

UNIT 1: Introduction to OR

Origin of OR and its definition. Concept of optimizing performance measure, Types of OR problems, Deterministic vs. Stochastic optimization, Phases of OR problem approach – problem formulation, building mathematical model, deriving solutions, validating model, controlling and implementing solution.

UNIT 2: Linear Programming

Linear programming – Examples from industrial cases, formulation & definitions, Matrix form. Implicit assumptions of LPP.

Some basic concepts and results of linear algebra – Vectors, Matrices, Linear Independence / Dependence of vectors, Rank, Basis, System of linear eqns., Hyperplane, Convex set, Convex polyhedron, Extreme points, Basic feasible solutions.

Geometric method: 2-variable case, Special cases – infeasibility, unboundedness, redundancy & degeneracy, Sensitivity analysis.

Simplex Algorithm – slack, surplus & artificial variables, computational details, big-M method, identification and resolution of special cases through simplex iterations.

Duality – formulation, results, fundamental theorem of duality, dual-simplex and primal-dual algorithms.

UNIT 3: Transportation and Assignment problems

TP - Examples, Definitions – decision variables, supply & demand constraints, formulation, Balanced & unbalanced situations, Solution methods – NWCR, minimum cost and VAM, test for optimality (MODI method), degeneracy and its resolution.

AP - Examples, Definitions – decision variables, constraints, formulation, Balanced & unbalanced situations, Solution method – Hungarian, test for optimality (MODI method), degeneracy & its resolution.

UNIT 4: PERT – CPM & Inventory Control

Project definition, Project scheduling techniques – Gantt chart, PERT & CPM, Determination of critical paths, Estimation of Project time and its variance in PERT using statistical principles, Concept of project crashing/time-cost trade-off.

Functions of inventory and its disadvantages, ABC analysis, Concept of inventory costs, Basics of inventory policy (order, lead time, types), Fixed order-quantity models – EOQ, POQ & Quantity discount models. EOQ models for discrete units, sensitivity analysis and Robustness, Special cases of EOQ models for safety stock with known / unknown stock out situations, models under prescribed policy, Probabilistic situations.

UNIT 5: Queuing Theory & Simulation Methodology

Definitions – queue (waiting line), waiting costs, characteristics (arrival, queue, service discipline) of queuing system, queue types (channel vs. phase).

Kendall's notation, Little's law, steady state behaviour, Poisson's Process & queue, Models with examples - M/M/1 and its performance measures; M/M/m and its performance measures; brief description about some special models.

Definition and steps of simulation, random number, random number generator, Discrete Event System Simulation – clock, event list, Application in Scheduling, Queuing systems and Inventory systems.

Text Books:

H.A. Taha., Operations Research: An Introduction.

Reference Books:

K.G. Murthy ,Linear Programming..

G. Hadley, Linear Programming.

H.M. Wagner, Principles of OR with Application to Managerial Decisions.

F.S. Hiller and G.J. Lieberman , Introduction to Operations Research.

Thomas L. Saaty , Elements of Queuing Theory.

A. Ravi Ravindran, Operations Research and Management Science.

Wiest & Levy, Management Guide to PERT/CPM..

J.W. Prichard and R.H. Eagle, Modern Inventory Management.

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
OE00092	Marketing Research and Marketing Management	2	0	0	2

UNIT – I

Marketing Concepts and Applications: Introduction to Marketing & Core Concepts, Marketing of Services, Importance of marketing in service sector.

Marketing Planning & Environment: Elements of Marketing Mix, Analyzing needs & trends in Environment - Macro, Economic, Political, Technical & Social

Understanding the consumer: Determinants of consumer behavior, Factors influencing consumer behavior

Market Segmentation: Meaning & Concept, Basis of segmentation, selection of segments, Market Segmentation strategies, Target Marketing, Product Positioning

UNIT – II

Product Management: Product Life cycle concept, New Product development & strategy, Stages in New Product development, Product decision and strategies, Branding & packaging

UNIT – III

Pricing, Promotion and Distribution Strategy: Policies & Practices – Pricing Methods & Price determination Policies. Marketing Communication – The promotion mix, Advertising & Publicity, 5 M's of Advertising Management. Marketing Channels, Retailing, Marketing Communication, Advertising

UNIT – IV

Marketing Research: Introduction, Type of Market Research, Scope, Objectives & Limitations

Marketing Research Techniques, Survey Questionnaire design & drafting, Pricing Research, Media Research, Qualitative Research

Data Analysis: Use of various statistical tools – Descriptive & Inference Statistics, Statistical Hypothesis Testing, Multivariate Analysis - Discriminant Analysis, Cluster Analysis, Segmenting and Positioning, Factor Analysis

UNIT – V

Internet Marketing: Introduction to Internet Marketing. Mapping fundamental concepts of Marketing (7Ps, STP); Strategy and Planning for Internet Marketing

Business to Business Marketing: Fundamental of business markets. Organizational buying process. Business buyer needs. Market and sales potential. Product in business markets. Price in business markets. Place in business markets. Promotion in business markets. Relationship, networks and customer relationship management. Business to Business marketing strategy

Home Assignments:

Written Analyses of Cases – Students are expected to report on their analysis and recommendations of what to do in specific business situations by applying concepts and principles learned in class (Case Studies to be shared by Faculty) e.g. "Marketing Myopia"

Field visit & live project covering steps involved in formulating Market Research Project

Measuring Internet Marketing Effectiveness: Metrics and Website Analytics

Text Books:

Philip Kotler, Marketing Management (Analysis, Planning, Implementation & Control)

William J. Stanton & Others, Fundamentals of Marketing

V.S. Ramaswamy and S. Namakumari, Marketing Management

Rajendra Nargundkar , Marketing Research

G.C. Beri, Market Research

Cooper Schindler, Market Research, Concepts, & Cases

Reference Books:

Rajan Saxena, Marketing Management

S.A. Sherlekar, Marketing Management

S.M. Zha, Service Marketing

Journals – The IUP Journal of Marketing Management, Harvard Business Review

Paul Green, Donald, Tull, Research for Marketing Decisions

David M Levine , Business Statistics, A First Course, Pearson Publication

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
CB3NG05	Essence of Indian Traditional Knowledge	2	0	0	2

UNIT-I:

Introduction to Indian tradition and traditional understanding: Define traditional knowledge, nature, characteristics, significance and scope, Different traditions vis-a-vis indigenous knowledge, Indigenous Knowledge (IK), Indian tradition Vs western tradition

UNIT-2:

Fortification of Traditional Knowledge: The need for protecting traditional knowledge, Role of Society, Rituals,

UNIT-3:

Varna Vyavastha and ITK: Tribe culture and Civilization value of TK in global economy, Role of Government to harness TK. Strategies to increase protection of traditional knowledge

UNIT-4 :

Religion Vs Spirituality : Correlation of culture, civilization and religion, Regional Culture, Traditions and Food. Plants and Biological diversity. Sarva Dharma Sambhav, Strategies to increase Sarva Dharma Sambhav

Unit 5:

Language and Literature: Language diversity, linguistic chauvinism, Correlation of language, literature and ITK, learnings of Holy books and implementation.

Text Book:

1. Amit Jha, Traditional Knowledge System in India.

Reference Books:

1. Amit Jha, Traditional Knowledge System in India, Atlantic publishers

2. Kapil Kapoor, Michel Danino ,"Knowledge Traditions and Practices of India"

Other References:

http://nptel.ac.in/courses/121106003/

https://www.youtube.com/watch?v=LZP1StpYEPM

SEMESTER V

ID	Course Code	Course	L	T	P	Credit
1	CB3CO25	Software Design with UML	3	0	2	4
2	CB3CO10	Compiler Design	3	0	2	4
3	CB3NG06	Fundamentals of Management	2	0	0	2
4	OE00090	Business Strategy	2	0	0	2
5	EN3HS07	Business Communication & Value Science – III	2	0	2	3
6	CB3EL01	Elective I : Machine Learning	3	0	2	4
7	CB3EL13	Elective II: Cryptology	3	0	2	4
8	CB3PC04	Mini Project	0	0	2	1
		Total	**18**	**0**	**12**	**24**
			30 Hrs			

Course Code	Course Name	Hours per Week			Total
		L	**T**	**P**	**Credits**
CB3CO25	Software Design with UML	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Knowledge of basic SW engineering methods and practices, and their appropriate application. Along with general understanding of software process models such as the waterfall and evolutionary models

CLO02 Understanding of software requirements and the SRS documents.

CLO03 Describe data models, object models, context models and behavioural models with Understanding of different software architectural styles.

CLO04 Understanding of software testing approaches such as unit testing and integration testing. Describe software measurement and software risks.

CLO05 Understanding on quality control, software metrices and how to ensure good quality software.

UNIT I
Introduction to on Object Oriented Technologies and the UML Method: Software development process: The Waterfall Model vs. The Spiral Model, The Software Crisis, description of the real world using the Objects Model. Classes, inheritance and multiple configurations. Quality software characteristics, Description of the Object-Oriented Analysis process vs. the Structure Analysis Model.

UNIT II

Introduction to the UML Language: Standards, Elements of the language. General description of various models. The process of Object-Oriented software development. Description of Design Patterns. Technological Description of Distributed Systems. **Requirements Analysis Using Case Modeling:** Analysis of system requirements, Actor definitions, writing a case goal, Use Case Diagrams, Use Case Relationships.

