COURSE SCHEME

FOR

BE (CIVIL WITH COMPUTER APPLICATIONS – FIRST AND SECOND YEAR)

2023

Break-up of Credits

SEMESTER	CREDITS
I	18.0
II	18.0
III	26.0
IV	22.5

Nature of course and code

Nature of the course	CODE**
Basic Science Courses	BSC
Engineering Science Courses	ESC
Humanities and Social Science Courses	HSS
Professional Core Courses	PCC
Professional Elective Courses	PEC
Open Elective Courses	OEC
Project	PRJ

SEMESTER-I

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UPH013	APPLIED PHYSICS	BSC	3	1	2	**4.5**
2.	UES101	ENGINEERING DRAWING	ESC	2	4	0	**4.0**
3.	UHU003	PROFESSIONAL COMMUNICATION	HSS	2	0	2	**3.0**
4.	UES102	MANUFACTURING PROCESSES	ESC	2	0	2	**3.0**
5.	UMA010	MATHEMATICS–I	BSC	3	1	0	**3.5**
		TOTAL		12	6	6	**18.0**

SEMESTER-II

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCB009	APPLIED CHEMISTRY	BSC	3	0	2	**4.0**
2.	UES103	PROGRAMMING FOR PROBLEM SOLVING	ESC	3	0	2	**4.0**
3.	UES013	ELECTRICAL & ELECTRONICS ENGINEERING	BSC	3	1	2	**4.5**
4.	UEN008	ENERGY AND ENVIRONMENT	BSC	2	0	0	**2.0**
5.	UMA004	MATHEMATICS–II	BSC	3	1	0	**3.5**
		TOTAL		14	2	6	**18.0**

SEMESTER-III

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCC301	SOLID MECHANICS	PCC	3	1	2	**4.5**
2.	UCC302	CIVIL ENGINEERING MATERIALS	ESC	3	0	2	**4.0**
3.	UCC303	FLUID MECHANICS	PCC	3	1	2	**4.5**
4.	UCC304	ARTIFICIAL INTELLIGENCE	PCC	3	0	2	**4.0**
5.	UCE306	ARCHITECTURE DRAWING AND BUILDING CONSTRUCTION	PCC	2	0	2	**3.0**
6.	UMA303	OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING	BSC	3	0	2	**4.0**
7.	UTD003	APTITUTE SKILLS BUILDING	HSS	2	0	0	**2.0**
		TOTAL		19	2	12	**26.0**

SEMESTER-IV

S. No.	Course Code	Course Name	CODE**	L	T	P	Cr
1.	UCC401	STRUCTURAL ANALYSIS	PCC	3	1	2	**4.5**
2.	UCC402	GEOINFORMATICS	PCC	3	0	3	**4.5**
3.	UCC403	DESIGN OF CONCRETE STRUCTURES	PCC	3	1	2	**4.5**
4.	UCC404	FUNDAMENTALS OF DATA SCIENCE	ESC	3	0	2	**4.0**
5.	UMA012	NUMERICAL AND STATISTICAL COMPUTATIONS	BSC	3	0	2	**4.0**
6.	UHU050	EVOLUTIONARY PSYCHOLOGY (1Self Effort Hour)	HSS	1*	0	0	**1.0**
		TOTAL		15+1*	2	11	**22.5**

SEMESTER-I

UPH013: Physics

L	T	P	Cr
3	1	2	4.5

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

Syllabus

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

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

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

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

Laboratory Work

1. Determination of damping effect on oscillatory motion due to various media.
2. Determination of velocity of ultrasonic waves in liquids by stationary wave method.
3. Determination of wavelength of sodium light using Newton's rings method.
4. Determination of dispersive power of sodium-D lines using diffraction grating.
5. Determination of specific rotation of cane sugar solution.
6. Study and proof of Malus' law in polarization.
7. Determination of beam divergence and beam intensity of a given laser.
8. Determination of displacement and conducting currents through a dielectric.
9. Determination of Planck's constant.

Micro Project:

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

Course Learning Objectives (CLO)

The students will be able to:

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

Text Books

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

Reference Books

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

Evaluation Scheme

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

UES101: Engineering Drawing

L	T	P	Cr
2	4	0	4.0

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

Syllabus

Engineering Drawing Concepts

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

2D Drafting

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

3D Modelling

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

Micro Projects /Assignments:

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

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

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

Course Learning Objectives (CLO)

The students will be able to:

1. Creatively comprehend the geometrical details of common engineering objects
2. Draw dimensioned orthographic and isometric projections of simple engineering objects
3. Interpret the meaning and intent of limits, fits and tolerances in the drawing

Ccreate/edit the engineering drawings for simple engineering objects using 2D drafting software

4. Create/edit 3D models of engineering components using 3D modelling software

Text Books

1. Jolhe, D.A., Engineering Drawing, Tata McGraw Hill, 2008

2. Davies, B. L., Yarwood, A., Engineering Drawing and Computer Graphics, Van Nostrand Reinhold (UK), 1986

Reference Books

1. Gill, P.S., Geometrical Drawings, S.K. Kataria & Sons, Delhi (2008).

2. Gill, P.S., Machine Drawings, S.K. Kataria & Sons, Delhi (2013).

3. Mohan, K.R., Engineering Graphics, Dhanpat Rai Publishing Company (P) Ltd, Delhi (2002).

4. French, T. E., Vierck, C. J. and Foster, R. J., Fundamental of Engineering Drawing & Graphics Technology, McGraw Hill Book Company, New Delhi (1986).

