COURSE STRUCTURE

AND

SYLLABUS FOR

UNDER GRADUATE (B. Tech)

IN

CIVIL ENGINEERING

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

CE UG 3rd Semester Course Structure & Syllabus

(In line with AICTE / NEP)

Semester – 3

Sl.	Code No.	Course Title	L	T	P	Credits
1.	UCE301	Concrete Technology	3	0	0	3
2.	UCE302	Fluid Mechanics	2	1	0	3
3.	UCE303	Solid Mechanics	2	1	0	3
4.	UCE304	Civil Engineering Materials, Testing & Evaluation	3	0	0	3
5.	UMA301	Engineering Mathematics-III	2	1	0	3
6.	UCE371	Concrete Technology and Materials Testing Laboratory	0	0	2	1
7.	UCE372	Fluid Mechanics Laboratory	0	0	2	1
8.	UCE373	Building Planning and Computer Aided Drawing Laboratory	0	0	2	1
9.	UHS301	Indian Knowledge System	2	0	0	2
10.	UCH301	Environmental Science	2	0	0	0
		Total Credit	16	3	6	20

Course Code:	UCE301
Course Title:	Concrete Technology
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	The objective of this course is to impart knowledge on: 1. the theoretical concept of producing concrete as a construction material with different types of aggregates and admixtures, 2. the properties of fresh and hardened concrete, mechanism of hydration of cement, factors affecting elasticity, creep and shrinkage in concrete, 3. the concept of mix design of concrete; its importance in estimation of composition of materials, 4. various types and applications of special concrete, and 5. various types of non-destructive testing of concrete
Pre-requisites:	UCH201: Engineering Chemistry
Course outcomes:	After completion of this course students will be able to 1. Define the functional role of all ingredients of concrete and their use for normal and special purpose concrete. 2. Apply the principle of sustainability for the utilization of waste, novel and innovative materials for use in concrete. 3. Formulate concrete mix for normal and special purpose concrete. 4. Use of various non-destructive testing procedure for evaluation of concrete properties.

Module no.	Topic	Nos. of contact hours
1	**Properties of ingredients:** Properties of coarse and fine aggregates and their influence on concrete, types of cement and their use, Grades of ordinary Portland cement, Portland pozzolana cement, rapid hardening Portland cement, hydrophobic cement, low heat Portland cement and sulphate resisting Portland cement as per relevant IS codes. Types of aggregates and their properties. Testing of aggregates as per relevant IS Codes.	6
2	**Properties of different types of concrete:** Concrete for structural work, light weight concrete, high density concrete, biological concrete, workability, durability and strength requirements, effect of w/c ratio on properties of fresh and hardened concrete, acceptability criteria, laboratory testing of fresh and hardened concrete, Fire resistant properties of hardened concrete.	4
3	**Concreting methods:** Process of manufacturing of concrete, transportation, placing, compaction and curing of concrete. Extreme weather concreting, special concreting methods, vacuum dewatering– underwater concrete, special form work., Plum Concrete, Self-Compacting Concrete.	4

4	**Admixtures:** Plasticizers, Retarders, Accelerators and other Admixtures, Test on Admixtures, Chemistry and Compatibility with concrete. GGBS fly Ash, Metakaolin, Silica Fumes, crush sand.	4
5	**Ready mix concrete:** Requirements of ready-mix concrete, properties of RMC, transit mixer details, Automation, instrumentation and Layout of RMC plant.	4
6	**Concrete mix design:** Mix Design for compressive strength by I.S. methods, road note method, British method, ACI Method, Mix design for flexural strength.	6
7	**Concrete for repairs and rehabilitation of structures:** High Performance concrete, Polymer Concrete, Fiber Reinforced Concrete, Light weight concrete and its manufacture, Polymer Impregnated Cement Concrete, Polymer Modified cement concrete and Ferro Cement, Special Tests for concrete used for repairs and rehabilitation.	4
8	**Non-destructive testing of concrete:** Rebound hammer test, Ultrasonic pulse velocity test, Magnetic particle testing, Liquid penetration testing, Visual testing, Laser Testing methods, Leak Testing, Impact echo test, carbonation test, Half-cell potentiometer and corrosion of steel, Core test and relevant provisions of IS codes.	4

Textbooks:

1. M.L. Gambhir (2017). Concrete Technology (*5th ed.*). McGraw Hill Book Company. ISBN-1259062554, 978-1259062551.
2. M.S. Shetty (2018). Concrete Technology, Theory and Practice (*6th ed.*). S. Chand Publication. ISBN- 9788121900034,978-8121900034
3. B.L. Gupta and A. Gupta (2013). Concrete Technology. Jain Book Agency. ISBN - 8180140407,978-8180140402.

Recommended Reading:

1. IS 10262: 2009. Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi.
2. IS 10262: 2009. Mix Design. Bureau of Indian Standards, New Delhi.
3. IS 269: 2015. Ordinary Portland Cement (33 Grade). Bureau of Indian Standards, New Delhi.
4. IS 12269: 2013. Ordinary Portland Cement (53 Grade). Bureau of Indian Standards, New Delhi.
5. IS 650: 1991. Specification of Standard Sand. 8. IS383 (1970), Specification for Coarse and Fine Aggregates. Bureau of Indian Standards, New Delhi.
6. IS 456: 2000. Plain And Reinforced Concrete Code of Practice. Bureau of Indian Standards, New Delhi.

Course Code:	UCE302
Course Title:	Fluid Mechanics
Course Credit:	3 (L: 2 T: 1 P: 0)

Course objective:	1. Introduce the concepts of fluid mechanics useful in Civil Engineering applications 2. Measurement of pressure, computations of hydrostatic forces and the concepts of Buoyancy. 3. Identifying the nature and behavior of fluid flows and distinguishing fluid dynamics and kinematics 4. Describe the boundary layer flows and predict the drag and lift forces 5. Classify the head losses in pipe flows and skill seeing of measurement of flows.
Pre-requisites:	Basic engineering mathematics; Engineering mechanics
Course outcomes:	After completion of this course students will 1. Understand the various properties of fluids and their influence on fluid motion and analyse a variety of problems in fluid statics and dynamics. 2. Calculate the forces that act on submerged planes and curves. 3. Identify and analyse various types of fluid flows. 4. Draw simple hydraulic and energy gradient lines. 5. Measure the quantities of fluid flowing in pipes and channels

Module no.	Topic	Nos. of contact hours
1	**Basic Concepts and Definitions –** Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.	8
2	**Fluid Statics** - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.	9
3	**Fluid Kinematics**- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Streamline, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three - dimensional continuity equations in Cartesian coordinates	7

4	**Fluid Dynamics**- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.	12

Textbooks:

1. Streeter, Victor L., Streeter, Bedford, Keith W. (1997). Fluid Mechanics, McGraw Hill.
2. F.M., White. (2007). Fluid Mechanics, 6th Edition, Tata McGraw Hill.
3. P.N., Modi. and S.M., Seth. (1998). Hydraulics and Fluid Mechanics, Standard Book House.
4. Fox and Mc Donald, Introduction to Fluid Mechanics, 7th Edition, John Wiley, 2009.

Reference Books:

1. K. S., Massey. (1979). Mechanics of Fluids, Van Nostrand Reinhold Co., 1979
2. J., Frabzini. (1997). Fluid Mechanics with Engineering Applications, McGraw Hill, 1997
3. J.H., Spurk. (2003). Fluid Mechanics - Problems and Solutions, Springer, 2003

Course Code:	UCE303
Course Title:	Solid Mechanics
Course Credit:	3 (L: 2 T: 1 P: 0)

Course objective:	1. Introduces continuum mechanics and material modeling based on energy principles. 2. Covers key concepts: deformation, strain, momentum balance, stress, elasticity, and plasticity. 3. Emphasizes a unified approach using thermodynamics for material understanding and design. 4. Focuses on analytical methods to determine strength, stiffness, and stability of structural members. 5. Considers both equilibrium laws and material mechanical properties. 6. Highlights the role of experimental data in understanding material behavior.
Pre-requisites:	Basic engineering mathematics; Engineering mechanics
Course outcomes:	After completion of this course students will 1. Understand elasticity theory, strain/displacement relationships, and Hooke's law; perform strength and stability calculations. 2. Analyze and calculate combined stresses in members and structures using classical and energy methods. 3. Use Mohr's circle to evaluate combined stresses; determine shear center in thin-walled beams. 4. Compute beam deflections under various loads; analyze unsymmetrical loading; apply failure criteria and solve torsion problems in solid and thin-walled members.