UNIT III

Transfer from Analysis to Design in the Characterization Stage: Interaction Diagrams: Description of goal, Defining UML Method, Operation, Object Interface, Class, Sequence Diagram, Finding objects from Flow of Events,Describing the process of finding objects using a Sequence Diagram, Describing the process of finding objects using a Collaboration Diagram.

The Logical View Design Stage: The Static Structure Diagrams: The Class Diagram Model, Attributes descriptions, Operations descriptions, Connections descriptions in the Static Model., Association, Generalization, Aggregation, Dependency, Interfacing, Multiplicity.

UNIT IV

Package Diagram Model: Description of the model, White box, Black box, Connections between packagers, Interfaces, Create Package Diagram, Drill Down.

Dynamic Model: State Diagram / Activity Diagram: Description of the State Diagram, Events Handling, Description of the Activity Diagram, Exercise in State Machines.

UNIT - 5

Component Diagram Model: Physical Aspect, Logical Aspect, Connections and Dependencies, User face, Initial DB design in a UML environment.

Deployment Model: Processors, Connections, Components, Tasks, Threads, Signals and Events.

Text Books:

1. Bernd Bruegge and Allen H. Dutoit. *Object-Oriented Software Engineering: using UML, Patterns, and Java.*

References:

1. Erich Gamma, Richard Helm, Ralph Johnson, and John M. Vlissides. *Design Patterns: Elements of Reusable Object-Oriented Software*.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01	Knowledge of basic SW engineering methods and practices, and their appropriate application. Along with general understanding of software process models such as the waterfall and evolutionary models
CO01	Students will have thorough understanding of the basic structure and operation of software & various SDLC models.
CO02	Students will be able to trace out requirements of a software to be build and also learn to prepare SRS.
CO03	They will be able to draw the different types design models (UML Diagrams).
CO04	Students will be able to understand the role & importance of SQA & software testing.
CO05	They learnt different ways of maintenance in software and measuring project.

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
CB3CO10	Compiler Design	3	0	2	4

Course Learning Objectives (CLOs):

CLO₀₁ To teach the design of a compiler including all its phases and components.

CLO₀₂ To develop a large, complex, but well-structured software system that implements various phases of a compiler such as the scanner, parser, code generator, and optimizer.

CLO₀₃ To identify the similarities and differences among various parsing techniques and grammar transformation techniques.

CLO₀₄ To provide knowledge about current developments in compiler design and implementation.

CLO₀₅ To develop an understanding of the compilation process

Unit-I

Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

Unit-II

Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, First and Follow functions, Closure and Goto Operations.

Unit-III

LR Parsers: LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree.

Unit-IV

Symbol Table: Basic structure, symbol attributes and management. Run-time environment: Procedure activation, parameter passing, value return, memory allocation, scope.

Intermediate Code Generation: Translation of different language features, different types of intermediate forms.

Unit-V

Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation.

Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

Text Books:

1. V. Aho, R. Sethi and J. Ullman, Compilers: Principles, Techniques and Tools, Pearson, Addison Wesley
2. Levine R. John, Tony Mason and Doug Brown, Lex & Yacc, O'Reilly
3. O.G. Kakde, Compiler Design, Laxmi Publications

References:

1. Bjarne Stroustrup, The Design and Evolution of C++, Addison Wesley
2. A.Barret William and R.M. Bates, Compiler construction (Theory and Practice), Galgotia Publication.
3. A.C. Holub, Compiler design in C, PHI.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Specify and analyse the lexical, syntactic and semantic structures of advanced language features

CO$_{02}$ Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation

CO$_{03}$ Write a scanner, parser, and semantic analyser without the aid of automatic generators

CO$_{04}$ Turn fully processed source code for a novel language into machine code for a novel computer

CO$_{05}$ Know about techniques for intermediate code and machine code optimisation

Course Code	Course Name	Hours per Week			Total Hrs.	Total Credits
		L	T	P		
CB3NG06	Fundamentals of Management	2	0	0	2	2

Course Learning Objectives (CLOs):

CLO$_{01}$ To explore the evolution of management theories and develop an understanding of the fundamental functions of management.

CLO$_{02}$ To examine the principles of organizational behaviour and their application in managing individuals and groups within organizations.

CLO$_{03}$ To analyse different approaches to organizational design and understand their implications for organizational structure.

CLO$_{04}$ To foster ethical awareness and decision-making skills in students, focusing on the ethical dimensions of managerial roles and responsibilities.

CLO$_{05}$ To develop an understanding of leadership concepts, attributes, and strategies for developing leaders across organizations.

Unit-I

Management Theories and Functions: Concept and Foundations of Management, Evolution of Management Thoughts [Pre-Scientific Management Era (before 1880), Classical management Era (1880-1930), Neo-classical Management Era (1930-1950), Modern Management era (1950-onward)]. Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.
Functions of Management- Planning, Organizing, Staffing, Directing, Controlling

Unit-II

Organization Behavior: Introduction, Personality, Perception, Learning and Reinforcement, Motivation, Group Dynamics, Power & Influence, Work Stress and Stress Management, Decision Making, Problems in Decision Making, Decision Making, Organizational Culture, Managing Cultural Diversity.

Unit-III

Organizational Design: Classical, Neoclassical and Contingency approaches to organizational design; Organizational theory and design, Organizational structure (Simple Structure, Functional Structure, Divisional Structure, Matrix Structure)

Unit-IV

Managerial Ethics: Ethics and Business, Ethics of Marketing & advertising, Ethics of Finance & Accounting, Decision – making frameworks, Business and Social Responsibility, International Standards, Corporate Governance, Corporate Citizenship, Corporate Social Responsibility

Unit-V

Leadership: Concept, Nature, Importance, Attributes of a leader, developing leaders across the organization, Leadership Grid

Text Books:

1. Richard L. Daft, Understanding the Theory and Design of Organizations, 11ᵗʰ Edition, 2014, Cengage.
2. Prasad L.M, Principles & Practice of Management, Sultan Chand & Sons, New Delhi.
3. Tipathy PC and Reddy P. N., Principles of Management, Tata McGraw –Hill.

References:

1. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, Organizational Behavior, 18ᵗʰ Edition, 2019, Pearson Education
2. Harold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, Tata McGraw Hill.
3. Stephen P. Robbins, David A. Decenzo, Sanghmitra Bhattacharya, Madhushree Nanda Agarwal, Fundamentals of Management, Pearson Education.
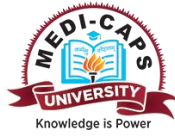
Web Resources:

- **Management Theories and Functions**
- https://mdu.ac.in/UpFiles/UpPdfFiles/2021/Jul/4_07-01-2021_12-32-15_Organizational%20Behaviour.pdf
- *https://www.theknowledgelibrary.in/classical-neoclassical-and-contingency-approaches-to-organizational-design/*
- *https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SBAA1503.pdf*
- *https://egyankosh.ac.in/bitstream/123456789/8005/1/Unit-6.pdf*

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Analyze management theories throughout history and apply the functions of planning, organizing, staffing, directing, and controlling in organizational settings.

CO$_{02}$ Understand the impact of personality, perception, motivation, group dynamics, and organizational culture on behavior, and develop skills to manage and lead effectively.

CO$_{03}$ Evaluate and apply classical, neoclassical, and contingency theories of organizational design, and assess various organizational structures.

CO$_{04}$ Recognize ethical issues in business, analyze the impact of managerial decisions on stakeholders, and apply ethical frameworks in resolving dilemmas.

CO$_{05}$ Demonstrate knowledge of leadership theories, identify effective leadership attributes, and apply leadership strategies in real-world scenarios.

Course Code	Course Name	L	T	P	Credit
OE00090	Business Strategy	2	0	0	2

Course Learning Objectives (CLOs):

CLO01 To introduce students to the fundamental concepts and principles of strategic management.

CLO02 To enable students to analyze the external environments of a firm and develop competitive strategies based on industry attractiveness and strategic groups.

CLO03 To help students recognize and analyze the intellectual assets within a firm that contribute to its competitive advantage.

CLO04 To familiarize students with corporate strategy and various growth strategies, including diversification, strategic alliances, and mergers & acquisitions.

CLO05 To provide students with an understanding of strategy implementation through effective organizational structures and control systems.

Unit I- Introduction to Strategic Management

Definition, nature, scope, and importance of strategic management, Vision Mission and Objectives, Schools of thought in Strategic Management, Strategy Content, Process, and Practice, Fit Concept and Configuration Perspective in Strategic Management
Unit: II- Internal Environment of Firm- Recognizing a Firm's Intellectual Assets

Core Competence as the Root of Competitive Advantage, Sources of Sustained Competitive Advantage, Business Processes and Capabilities-based Approach to Strategy
Unit: III- External Environments of Firm- Competitive Strategy

Forces of Industry Attractiveness that Shape Strategy, The concept of Strategic Groups, and Industry Life Cycle, Generic Strategies, Generic Strategies and the Value Chain
Unit: IV- Corporate Strategy, and Growth Strategies
The Motive for Diversification, Related and Unrelated Diversification, Business Portfolio Analysis, Expansion, Integration and Diversification, Strategic Alliances, Joint Ventures, and Mergers & Acquisition, BCG Matrix
Unit: V- Strategy Implementation: Structure and Systems

The 7S Framework, Strategic Control and Corporate Governance Strategy Evaluations and Control: Motivation to Evaluate; Criteria for Evaluation; Measuring and Feedback

Text Books:
1. Robert M. Grant (2012). Contemporary Strategic Management, Blackwell.
2. Kazmi, Ajhar Strategic Management and Business Policy, Tata McGraw Hill.
3. Tushman Managing Strategic Innovation& Change, Oxford Press.
4. Alpana Trehan Strategic Management Dreamtech, Wiley

References:

1. M.E. Porter, Competitive Strategy, 1980. M.E. Porter,
2. Pankaj Ghemawat-Strategy and the Business Landscape, Pearson
3. Haberberg Strategic Management, Oxford Press
4. Lawerence G. Hrebiniak, Making strategy work, Pearson.
5. A A Thompson Jr., A J Strickland III, J E Gamble, Crafting & Executing Strategy- The Quest for Competitive Advantage, Tata McGraw Hill.