5. Rowan, J. and Sidwell , E. H., Graphics for Engineers, Edward Arnold, London (1968).

6. Mastering AutoCAD 2021 and AutoCAD LT 2021, Brian C. Benton, George Omura, Sybex - John Wiley and Sons, Indiana (2021).

Evaluation Scheme

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

***Students are required to bring their personal computers for the** tutorial work.*

**Availability of institute server resources for sharing the software licences with the student community.*

***Institute computational resources in collaboration with other academic units / departments for conducting the mid semester and end semester test.*

UHU003: Professional Communication

L	T	P	Cr
2	0	2	3.0

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

Syllabus

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

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

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

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

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

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

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

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

Laboratory Work

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

Course Learning Objectives (CLO)

The students will be able to:

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

Text Books

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

Reference Books

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

Evaluation Scheme

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

UES102: MANUFACTURING PROCESSES

L	T	P	Cr
2	0	2	3.0

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

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

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

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

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

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

Laboratory Work:

Relevant shop floor exercises involving practices in Sand casting, Machining, Welding, Sheet metal fabrication techniques, CNC turning and milling exercises, Experiments on basic engineering metrology and measurements to include measurements for circularity, ovality, linear dimensions, profiles, radius, angular measurements, measurement of threads, surface roughness. Basic knowledge and derivations related to above measurements, uncertainties, statistical approaches to estimate uncertainties, Line fitting, static and dynamic characteristics of instruments will be discussed in laboratory classes.

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

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

Course Learning Outcomes (CLO):

After the completion of this module, students will be able to:

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

Text books:

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

Reference Books:

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

Evaluation Scheme:

Sr. No.	Evaluation elements	Weightage (%)
1	MST	35
2	EST	35
3	Sessional: (May include the following) Assignment, Sessional (Includes Regular Lab assessment and Quizzes Project (Including report, presentation etc.)	30

UMA010: Mathematics-I

L	T	P	Cr
3	1	0	3.5

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

Syllabus

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

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

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

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

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

Course Learning Objectives (CLO)

The students will be able to:

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

Text Books

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic Geometry, Pearson Education (2007), 9th ed.
2. Stewart James, Essential Calculus; Thomson Publishers (2007), 6th ed.

3. Kasana, H.S., Complex Variables: Theory and Applications, Prentice Hall India, 2005 (2nd edition).

Reference Books

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

Evaluation Scheme

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

SEMESTER-II

UCB009: Chemistry

L	T	P	Cr
3	0	2	4.0

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

Syllabus

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

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

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

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

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

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

Laboratory Work

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

Course Learning Objectives (CLO)

The students will be able to:

1. recognize principles and applications of atomic and molecular spectroscopy.
2. explain the concepts of conductometric titrations, modern batteries and corrosion.
3. apply and execute water quality parameter and treatment methods.

4. discuss the concept of alternative fuels, application of polymers and SMILES.
5. execute laboratory techniques like pH metry, potentiometry, spectrophotometry, conductometry and volumetry.

Text Books

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

Reference Books

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

Evaluation Scheme

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

UES103: Programming for Problem Solving

L	T	P	Cr
3	0	2	4.0

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

Syllabus

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

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

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

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

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

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

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

File Handling: Introduction of Files (streams in C), using File (Declaring, Opening and Closing), Operations on File (Reading, Writing and appending), and Random Access of a

file, command line argument.

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

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

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

1. Comprehend and analyze the concepts of number system, memory, compilation and debugging of the programs in C language.
2. Analyze the control & iterative statements to solve the problems with C language source codes.
3. Design and create programs for problem solving involving arrays, strings and pointers.
4. Evaluate and analyze the programming concepts based on user define data types and file handling using C language.

Text Books
1. C Programming Language, Brian W. Kernighan Dennis M. Ritchie, 2nd ed, 2012.
2. Programming in ANSI C, Balagurusamy G., 8th ed., 2019

Reference Books
1. Let Us C, Kanetkar Y., 16th ed., 2017
2. Programming with C, Byron S Gottfried, McGraw Hill Education, Forth edition, 2018

UES013: Electrical and Electronics Engineering

L	T	P	Cr
3	1	2	4.5

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

Syllabus

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

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

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

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

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

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

1. apply various networks laws and theorems to solve dc circuits
2. compute different ac quantities with phasor representation
3. comprehend the operation in magnetic circuits, single phase transformer and rotating machines
4. recognize and apply the number systems and Boolean algebra.
5. reduce and simplify Boolean expressions and implement them with logic gates.

6. discuss and explain the working of diode, transistor and operational amplifier, their configurations and applications.

Text Books

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

Reference Books

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

Evaluation Scheme

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

UEN008: Energy and Environment

L	T	P	Cr
2	0	0	2.0

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

Syllabus

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

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

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

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

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

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

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

Text Books

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

Reference Books

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

Evaluation Scheme

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

UMA004: Mathematics - II

L	T	P	Cr
3	1	0	3.5

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

Syllabus

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

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

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

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

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

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

Text Books

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

Reference Books

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

Evaluation Scheme

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

SEMESTER-III

UCC301: SOLID MECHANICS

L	T	P	Cr
3	1	2	4.5

Course Objective: This subject introduces fundamental concepts of structural mechanics to solve general engineering mechanics problems. It aims to develop an understanding of the stresses and strains that develop in solid materials when they are subjected to different types of loading and to develop an understanding of the conditions at failure of such materials.

Introduction of equilibrium of bodies: Free-body diagrams, conditions of equilibrium, torque due to a force, static determinacy.

Plane Trusses: Forces in members of a truss by method of joints and method of sections.