Module no.	Topic	Nos. of contact hours
1	**Simple Stresses and Strains** Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.	8
2	**Compound Stresses and Strains** Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.	5
3	**Bending moment and Shear Force Diagrams**	8

	Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.	
4	**Flexural Stresses** *Theory of simple bending* – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.	5
5	**Shear Stresses** Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.	3
6	**Torsion** Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs.	5
7	**Thin Cylinders and Spheres** Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.	3

Textbooks:

1. D.S. Bedi, “Strength of Materials”, Khanna Book Publishing Co.
2. AICTE Prescribed Textbook: Physics (Introduction to Mechanics), Bhattarchaya, A.B., Khanna Book Publishing Co., 2023.
3. Timoshenko, S. and Young, D. H., “Elements of Strength of Materials”, DVNC, New York, USA.

Reference Books:

1. Kazmi, S. M. A., “Solid Mechanics” TMH, Delhi, India.
2. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
3. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
5. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf – TMH 2002.
6. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
7. Laboratory Manual of Testing Materials - William Kendrick Hall

Course Code:	UCE304
Course Title:	Civil Engineering Materials, Testing and Evaluation
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	1. To learn about various construction materials and understand their relevant characteristics. 2. To be able to identify suitability of various materials for different construction purposes. 3. To know about natural, artificial, and processed materials available for various purposes of construction activities.
Pre-requisites:	Engineering Chemistry
Course outcomes:	After competing this course, student will be able to: 1. Identify relevant construction materials. 2. Identify relevant natural construction materials. 3. Select relevant artificial construction materials. 4. Select relevant special type of construction materials. Identify and use of processed construction materials.

Unit	Topic	Nos. of contact hours
1	**Natural Construction Materials** Stones – Requirements of good building stone, General characteristics of stone, Quarrying and dressing methods and tools for stone, Timber – Structure of timber, General properties and uses of good timber, Different methods of seasoning for preservation of timber, Defects in timber, Use of bamboo in construction, Asphalt, bitumen and tar used in construction, their properties and uses, Properties of lime, its types and uses, Properties of sand and uses, Classification of coarse aggregate according to size.	10
2	**Artificial Construction Materials** Bricks – Constituents of brick earth, Conventional / Traditional bricks, Modular and Standard bricks, Special bricks –fly ash bricks, Characteristics of good brick, Field tests on Bricks, Flooring tiles – types and uses, Precast concrete blocks – hollow, solid, pavement blocks, and their uses, Plywood, Particle board, Veneers, laminated board and their uses, Types of glass – Soda lime glass, lead glass and borosilicate glass and their uses, Ferrous and non-ferrous metals – Manufacturing processes, properties, defects and uses.	10
3	**Special Construction Materials** Types of material and suitability in construction works of following materials, Water proofing, Termite proofing, Thermal and sound insulating materials, Fibers – Types –Jute, Glass, Plastic Asbestos Fibers, (only uses)	7
4	**Processed Construction Materials**	10

	Constituents and uses of POP (Plaster of Paris), POP finishing boards, sizes and uses, Wall Putty, Paints – Whitewash, Cement paint, Distempers, Oil Paints and Varnishes with their uses (Situations where used), Industrial waste materials- Fly ash, Blast furnace slag, Granite and marble polishing waste and their uses	

Textbooks:

1. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, Delhi
2. Varghese, P.C., Building Materials, PHI learning, New Delhi.

Reference Books:

1. Rangwala, S.C., Engineering Materials, Charator publisher, Ahemdabad.
2. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.

Course Code:	UCE371
Course Title:	**Concrete Technology and Materials Testing Laboratory**
Course Credit:	1 (L: 0 T: 0 P: 2)

Course objective:	The objective of this course is to impart knowledge on: 1. the properties of cement, aggregate and water used in concrete, 2. the characteristics of concrete and its components including admixtures, 3. the types and characteristics of various construction materials and their suitability for different construction purposes.
Pre-requisites:	UCH271: Engineering Chemistry Lab
Course outcomes:	After completion of this course students will be able to 1. identify different types of cement by performing laboratory tests. 2. know the physical properties of fine and coarse aggregates. 3. prepare concrete of required specification. 4. use appropriate admixtures for improving the workability of concrete. 5. identify appropriate natural, artificial, processed of special types of materials for different construction purposes

Unit	Experiments	Nos. of contact hours
1	1. Determination of zones of fine aggregate by sieve analysis. 2. Determination of bulking of sand. 3. Determination of standard consistency of cement. 4. Determination of Initial and final setting time of cement. 5. Determination of Compressive strength of cement. 6. Determination of workability of concrete by slump cone test. 7. Determination of workability of concrete by compaction factor test. 8. Determination of percentage of flow by flow table test. 9. Determination of compressive strength of concrete. 10. Demonstration of NDT equipment.	12
2	1. Determination of various sizes of available coarse aggregates from sample of ___ kg in laboratory and prepare report (60, 40, 20, 10 mm) 2. Determination of Flakiness index and elongation index test of coarse aggregates. 3. Determination of Water absorption test of coarse aggregates. 4. Determination of Particle size distribution of fine aggregates. 5. Specific gravity test of fine aggregates.	12

	6. Determination and selection of first class, second class and third-class bricks from the stake of bricks and prepare a report based on its shape and dimensions. 7. Field tests like dropping, striking and scratching by nail and correlate the results obtained. 8. Determination of Water Absorption on bricks per IS: 3495 (part II), IS: 1077 or tile IS: 1237. 9. Determination of Compressive strength of dry and wet bricks as per IS: 3495(part I), IS: 1077 10. Determination of Elastic Behaviour of metals / Tension test on mild steel as per IS: 432(1). 11. Determination of tension test on Tor steel as per IS: 1608, IS: 1139. 12. Conduct Abrasion Test on flooring tiles (anyone) e.g. Mosaic tiles, Ceramic Tiles as per IS:13630 (part7), Cement Tile as per IS: 1237. 13. Tests on unmodified bitumen and modified binders with and without polymers.	

Textbooks:

1. Sood, H., Kulkarni P. D., Mittal L. N. (2003). Laboratory Manual in Concrete Technology (*1st ed.*). CBS Publishers, New Delhi. ISBN-13 9788123909417
2. Sood H. (1996) Laboratory Manual on Testing of Engineering Materials (*1st ed.*). New Age Publishers, New Delhi. ISBN-10 8122407579, ISBN-13 978-8122407570

Recommended Books:

1. Gambhir, M.L., Concrete Technology, Tata McGraw Hill Publishing Co. Ltd., Delhi.
2. Shetty, M.S., Concrete Technology, S. Chand and Co. Pvt. Ltd., Ram Nagar, Delhi.
3. Santhakumar, A. R., Concrete Technology, Oxford University Press, New Delhi.
4. Neville, A. M. and Brooks, J.J., Concrete Technology, Pearson Education Pvt. Ltd.
5. Neville, A. M., Concrete Technology, Pearson Education Pvt. Ltd., New Delhi.
6. Ghose, D. N., Construction Materials, Tata McGraw Hill, New Delhi.
7. S.K. Sharma, Civil Engineering Construction Materials, Khanna Publishing House, New Delhi
8. Varghese, P.C., Building Materials, PHI learning, New Delhi.
9. Rangwala, S.C., Engineering Materials, Charator publisher, Ahmedabad.
10. Somayaji, Shan, Civil Engineering Materials, Pearson education, New Delhi.
11. Rajput, R.K, Engineering Materials, S. Chand and Co., New Delhi.
12. Sharma C. P., Engineering Materials, PHI Learning, New Delhi.
13. Duggal, S. K, Building Materials, New International, New Delhi.

Course Code:	UCE372
Course Title:	Fluid Mechanics Laboratory
Course Credit:	1 (L: 0 T: 0 P: 2)

Course objective:	1. To understand basic properties of fluids. 2. To learn fluid statics and dynamics 3. To study basics of flow visualization. 4. To understand Bernoulli's theorem and its applications. 5. To understand losses in flow, drag and lift forces. 6. To learn to establish relation between flow parameters.
Pre-requisites:	--
Course outcomes:	After completion of this course students will 1. Understanding of basic physics of fluids. 2. Gaining knowledge to calculate and design engineering applications involving fluid. 3. Understanding of analyzing flow systems in terms of mass, momentum, and energy balance. 4. Having knowledge about current research topics about fluid mechanics.