Web Resources

- http://osou.ac.in/eresources/Strategic%20Management-OSOU.pdf
- https://courses.lumenlearning.com/suny-osintrobus/chapter/understanding-the-business-environment/
- https://airfocus.com/glossary/what-is-competitive-advantage/

- *https://www.managementstudyguide.com/strategy-evaluation.htm*
  https://www.lkouniv.ac.in/site/writereaddata/siteContent/202003291621085882smitasingh_mcKinsey_7s_model.pdf

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Define strategic management, explain its nature and scope, and understand its importance in organizational success.

CO$_{02}$ Core competencies within a firm, understand their role in achieving competitive advantage, and evaluate the sources of sustained competitive advantage.

CO$_{03}$ Assess the attractiveness of an industry, identify strategic groups within an industry, and formulate competitive strategies aligned with industry dynamics.

CO$_{04}$ Able to analyze and evaluate different corporate strategies, understand the motives and implications of diversification, and assess the potential of strategic alliances, joint ventures, and mergers & acquisitions.

CO$_{05}$ Able to apply the 7S Framework to design and evaluate organizational structures, understand the importance of strategic control and corporate governance, and employ appropriate evaluation criteria and measurement tools for strategy implementation.

Course Code	Course Name	L	T	P	Credit
EN3HS07	Business Communication & Value Science – III	2	0	2	3

Course Learning Objectives (CLOs):

CLO01 To Introduce students to Self-analysis techniques like SWOT & TOWS

CLO02 To make students aware of key concepts of:

Pluralism & cultural spaces

Cross-cultural communication

CLO03 To aware about the roles and relations of different genders.

CLO04 To develop the science of Nation building

CLO05 To understand, apply & develop technical writing skills

Unit I

Introduce students to Self-analysis techniques like SWOT & TOWS, Summarize the basic principles of SWOT and Life Positions, Apply SWOT in real life scenarios, Research on TOWS and find out how you can turn your threat into opportunity. SWOT Vs. TOWS: The Balancing Act

Motivation in real life: Recognize how motivation helps real life, Leverage motivation in real-life scenarios.

Unit II

Identify pluralism in cultural spaces, Respect pluralism in cultural spaces, Awareness and respect for pluralism in cultural spaces, differentiate between the different cultures of India, Recognize the implications of cross-cultural communication, Identify the common mistakes made in cross-cultural communication, Verbal and non-verbal communication in cross-cultural communication

Unit III

Define the terms global, glocal and translocational, Differentiate between global, glocal and translocational culture.

Gender awareness, Differentiate between the roles and relations of different genders, Gender awareness campaign

Unit IV

Role of science in nation building, Introduce the topic and discuss the role of scientists and mathematicians from ancient India. Role of science post- independence Introduction to technical writing.

Basic rules of technical writing, Apply technical writing in real-life scenarios.

Unit V

Define AI (artificial intelligence), Recognize the importance of AI.

Text Books:
There are no prescribed texts for Semester 4 – there will be handouts and reference links shared.

Web References:
1. Examples of Technical Writing for Students https://freelance-writing.lovetoknow.com/kinds-technical-writing
2. 11 Skills of a Good Technical Writerhttps://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/

3. 13 benefits and challenges of cultural diversity in the workplace

https://www.hult.edu/blog/benefits-challenges-cultural-diversity-workplace/

Online Resources:

1. https://youtu.be/CsaTslhSDI
2. https://m.youtube.com/watch?feature=youtu.be&v=IIKvV8_T95M
3. https://m.youtube.com/watch?feature=youtu.be&v=e80BbX05D7Y
4. https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtu.be
5. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtu.be

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01 Will be able to apply & analyse SWOT & the power of motivation in various life positions.

CO02 Will develop respect for pluralism in cultural spaces and analyze cross cultural communication and apply the concepts of Global, glocal and translocational

CO03 Recognize the roles and relations of different genders.

CO04 Apply the science of Nation building

CO05 Understand, apply & analyse the tools of technical writing

CO06 Understand Artificial intelligence &recognize its impact in daily life

Course Code	Course Name	Hours per Week			Credit
		L	T	P	
CB3EL01	Machine Learning	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Have a broad understanding of Machine Learning algorithms.

CLO02 Have a high-level understanding of the Supervised and Unsupervised approaches.

CLO03 Be able to build a model using various machine learning algorithms.

Unit I

Introduction to Machine Learning (ML); Relationship between ML and human learning; A quick survey of major models of how machines learn; Example applications of ML.
Supervised Algorithms; Regression: Cost Function, Gradient Descent; Multi-variable regression; Least squares regression; Bias and Variance, Underfitting and Overfitting, Regularization; LASSO; Applications of regression.

Unit-II

Classification: Supervised Learning; The problem of classification; Feature engineering; Training and testing classifier models; Model evaluation: Cross-validation; Model evaluation Metrics (precision, recall, F1-mesure, accuracy, area under curve).
Statistical decision theory including discriminant functions and decision surfaces.

Unit-III

Naive Bayes classification; Bayesian networks; Decision Tree and Random Forests; k-Nearest neighbor classification; Support Vector Machines;
Artificial neural networks including backpropagation;
Applications of classifications; Ensembles of classifiers including bagging and boosting

Unit-IV

Association rule mining algorithms including apriori;
Hidden Markov Models (HMM) with forward-backward and Vierbi algorithms; Sequence classification using HMM;
Conditional random fields; Applications of sequence classification such as part-of-speech tagging.

Unit-V

Clustering: average linkage; Ward's algorithm; Minimum spanning tree clustering; K-nearest neighbors clustering; BIRCH; CURE; DBSCAN
Anomaly and outlier detection methods
Expectation-Maximization (EM) algorithm for unsupervised learning

Text Books:

1. R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley.
2. C. Bishop, Pattern Recognition and Machine Learning, Springer.

References:

1. E. Alpaydin, Introduction to Machine Learning, 3/e, Prentice-Hall.
2. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
3. A. Webb, Statistical Pattern Recognition, 3/e, Wiley.

Course Code	Course Name	Hours per Week			
		L	T	P	Credits
CB3EL13	Cryptology	3	0	2	4

Course Learning Objectives (CLOs):

CLO01   To understand the concept of cryptology.

CLO02   To learn fundamental concepts of different popular stream ciphers.

CLO03   To learn concepts of public key cryptography.

CLO04   To gain knowledge of Authentication mechanisms

CLO5   To gain insight into modern cryptographic systems.

Syllabus (Copy of syllabus to be attached)

Unit-I

Basic security services: confidentiality, integrity, availability, non-repudiation, privacy. Introduction to Cryptography: Elementary number theory, Pseudo-random bit generation, Elementary cryptosystems.

Unit-II

Symmetric key Cryptosystems: Stream Cipher: Basic Ideas, Hardware and Software Implementations, Examples with some prominent ciphers: A5/1, Grain family, RC4, Salsa and ChaCha, HC128, SNOW family, ZUC.

Unit-III

Block Ciphers: DES, AES, Modes of Operation; Public Key Cryptosystems: RSA, ECC,Key exchange and encryption/decryption.

Unit-IV

Hash Functions: Authentication: types and requirements, Digital signatures concepts and algorithms.

Unit-V

Security Application: Electronic commerce (anonymous cash, micro-payments), Key management, Zero-knowledge protocols, Cryptology in Contact Tracing Applications, Issues related to Quantum Cryptanalysis. Introductory topics in Post-Quantum Cryptography.

Text Books:

1. *Cryptography, Theory and Practice.* D. R. Stinson, CRC Press.
2. *Handbook of Applied Cryptography.* A. J. Menezes, P. C. van Oorschot, and S. A. Vanstone, CRC Press

References Books
1. *A course in number theory and cryptography.* N. Koblitz:, GTM, Springer.
2. *Cryptography and Network Security.* W. Stallings, Prentice Hall.
3. *Security Engineering,* R. Anderson, Wiley
4. *RC4 Stream Cipher and Its Variants.* G. Paul and S. Maitra: CRC Press, Taylor

5. & Francis Group, A Chapman & Hall Book, 2012
6. *Design & Cryptanalysis of ZUC - A Stream Cipher in Mobile Telephony.* C. S. Mukherjee, D. Roy, S. Maitra, Springer 2020
7. *Contact Tracing in Post-Covid World - A Cryptologic Approach.* P. Chakraborty, S. Maitra, M. Nandi, S. Talnikar, Springer 2020
8. Presskil Lecture notes: Available online: http://www.theory.caltech.edu/~preskill/ph229/

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Understand the basic concepts and the applications of cryptography.

CO02   Compare the different stream ciphers and their applications.

CO03   Apply design principles of public key cryptography.

CO04   Understand basic issues of digital signature authentication.

CO05   Develop a cipher and it's cryptanalysis.