Axial Stress and Strain: Concept of stress, strain, elasticity and plasticity; one-dimensional stress-strain relationships; statically determinate and indeterminate problems, compound and composite bars, thermal stresses, concept of factor of safety.

Shear Force and Bending Moment Diagrams: Types of load on beams, classification of beams; axial, shear force and bending moment diagrams: simply supported, overhung and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load and moment.

Properties of Plane Surfaces: Concept of first moment of area, centroid and second moment of area.

Bending & Shear Stresses in beams: Derivation of flexural formula for straight beams, bending stress calculation for beams of simple and built- up sections, flitched beams. Shear stress formula for beams, shear stress distribution in beams.

Deformations: Governing differential equation for deflection of straight beams having constant flexural rigidity, Double Integration Method and Macaulay's for determining slopes and deflection in beams

LABORATORY WORK

1. Calculation of **Tensile Strength** of materials
2. To determine the **Hardness** of various materials.
3. Experimental Verification of Theory of **Bending** (Calculation of bending stress and deflections at various points in the beam theoretically and verifying the same experimentally) and indirect evaluation of the modulus of elasticity
4. Determine the **Impact Strength** of Brittle and Ductile Materials
5. **Torsion:** Study the behaviour of circular shafts under torsion (**Destructive)** and analysis of failure of brittle and ductile materials and indirect evaluation of the modulus of rigidity.

EXPERIMENTAL PROJECT ASSIGNMENT

Students in groups of 4/5 will do project on Model Bridge Experiment: This will involve construction of a model bridge using steel wire and wood.

Course Learning Objectives (CLO)

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

1. Identify and quantify all forces associated with a static framework/plane force system.
2. Evaluate axial forces in trusses and axial stresses and strains in various determinate and indeterminate structural systems.
3. Draw shear force diagram and bending moment diagram in various kinds of beams subjected to different kinds of loads,
4. Evaluate bending and shear stresses in such beams.
5. Determine deformations and rotations at various locations in determinate beams.

Text Books

1. Engineering Mechanics of Solids,E.P. Popov and T.A. Balan, Pearson India Education Services, 2018.
2. Strength of Materials, D.K. Singh, Springer International Publishing, Fourth edition, 2020.\

Reference Books

1. Mechanics of materials, R. C. Hibbeler, Pearson, Tenth edition, 2016.
2. Mechanics of materials, F.P. Beer, E.R. Johnston, D. Mazurek, McGraw-Hill Higher Education, 2011.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional: (May include the following) Assignment, Regular Lab assessmentand Quizzes, Project (Including report, presentation etc.)	40

UCC302: CIVIL ENGINEERING MATERIALS

L	T	P	Cr
3	0	2	4.0

Course Objective: To expose students to the various building and general construction products and their associated quality, durability and availability.

Cement: Manufacturing, raw ingredients, chemical and mineralogical composition, types of cement, and chemistry of cement hydration

Aggregates: Classification and mechanical properties of aggregate, gradation, effect aggregate type on concrete properties, light weight aggregates

Cement mortar and concrete: Classification, properties and applications, water cement ratio, fresh, mechanical and durability properties of concrete. Production of concrete and mix design.

Chemical and Mineral admixtures: Supplementary Cementitious materials (Fly ash, GGBS, Metakoline**,** Silica Fume)**, Admixtures:** accelerating admixture, water reducing admixture, retarding admixture, air-entraining admixture.

Characterization of cementitious composites (cement and concrete): Characterization techniques with their meaning and uses, microstructure investigation methods including X-ray diffraction, scanning electron microscopy and Thermo-Gravimetric Analysis

Bricks and blocks: Classification and characteristics of bricks, AAC blocks, hollow concrete blocks.

Steel: Market forms of steel, classification and mechanical properties of steel.

Composites materials and nanomaterials in Civil engineering: Introduction to composite laminates – FRP and their use in civil engineering applications. Different types of Nanomaterials in Civil Engineering Applications

Laboratory Work

1. Tests on cement (fineness, specific gravity, consistency and strength test).
2. Tests on fine and coarse aggregates (gradation, specific gravity, water absorption).
3. Design of concrete mix for required grade of concrete.
4. Tests on fresh concrete (workability test).
5. Tests on hardened concrete (compressive strength, flexural strength and split tensile strength).
6. Characterization of cementitious composites using SEM and XRD

Experiential Learning (ELC) Activity

Casting of concrete canoe using innovative lightweight concrete.

Course Learning Objectives (CLO)

The students will be able to:

1. Design the mix proportions for required grade of concrete.
2. Perform various quality control tests for the civil engineering materials in the laboratory
3. Characterize cementitious composites (identify hydration products of cement, interfacial zones in concrete).
4. Evaluate the mechanical properties of steel using uniaxial stress-strain curve

Text Books

1. Gambhir M. L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2013.
2. Rangawala S. C., Engineering Materials, Charotar Publishing House, Anand, 2005.
3. Chaudhary S. C., Patel K. A., Testing & Evaluation of Civil Engineering Materials, All India Council for Technical Education (AICTE), 2023.

Reference Books

1. Shetty M. S., Concrete Technology: Theory and Practice, S. Chand & Company, 2019.
2. Mehta and Monterio, Concrete Microstructure, Properties and Materials, McGraw-Hill Publishers, 2017.