Unit/ Module no.	Topic	Nos. of contact hours
1	1. Measurement of viscosity 2. Study of Pressure Measuring Devices 3. Stability of Floating Body 4. Hydrostatics Force on Flat Surfaces /Curved Surfaces 5. Verification of Bernoulli's Theorem 6. Venturi meter 7. Orifice meter. Impacts of jets 9. Flow Visualisation -Ideal Flow 10. Length of establishment of flow 11. Velocity distribution in pipes 12. Laminar Flow	24

Textbooks:

1. Streeter, Victor L., Streeter, Bedford, Keith W. (1997). Fluid Mechanics, McGraw Hill.
2. F.M., White. (2007). Fluid Mechanics, 6th Edition, Tata McGraw Hill.
3. P.N., Modi. and S.M., Seth. (1998). Hydraulics and Fluid Mechanics, Standard Book House.
4. Fox and Mc Donald, Introduction to Fluid Mechanics, 7th Edition, John Wiley, 2009.

Reference Books:

1. K. S., Massey. (1979). Mechanics of Fluids, Van Nostrand Reinhold Co., 1979
2. J., Frabzini. (1997). Fluid Mechanics with Engineering Applications, McGraw Hill, 1997
3. J.H., Spurk. (2003). Fluid Mechanics - Problems and Solutions, Springer, 2003

Course Code:	UCE373
Course Title:	Building planning and computer-aided drawing lab
Course Credit:	1 (L: 0 T: 0 P: 2)

Course objective:	**1.** To understand the details of construction of different building elements. **2.** To visualize the completed form of the building and the details of construction based on the engineering drawings. **3.** To achieve skill sets to prepare computer aided engineering drawings
Pre-requisites:	Civil Engineering Drawing, AutoCAD Software
Course outcomes:	After completion of course, students will be able to 1. Implement principles of planning of buildings 2. Design and draw various constructional drawing of the buildings. **3.** Plan various building services.

Unit	Topic	Nos. of contact hours
1	Preparation of detailed constructional plan of a residential building.	4
2	Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.	4
3	Concept of perspective drawing- one point, two-point, three point and uses. • Preparation of line plans of various public buildings like: Building for Education – School, College, Library • Building for health –Dispensary, Hospital Industrial structure Building for entertainment Theatre, Club House, Sports Club. Other Structure- Office, Hostel, Guest house.	6
4	Prepare layout for water supply and drainage for a residential building and for multi-storied buildings.	4
5	Building's Solid Waste Collection and disposal system: Wet and dry solid waste segregation, Vermi-composting etc. Provision of Chutes.	4
6	Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols	4

Textbooks:

1. Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)
2. M.G. Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).

3. Building Services Environmental and Electromechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

Reference Books:

1. Bureau of Indian Standards, "Handbook of Functional Requirements Of Buildings, (SP-41 & SP- 32)", BIS 1987 and 1989, (SP-41: ISBN: 8170610117).
2. Croome, J. D. & Roberts, B. M., "Air-Conditioning and Ventilation of Buildings Vol-1". Pergamon Press, (ISBN: 0080247792).
3. SP-35 (1987): Handbook of Water supply & drainage-BIS, (SP- 35: ISBN: 8170610095).
4. N.B.C.-2016, Volume 1 & 2, BIS, (ISBN: 8170610990).

Course Code:	UHS301
Course Title:	Indian Knowledge System
Course Credit:	2 (L: 2 T: 0 P: 0)

Course objective:	This course aim is 1. To understand our rich culture and traditions of Indian knowledge system to students of various discipline. 2. To spread awakening about scientific and eternal knowledge of the Indian knowledge system. 3. To promote advance study and inter disciplinary research on all aspects of Indian knowledge system.
Pre-requisites:	
Course outcomes:	At the end of the course, students will be able to gain insights into the concept of traditional knowledge and its relevance. They will also be able to understand and connect up the basics of Indian traditional knowledge with modern perspective and how to carry forward.

Module no.	**Topic**
Module I	**Bhārātīya Civilization and Development of Knowledge System**
	An Overview of Indian Knowledge System (IKS), Importance of Ancient Knowledge, Definition of IKS, Classification Framework of IKS, The Vedas, Indian Philosophical System, Different Schools of Philosophy, Ancient Education System, the TakṢaśilā University, the Nālandā University, Governance, Public Administration and Management System reference to Artha Sastra, Kautilyan State.
Module II	**Arts, Literature and Scholars**
	Linguistics: Components of a Language – Panini's work on Sanskrit Grammar, Phonetics in Sanskrit and the role of Sanskrit in Natural Language Processing, Art, Music, and Dance, Natarāja - a Masterpiece of Bhārātīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghosā, Vālmiki, Patañjali, Vedavyāsa, Kautilya, Panini, Aryabhata.
Module III	**Engineering, Technology, and Architecture**

	-Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, -Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet-Dwārkā. Concepts of Zero and Pi, Number System. Pythagoras Theorem and Vedic Mathematics.
Module IV	**Life, Environment, and Health**
	Ethnic Studies, Health, Wellness & Psychology, Agriculture, Ecology and Environment, Triguna System Body-Mind-Intellect-Consciousness Complex, Āyurveda, Integrated Approach to Healthcare, Yoga, etc.

Textbooks:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2. History of Science in India Volume- 1, Part-1, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishna Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et at. Sanskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012)
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Paper code: UCH301

Paper name: Environmental Science **Credit:0**

Total contact hours: 24 **L-T-P: 2-0-0**

Module 1

General concept and ecosystem: Basic idea of environment and basic concepts related to perspectives. Man, society and environment and their inter relationship. Ecosystem, biotic and a biotic component. Open system, closed system, species, population, community. Ecological balance and consequence of change.

Module 2

Population dynamics and Environment: Mathematics of population growth and associated problems. Different types of resources, renewable, non-renewable and potentially renewable resources and effects of population growth on resources and environment. Environmental impact assessment.

Module 3

Air pollution and Control:

3.1 Atmospheric composition and energy balance: Different layers of atmosphere, tropopause, stratopause and mesopause. Conductive and Convective and Radiation heat transfer and concepts of blackbody. Global temperature model (Earth as black body and Earth's albedo) Greenhouse effect and it's consequence on global climate change, sea water level, agriculture and marine food.

3.2 Atmospheric dispersion of pollutants: Atmospheric stability, Temperature and Radiation inversions, Adiabatic lapse rate and ambient lapse rate, maximum mixing depth, ventilation coefficient.

3.3 Air pollutant sources and biochemical effects: Toxic chemicals in the air, suspended particulate matter, carbon dioxide, sulphur dioxide, oxides of nitrogen, lead, carbon monoxide. Primary and secondary pollutants, criteria pollutants, sulphurous smog and photochemical smog. CFC and its impact on depletion of ozone layer.

3.4 Standards and Control measures: Industrial commercial and residential air quality standard. Electrostatic precipitator, Cyclone separator, bag house, catalytic converter, scrubber (Venturi).

Module 4
Water Pollution and Control:
4.1 Important parameters: Effect of Oxygen demanding wastes, pathogens, nutrients, dissolved oxygen, Concepts of BOD and COD and BOD reaction rate constant.
4.2 Wastewater treatment: Primary and secondary treatments (Activated sludge process, trickling filters, rotating biological contactor, oxidation ponds) and tertiary treatment.
4.3 Basics of ground water flow: Aquifers, Hydraulic gradient and ground water flow.

Module 5
Land Pollution: Municipal, Industrial, commercial, agricultural and hazardous solid wastes. Recovery and conversion methods. Waste management, land filling, incineration and composting.

Module 6

Noise pollution: Definition of noise pollution, Concept of decibel (dB) and effects of noise pollution, noise classification and control of noise pollution.

References Books:
1. Masters, G.M., “Introduction to Environmental Engineering and Science” Prentice –Hall of India Pvt. Ltd., 1991.
2. Nebel, B.J., “Environmental Science”, Prentice – Hall Inc., 1987
2. Environmental Chemistry by A. K. De, New Age International.
3. Water Pollution and Management – Varshney C.K., New Age International.