List of Experiments (if applicable): List of Practicals:

- XOR a string with a Zero
- Encryption & Decryption using Cipher algorithm
- Hill cipher
- DES algorithm
- Blow fish
- RSA algorithm
- Diffie Hellman
- SHA-I
- MDS

Course Code	Course Name	Hours per Week			
		L	T	P	Credits
CB3PC04	Mini Project	0	0	2	1

Course Learning Objectives (CLOs):

CLO01 Apply theoretical knowledge and practical skills acquired during the program to solve real-world problems.

CLO02 Gain hands-on experience in software development, system design, or business analysis.

CLO03 Enhance teamwork and collaboration skills by working in small groups

CLO04 Develop project management skills, including planning, organizing, and executing a project within specified timelines.

CLO05 Present project outcomes effectively and demonstrate the ability to communicate technical ideas to a non-technical audience.

Course Description:

The Mini Project course is designed to provide students with an opportunity to apply the knowledge and skills acquired throughout their computer science and business systems program in a practical setting. Students will work on a small-scale project in small groups, under the guidance of a faculty mentor. The project will focus on solving a real-world problem or developing a software solution aligned with the program's objectives.

Course Outcomes (COs):
After completion of this course the students shall be able to:

CO01 Demonstrate practical application of theoretical knowledge and skills acquired throughout the program.

CO02 Develop and deliver a functional software solution or solve a real-world problem.

CO03 Showcase effective project management skills, including planning, organization, and timely execution.

CO04 Communicate project outcomes and technical ideas effectively to a non-technical audience.

CO05 Enhance teamwork and collaboration skills through effective group work.

SEMESTER-VI

ID	Course Code	Course	L	T	P	Credit
1	CB3CO12	Computer Networks	3	0	2	4
2	CB3CO29	Usability Design of Software Applications	2	0	2	3
3	CB3CO14	Artificial Intelligence	3	0	2	4
4	OE00086	Financial & Cost Accounting	2	0	2	3
5	CB3CO27	IT Workshop Scilab / MATLAB	2	0	2	3
6	CB3EL08	Elective III: Data Mining and Analytics	3	0	2	4
7	CB3EL04	Elective IV: Advance Finance	3	0	0	3
		Total	**18**	**0**	**12**	**24**
			30 Hrs			

Course Code	Course Name	Hours per Week			Total	
		L	T	P	Hrs.	Credits
CB3CO12	Computer Networks	3	0	2	4	4

Course Objectives:

1. Describe how computer networks are organized with the concept of layered approach.

2. Implement a simple LAN with hubs, bridges and switches.....

3. Describe techniques for Bandwidth utilization; Analyze the contents in a given Data Link layer packet, based on the layer concept.

4. Fundamentals of Error Detection and Error Correction at Data link layer

5. Design how packets in the Internet are delivered, and about logical addressing

6. Basic knowledge about transport layer protocol

7. Describe the application layer protocol and working

8. Describe basics about network security and cryptography

UNIT – I

Introduction: Computer networks and distributed systems, Classifications of computer networks, Preliminaries of layered network structures. **Data communication Components:** Representation of data and its flow, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media.**LAN:** Wired LAN, Wireless LAN, Virtual LAN. **Techniques for Bandwidth utilization:** Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT – II

Data Link Layer and Medium Access Sub Layer: Fundamentals of Error Detection and Error Correction, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go-back–N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

UNIT – III

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT – IV

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service (QoS), QoS improving techniques - Leaky Bucket and Token Bucket algorithms.

UNIT – V

Application Layer: DNS, DDNS, TELNET, EMAIL, FTP, WWW, HTTP, SNMP, Bluetooth, Firewalls. **Network Security**: Electronic mail, directory services and network management, Basic concepts of Cryptography.

Text Books:

1. Computer Networks, A. Tannenbaum.
2. Data and Computer Communication, William Stallings.

Reference Books:

3. Network Security, Kaufman, R. Perlman and M. Speciner.
4. UNIX Network Programming, Vol. 1,2 & 3, W. Richard Stevens

Web Source:

1. Computer Networks Notes | Gate Vidyalay
2. Tutorials List - Javatpoint/computer network

Open Learning Source:

1. https://nptel.ac.in/agmoocs_news.php
2. https://swayam.gov.in/

Course Outcomes:

After the completion of the course, the students shall be able to:

1. Analyse the requirements for a given organizational structure and select the mostappropriate networking architecture and technologies To Understand the working of non linear magnification, principles of Abstraction

2. Have a basic knowledge of the use of various networking devices such as L-2 switch ,L-3 Switch and Routers

3. Specify and identify deficiencies in existing protocols, and then go onto formulate newand better protocols

4. Analyse, specify and design the topological and routing strategies for an IP basednetworking infrastructure

5. Have a working knowledge of datagram and internet socket programming

6. Perform help desk functions to answer user questions and provide user training onapplication software and fundamental operating systems functions.

7. Disassemble, troubleshoot/debug, upgrade, replace basic components, and reassembleservers and client systems

8. Implement Local Area Networks using both static and dynamic addressing techniques.

Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CB3CO29	Usability Design of Software Applications	2	0	2	3

Course Learning Objectives (CLOs):

CLO01 Ability to defined objective of real-life problems, plan, design, develop and execute.

CLO02 Ability to work in team at component level, system level and troubleshoot of problems.

CLO03 Ability to reuse, integrate with existing components.

CLO04 Ability to derive performance metrics and assess quantitatively the performance of system.

CLO05 Ability to report and present the findings in standard formats.

Unit 1:

Introduction to user centred Design, sepration of user interface, tools of user interface , Future of user interface , Usability guidelines for software development & uses.

Unit 2:

Aspects of User Centred Design, Product Appreciation Assignment – Evaluating the product from user centred design aspects such as functionality, ease of use, ergonomics, aesthetics.

Unit 3:

Heuristic Evaluation: 10 Heuristic Principles, Examples ,Heuristic Evaluation- for key tasks of the app or website for heuristic principles, severity, recommendations.

Unit 4:

 Empirical study, Hypothesis of usibility desigen,Experimtnal Desigen,procedure, Data Analysis & results and findings.

Unit 5:

Project design lifecycle, Discovery,Define, Design Ux Research, Understanding users theirs, goals context of use environment of use Research Techniques-contextual Enquiry,user Interviews competative Analysis for the group project design Thinking Technique , Discovery and brainstorming.

Text Books:

1. Class Handouts
2. Online forum links, reference articles, blogs
3. Interaction Design: Beyond Human-Computer Interaction, 4th Edition, Jenny Preece, Helen Sharp and Yvonne Rogers
4. About Face, 4th Edition, Alan Cooper and Robert Reimann

Reference Books:

1. Observing the User Experience, Second Edition: A Practitioner's Guide to User Research. Elizabeth Goodman, Mike Kuniavsky, Andrea Moed
2. The Elements of User Experience: User-Centred Design for the Web and Beyond. 2nd Edition, Jesse James Garrett
3. Understanding Design Thinking, Lean, and Agile - Jonny Schneider

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$	Able to defined objective of real-life problems, plan, design, develop and execute.
CO$_{02}$	Able to work in team at component level, system level and troubleshoot of problems.
CO$_{03}$	Able to reuse, integrate with existing components.
CO$_{04}$	Able to derive performance metrics and assess quantitatively the performance of system.
CO$_{05}$	Able to report and present the findings in standard formats.

List of Experiments: -

1. Develop requirements specification for a given problem.

2. Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project.

3. Develop Structured design for the DFD model developed.

4. Develop UML Use case model for a problem.

5. Develop sequence diagram.

6. Develop Class

| Course Code | Course Name | Hours per Week | | | Total | Total |
		L	T	P	Hrs.	Credits
CB3CO14	**Artificial Intelligence**	3	0	2	5	4

Course Outcome(s)

This course introduces students to the basic knowledge representation, problem solving, and learning methods of artificial intelligence.

Unit 1

Introduction, Overview of Artificial intelligence: Problems of AI, AI technique, Tic - Tac - Toe problem. Intelligent Agents, Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. Problem Solving, Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.

Unit 2

Search techniques: Problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. Heuristic search strategies Greedy best-first search, A* search, AO* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search

Unit 3

Constraint satisfaction problems: Local search for constraint satisfaction problems. Adversarial search, Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Unit 4

Knowledge & reasoning: Knowledge representation issues, representation & mapping, approaches to knowledge representation. Using predicate logic, representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. Representing knowledge using rules, Procedural verses declarative knowledge, logic programming, forward verses backward reasoning, matching, control knowledge.

Unit 5

Probabilistic reasoning: Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Planning Overview, components of a planning

system, Goal stack planning, Hierarchical planning, other planning techniques. Expert Systems: Representing and using domain knowledge, expert system shells, and knowledge acquisition.

Home Assignments

Assignments should include problems related to the topics covered in lectures, like heuristics, optimal search, and graph heuristics. Constraint satisfaction problems, k-nearest neighbors, decision trees, etc. can be included in home assignments.

Text Books

Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach
Artificial Intelligence, Russel, Pearson

Reference Books

Artificial Intelligence, Ritch & Knight, TMH
Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
Logic & Prolog Programming, Saroj Kaushik, New Age International
Expert Systems, Giarranto, VIKAS

Course Code	Course Name	Hours per Week			Credits
		L	T	P	
OE00086	Financial & Cost Accounting	2	0	2	3

Course Learning Objectives (CLOs):

CLO₀₁ To get acquainted the students with the fundamental of financial accounting.