Evaluation Scheme

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

UCC303: **Fluid Mechanics**

L	T	P	Cr
3	1	2	4.5

Course Objective: To understand basic concepts of fluid flow and their applications in solving engineering problems

Introduction: Definition of a fluid and its properties, Types of fluids
Fluid statics: Differential equation of pressure field, Pascal law, Measurement of fluid pressure, force on submerged surfaces, Buoyancy and Flotation
Fluid kinematics: Methods of describing fluid motion, Velocity and acceleration of a fluid particle, Type of fluid flows, Displacement of a fluid particle, Continuity equation, Velocity potential and stream function, Flow net.
Fluid dynamics: Euler's equation; Bernoulli's equation; Momentum equation; Applications
Flow though pipes: Energy losses, Hydraulic gradient line and total energy line, Concept of equivalent pipe, Pipes in series and parallel, Flow through a siphon, Transmission of power
Flow measuring devices: Venturimeter, Orificemeter, orifice, Pitot tube, Notch, Time of emptying tanks of different cross-sections.
Dimensional analysis: Methods of dimensional analysis, Model studies
Application of computational techniques in fluid mechanics problems

Laboratory Work

1. Verification of Bernoulli's Theorem
2. Calibration of venturimeter/orifice meter.
3. Determination of hydrostatic force and its location on a vertically immersed surface.
4. Determination of friction factor for pipes of different materials
5. Determination of hydraulic coefficients of an orifice
6. Verification of momentum equation
7. Visualization of laminar and turbulent flow.

Course Learning Objectives (CLO)

The students will be able to:

1. Analyze and solve problems of simple fluid based engineering systems including pressures and forces on submerged surfaces.
2. Analyze fluid flow problems with the application of the mass, momentum and energy equations
3. Evaluate practical problems associated with pipe flow systems
4. Analyze the significant variables in hydraulic problems and to predict the performance of hydraulic prototypes.

Text Books

1. Fluid Mechanics, *Streeter*, V.L., *Wylie* E. B. and Bedford, K.W., McGraw Hill Book Company, 9th Edition, 2017.
2. Fluid Mechanics and Fluid Power Engineering, Kumar D.S., S. K. Kataria, 9th Edition, 2015.

Reference Books

1. Theory and Application of Fluid Mechanics, Subramanya, K., Tata McGraw Hill, 1st Edition, 2010.
2. Hydraulics and Fluid Mechanics *Modi* P.N. and *Seth* S.M., Standard Book House, 22nd Edition, 2019.
3. Mechanics of Fluid Shames I. H., McGraw Hill, 4th Edition, 2002.
4. Introduction to Fluid Mechanics, Fox, R.W. and McDonald A.T., John Wiley and Sons. 10th Edition, 2020

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional: (May include the following) Assignment, Regular Lab assessmentand Quizzes, Project (Including report, presentation etc.)	35

UCC304: **Artificial Intelligence**

L	T	P	Cr
3	0	2	4.0

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

Introduction to Artificial Intelligence: Foundations, scope, types of AI, problems, and approaches of AI
Intelligent agents: Structure of agents, Types of agent programs: reflux, model-based, goal-driven, utility-driven, and learning agents
Problem spaces: State Space Representation, Representation of problems as state space, problem characteristics, sample applications
Uninformed Search Algorithms: Brute Force search, Depth-First Search, Breadth-First search, Depth-Limited Search, Uniform Cost Search, Bidirectional Search
Informed search algorithms: Heuristic Functions, Best-First search, Beam Search, Hill Climbing, A* algorithm, AO graph, stochastic search algorithms: Simulated Annealing and Genetic Algorithm
Game playing: Minimax algorithm, alpha-beta pruning, iterative deepening
Introduction to Machine Learning: Well-Posed learning problems, Basic concepts, Designing a learning system, Types of machine learning: Supervised learning, Unsupervised learning, Semi-supervised Learning and Reinforcement learning, Types of data: structured and unstructured data. **Supervised Learning:** Introduction to supervised learning tasks, Tree induction algorithms: split algorithm based on Information Gain (ID3), split algorithm based on Gain Ratio (C4.5), split algorithm based on Gini Index (CART), Instance based algorithms: K Nearest Neighbours (K-NN), Probabilistic algorithms: Naïve Bayes algorithm, Evaluation metrics
Unsupervised Learning: Introduction to supervised learning tasks, Partitioning-based methods

Laboratory Work (if applicable): Basics of Python programming language: Data Types, Data Structures, Flow Control, Functions, Basic Data Science packages: NumPy, Pandas, SciPy
Implementing Search algorithms in C/C++/Java/Python: Depth first, Breadth first, Hill climbing, best first, A* algorithm, Implementation of games: 8-puzzle, Tic-Tac-Toe, tower of Hanoi and water jug problem using heuristic search
Implementing Machine Learning algorithms: Tree-based methods, K-NN, Naïve-Bayes algorithms, K-Means (from scratch and using sklearn library)

Course Learning Objectives (CLO)
The students will be able to:
1. Analyze methods and theories in the field of Artificial Intelligence and categorize various problem domains.
2. Design intelligent agents for concrete computational problems.
3. Analyze and apply different problem-solving strategies and search algorithms.
4. Implement and evaluate machine learning algorithms for various real-world tasks

Text Books

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

Reference Books

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

UCE306: ARCHITECTURE DRAWING AND BUILDING CONSTRUCTION

L	T	P	Cr
2	0	2	3.0

Course Objective: To expose students to the concepts of architectural drawings and building construction.

Introduction to Architecture Drawing: Proportion, orientation, building bye laws, site plan, building layout, Architectural and structural working drawings, Modular co-ordination and drawing on modules,

Building structures: Various building components in load bearing and framed structures.

Building information modelling (BIM): Introduction to BIM and basics of modelling.