COURSE STRUCTURE

AND

SYLLABUS FOR

UNDER GRADUATE (B. Tech)

IN

COMPUTER SCIENCE AND ENGINEERING

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

CSE UG 3rd Semester Course Structure & Syllabus

(In line with AICTE / NEP)

Semester – 3

Sl.	Code No.	Course Title	L	T	P	Credits
1.	UEC305	Digital Electronics	3	0	0	3
2.	UEC375	Digital Electronics -Lab	0	0	4	2
3.	UCS301	Data Structures and Algorithms	3	1	0	4
4.	UCS371	Data Structures and Algorithms-Lab	0	0	4	2
5.	UCS302	Introduction to Programming using Python	2	1	0	3
6.	UCS372	Introduction to Programming using Python -Lab	0	0	2	1
7.	UMA301	Engineering Mathematics-III	2	1	0	3
8.	UHS301	Indian Knowledge System	2	0	0	2
9.	UCH301	Environmental Science	2	0	0	0
		Total Credit				20

Course Code:	UEC305
Course Title:	Digital Electronics
Course Credit:	3 (L: 3 T: 0 P: 0)

Course objective:	To equip students with a comprehensive understanding of digital electronics principles and their applications in designing and analyzing digital systems. The course aims to develop proficiency in binary number systems, Boolean algebra, and logic minimization techniques; enable students to design and analyze combinational and sequential logic circuits; and provide knowledge of semiconductor devices and various logic families, focusing on their characteristics and performance parameters. By the end of the course, students will be able to apply these concepts to construct efficient digital circuits and understand their practical implementation in modern electronic systems.
Pre-requisites:	Nil
Course outcomes:	After completion of this course students will 1. Manipulate binary numbers, codes, and floating-point representations for digital systems. 2. Apply Boolean algebra and minimization techniques to optimize logic expressions. 3. Design and analyze combinational circuits like adders, decoders, and multiplexers. 4. Develop sequential circuits, including flip-flops, registers, and counters efficiently. 5. Evaluate semiconductor devices and logic families for circuit performance.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	**Binary Numbers & Digital Logic:** Signed binary numbers, binary codes, cyclic codes, error detecting and correcting codes, hamming codes. Floating point representation. Boolean algebra, minimization of logic expressions, the map method up to five variable, don't care conditions, POS simplification, NAND and NOR implementation, QuineMc-Clusky method (Tabular method).	12	25
2	**Combinational Logic:** Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers, multiplexer based design.	10	25
3	**Sequential Logic:** Sequential circuits, storage elements: latches, flip flops, analysis of clocked sequential circuits, state reduction and assignments, design procedure. Registers and counters: Shift registers, ripple counter, synchronous counter, other counters.	10	25
4	**Semiconductor Devices and Logic Families:** BJT characteristics, BJT as a switch, n-MOSFET and p-MOSFET characteristics,	10	25

	MOSFET as a switch. TTL, ECL and CMOS logic families – Key parameters: Fan in, Fan out, Noise margin, Propagation delay, Power dissipation.		

Text Book:

1. M. Morris Mano and M. D. Ciletti, Digital Design, 4th Edition, Pearson Education
2. A. P. Malvino, D. P. Leach and G.Saha, Digital Principles and Applications, 7/e, McGraw Hill, 2010.

References:

1. R. H. Katz and G. Boriello, Contemporary Logic Design, 2/e, Prentice Hall of India, 2009.
2. A. S. Sedra and K. C. Smith, Microelectronics Circuits, Oxford, 2014.
3. S. C. Lee, Digital Circuits and Logic Design, Prentice Hall of India, 2006.

Course Code:	UEC375
Course Title:	Digital Electronics Lab
Course Credit:	1 (L: 0 T: 0 P: 2)

4. J. F. Wakerly, Digital Design Principles and Practices, 4/e, Prentice Hall of India, 2008.

Course objective:	The objective of the Digital Electronics Lab is to provide hands-on experience in designing, implementing, and verifying digital circuits using standard integrated circuits (ICs) and simulation tools like Logisim. Students will develop practical skills in constructing and analyzing logic gates, combinational circuits (e.g., adders, multiplexers, decoders, encoders, and code converters), and sequential circuits (e.g., latches, flip-flops, counters, and sequence detectors). The lab aims to foster an understanding of Boolean algebra, TTL and CMOS logic gate implementations, and their real-world applications, enabling students to effectively translate theoretical concepts into functional digital systems.
Pre-requisites:	Nil
Course outcomes:	Upon successful completion of the Digital Electronics Lab, students will be able to: 1. Verify Boolean algebra postulates using logic gate ICs experimentally. 2. Design and implement combinational circuits like adders, multiplexers, and decoders. 3. Construct and analyze code converters for binary-to-grey and grey-to-binary operations. 4. Develop sequential circuits, including latches, flip-flops, and counters using Logisim. 5. Implement and compare TTL and CMOS logic gates for practical applications.

Unit/ Module no.	Topic	Nos. of contact hours	Distribution of marks (out of 100)
1	Familiarization of Logic Gate ICs OR Verification of Boolean algebra postulates	2	10
2	1-bit comparator OR Binary-to-Grey & Grey-to-Binary code converters	2	10
3	Half adder & Full adder	2	10
4	4x1 Multiplexer and 1x4 Demultiplexer OR 2x4 Decoder and 4x2 Encoder	2	10
5	BCD adder using IC74LS83	2	10
6	Multiplexer (IC74153) based logic design	2	10
7	Latches, Flipflops and their conversion using Logisim OR Ripple Counter using Logisim	2	10
8	Synchronous counter using Logisim	2	10
9	Sequence detector using Logisim	2	10
10	Implementation TTL Gates OR Implementation CMOS Gates	2	10

Text Book:

1. Digital Electronics: A Comprehensive Lab Manual by Cherry Bhargava (BS Publications, 1st Edition, 2020).
2. A Textbook of Digital Electronics by S.S. Bhatti and Rahul Malhotra (I K International Publishing House Pvt. Ltd, 2011).

References:

1. "Digital Design" by M. Morris Mano and Michael D. Ciletti (Pearson, 5th Edition, 2012).
2. "Fundamentals of Digital Logic with Verilog Design" by Stephen Brown and Zvonko Vranesic (McGraw-Hill Education, 3rd Edition, 2013).

Subject Code	Subject Name	L-T-P	Credit
UCS301	Data Structures and Algorithms	3-1-0	4

UCS301: Data Structures and Algorithms

L-T-P: 3-1-0 Credit: 4 Total Contact Hours: 45

Module 1: Hours: 3

Introduction: Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Abstract Data Types (ADT), Structures, Union.

Performance of algorithms: Space and Time complexity measures, Asymptotic notations, Best case, Worst case and Average case analysis, Lower and Upper bounds, Operations on data.

Module 2: Hours: 4

Arrays: Definition, Single and Multidimensional Arrays, Concept of Pointers, Representation of Arrays: Row Major Order and Column Major Order, Application of arrays, Sparse Matrices and their representations.

Module 3: Hours: 5

Linked lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly linked List, Circularly Linked List, Operations on a Linked List- Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List.

Module 4: Hours: 5

Stacks: Introduction, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion.

Module 5: Hours: 5

Queues: Introduction, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues, Dequeue and Priority Queue, Application of queues.

Module 6: Hours: 5

Trees: Basic terminology, Binary Trees, Binary Tree Representation: Array and Linked Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Tree Traversal algorithms: Inorder, Preorder and Postorder.

Module 7: Hours: 5

Searching: Sequential search, Binary Search, Comparison and Analysis

Internal Sorting: Insertion Sort, Selection Sort, Bubble Sort, Quick Sort, Merge Sort, Heap Sort, Radix Sort, Practical consideration for Internal Sorting.

Module 8: Hours: 4

Search Trees: Binary Search Trees (BST), Insertion and Deletion in BST, Complexity of Search Algorithms, AVL trees, Introduction to m-way Search Trees, B Trees & B+ Trees

Module 9: Hours: 5

Graphs: Terminology, Sequential and Linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth First Search

Module 10: **Hours: 4**

Hashing: Hash Function, Collision Resolution Strategies Storage Management: Garbage Collection and Compaction.

File Structures: Sequential and Direct Access, Relative files, Indexed files, B+ tree as index, Multi-index files, Hashed files.

Books/References:

Data Structures and Algorithms, A. V. Aho, J. E. Hopcroft, J. E. Ullman, Addison Wesley.