CLO₀₂ To get acquainted the students with the rules of debit and credit, journal, preparation subsidiary book, ledger, trial balance

CLO₀₃ To Understand and analyse various tools used in financial statement analysis.

CLO₀₄ To exhibit various techniques used in the financial and cost accounting

CLO₀₅ To help students understand company audit.

UNIT – I

Accounting Concept: Introduction, Techniques and Conventions, Financial Statements-Understanding & Interpreting Financial Statements, Book Keeping and Record Maintenance Fundamental Principles and Double Entry System.

UNIT – II

Accounting Process: Journal, Ledger, Trial Balance, Balance Sheet, Final Accounts, Cash Book and Subsidiary Books and Rectification of Errors

Financial Statements: Form and Contents of Financial Statements, Analysing and Interpreting Financial Statements, Accounting Standards.

Class Discussion: Corporate Accounting Fraud- A Case Study of Satyam

UNIT – III

Cash Flow and Fund Flow Techniques: Introduction, How to prepare, Difference between them

UNIT – IV

Costing Systems: Elements of Cost, Cost Behaviour, Cost Allocation, OH Allocation, Unit Costing, Process Costing, Job Costing, Absorption Costing, Marginal Costing, Cost Volume Profit Analysis, Budgets, ABC Analysis Technique.

Class Discussion: Application of costing concepts in the Service Sector

UNIT – V

Company Accounts and Annual Reports: Audit Reports and Statutory Requirements, Directors Report, Notes to Accounts, Pitfalls

Home Assignment:

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class.

Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

> Topic: Corporate Accounting Fraud: A Case Study of Satyam
> Topic: Application of costing concepts in the Service Sector

Text Books:

> Robert N Anthony, David Hawkins, Kenneth Marchant, *Accounting: Texts and Cases*, McGraw-Hill
> Case Study Materials: To be distributed for class discussion

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01 The students will understand the fundamentals of financial accounting.

CO02 The students will able to understand the concept of debit and credit, journalize the transaction, post them into ledger, prepare petty cash book.

CO03 Students will learn various classification tools and methods for decision making in business.

CO04 Students will be able to understand the relationship between the variables used in business.

CO05 Students will able to understand and explain annual reports and ethical standards of a company audit.

Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CB3CO27	IT Workshop Scilab / MATLAB	2	0	2	3

Unit-I

Introduction to MATLAB

History, basic features, strengths and weaknesses, good programming practices and plan your code

Working with variables, workspace and miscellaneous commands

Creating MATLAB variables, overwriting variable, error messages, making corrections, controlling the hierarchy of operations or precedence, controlling the appearance of floating point number, managing the workspace, keeping track of your work session, entering multiple statements per line, miscellaneous commands.

Unit-II

Matrix, array and basic mathematical functions

Matrix generation, entering a vector, entering a matrix, matrix indexing, colon operator, linear spacing, creating a sub-matrix, dimension, matrix operations and functions matrix generators, special matrices, array and array operations, solving linear equations, other mathematical functions.

Unit-III

Basic plotting

Overview, creating simple plots, adding titles, axis labels, and annotations, multiple data sets in one plot, specifying line styles and colours

Unit-IV

Introduction to programming

Introduction, M-File Scripts, script side-effects, M-File functions, anatomy of a M-File function, input and output arguments, input to a script file, output commands

Control flow and operators

``if ... end'' structure, relational and logical operators, ``for ... end'' loop, ``while ... end'' loop, other flow structures, operator precedence, saving output to a file

Unit-V

Debugging M-files

Debugging process, preparing for debugging, setting breakpoints, running with breakpoints, examining values, correcting and ending debugging, correcting an M-file

Laboratory

Implementation of various Image Processing Algorithms

Text Books:

1. *Digital Image Processing using MATLAB*. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, Pearson Education, Inc., 2004.
2. *MATLAB: A Practical Introduction to Programming and Problem Solving*. Stormy Attaway, Butterworth-Heinemann.

Reference Books:

1. https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/moler/exm/book.pdf
2. https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf

Course Code	Course Name	Hours per Week			
		L	T	P	Credits
CB3EL04	Advance Finance	3	0	0	3

Course Learning Objectives (CLOs):

CLO₀₁   To understand the various Financial Instruments and their activities.

CLO₀₂   To understand the various application of financial theory in corporate decisions.

CLO₀₃   To explain and understand the investment decisions with special emphasis on working capital management.

CLO₀₄   To understand the knowledge about the financial derivatives and their various models.

CLO₀₅   To gaining an in-depth knowledge and familiarize the corporate and financial restructuring.

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UNIT – I

Sources of Funds (including regulatory framework): Types of securities, issuing the capital in market, Pricing of issue, Valuation of Stocks and bonds.

UNIT – II

Dividend Decisions: Traditional Approach, Dividend Relevance Model, Miller and Modigliani Model, Stability of Dividends, Forms of Dividends, Issue of bonus shares, Stock Split. Evaluation of Lease Contract

UNIT – III

Corporate Restructuring: Mergers and Acquisitions- Types of Mergers, Evaluation of Merger Proposal, Take-over, Amalgamation, Leverage buy-out, Management buy-out, Corporate Failure and Liquidation.

Financial Restructuring: Share Split, Consolidation, Cancellation of Paid-up Capital, Other Mechanisms

UNIT-IV

Working Capital Management: Working Capital Planning, Monitoring and Control of Working Capital, Working Capital Financing, Managing the Components of Working Capital

Cash Management: Receivable Management, Inventory Management

UNIT – V

Introduction to derivatives: Basics of Futures, Forwards, Options, Swaps, Interest rate Payoff Diagrams, Pricing of Futures, Put Call Parity, Option Pricing using Binomial Model and Black Scholes Model, Use of Derivatives for Risk-Return Management-Credit Default Swaps

Home Assignment:

Case study materials book will be given to students. Students are required to meet in groups before coming to class and prepare on the case for the day. Instructor may ask the student groups to present their analysis and findings to the class. Further, the topic for class discussion will be mentioned beforehand and students should be prepared to discuss these topics in class. Few topics are mentioned below as examples. Instructor can add or change any topic as per requirement.

Topic: Historical perspectives of markets like major boom and busts, bull and bear cycles, major market crashes, bubbles Topic: Major scams in the market, e.g. Satyam case

Text Books:

1. Brealey, Myers and Allen, Principles of Corporate Finance

2. Case Study Materials: To be distributed for class discussion

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$	Imbibe knowledge about the decisions and decision variables involved with financial activities of the firm.
CO$_{02}$	Gaining knowledge about the dividend decisions and various models.
CO$_{03}$	Familiarizing the students with the corporate and financial restructuring
CO$_{04}$	Develop skills for interpretation business information and application of financial theory in corporate investment decisions, with special emphasis on working capital management.
CO$_{05}$	In depth knowledge about the financial derivatives and the various uses of derivates for risk- return management

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
CB3EL08	Data Mining and Analytics	3	0	2	4

(Elective-III)

Course Learning Objectives (CLOs):

CLO₀₁ Understand the key terms and basic concepts of Data Mining.

CLO₀₂ To gain knowledge and apply data pre-processing techniques using Weka tool.

CLO₀₃ Understand and exhibit pattern of the data through data mining concepts.

CLO₀₄ Analyse various classification algorithms.

CLO₀₅ Study of descriptive analytics and some of the important models.

CLO₀₆ Study of time series analysis and models.

Unit 1

Introduction to Data Mining: What is data mining? Related technologies - Machine Learning, DBMS, OLAP, Statistics, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications.

Unit 2

Data preprocessing: Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

Data mining knowledge representation: Task relevant data, Background knowledge, Representing input data and output knowledge, Visualization techniques

Attribute-oriented analysis: Attribute generalization, Attribute relevance, Class comparison, Statistical measures.

Unit 3

Data mining algorithms - **Association rules:** Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis

Data mining algorithms - Classification: Basic learning/mining tasks, Inferring rudimentary rules: 1R, algorithm, Decision trees, covering rules

Data mining algorithms – Prediction: The prediction task, Statistical (Bayesian) classification, Bayesian networks, Instance-based methods (nearest neighbor), linear models.

Unit 4

Descriptive analytics: Data Modeling, Trend Analysis, Simple Linear Regression Analysis

Forecasting models: Heuristic methods, predictive modeling and pattern discovery, Logistic Regression: Logit transform, ML estimation, Tests of hypotheses, Wald test, LR test, score test, test for overall regression, multiple logistic regression, forward, backward method, interpretation of parameters, relation with categorical data analysis. Interpreting Regression Models, Implementing Predictive Models

Generalized Linear model: link functions such as Poisson, binomial, inverse binomial, inverse Gaussian, Gamma.

Non Linear Regression (NLS): Linearization transforms, their uses & limitations, examination of non-linearity, initial estimates, iterative procedures for NLS, grid search, Newton-Raphson, steepest descent, Marquardt's methods. Introduction to semiparametric regression models, additive regression models. Introduction to nonparametric regression methods.

Unit 5

Time Series Analysis: Auto - Covariance, Auto-correlation and their properties. Exploratory time series analysis, Test for trend and seasonality, Exponential and moving average smoothing, Holt – Winter smoothing, forecasting based on smoothing

Linear time series models: Autoregressive, Moving Average, Autoregressive Moving Average and Autoregressive Integrated Moving Average models; Estimation of ARMA models such as Yule-Walker estimation for AR Processes, Maximum likelihood and least squares estimation for ARMA Processes, Forecasting using ARIMA models

Prescriptive Analytics: Mathematical optimization, Networks modeling-Multi-objective optimization-Stochastic modeling, Decision and Risk analysis, Decision trees.