Foundations: *Shallow foundations:* Continuous, spread, arch, combined, cantilevered, Raft, Grillage, *Deep foundations:* Piles & wells, Footings in block cotton soil, Basement & Retaining walls

Masonry: Stone, Brick & Concrete Block masonry, Bonds and junctions, Walling, Mud wall, Sun-dried bricks, burnt bricks, stones walling, load bearing & non load bearing brick masonry, panel wall and reinforced masonry for multi-storied construction.

Special treatments: Damp Proof Course, points of its requirement in buildings, D.P.C. at Plinth level, in basement and roof tops etc., waterproofing treatments, anti-termite treatment, heat and acoustic insulation of buildings

Lintels & Arches: Location and construction details in wood, brick, stone and R.C.C.

Stairs & Stair cases: Suitability of location, stairs in multistoried buildings, Residential and public buildings, Fire escape, Stairs in timber, stone, brick, RCC and Metal Drawings in Plan elevation and sections. Hand rail & railings, description and sketches of lifts escalators.

Doors & Windows: Details, Location in buildings, sizes, Door-window schedule & construction for wooden & metal, Battened braced, framed, flush and paneled, sliding, folding telescopic, with louvers, collapsible, Revolving doors, Aluminum doors, etc. Windows in timber, aluminium frame & metal casement, double hung, Dormer, Corner, Fanlight, skylight, clear storey etc., and low-cost ideas.

Roofing and Flooring: Types of flooring, Flat roofs: Waffle floor, wooden flooring, channels, cored units etc, inclined roofs.

Miscellaneous: Formwork, scaffolding, underpinning.

Precast and Prefabricated Elements: Pre-engineered buildings (PEB), Prefabricated Prefinished Volumetric Construction (PPVC), Prefabricated components, Assembly at site, joints in prefabricated construction, low-cost housing & hollow blocks.

Laboratory Work

Modelling of building layout and building components in BIM based software

- A two-storey building plan with three/four rooms: Plan, Elevations & Section (Modular), Site Plan (Application of Bye laws), Foundation for walls – Construction details, Proposed doors and windows – Construction details, Roof & floor – details, in construction Stair case details
- Drawings of all the above building components e.g. Brick masonry bonds and junctions, DPC, Lintels and Arches, Stairs, Doors & Windows, Roof &roof coverings
- Drawing and detailing of typical building components

Course Learning Objectives (CLO)

The students will be able to:

1. Plan and draw constructional details of different building components
2. Capable of working with an architect and contractor
3. Prepare building plans and other components for a project
4. Capable of supervising building constructions

Text Books

1. Building Construction and Materials, Singh, Gurcharan, Standard Book House (2019).
2. Building Construction, Sharma, S. K., S. Chand and Company (2012).

Reference Books

3. Building Construction, Kumar, Sushil, Standard Publisher and Distributors (2020).
4. Building Construction, Punmia, B. C., Laxmi Publishing House (2016).
5. National Building Code, Volume-I and Volume-II, Bureau of Indian Standards (2016)
6. IS 962: 2001 Code of Practice for Architectural and Building Drawings, Bureau of Indian Standards

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional: (May include the following) Assignment, Regular Lab assessmentand Quizzes, Project (Including report, presentation etc.)	40

UMA303: **OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING**

L	T	P	Cr
3	0	2	4.0

Course Objective: The primary objective of the course is to provide students with a comprehensive understanding of optimization techniques applicable to civil engineering problems. The course aims to introduce the fundamentals of optimization methods and delve into the theory of non-advance optimization techniques and algorithms designed for addressing diverse civil engineering optimization challenges. By the end of the course, students will be proficient in applying optimization methods using computational tools

Scope of optimization techniques in civil engineering: Introduction to linear and non-linear programming formulation of different models and it use in civil engineering problems such as structural design, mix-design of concrete, transportation engineering, traffic flow management, route planning, and transportation network design, water distribution/pipe flow, construction planning and scheduling.

Linear Programming: Basics of the geometry of linear programming, graphical method, linear programming (LP) in standard form, solution of LP by simplex method, exceptional cases in LP, duality theory, dual simplex method.

Integer Programming: Branch and bound technique.

Network Models: Transportation problems, assignment problem, construction of networks, network computations, free floats, critical path method (CPM), optimal scheduling (crashing).

Multi-objective Programming: Introduction to multi-objective linear programming, efficient solution, efficient frontier.

Nonlinear Programming: Single-variable, multivariable, unconstrained optimization: unimodal functions, fibonacci search method, gradient method, constrained Optimization: concept of convexity and concavity, Maxima and minima of functions of n-variables, lagrange multipliers, Karush-Kuhn-Tucker conditions for constrained optimization.

Advanced Topics in Optimization: Introduction to evolutionary algorithms for optimization and applications in civil engineering (case study related to optimization methods use in water resources planning & management, water infrastructures, and irrigation and hydropower projects).