Fundamentals of Data Structures, E. Horowitz, S. Sahni, Galgotia Publ.

Data Structures using C, A.S. Tanenbaum

Algorithms, Data Structures, and Problem Solving, Addison Wesley.

Data Management and File Structures, Loomis, Marry, PHI

Data Structures & Algorithm Analysis in C++, M. A. Weiss, Addison Wesley.

Theory and Problems of Data Structures, Lipschutz, McGraw Hill.

Learning with C++, Neil Graham, McGraw Hill

Subject Code	Subject Name	L-T-P	Credit
UCS371	Data Structures and Algorithms Lab	0-0-4	2

UCS371: Data Structures and Algorithms Lab

L-T-P: 0-0-4 Credit: 2 Total Contact Hours: 45

Linear Data Structure

Implementation of arrays, 1-D and 2–D arrays, array operations: insertion, deletion, searching, sorting and merging.

Implementation of linked lists: operations on single linked lists: inserting, deleting, traversing, merging and inverting a linked list, operations on doubly linked lists and circular linked lists, polynomial addition and polynomial multiplication.

Stacks and Queues: Implementation of stack and queue using array and linked list, adding and deleting elements, Applications of stack, implementation of circular queue, operations on circular queue.

Non Linear Data Structure

Implementation of trees, recursive and non-recursive tree traversals, operations on binary trees.Threaded binary trees, insertion and deletion on Binary search trees, AVL trees, application of trees. Implementation of graphs using adjacency matrix and adjacency lists, Graph traversals.

Application of sorting and searching algorithms

Hash table implementation: inserting and deleting, searching & sorting techniques.

Subject Code	Subject Name	L-T-P	Credit
UCS302	Introduction to Programming using Python	2-1-0	3

UCS302 : Introduction to Programming using Python

L-T-P: 2-1-0 Credit: 3 Total Contact Hours: 26

Module 1: Introduction Hours: 3

Basic components of computer, Execution mechanism of program in computer, Concept of Compiler, Interpreter. Brief of Machine Language, Assembly Language, and High Level language.

Module 2: Basic Concepts in Programming Paradigms Hours: 3

Problem analysis, Principles and styles of problem-solving, Algorithm, Flow chart, Pseudo code, Syntax, Introduction to Python.

Module 3: Data types and control structures Hours: 5

Data types, variables, expressions, and statements, Operators (unary, arithmetic, etc.), Conditional statement, Assignment statements, Strings and string operations, Control Structures: loops and decision

Module 4: Function Hours: 5

Defining functions, Functions and arguments (signature), Recursion, Modularization.

Module 5: Array, List, Dictionary Hours: 5

Array, 2D array, Matrix operation, List and Dictionary and their advantages and utility, Tuple and Set.

Module 6: Object oriented concept Hours: 3

Basic concept of object oriented, Class and Object, Difference with structural programming, Object oriented design.

Module 7: Python libraries Hours: 2

NumPy, Basics of NumPy, Various operations on NumPy, Pandas, Basics of Pandas, Reading file using Pandas, DataFrames creation using Pandas.

Books

Introduction to Computation and Programming using Python, by John Guttag,

Python Programming: Using Problem Solving Approach by Reema Thareja

Python Programming: An Introduction to Computer Science by John Zelle

Introduction to Python Programming by Gowrishankar S and Veena A

Online Materials:

https://www.kaggle.com/learn/python

https://docs.python.org/3/tutorial/index.html

Subject Code	Subject Name	L-T-P	Credit
UCS372	Introduction to Programming using Python - Lab	0-0-2	1

UCS372 Introduction to Programming using Python- Lab

L T P: 0 0 2 Credit: 1 Total Contact Hours: 26

1.1 Swap of two numbers

1.2 Find the largest of three numbers

1.3 Given the principal amount, rate of interest, and number of years, calculate both simple interest and compound interest.

2.1 Find the GCD and LCM of two numbers

2.2 Computes the roots of a quadratic function.

2.3 Write a program to find the factorial of the given number (n! = n*n-1*n-2* … * 2* 1)

3.1 Print the "Hello World" ***n*** times, where n is any user defined number.

3.2 Print the Pascal triangle of row ***n,*** where n is any user defined number.

3.3 Write a program for Bubble sort.

4.1 Write a function to calculate ***n!*** recursively.

4.2 Calculate the value of ***nCr*** and ***nPr*** for a given ***n*** and ***r***.

4.3 Given a number, check whether it is prime.

5.1 Add and multiply two matrices.

5.2 Using list, store all the user input names and display in the same ordered as entered.

5.3 Store the content of a list (with duplicate entries) in a set and display the set content.

5.4 Store the student information in a (RollNo, Name) pare in a dictionary and retrieve any name with a given RollNo.

5.1 Using NumPy library perform the matrix operations like addition, multiplication, inverse.

5.2 Solve a set of linear equations (Example, 2x + y = 8 and 3x + 4y = 18).

5.3 Read the content of a .csv file using pandas.

5.4 Read the content of a .csv file (that contains an arbitrary English text) using pandas. Find the frequencies of individual tokens and store them in another .csv file.

Books

Python Programming: Using Problem Solving Approach by Reema Thareja

Python Programming: An Introduction to Computer Science by John Zelle

Introduction to Python Programming by Gowrishankar S and Veena A

Online Materials:

https://www.kaggle.com/learn/python

https://docs.python.org/3/tutorial/index.html

Subject Code	Subject Name	L-T-P	Credit
UMA301	Engineering Mathematics-III	2-1-0	3

Hour 36

Course Objectives:

1. This course aims to develop a foundation in optimization theory of linear and nonlinear, convex, transportation, assignment, and integer programming. Enabling them to formulate, analyze, and solve the optimization problems across various disciplines.
2. This course aims to equip students with the understanding of PDEs to develop a strong foundation in classification and formulation of PDEs, analytical solutions and solution techniques of various PDEs.
3. This course aims to equip students with the understanding of fundamental concepts and various formulae of Laplace transforms, z-transformations and their applications.
4. In Probability and Statistics, students will learn the fundamental principles of probability, conditional probability, independence, and Bayes' theorem. They will be introduced to random variables, various discrete and continuous probability distributions and their properties.

Module 1:

Optimization: Classification and general theory of optimization, Linear programming (LP) - formulation and geometric ideas, simplex and revised simplex methods, duality and sensitivity, transportation, assignment, and integer programming problems, Nonlinear optimization, method of Lagrange multipliers.

Module 2:

Partial Differential Equations: First order partial differential equations, solutions of first order linear and non-linear PDEs, solution of second and higher order linear homogeneous and non-homogenous partial differential equations by complementary function and particular integral method, method of separation of variables.

Module 3:

Option-1:
Transformations: Laplace transformation of elementary functions, Linearity, Shifting theorems, Laplace transform of derivatives and integrals, Inverse Laplace transform. Application for the solution of differential equations.
Z-Transform: Definition, properties, Z-transform of some basic sequences, Theorems/Properties of Z-transforms: Linearity, Shifting theorems.

Option 2:

Probability and Statistics:

Probability space, Conditional probability and Bayes theorem. Discrete Random Variable, distribution function, probability mass function, expected value and variance. Continuous Random Variable,

distribution function, probability density function, expectation and variance. Moments, moment generating function, characteristic function.

Bivariate random variables, joint distribution functions, joint probability mass function and joint probability density function and their properties, independent random variables, conditional distributions (discrete and continuous). Covariance of random variables.

****(Modules 1 and 2 are compulsory for all students. Additionally, students must select only one option from module 3)**

Course Outcomes:

1. By the end of the course, learners will develop the ability to formulate real-world problems as optimization models of linear and nonlinear programming, convex programming, transportation and assignment and analyze their structure to determine appropriate solution techniques.
2. By the end of this, students will be able to learn classical methods to solve PDEs. Also, develop a deep understanding of the fundamental concepts of partial differential equations, including their classifications and applications.
3. By the end of this, students will be able to learn the standard Laplace transform formulas and their derivations; Apply Laplace transforms to solve ordinary differential equations (ODEs) and partial differential equations (PDEs). Analyze applications in engineering, physics, and signal processing.
4. In Probability and Statistics, students will be able to apply the concept of probability to solve problems involving events, conditional probabilities, and independence. They will be able to understand different types of random variables and calculate their expected value, variance, and moments. Further, they will be able to identify and apply appropriate probability distributions to model real-world phenomena.