Home Assignments

>**Experiments with Weka** – Visualization Techniques, using filters and statistics, mining association rules, decision trees rules, Prediction
>**Mining real data:** Preprocessing data from a real domain (Medical/ Retail/ Banking);Applying various data mining techniques to create a comprehensive and accurate model of the data
>**Analytics Assignment 1:** Conduct and Present a summary report on an End to end statistical model building exercise using sample data – Data preprocessing, Descriptive Analysis (Exploratory Data Analysis), Hypothesis building, Model Fitting, Model Validation and Interpretation of results
>**Analytics Assignment 2:** Build statistical models using any two linear and non-linear

regression techniques: Simple Linear Regression; Multiple Regression; Variable Selection Problem; Multicollinearity and Ridge Regression; Nonlinear regression; Non-parametric regression; Logistic regression (binary and multiple); Poisson/Negative binomial regression (Use sample data sets)

Text Books

Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", Morgan Kaufmann Publishers, 3rd ed, 2010.
LiorRokach and Oded Maimon, "Data Mining and Knowledge Discovery Handbook", Springer, 2nd edition, 2010
Box, G.E.P and Jenkins G.M. (1970) Time Series Analysis, Forecasting and Control, Holden-Day.

Reference Books

Draper, N. R. and Smith, H. (1998). Applied Regression Analysis (John Wiley) Third Edition. Hosmer, D. W. and Lemeshow, S. (1989). Applied Logistic Regression (Wiley).

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Understand the basic concepts and techniques of Data Mining.

CO02   Develop skills of using data mining software for solving practical problems.

CO03   Understand various classification algorithms and methods to extract patterns of the data.

CO04   Analyse different models used for regression.

CO05   Understand the concept of time series analysis and models.

SEMESTER VII

ID	Course Code	Course	L	T	P	Credit
1	EN3HS11	Business Communication & Value Science-IV	2	0	0	2
2	OE00087	Financial Management	2	0	0	2
3	OE00091	Human Resource Management	2	0	0	2
4	CB3EL02	Elective V: Industrial Psychology	3	0	0	3
5	CB3EL11	Elective VI: Advanced Social, Text and Media	3	0	2	4
6	CB3CO19	Services Science & Service Operational Management	3	0	0	3
7	CB3PC06	Industrial Training	0	2	0	2
8	CB3PC05	Minor Project	0	0	8	4
		Total	**15**	**2**	**10**	**22**
			27 Hrs			

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
EN3HS11	Business Communication & Value Science – IV	2	0	0	2

Unit I

Auld Lang Syne- A group activity- given some key words (from what they taught in the previous semesters Communicative Writing- Principles of Communicative Writing, Formal and Business letters. Writing proposals to create a business proposal to get funding to begin a start-up of their choice. Sharing their presentations, the best practices and templates for writing proposals How to tell a story with charts and graphs- Emotional Intelligence- Ref Why do we need public speaking?

Public speaking – best practices- Get, Set, Go – sell your start-up ideas-

Unit II

Corporate Social Responsibility (CSR)- Ubuntu story – A story to introduce the concept of social responsibility. The story will be played through an audio embedded in the PPT (similar to an audiobook).

Hear CSR stories- Lecture

Tell a CSR story- (Attributes required for work and life---(Lecture and discussion) Qualities of a good team member:, a) Resilience , b) Flexibility, c) Strategic thinking and planning, d) Decision making, e) Resolving conflicts.

Unit III

Who am I? (Image Management. Building a perfect image)

Applying emotional intelligence- Lab Activity-Activity for applying Emotional Intelligence using scenarios within each start-up group.

Unit IV

Sensitivity to diversity Understanding conflicts- Tips to manage conflicts- Corporate etiquette-Business idioms and Corporate Terms - Managing Stress Tips to manage stress.

Unit V

Time management Managing your time better-Activity- The class will start with the YouTube video: A valuable lesson for a happy life (2:33 mins) Time Squared Activity: Create memories Project.

Reference Books:

1 Emotional Intelligence: Why it Can Matter More Than IQ by Daniel Goleman

2 Putting Emotional Intelligence To Work by Ryback David

3 How to Develop Self Confidence and Improve Public Speaking - Time - Tested Methods of Persuasion by Dale Carnegie

4 TED Talks: The official TED guide to public speaking: Tips and tricks for giving unforgettable speeches and presentations

Web References:

1 https://www.tata.com/about-us/tata-group-our-heritage

2 https://economictimes.indiatimes.com/tata-success-story-is-based-on-humanity-philanthropy-and-ethics/articleshow/41766592.cms

Online Resources:

1 https://youtu.be/reu8rzD6ZAE

2 https://youtu.be/Wx9v_J34Fyo

3 https://youtu.be/F2hc2FLOdhI

4 https://youtu.be/wHGqp8lz36c

5 https://youtu.be/hxS5He3KVEM

6 https://youtu.be/nMPqsjuXDmE

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
OE00087	Financial Management	2	0	0	2

Course Learning Objectives (CLOs):

CLO$_{01}$ To Inculcate Management skills in the students.

CLO$_{02}$ To inculcate the spirit and perspective of financial management among students.

CLO$_{03}$ To make students understand diverse functional areas of management.

CLO$_{04}$ To enable the students to manage the business organizations.

CLO$_{05}$ To use the concepts of management, organization structure dynamics effectively to achieve organizational goals.

Unit- I:

Introduction: Introduction to Financial Management - Goals of the firm - Financial Environments.

Time Value of Money: Simple and Compound Interest Rates, Amortization, Computing more than once a year, Annuity Factor.

Unit-II:

Valuation of Securities: Bond Valuation, Preferred Stock Valuation, Common Stock Valuation, Concept of Yield and YTM.

Risk & Return: Defining Risk and Return, Using Probability Distributions to Measure Risk, Attitudes Toward Risk, Risk and Return in a Portfolio Context, Diversification, The Capital Asset Pricing Model (CAPM)

Unit- III:

Operating & Financial Leverage: Operating Leverage, Financial Leverage, Total Leverage, Indifference Analysis in leverage study

Cost of Capital: Concept, Computation of Specific Cost of Capital for Equity - Preference – Debt, Weighted Average Cost of Capital – Factors affecting Cost of Capital 4L

Capital Budgeting: The Capital Budgeting Concept & Process - An Overview, Generating Investment Project Proposals, Estimating Project, After Tax Incremental Operating Cash Flows, Capital Budgeting Techniques, Project Evaluation and Selection - Alternative Methods.

UNIT-IV:

Working Capital Management: Overview, Working Capital Issues, Financing Current Assets (Short Term and Long Term- Mix), Combining Liability Structures and Current Asset Decisions, Estimation of Working Capital.

Unit-V:

Cash Management: Motives for Holding cash, Speeding Up Cash Receipts, Slowing Down Cash Payouts, Electronic Commerce, Outsourcing, Cash Balances to maintain, Factoring.

Accounts Receivable Management: Credit & Collection Policies, Analyzing the Credit Applicant, Credit References, Selecting optimum Credit period. 4L

Text Books:

1. Chandra, Prasanna - Financial Management - Theory & Practice, McGraw Hill.
2. Khan and Jain, Financial Management, Tata McGraw Hill.

Reference Books:

1. Srivastava, Misra: Financial Management, OUP
2. Van Horne and Wachowicz : Fundamentals of Financial Management, Prentice Hall/ Pearson Education.

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$	Students will able to understand the overall role and importance of financial management.
CO$_{02}$	Students will learn about various methods of securities and the concepts of risk and return.
CO$_{03}$	Gaining knowledge about the concept of leverage and the various capital budgeting techniques and methods.
CO$_{04}$	Imbibe knowledge about the working capital management and include its decisions.
CO$_{05}$	Students will able to understand the concept of cash management and account receivable management.

| Course Code | Course Name | Hours per Week | | | Total |
		L	T	P	Credits
OE00091	Human Resource Management	2	0	0	2

Course Learning Objectives (CLOs):

CLO₀₁   To Inculcate Management skills in the students.

CLO₀₂   To inculcate the spirit and perspective of entrepreneurship among students.

CLO₀₃   To make students understand diverse functional areas of management.

CLO₀₄   To enable the students to manage the business organizations.

CLO₀₅   To use the concepts of management, organization structure dynamics effectively to achieve organizational goals.

Unit – I

Human Resource Management: Concept and Challenges, HR Philosophy, Policies, Procedures and Practices.

Human Resource System Design: HR Profession, and HR Department, Line Management Responsibility in HRM, Measuring HR, Human resources accounting and audit; Human resource information system

Unit – II

Functional Areas of HRM: recruitment and staffing, benefits, compensation, employee relations, HR compliance, organizational design, training and development, human resource information systems (H.R.I.S.) and payroll.

Unit – III

Human Resource Planning: Demand Forecasting, Action Plans– Retention, Training, Redeployment & Staffing, Succession Planning

Unit – IV

Strategic Management of Human Resources: SHRM, relationship between HR strategy and overall corporate strategy, HR as a Factor of Competitive Advantage, Managing Diversity in the Workplace

Unit – V

Human Resource Management in Service Sector- Special considerations for Service Sector including

- Managing the Customer – Employee Interaction
- Employee Empowerment and Customer Satisfaction
- Service Failure and Customer Recovery – the Role of Communication and Training
- Similarities and Differences in Nature of Work for the Frontline Workers and the Backend
- Support Services - Impact on HR Practices Stressing Mainly on Performance
- Flexible Working Practices – Implications for HR

Text Books:

1. Gary Dessler, Human Resource Management, Pearson
2. K. Asawatthapa, Human Resource Management, Tata McGraw Hill

Reference Books:

1. Subbarao, Essential of HRM and Industrial Relations, Himalaya Publishing House
2. R. Wayne Mondy, Human Resource Management, Pearson

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Students will be able to understand concept of Human Resource Management.