Laboratory Work: Lab experiments will be set in consonance with materials covered in the theory using scientific computational techniques

Laboratory Work

1. To determine optimal water flow through each pipe of a water supply network while minimizing the pumping cost
2. To design a steel truss to carry a certain load while minimizing the self-weight and material cost
3. To optimize the design of a concrete mix while minimizing the cost
4. To evaluate the mean speed of vehicles on a highway while satisfying various constraints
5. Case studies related to Optimization techniques commonly used in water resources planning & management, water infrastructures, and irrigation and hydropower projects

Course Learning Objectives (CLO)

The students will be able to:

1. Formulate linear programming problems in civil engineering
2. Solve linear programming problems using simplex methods and its variants
3. Construct and optimize network models and apply it to project management in civil engineering
4. Formulate and solve non-linear programming problems in civil engineering

Text Books

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International Pvt Ltd., New Delhi, 2019.
2. G. Hadley, "Linear programming", Narosa Publishing House, New Delhi, 2002.
3. H.A. Taha, "Operations Research: An Introduction", 9th Edition, Pearson, 2017.
4. K. Deb, "Optimization for Engineering Design- Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 2006

Evaluation Scheme

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

SEMESTER-IV

UCC401 : STRUCTURAL ANALYSIS

L	T	P	Cr
3	1	2	4.5

Course Objective: This course aims to develop an understanding of techniques of structural analysis to calculate displacements of statically determinate and indeterminate structures. This subject also introduces the concept of drawing influence line diagrams for determinate structures.

Displacements: Geometric Method**:** Conjugate Beam Method**,**Energy Methods: Strain energy in members, Betti's and Maxwell's Laws of reciprocal deflections, Castigliano's theorems, Unit load method for 2D-frames and trusses, Simulation of Unit Load Method for Trusses using Computer Programs

Indeterminate structures: Introduction, Static and Kinematic indeterminacies, Stability of structures, internal forces in two and three-dimensional structure

Analysis of Indeterminate Beams and Frames: Classical Methods: Methods of consistent deformation, Conventional methods of Analysis of rigid frames: Slope deflection method and Moment Distribution Method.

Matrix Methods: Introduction to and Formulation of Stiffness and Flexibility Matrices, Simulation of Stiffness and Flexibility Matrices and their application to Analysis of Structures using Computer Programs

Moving Loads and Influence Line Diagrams for Statically Determinate Beams: Bending moment and shear force diagrams due to single and multiple concentrated rolling loads and uniformly distributed moving loads, equivalent UDL, Muller Breslau principle**:** Influence lines for beams, calculations of the maximum and absolute maximum shear force and bending moment , SF and BM envelopes.

Laboratory Work:

List of experiments:

1. To study the variation of BM at different locations in a simply supported beam.
2. To plot the deflected shape of a simply supported beam and cantilever beam
3. To find the deflection of a pin connected truss
4. To analyze a portal frame with and without sway
5. Simulation of Unit Load Method for Trusses using Computer Programs
6. Simulation of Matrix Methods for analysis of Framed Structures
7. Development and Application of Influence Line Diagram for beams using computer programs

Project: Analysis and Design of Truss structure using software

Course Learning Objectives (CLO)

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

1. Calculate deformation of statically determinate structures
2. Analyze statically indeterminate beams using classical and conventional methods.
3. Develop qualitative diagrams showing the deformed shape, bending moment and shear force diagram for an indeterminate plane frame.
4. Draw influence line diagrams for statically determinate beams
5. Analyze the structures for static and moving loads using computer programs

Text Books

1. Structural Analysis, R. C. Hibbler (9th ed.), Prentice Hall Publishers, 2017.
2. Basic Structural Analysis, C.S. Reddy, Tata McGraw Hill Publishers, 2017
3. Wang, C. K., Indeterminate Structural Analysis, Tata McGraw-Hill Education Pvt. Ltd (2017).

Reference Books

1. Adavnced Structural Analysis, P. Dayaratnam, McGraw Hill Publishers, 2020.
2. Theory of Structures, B.C. Punmia and A.K. Jain, Luxmi Publications 2017.

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional: (May include the following) Assignment/Lab evaluations)	25
4	Project	15

UCC402: GEOINFORMATICS

L	T	P	Cr
3	0	3	4.5

Course Objective: Surveying as a subject in civil engineering aims to provide basic knowledge about the principles of surveying for a location and its application in the design and construction of engineering projects. The students develop skills using surveying instruments, including measuring tapes, theodolites, and advanced measurement equipment, such as laboratory stations, GPS, and drones.

Introduction to Surveying: Definition, classification of surveys, Principle, distorted or shrunk scales, precision in surveying, different types of errors.

Linear Measurements:

(a) Chain and Tape Surveying: Chain surveying, tapes, ranging–direct & indirect, chaining on sloping ground, corrections for linear measurements, offsets

(b) Leveling: Definitions of terms used in leveling, different types of levels, temporary adjustments, benchmarks, booking and reducing the levels, rise and fall method, line of collimation method, errors in leveling, permanent adjustments, corrections to curvature and refraction, setting out grades.

(c) Tacheometry: Definitions and terms used in tacheometry, determination of constants, angular tacheometry with staff vertical and staff inclined, Merits and Demerits; Analytic lens, tangential method of tachometry.

(d) Contours: Definition, representation of reliefs, horizontal equivalent, contour interval, characteristics of contours, methods of contouring, contour gradient, uses of contour maps.

Angular Measurements:

(a) Compass Traversing: Types of compasses, bearings, meridians, declination, the dip of the magnetic needle, bearing of lines from included angles, local attraction.

(b) Theodolite: Types of theodolites, measurement of angles, temporary and permanent adjustments, closed and open traverse, consecutive and independent coordinates, advantages and disadvantages of traversing closing error, Gale's traverse table.

Curve Setting: Types of curves, calculations for simple circular curve and tangential curve, Rankine's method of tangential angle measurements.

Total Station: Working principle and survey with total station

Global Positioning Systems (GPS): Working Principle, Types of GPS, Application of GPS, DGPS-working Principle, DGPS errors (RT & PP).

Remote Sensing and GIS: Introduction to Remote sensing and electromagnetic spectrum, types of sensors, image interpretation-visual and digital, map, scale, and projections.