Texts Books:

1. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, Linear Programming and Network Flows, 4th Ed., Wiley.
2. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, S Chand Publishing, New Delhi, 12th Edition, 2004
3. George F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Education.
4. S. Ross, A First Course in Probability, 9th Ed., Pearson Education India, 2014.
5. J. Medhi, Statistical Methods – An Introductory Textbook, New Age International Publishers, 1992.
6. E. Kreyszig, Advanced Engineering Mathematics, 10th Ed., Wiley, 2015.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

References:

1. E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 4th Ed., Wiley, 2013.

2. M. S. Bazaraa, H. D. Sherali and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, 3rd Ed., Wiley, 2013.
3. K. G. Murty, Linear Programming, Wiley, 1983.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
6. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
7. Murray R. Spiegel, Laplace transforms, Schaum's Outline, 1st Edition, McGraw-Hill
8. Dwight F. Mix, Fourier, Laplace, and z Transforms, International Kindle Paperwhite.

Subject Code	Subject Name	L-T-P	Credit
UHS301	Indian Knowledge System	2-0-0	2

The Syllabus to be given by Humanities and Social Science

Subject Code	Subject Name	L-T-P	Credit
UCH301	Environmental Science	2-0-0	0

The Syllabus to be given by Chemistry Department

COURSE STRUCTURE

AND

SYLLABUS FOR

UNDERGRADUATE PROGRAMMES (B. Tech)

IN

ELECTRONICS AND COMMUNICATION

ENGINEERING

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

Semester 3

S No.	Course Code	Course Title	L	T	P	Credit
1	UEC301	Electronic Devices	3	0	0	3
2	UEC371	Electronic Devices Lab	0	0	2	1
3	UEC302	Digital System Design	3	0	0	3
4	UEC372	Digital System Design Lab	0	0	2	1
5	UEC303	Signals and Systems	3	1	0	4
6	UEC304	Network Theory	3	0	0	3
7	UMA301	Mathematics - III	3	0	0	3
8	UHS301	IKS (Indian Knowledge System)	2	0	0	2
9	UCH301	Environmental Science	2	0	0	0
Total						**20**

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC301**
Course Title:	**Electronic Devices**
Course Credit:	**3** (L: 3 T: 0 P: 0)

Course objective:	The objective of this course is to provide a comprehensive understanding of the fundamental principles and operation of key electronic components used in modern circuits and systems. The course focuses on the physics, functionality, and application of electronic devices, with an emphasis on: 1) Semiconductor Physics: Developing a foundational grasp of charge carriers, energy bands, and carrier transport phenomena in intrinsic and extrinsic semiconductors. 2) PN Junction and Diode Devices: Exploring the formation and behavior of PN junctions, including characteristics and applications of various diodes (e.g., Zener, LED, photodiodes). 3) Bipolar Junction Transistors (BJTs): Understanding the structure, operation modes, characteristics, and applications of BJTs in amplification and switching. 4) Field Effect Transistors (FETs): Analyzing the working principles, types, and roles of FETs and MOSFETs in analog and digital circuit design.
Pre-requisites:	Engineering Physics, Basic Electrical Engg., Engineering Mathematics
Course outcomes: *	After completion of this course students will 1. Understand the principles of semiconductor Physics and apply it to electronic devices 2. Analyze p-n junctions, diodes, and their electrical behavior. 3. Understand BJT operation, characteristics, and transistor applications. 4. Design and analyze MOS capacitors and MOSFETs.

Unit/ Module no.	Topic	Nos. of contact hour	Distribution of marks (out of 100)
1	**Module 1: Semiconductor Physics** Introduction to solids and crystals, crystal structures and lattice properties, crystal planes and Miller indices, quantum mechanics overview, electrons in periodic lattices, energy bands and band gaps (direct and indirect semiconductors), intrinsic and extrinsic semiconductors, doping and its effects, Fermi level, density of states, equilibrium carrier concentration, carrier generation and recombination processes, excess carriers in semiconductors, drift current, diffusion current, carrier mobility and lifetime, continuity equation, Poisson equation, Hall effect, sheet resistance, and design of resistors.	12	20
2	**Module 2: P-N Junctions & Diode Devices** Formation of p-n junction, depletion region, built-in potential, energy band diagrams, equilibrium conditions, carrier injection under forward bias, current-voltage (I-V) characteristics, small-signal and large-signal diode models, depletion capacitance, transient behavior, avalanche and Zener breakdown mechanisms, Schottky diode and barrier formation, ohmic and rectifying contacts, light-emitting diode (LED) emission mechanism and efficiency, material properties, photodiode operating principle and spectral response, solar cell efficiency, performance characteristics, and applications in optoelectronics.	8	20

3	**Module 3: Bipolar Junction Transistors (BJTs)** BJT structure and operation, energy band diagrams, current components, transistor action, DC characteristics, Early effect, Ebers-Moll model, small-signal equivalent circuit, switching characteristics, delays, power dissipation, thermal runaway, heterojunction bipolar transistor (HBT) structure and advantages, high-frequency applications of HBT, BJT as an amplifier and switch, transient behavior, and application in analog circuits.	10	30
4	**Module 4: FETs** Introductory ideas and concepts on JFETs, Device Structure and Physical Operation, MOS Field-Effect Transistor, Current–Voltage characteristics, DC Circuit Analysis, Channel length modulation, Small-signal equivalent model, Short-channel effects, device scaling trends in MOSFETs, impact of scaling on performance. Introduction to Metal-Insulator-Semiconductor (MIS) capacitors, ideal vs. real MOS capacitors, silicon MOS capacitors, capacitance-voltage (C-V) characteristics of MOS structures.	12	30

Text Books:

1. B. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition, Pearson,2014.
2. Donald Neamen, D. Biswas "Semiconductor Physics and Devices" McGraw-Hill Education

Reference Books:

1. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.
2. C.T. Sah, "Fundamentals of solid-state electronics," World Scientific Publishing Co Inc, 1991.
3. Robert F. Pierret, "Semiconductor Device Fundamentals," Pearson
4. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor." Oxford Univ. Press, 2011.
5. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Pearson
6. Richard S. Muller, Theodore I. Kamins, "Device Electronics for Integrated Circuits," Wiley.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC371**
Course Title:	**Electronic Devices Lab**
Course Credit:	**1** (L: 0 T: 0 P: 2)

Course objective:	The objective of this course is to provide a comprehensive understanding of the fundamental principles and operation of key electronic components used in modern circuits and systems. The course focuses on the physics, functionality, and application of electronic devices, with an emphasis on: 1) Semiconductor Physics: Developing a foundational grasp of charge carriers, energy bands, and carrier transport phenomena in intrinsic and extrinsic semiconductors. 2) PN Junction and Diode Devices: Exploring the formation and behavior of PN junctions, including characteristics and applications of various diodes (e.g., Zener, LED, photodiodes). 3) Bipolar Junction Transistors (BJTs): Understanding the structure, operation modes, characteristics, and applications of BJTs in amplification and switching. 4) Field Effect Transistors (FETs): Analyzing the working principles, types, and roles of FETs and MOSFETs in analog and digital circuit design.
Pre-requisites:	Engineering Physics, Basic Electrical Engg., Engineering Mathematics
Course outcomes: *	After completion of this course students will 1. Understand the principles of semiconductor Physics and apply it to electronic devices 2. Analyze p-n junctions, diodes, and their electrical behavior. 3. Understand BJT operation, characteristics, and transistor applications. 4. Design and analyze MOS capacitors and MOSFETs.