CO$_{02}$ Students will be familiarized with the various Functional Areas of HRM.

CO$_{03}$ Students will have good knowledge about Human Resource Planning.

CO$_{04}$. Students will be able to understand the concept of Strategic Management of Human Resources

CO$_{05}$ Students will understand Human Resource Management in Service Sector.

Course Code	Course Name	Hours per Week			
		L	T	P	Credits
CB3EL02	Industrial Psychology	3	0	0	3

Course Learning Objectives (CLOs):

CLO01 To equip the students with basic concepts of Industrial Psychology and the various Research methods in IP

CLO02 To facilitate a clear perspective to diagnose and effectively handle human behaviour issues in Organizations.

CLO03 To create an awareness of healthy Organizational Climate, Culture, and Development of Teams in the organizations.

Unit- I:
What is I/O Psychology? Research Methods, Statistics, and Evidence-based Practice, Introduction & Legal Context of Industrial Psychology, Job Analysis & Competency Modelling, Job Evaluation & Compensation, Job Design & Employee Well-Being, Recruitment.

Unit-II:
Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods.

Unit-III:
Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance.

UNIT-IV:
Employee Motivation, Satisfaction and Commitment, Fairness and Diversity.

Unit-V:
Leadership, Organizational Climate, Culture, and Development, Teams in Organizations, the Organization of Work Behaviour. Stress Management: Demands of Life and Work

Text Books:
1. Landy, F. J. and Conte, J. M. (2013). Work in the 21st Century (4th Edition). Oxford:Blackwell Publishing
2. Paul E. Levy (2016). Industrial/Organizational Psychology: Understanding theWorkplace. Worth Publishers.
3. Michael G. Aamodt (2015). Industrial/Organizational Psychology: An Applied Approach. Wadsworth Publishing Co Inc; 8th edition (1 January 2015).

Problem and Assignments Book:
1. Myers, C. S. (2013). Industrial psychology. Read Books Ltd.

2. Ryan, T. A., & Smith, P. C. (1954). *Principles of industrial psychology.* Ronald Press.

Reference Books:
1. Spector Paul E. (2016). Industrial and Organizational Psychology: Research and Practice. Wiley India Pvt. Ltd.

2. H.L. Kaila (2019). Organizational Psychology. Wiley India Pvt. Ltd.
3. Dr P.K. Ghosh and Dr M. B. Ghorpade (2016). Industrial and Organizational Psychology. Himalaya Publishing House

Web Resources
- https://pdx.pressbooks.pub/psy204/chapter/industrial-organizational-i-o-psychology-noba/
- https://www.studocu.com/in/document/symbiosis-international-university/indian-psychology/industrial-psychology-notes/28150271
- https://catalogimages.wiley.com/images/db/pdf/0471394955.excerpt1.pdf

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Understand the basic IP concepts.
CO$_{02}$ Understand the process of Identifying Criteria & Validating Tests and Measures in IP.
CO$_{03}$ Understand importance of Performance Goals and Feedback, Performance Coaching and Evaluation of Employee performance.
CO$_{04}$ Importance of Employee Motivation & Satisfaction.
CO$_{05}$ Implement Organizational Climate, Culture, and Development in Organizations.

Course Code	Course Name	Hours per Week			Credits
		L	T	P	
CB3EL11	Advance Social, Text and Media	3	0	2	4

Course Learning Objectives (CLOs):

CLO01 Understand key terms and basic concepts of social media analytics.

CLO02 Understand the key terms, concepts, and process of data mining.

CLO03 Exhibit pattern of the data through text mining concepts.

CLO04 Understand and analyze various classification algorithms.

CLO05 Study of some of the important data mining tools and understand the role of business analyst.

CLO06 Study various tools and technologies for data analysis at industry level.

UNIT – I
Text Mining: Introduction, Core text mining operations, Pre-processing techniques, Categorization, Clustering, Information extraction, Probabilistic models for information extraction, Text mining applications

UNIT-II
Methods & Approaches: Content Analysis; Natural Language Processing; Clustering & Topic Detection; Simple Predictive Modelling; Sentiment Analysis; Sentiment Prediction

UNIT – III
Web Analytics: Web analytics tools, Clickstream analysis, A/B testing, online surveys; Web search and retrieval, Search engine optimization, Web crawling and Indexing, Ranking algorithms, Web traffic models

UNIT – IV
Social Media Analytics: Social network and web data and methods. Graphs and Matrices. Basic measures for individuals and networks.

UNIT-V
Social Media Analytics: Information visualization; Making connections: Link analysis. Random graphs and network evolution. Social contexts: Affiliation and identity; Social network analysis

Home Assignments:

1. Language Analysis: Students are expected to analyse the language of a category of text (e.g., literary, academic, social media) of their selection. Based on the analysis, students are expected to provide a critical description of the texts involved and possibly distinguishing them from other texts and/or uncovering relationships or concepts communicated by the text authors.

2. Students are required Perform sentiment analysis using Twitter. Students will be required to use off the-shelf software and/or code of their own to detect sentiment/emotion in the data and write a description of the methods they use and the results.

Text Books:
1. Ronen Feldman and James Sanger, "The Text Mining Handbook: Advanced Approaches in Analyzing Unstructured Data", Cambridge University Press.

2. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011 Analyzing Social Media Networks with NodeXL: Insights from a Connected World, Morgan Kaufmann, 304

3. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.

4. Hanneman, Robert and Mark Riddle. 2005. Introduction to Social Network Method

Reference Books:
1. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press.

2. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press. http://nosh.northwestern.edu/vita.html

Course Outcomes (COs):

After completion of this course the students shall be able to:

- **CO01** Student will demonstrate the ability to work for social media and text analytics

- **CO02** Students can effectively apply mining approach over the data.

- **CO03** Students will understand various classification tools and methods to extract patterns of the data.

- **CO04** Students will understand different data mining tools.

- **CO05** Student will understand the need of Business models to adapt to new engineering tools and technology.
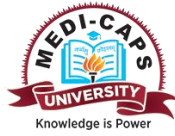
Course Code	Course Name	Hours per Week			
		L	T	P	Credits
CB3CO19	Service Science and Service operations Management	3	0	0	3

Course Learning Objectives (CLOs):

CLO$_{01}$ To introduce students with the concept of Service operations.

CLO$_{02}$ To make the students aware of the Service Design and Service quality model.

CLO$_{03}$ To enable the students to understand Service Guarantee and Service Recovery.

CLO$_{04}$ To explain Demand forecasting and Vehicle Routing problem.

CLO$_{05}$ To enable the student to understand about the aspects of Service Innovation.

UNIT – I

Introduction: Introduction to the course, Introduction to service operations, Role of service in economy and society, Introduction to Indian service sector
Nature of Services and Service Encounters: Differences between services and operations, Service package, characteristics, various frameworks to design service operation system, Kind of service encounter, importance of encounters
Service-Dominant Logic: From Goods-Dominant logic to Service-Dominant logic, Value Co-creation

UNIT – II

Service Strategy and Competitiveness: Development of Strategic Service Vision (SSV), Data Envelopment Analysis
New Service Development: NSD cycle, Service Blueprinting, Elements of service delivery system
Service Design: Customer Journey and Service Design, Design Thinking methods to aid Service Design
Locating facilities and designing their layout: models of facility locations (Huff's retail model), Role of service-scape in layout design
Service Quality: SERVQUAL, Walk through Audit, Dimensions of Service quality & other quality tools

UNIT – III

Service Guarantee & Service Recovery: How to provide Service guarantee? How to recover from Service failure?

UNIT – IV

Forecasting Demand for Services: A review of different types of forecasting methods for demand forecasting.

Managing Capacity and Demand: Strategies for matching capacity and demand, Psychology of waiting, Application of various tools used in managing waiting line in services.

Managing Facilitating Goods: Review of inventory models, Role of inventory in services

Managing service supply relationship: Understanding the supply chain/hub of service, Strategies for managing suppliers of service

Vehicle Routing Problem: Managing after sales service, Understanding services that involve transportation of people and vehicle, Techniques for optimizing vehicle routes

UNIT – V

Service Innovation: Services Productivity, Need for Services Innovation

Student Project:

Option 1: Choose any service organization around and present it from the perspective of: nature of service, classification of service, blueprint or service design analysis, service quality, and any additional perspective you would like to add.

Option 2: Choose any latest research paper in services and explain your understanding and feedback on the same.

Text Books:

1. Fitzsimmons & Fitzsimmons, Service Management: Operations, Strategy, Information Technology, McGraw Hill publications (7th edition)

Reference Books:

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Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Explain the basic concepts of Service Encounters and Service Dominant Logic.

CO02   Discuss New Service Development process and service Quality Model.

CO03   To make sure that student must become aware concept of service Recovery.

CO04   Analyze Service supply relationships. Evaluate Vehicle Routing problems.