Photogrammetric surveys: Basic concepts, principles, and applications of photogrammetry,concepts, and applications for map preparation.

Drone Surveying: Introduction to drones, comparison of surveying drone and its accuracy;techniques of controlling errors

Laboratory Work

1. Measurement of distances/offsets, and bearings with chain and tape, and compass
2. Levelling to calculate RLs of various points
3. Measurement of vertical and horizontal angles with theodolite
4. Tacheometric Survey and determination of tacheometric constants
5. Surveying with Total Station
6. Survey with GPS and DGPS
7. Introduction to GIS software

Course Learning Objectives (CLO)

The students will be able to:

1. Survey an area under various topography and obstructions using various instruments
2. Prepare the plan or map of the area surveyed.
3. Set out curve and building layout.
4. Analyze and process satellite data and retrieve information

Text Books

1. Anderson and Mikhail. Surveying Theory and Practice, 7th Edition, McGraw Hill Education (2012)
2. Duggal, S.K. Surveying, Vol.I and II, 5th Edition, (2019)
3. Subramanian,R. Surveying and Levelling,Oxford 2nd edition (2012)
4. Venkatramaiah,C.,ATextBookofSurveying,UniversitiesPress(2011)
5. PK Garg, Introduction to Unmanned Aerial Vehicles, New Age International Publishers New Age International Private Limited; First edition (1 October 2020); NEW AGE International Pvt Ltd.

Reference Books

1. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol.I and II, Laxmi publications (2016)
2. Garvit Pandya, Basics of Unmanned Aerial Vehicles: Time to start working on Drone Technology, Notion Press (6 March 2021)
3. Kike Calvo, So You Want to Create Maps Using Drones?,Bluerb publication (2015)

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional: (May include the following) Assignment, Regular Lab assessmentand Quizzes	40

UCC403 :DESIGN OF CONCRETE STRUCTURES

L	T	P	Cr
3	1	2	4.5

Course Objective:To expose the students to design methodologies of various reinforced concrete elements using manual and programmable techniques

Introduction*:* Reinforced concrete, definition, properties of materials, grades of concrete and reinforcing steel, stress-strain curves, permissible stresses,design philosophies: working stress design, ultimate strength and limit state design method.

Limit State Design Method: Introduction, Limit States, Characteristic values, characteristic strength, service loads, design values for material strength and loads, factored loads.

Limit State of Collapse (Flexure): Types of failures, assumptions for analysis, design of singly rein reinforced, doubly reinforced sections, design of flanged beams, Design of one-way slabs and two-way rect

Limit State of Collapse (Shear, bond and torsion): Introduction - Design for shear, design of structural components subjected to torsion, design of rectangular beam section for torsion, development length, continuation of reinforcement (beyond cut-off points).

Limit State of Serviceability*:* Deflection, effective span to effective depth ratio, modification factors for singly reinforced, doubly reinforced and flanged beams

Limit State of Collapse (Compression): Columns and their classification, reinforcement in columns, assumptions, design of short (both tied and helical) columns subjected to axial load, uniaxial and biaxial bending using SP16 (1980) Interaction diagrams

Limit State Design of miscellaneous structures: Design of isolated footings, Design of staircases.

Detailing of Reinforcement using SP:34 (1987) and Ductile Detailing using IS 13920:2016

Laboratory Work

Project 1: Design of Concrete Mixes of Different Grades, Study of Strength Properties and Flexural Behaviour of RCC Beams

The students will be divided into 4-5 sub-groups. Each sub-group will be required to:

1. Design and development of Concrete Mix of a particular Grade of concrete and estimate its hardened properties and stress –strain curve at 28 days
2. Design under-reinforced RC beams using that particular grade of concrete
3. Test the casted RC beams under flexural loading

Project 2: Development of design Sheets for design of beams, rectangular slabs and short columns, and validation of the same using STAAD Pro. Detailing of the Reinforcement of structural elements using AutoCAD

Course Learning Objectives (CLO)

Upon completing this course, the students can:

1. Analyse the flexural members
2. Design and Detail the flexural member with consideration for deflection, shear, bond and torsion
3. Design and detail compression members
4. Design other elements such as footings, stair-case
5. Prepare programmable sheets for design of structural elements and detail the same

Text Books

1. Reinforced Concrete Design, Gambhir, M. L., Prentice Hall of India(2013).
2. Limit State Design of Reinforced Concrete, Jain, A. K.,Arun K. Jain, Dr. Punmia, Laxmi Publications (2016).
3. Limit State Design, Ram Chandra, Standard Book House(2014).
4. Limit State Design of Reinforced Concrete Structures, P. Dayaratnam, P Sarah, Meditech, 2nd Edition, (2017)
5. Design of Reinforced Concrete Structures, N. Subramanian, Oxford University Press, (2013)

Reference Books

1. Reinforced Concrete Design, Pillai &Menon, Tata McGraw Hill Publishers(2022).
2. Limit State Design of Reinforced Concrete, Varghese, P. C., Prentice Hall of India(2008).
3. Fundamentals of Reinforced Concrete, Sinha, S. N. and Roy, S Chand Publishers(2014)

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	35
3	Sessional: (May include the following) Assignment, Regular Lab assessmentand Quizzes, Project	40

UCC404: FUNDAMENTALS OF DATA SCIENCE

L	T	P	Cr
3	0	2	4.0

Course Objective: To elaborate the basics of data science and provide a foundation for understanding the challenges and applications in the field of civil engineering.