Unit/ Module no.	**Topic**	**Nos. of contact hour**	**Distribution of marks (out of 100)**
1	I-V Characteristics of a PN Junction Diode	1/2	10
2	Zener Diode as Voltage Regulator	1/2	5
3	Wave shaping circuits such as clippers and clampers.	1	10
4	Photodiode Characteristics	1/2	5
5	P-N Junction as Rectifier (Half-wave and Full-wave Rectifiers)	1	10
6	BJT Characteristics: Active, Saturation, and Cutoff Regions	1	10
7	Small-Signal Model of a BJT	1	5
8	BJT as a Switch	1/2	5
9	MOS Capacitor: C-V	1/2	5

	Characteristics		
10	MOSFET Characteristics: Transfer and Output Curves	1	10
11	Voltage Divider Biasing of BJT	1	10
12	CMOS Inverter Circuit	1/2	5
13	RC integrator and differentiators	1/2	5
14	Frequency response of RC low-pass and high-pass filters	1/2	5

Text Books:

1. B. G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition, Pearson,2014.

2. Donald Neamen, D. Biswas "Semiconductor Physics and Devices" McGraw-Hill Education

Reference Books:

7. S. M. Sze and K. N. Kwok, “Physics of Semiconductor Devices,” 3rd edition, John Wiley & Sons, 2006.
8. C.T. Sah, “Fundamentals of solid-state electronics,” World Scientific Publishing Co Inc, 1991.
9. Robert F. Pierret, “Semiconductor Device Fundamentals,” Pearson
10. Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor.” Oxford Univ. Press, 2011.
11. Robert L. Boylestad, Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson
12. Richard S. Muller, Theodore I. Kamins, “Device Electronics for Integrated Circuits,” Wiley.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC302**
Course Title:	**Digital System Design**
Course Credit:	**3** (L: 3 T: 0 P: 0)

Course objective:	This course aims to develop a solid understanding of the principles and practices involved in designing reliable digital systems. Through foundational and advanced topics—ranging from number systems and Boolean algebra to logic families and HDL programming—students will acquire both theoretical knowledge and practical skills necessary to engineer digital hardware for real-world applications. The course will focus on: 1) The fundamentals of number systems and Boolean algebra to simplify and manipulate logic expressions. 2) Designing and analysing combinational logic circuits, including adders, multiplexers, decoders, and logic minimization techniques. 3) Sequential logic systems, such as flip-flops, registers, counters, and state machines. 4) Logic families (TTL, CMOS) and evaluate their electrical characteristics and applications. 5) Hardware Description Languages (HDL) to model, simulate, and synthesize digital circuits using platforms like Verilog or VHDL.
Pre-requisites:	Engineering Physics, Engineering Mathematics
Course outcomes: *	After completion of this course students will 1. Understand the basic logic operations and combinational logic elements. 2. Design and analyze combinational circuits 3. Design and analyze synchronous sequential logic circuits 4. Use HDL and appropriate EDA tool for digital logic design and simulation

Unit/ Module no.	Topic	Nos. of contact hour	Distribution of marks (out of 100)
1	**Module 1: Number Systems, Boolean Algebra** Binary, octal, decimal, hexadecimal number systems, IEEE floating-point representation, Arithmetic operations: addition, subtraction, multiplication, division, Binary codes: Gray code, BCD, Excess-3, ASCII, Code conversion: Binary to Gray, Binary to BCD, Boolean algebra: properties, laws, De Morgan's Theorem, simplification using Boolean identities, Canonical forms (SOP, POS), Karnaugh maps (up to 6 variables), simplification techniques.	10	20
2	**Module 2: Combinational Logic Design** Combinational circuit design: Adders, subtractors, multipliers, Half and Full Adder, BCD Adder, Parallel and Serial Adders, Multiplexers, De-multiplexers, Encoder, Decoder, Comparator, ALU design, Barrel shifter, Driver circuits, Display multiplexing, Realization of Boolean functions using multiplexers, decoders, and other MSI devices, Code converters, Arithmetic circuits, Decoder, Encoder design, Design of combinational circuits using multiplexers and decoders, Implementation of basic functions using multiplexers and decoders.	10	30

3	**Module 3: Sequential Logic Design** Latches and Flip-Flops: SR, D, JK, Master-Slave JK FF, Edge-triggered FF, State diagrams, Timing diagrams, Setup and hold time, Propagation delay, Ripple counters, Synchronous counters, Mod-n counters, Shift Registers: Serial, Parallel, Universal shift registers, Finite State Machines (FSM): Moore and Mealy models, Design of synchronous FSMs: using state transition diagrams and state tables, Pulse train generators, Pseudo-random binary sequence generator, Clock generation, Sequence detectors.	12	30
4	**Module 4: Logic Families and HDL Programming** Logic Families: TTL, ECL, CMOS, noise margin, propagation delay, fan-in, fan-out, Tri-state buffers, implementations of NOT, NAND, and NOR gates. Bus systems. Introduction to Programmable logic devices (PLDs), CPLDs and FPGA. Different modeling styles in Verilog HDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation, Verilog constructs and codes for combinational and sequential circuits.	10	20

Text Books:

1. M. Morris Mano, “Digital Design,” Pearson Education

2. Gregory L. Moss, Neal S. Widmer, Ronald J. Tocci, “Digital Systems: principles and applications - Principles and Applications,” Pearson Education

Reference Books:

1. R.P. Jain, “Modern digital Electronics”, Tata McGraw Hill.

2. Stephen Brown, Zvonko Vranesic, “Fundamentals of Digital Logic with Verilog Design”, McGraw-Hill.
3. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning.
4. Gothman, “Digital Electronics-An introduction to theory and practice”, Pearson Education
5. Douglas-Hall, “Digital Circuits and Systems”, Tata McGraw Hill
6. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”, Pearson.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC372**
Course Title:	**Digital System Design Lab**
Course Credit:	**1** (L: 0 T: 0 P: 2)

Course objective:	This course aims to develop a solid understanding of the principles and practices involved in designing reliable digital systems. Through foundational and advanced topics—ranging from number systems and Boolean algebra to logic families and HDL programming—students will acquire both theoretical knowledge and practical skills necessary to engineer digital hardware for real-world applications. The course will focus on: 1) The fundamentals of number systems and Boolean algebra to simplify and manipulate logic expressions. 2) Designing and analysing combinational logic circuits, including adders, multiplexers, decoders, and logic minimization techniques. 3) Sequential logic systems, such as flip-flops, registers, counters, and state machines. 4) Logic families (TTL, CMOS) and evaluate their electrical characteristics and applications. 5) Hardware Description Languages (HDL) to model, simulate, and synthesize digital circuits using platforms like Verilog or VHDL.

Pre-requisites:	Engineering Physics, Engineering Mathematics
Course outcomes: *	After completion of this course students will 1. Understand the basic logic operations and combinational logic elements. 2. Design and analyze combinational circuits 3. Design and analyze synchronous sequential logic circuits 4. Use HDL and appropriate EDA tools for digital logic design and simulation.

Unit/ Module no.	Topic	Nos. of contact hour	Distribution of marks (out of 100)
1	Realization of Basic Gates using NAND/NOR Gates (7400/7402)	1/2	10
2	Design and Verification of Half Adder and Full Adder using Basic Gates [One experiment on MUX based design]	1/2	5
3	Implementation of 4-bit Binary to Gray Code Converter using XOR Gates (7486)	1	10
4	Design and Verification of SR and JK Flip-Flops using NAND Gates	1/2	5
5	Design and testing of 4-bit Magnitude Comparator using 7485	1	10
6	BCD to Seven-Segment Display Decoder using 7447	1	10
7	4-bit Parallel Adder using 7483 and Verify Sum and Carry	1/2	5
8	Design and Implementation of 3-bit Synchronous Counter using 7490	1	10
9	Modeling and Simulation of 4-bit Ripple Carry Adder in Verilog	1	5
10	Design and Verification of 8:1 Multiplexer and 3:8 Decoder in Verilog	1	10
11	Synthesis and Timing Analysis of Synchronous Counter using Verilog	1	10

12	Implementation of Mealy and Moore Finite State Machines in Verilog	1	10

Text Books:

1. M. Morris Mano, "Digital Design," Pearson Education

2. Gregory L. Moss, Neal S. Widmer, Ronald J. Tocci, "Digital Systems: principles and applications - Principles and Applications," Pearson Education

Reference Books:

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill.
2. Stephen Brown, Zvonko Vranesic, "Fundamentals of Digital Logic with Verilog Design", McGraw-Hill.
3. Charles H. Roth Jr., Larry L. Kinney, Fundamentals of Logic Design, Cengage Learning.
4. Gothman, "Digital Electronics-An introduction to theory and practice", Pearson Education
5. Douglas-Hall, "Digital Circuits and Systems", Tata McGraw Hill
6. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC303**
Course Title:	**Signals and System**
Course Credit:	**4** (L: 3 T: 1 P: 0)

Course objective:	This course aims to build a strong conceptual and analytical foundation in the representation, classification, and behavior of signals and systems. It guides students through mathematical tools and modeling techniques essential for analyzing both continuous-time and discrete-time systems, with real-world applications in control, communication, and signal processing. The course will focus on: 1) the fundamental concepts of signals and systems, including classification and system interconnections. 2) to apply Fourier series and transforms, Laplace transforms, and Z-transforms for analysis in time and frequency domains. 3) to explore state-space representations of dynamic systems and analyze their response and stability. 4) to examine the principles of sampling and signal reconstruction, understanding conditions for faithful signal recovery based on the sampling theorem.
Pre-requisites:	Engineering Physics, Engineering Mathematics
Course outcomes: *	At the end of this course students will demonstrate the ability to: 1. Analyze, characterize different types of signals 2. Represent continuous and discrete systems in time and frequency domain using different transforms 3. Investigate the system's stability. 4. Investigate and analyze sampling and reconstruction of a signal and its criterion.