CO05   To identify the need for Service Innovation

Course Code	Course Name	Hours Per Week			
CB3PC05	Minor Project	L	T	P	Credits
		0	0	8	4

Course Learning Objectives (CLOs):

CLO01   Apply theoretical knowledge and practical skills acquired during the program to solve real-world problems.

CLO02   Gain hands-on experience in software development, system design, or business analysis.

CLO03   Enhance teamwork and collaboration skills by working in small groups

CLO04   Develop project management skills, including planning, organizing, and executing a project within specified timelines.

CLO05   Present project outcomes effectively and demonstrates the ability to communicate technical ideas to a non-technical audience.

A project encourages students to learn new techniques and technology which will be required in their professional place / industry and gain experience in the professional employment world. This program is an essential component in the curriculum of Engineering Bachelor Degrees at Medi-Caps University.

This course is also essential to keep in pace with the advancements and expectations of industry. The development life cycle of any project is an essential component of learning in this course. Broadly, the objectives of the course may be defined as follows:

i.   To implement his knowledge to realistic and practical problems
ii. To encourage students to work in synergetic collaboration within teams.
iii. To develop professional attitude and critical thinking
iv. To learn organizational ethics and work culture
v.   To apply his skills in the actual development scenario

Prerequisites: Nil

Procedure: Project Completion Stages

Project Analysis and design Plan

Stages	Concern	Timeline
Topic Selection	• Interest in a domain • Interest in technology • Research interest • Availability of resources • Time feasibility • Course / Skill sufficiency	
Finalizing the Choice	• Finalize Title • Finalize supervisor	1st week
Pre-Project Planning	• Synopsis • Estimations – Time and Features	2nd week
Analysis	• Software Requirement Specification • Presentation I	4th week
Design	• Software Design Specification • Presentation II	8th week
Implementation	Presentation – III	14th week
	Dissertation – I Report + Viva – Voce	End Sem exam (Evaluation by External examiner must)

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO$_{01}$ Demonstrate practical application of theoretical knowledge and skills acquired throughout the program.

CO$_{02}$ Develop and deliver a functional software solution or solve a real-world problem.

CO$_{03}$ Showcase effective project management skills, including planning, organization, and timely execution.

CO$_{04}$ Communicate project outcomes and technical ideas effectively to a non-technical audience.

CO$_{05}$ Enhance teamwork and collaboration skills through effective group work.

Course Code	Course Name	Hours Per Week			Total
		L	T	P	Credits
CB3PC06	Industrial Training	0	2	0	2

Industrial training is a training program that helps students to gain experience in the professional employment world at the Industry. This program is an essential component in the curriculum of Engineering Bachelor Degrees at Medi-Caps University.

It is also essential in the stream to keep in pace with the expectations of industry. Broadly, the objectives of the course are as follows:

To motivate students to apply his knowledge to realistic and practical problems

    i.   To encourage students to work in synergetic collaboration within teams
    ii. To develop professional attitude and critical thinking
    iii. To learn organizational functioning and decision making
    iv. To set a stage for future recruitments and placements for students by potential employers

Prerequisites: Nil

Minimum days of Training: 4 weeks

Training Locations: Industry- Student's have choice to go Industry/Company/Educational Institution of Repute of their preferences. Permission of the University is necessary before the commencement of training. In case of training is opted by the students from the options provided by University, Students will not be allowed to change.

Procedure:
i.   Internal and external guide from the department and the industry/ institutions respectively will be finalised within a week of commencement of training. In case of training given in University campus only the internal guide is required.
ii. Daily log book must be maintained by the student, duly signed by the industry/ internal guide. This log book will be considered as attendance record. Student will report weekly to the departmental guide about the progress of training.
iii. Confidential report of the student's attitude and learning in the organization should be provided by the external guide to the internal guide through mail or sealed and signed hard copy.
iv. Student will submit Training completion certificate in the department before applying for examination.
v.   Well formatted summary of work and report is required to be submitted in the department as per the prescribed format.
vi. The student are required to give the Presentation during the semester in which they register for the industrial training course.
vii. Reports must be submitted during the presentation.

viii. During end semester examination a viva voce along with written examination will be conducted. Evaluation will be based on 60 marks internal and 40 marks external total 100 (60+40).

ix. Only industries registered and active with Ministry of Corporate Affairs will be accepted as industry for valuation of industry training.

x. Professor incharge Training/HOD must verify the company details from www.mca.gov.in before granting the permission.

Note : For the session 2019-20 those who are already permitted before 31st May, 2019 to a company which is not registered with Ministry of corporate affairs will be acceptable. After this date no permission will be granted for such companies.
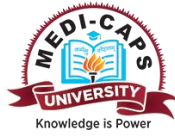
SEMESTER VIII

ID	Course Code	Course	L	T	P	Credit
1	CB3PC07	Major Project	0	0	20	10
		Total	**0**	**0**	**20**	**10**
				20 Hrs		

Course Code	Course Name	Hours per Week			Total
CB3PC07	Major Project	**L**	**T**	**P**	**Credits**
		0	0	20	10

Course Learning Objectives (CLOs):

CLO01   Ability to defined objective of real-life problems, plan, design, develop and execute.

CLO02   Ability to work in team at component level, system level and troubleshoot of problems.

CLO03   Ability to reuse, integrate with existing components to develop the solution for different client to help the society.

CLO04   Ability to derive performance metrics and assess quantitatively the performance of system.

CLO05   Ability to prepare the report and present the findings to the client.

Project Implementation Plan

Finalizing the Choice for New Project/ Continuation of Old Project	• Finalize Title • Finalize supervisor • Presentation I	1st week
Implementation	• Interfaces • Databases • Full Implementation • Presentation II	6th week
Testing and Deployment	• Test Cases • Test Reporting • Presentation III	10th week
Report in Format (Spiral Binding)	• Evaluation by supervisor and 2 additional teachers	
Final Presentation	• Presentation IV • Assessment by Departmental Project Evaluation Committee	14th week At least one paper must be presented in an International Conference or Publication in referred Journal.
Final Report Binding	• Assessment by Departmental Project Evaluation Committee with one external member. At least three members including External Member will make the Quorum. • Viva – Voce	End semester Examination

1. For external projects there will be an external guide in addition to the allotted guide from the department.
2. The schedule of meeting with the supervisor shall be depending on the nature of project execution.

3. Interdisciplinary projects will have guided from concerned departments duly approved by the Dean (Engineering).

4. The project conducted in the location of the industries with more than 10 crores Turn Over will be accepted for valuation of project. Professor in charge Training / HoDs must verify the company details from www.mca.gov.in before accepting the report for valuation. It is not mandatory have publications for these students for the evaluation of project.

5. For Project– I Total marks is 200 (80+ 120).
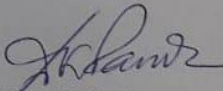   Project-II Total marks 500 (200+300).

Old notice of 2020 batch for the reference of students.

FACULTY OF ENGINEERING
(XX3PC02)
Project Phase II
Instructions for the Students

All the students of VIII Semester undertaking project phase II are required to note following:

1. The duration of the project will be from January 1st to April 30th, 20█
2. The students already placed may carry out their projects in their companies / organizations.
3. Outside University:
   a. They can carry out their project in any companies/organizations registered in www.mac.gov.in and should have turnover more than Rs 10 Crore.
   b. In this case paper publication is not mandatory. However it is always advisable to publish the paper after taking proper approval from the company/organization
   c. All the government organization viz.a.viz PWD, CPWD, all the research organizations like BARC, RRCAT, all IITs, NITs, Institutes of national repute, foreign Universities, all public sectors like IOCL, BORL, HPCL, SAIL etc. are exempted from above mentioned clause a.
4. In-house project:
   a. The students must maintain the required attendance (min 14 hrs/week) during the semester. Further they are expected to work for not less then 14 hrs for their projects in addition to the work in University.
   b. In the view of prevailing conditions of COVID-19 students may work in online mode till further notice. Hence their attendance will be monitored by their respective project guides. The guide will allot the task on daily basis during their project classes and at the end of the day on the successful completion of the given task; attendance may be given by the guide for the particular day. The record of such work to be maintained in diary. The HOD shall monitor the progress.
   c. At least one paper publication is mandatory in any of UGC approved journal/International Conference. Failing which the project could not be submitted by the student/s.
   d. In special cases acceptance letter from the journal//International Conference for paper publication may be accepted for project submission.
5. If the company is registered in www.mca.gov.in and having turnover less then 10 crore the project will be counted as inhouse project. Therefore, all the condition of point no. 4 will be applicable.
6. If the companies of the already placed students is not having turn over more than 10 crore, all the conditions of point no. 4 will be applicable.
7. Students may choose any of the area for project which he/she has studied during his/her BTech program.
8. Schedule for Presentation during the semester:
   a. In the present situation all the students will give the online / offline presentation as per the notified dates, till further orders.
   b. The students doing project outside the University and requiring travelling time less than 12 hrs, must have to give presentation in the University Campus (online, if not permitted to come to the University) as per notified dates.
   c. The students doing project outside the University and requiring travelling time more than 12 hrs. may be permitted to give presentation in online mode.

Dr. D. K. Panda
Dean (Engineering)

Course Outcomes (COs):

After completion of this course the students shall be able to:

CO01   Define objective of real life problems, plan, design, develop and execute.

CO02   Work in team at component level, system level and troubleshoot of problems.

CO03   Reuse, integrate with existing components to develop the solution for different client to help the society.

CO04   Derive performance metrics and assess quantitatively the performance of system.

CO05   Report and present the findings to the clients.