Data Science Introduction: Data and types, Big Data and Distributed Databases, Application and purpose of data, Data Science, The data science process.

Introduction to R and RStudio: Installing and configuring RStudio, R Packages, Basic syntax, variables, Operators, Data types, Control Flow, Sequence Generation (range function), StringOperations, Functions, Loop Functions and Debugging (lapply, apply, mapply, tapply, split, Diagnosing), Simulation & Profiling (Random Number, Linear Model, Random Sampling), File Handling in R (Reading different files in R), Introduction to Swirl, Regular Expression.

Data Cleaning and Summarization: Matrices, Factors, Data Frames, Vectors, Lists, Data Cleaning and reading data from different data source, Reading Large Tables, Subsetting and Sorting, Summarizing Data, Creating New Variables, Reshaping Data, Managing Data Frames with dplyr – Introduction, Managing Data Frames with dplyr - Basic Tools, Merging Data

Data Visualization in R: Setting Your Working Directory (Windows), Principles of Analytic Graphics, Lattice Plotting, Base Plotting System, Plotting using ggplot2/Matplotlib library (Histogram, Box Plot, Scatter Plot, Bar Graphs, Line Graph, etc). Data visualization in civil engineering.

Data Science Advance Topics in R: Basics of Correlation, Regression, Stochastic analysis, Working with Color in R Plots, Dimension Reduction:(Principle Component Analysis, Singular Value Decomposition), Model Evaluation Parameters.

Laboratory Work

Implementation of various data analysis techniques to civil engineering problems

Course Learning Objectives (CLO)

The students will be able to:

1. To manage, manipulate, clean, and analyze different types of data
2. To visualize data using different visualization techniques
3. To develop dashboards for real-time data sets
4. To understand data correlation, reduction, and summarization

Text Books

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining Concepts and Techniques, (4th Ed.), Morgan Kaufmann (2022)
2. Roger D. Peng, R Programming for Data Science, Leanpub (2016)

Reference Books

1. Trevor Hastie Robert, Tibshirani Jerome Friedman, The Elements of Statistical Learning, Springer (2017)

UMA012: NUMERICAL AND STATISTICAL COMPUTATIONS

L	T	P	Cr
3	0	2	4.0

Course Objective: The main objective of this course is to understand and implement various numerical and statistical methods to solve civil engineering problems.

Basic of Errors: Floating-point representation, rounding and chopping errors.
Non-Linear Equations: Bisection, Newton - method for simple and multiple roots and order ofconvergence.
Linear Systems and Eigen-Values: Gauss elimination method using partial pivoting, Gauss--Seidel method,
Rayleigh's power method for eigen-values and eigen-vectors of matrix.
Interpolation and Approximations: Lagrange (with error analysis), Newton's divided difference andforward difference interpolation formulas**.**
Numerical Integration: Newton-Cotes quadrature formulae (Trapezoidal and Simpson's rules) and theirerror analysis**.**
Differential Equations: Solution of initial value problems using Euler's, Modified Euler's and Runge-Kutta methods (fourth-order), Solution of boundary value problems using finite difference method.
Curve Fitting and Regression: Curve fitting by the method of least squares- fitting of straight lines, second
degree parabolas, Bivariate distribution, correlation coefficients, regression lines, formula for regressioncoefficients and rank correlation (only two variables).
Probability Distribution: Mathematical expectations, Definition of probability distribution (ProbabilityMass Function and Probability Density Function), Poisson, Binomial, Exponential, Uniform and Normaldistributions.
Laboratory Work: Lab experiments will be set in consonance with materials covered in the theory. Implementation of numerical and statistical techniques using computational software to solve following civil engineering problems:
1. Non Linear Equation: A simply supported beam problem to find the point (s) of zero shear and zero moments.
2. Linear System and Eigen Values: Column problem subjected to axial load and bi-axial moments and to find the principal normal stresses and the direction cosine of the normal principal stresses.
3. Interpolation and Approximation: Find the Water levels of reservoir at intermediate points.
4. Numerical Integration: Find the capacity of a reservoir.
5. Differential Equation: Finding the solution of a single degree of freedom (SDOF) subjected to free and forced vibration.
6. Curve Fitting: Annual rainfall and runoff Analysis to estimate annual runoff volume for a given annual rainfall value.
7. Probability Distribution: Transportation Engineering Problem to get the mean speed for highway design.

Course Learning Objectives (CLO)

The students will be able to:

1. Obtain numerical solution of nonlinear equations using bisection and Newton-Raphson methods.
2. solve system of linear equations numerically using direct and iterative methods.
3. construct interpolating polynomials with practical exposure and analyze the correlated data using linear regression models.
4. solve integration and initial value problems numerically. .
5. solve civil engineering problems using various probability distributions.

Text Books

1. E. Ward Cheney and David R. Kincaid, Numerical Mathematics and Computing, Cengage, 2013.
2. Walpole, Ronald E., Myers, Raymond H. Myers, and Sharon L. Myers, Probability and Statistics for Engineers and Scientists, 9th edition Pearson Education, 2012

Reference Books

1. Burden L. R., Faires D. J. and Burden A.M., Numerical Analysis, Brooks Cole, 10th edition, 2015.
2. Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers, McGraw-Hill Higher Education; 7th edition, 2016.
3. M.K. Jain, S.R.K. Iyengar, and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, 2022.
4. Richards A. Johnson, Probability and Statistics for Engineers, 9th Edition, PHI Learning,2018

Evaluation Scheme

Sr. No.	Evaluation elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessional: May include lab assignments/quizzes	15
4.	Laboratory evaluation	20