Unit/ Module no.	**Topic**	**Nos. of contact hour**	**Distribution of marks (out of 100)**
1	**Module 1:** Signals and systems as seen in everyday life, and in various branches of engineering and science.	2	5

2	**Module 2:** Energy and power signals, continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.	5	15
3	**Module 3:** Linear shift-invariant (LSI) systems, impulse response and step response, convolution, input output behavior with a-periodic convergent inputs. Characterization of causality and stability of linear shift-invariant systems. System representation through differential equations and difference equations.	5	15
4	**Module 4:** Periodic and semi-periodic inputs to an LSI system, the notion of a frequency response and its relation to the impulse response, Fourier series representation, the Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. Parseval's Theorem. The idea of signal space and orthogonal bases. The Laplace Transform, notion of eigenfunctions of LSI systems, a basis of eigenfunctions, region of convergence, poles and zeros of a system, Laplace domain analysis, solution to differential equations and system behavior.	15	30
5	**Module 5:** The z-Transform for discrete time signals and systems- Eigen functions, region of convergence, z-domain analysis.	5	10

6	**Module 6:** State-space analysis and multi-input, multi-output representation. The state-transition matrix and its role. The Sampling Theorem and its implications- Spectra of sampled signals.	5	10
7	**Module 7:** Reconstruction: ideal interpolator, zero-order hold, first-order hold, and so on. Aliasing and its effects. Relation between continuous and discrete time systems.	5	15

Text books:

1. A.V. Oppenheim, A.S. Willsky and I.T. Young, “Signals and Systems”, Prentice Hall, 1983.
2. R.F. Ziemer, W.H. Tranter and D.R. Fannin, “Signals and Systems - Continuous and Discrete”,
4th edition, Prentice Hall, 1998.
3. B.P. Lathi, “Signal Processing and Linear Systems”, Oxford University Press, 1998.

Reference books:

1. C. T. Chen, “Signals and Systems”, OUP, 3rd edition, 2004.
2. Robert A. Gabel, Richard A. Roberts, "Signals and Linear Systems", John Wiley and Sons, 1995.
3. Papoulis, "Circuits and Systems: A Modern Approach", HRW, 1980.
4. J. Nagrath, S. N. Sharan, R. Ranjan, S. Kumar, "Signals and Systems", TMH New Delhi, 2001.
5. Douglas K. Lindner, "Introduction to Signals and Systems", McGraw Hill International Edition: 1999.
6. Simon Haykin, Barry van Veen, "Signals and Systems", John Wiley and Sons (Asia) Private Limited, 1998.
7. L. Phillips, Eve Riskin, and John M. Parr, “Signals, Systems and Transforms”, Pearson Education, 4e, 2013.
8. M. J. Roberts, "Signals and Systems - Analysis using Transform methods and MATLAB", TMH, 2003.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UEC304**
Course Title:	**Network Theory**
Course Credit:	**3** (L: 3 T: 0 P: 0)

Course objective:	The objective of this course is to develop a comprehensive understanding of electrical network analysis using classical and transform-based methods. The course emphasizes both time and frequency domain techniques, equipping students with analytical tools essential for designing and analyzing complex electrical networks. The course will focus on: 1) to understand and apply network theorems, node and mesh analysis, and evaluate linear bilateral networks for steady-state circuit analysis. 2) to utilize Fourier and Laplace transforms to examine circuit behavior in the frequency domain and apply these tools in solving network problems. 3) to perform transient analysis of RLC circuits and interpret the time-domain response of electrical systems. 4) to analyze and model two-port networks, explore series and parallel resonance, and evaluate the design of T and π network configurations used in practical engineering systems.
Pre-requisites:	Engineering Physics, Engineering Mathematics, Basic Electrical Engg.

Course outcomes: *	At the end of this course students will demonstrate the ability to: 1. Understand basic electrical circuits with nodal and mesh analysis. 2. Appreciate electrical network theorems. 3. Apply Laplace Transform for steady state and transient analysis. 4. Determine different network functions and investigations on the frequency domain techniques.

Unit/ Module no.	**Topic**	**Nos. of contact hour**	**Distribution of marks (out of 100)**
1	**Module 1:** Node and Mesh Analysis, matrix approach of network containing voltage and current sources and reactance, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits [*including dependent sources wherever applicable*]. Concepts of linear bilateral networks.	15	25
2	**Module 2:** Response of linear networks under different excitation: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra.	9	20

3	**Module 3:** Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.	6	25
4	**Module 4:** Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, Sinusoidal response from pole-zero locations, convolution theorem and Two port network (Z, Y, h and ABCD parameters and their conversion) and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters. T-type and Pi-type of networks.	12	30

Text books:

1. W. H. Hayt, J. E. Kemmerly, and S. M. Durbin, "Engineering Circuit Analysis", McGraw Hill.
2. C. K. Alexander and M Sadiku, "Fundamentals of Electric Circuits", 7th ed, McGraw Hill.
3. A. Sudhakar, S. Palli, "Network Theory", McGraw Hill Education.

Reference books:

1. Van, Valkenburg, "Network analysis", Prentice Hall of India.

2. DeCarlo and P M Lin, "Linear Circuit Analysis: Time, Domain, Phasor and Laplace Transform Approaches", OUP.

3. D. Roy Choudhury, "Networks and Systems", New Age International Private Limited.

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UMA301**
Course Title:	**Engineering Mathematics-III**
Course Credit:	**3** (L: 2 T: 1 P: 0)

Course objective:	1. This course aims to develop a foundation in optimization theory of linear and nonlinear, convex, transportation, assignment, and integer programming enabling them to formulate, analyze, and solve optimization problems across various disciplines. 2. This course aims to equip students with the understanding of PDEs to develop a strong foundation in classification and formulation of PDEs, analytical solutions and solution techniques of various PDEs. 3. This course aims to equip students with the understanding of fundamental concepts and various formulae of Laplace transforms, z-transformations and their applications. 4. In Probability and Statistics, students will learn the fundamental principles of probability, conditional probability, independence, and Bayes' theorem. They will be introduced to random variables, various discrete and continuous probability distributions and their properties.
Pre-requisites:	Engineering Mathematics

Course outcomes: *	1. By the end of the course, learners will develop the ability to formulate real-world problems as optimization models of linear and nonlinear programming, convex programming, transportation and assignment and analyze their structure to determine appropriate solution techniques. 2. By the end of this, students will be able to learn classical methods to solve PDEs. Also, develop a deep understanding of the fundamental concepts of partial differential equations, including their classifications and applications. 3. By the end of this, students will be able to learn the standard Laplace transform formulas and their derivations; Apply Laplace transforms to solve ordinary differential equations (ODEs) and partial differential equations (PDEs). Analyze applications in engineering, physics, and signal processing. 4. In Probability and Statistics, students will be able to apply the concept of probability to solve problems involving events, conditional probabilities, and independence. They will be able to understand different types of random variables and calculate their expected value, variance, and moments. Further, they will be able to identify and apply appropriate probability distributions to model real-world phenomena.

Unit/ Module no.	**Topic**	**Nos. of contact hour**	**Distribution of marks (out of 100)**
1	**Module 1:** Optimization: Classification and general theory of optimization, Linear programming (LP) - formulation and geometric ideas, simplex and revised simplex methods, duality and sensitivity, transportation, assignment, and integer programming problems, Nonlinear optimization, method of Lagrange multipliers.		

2	**Module 2:** Partial Differential Equations: First order partial differential equations, solutions of first order linear and non-linear PDEs, solution of second and higher order linear homogeneous and non-homogenous partial differential equations by complementary function and particular integral method, method of separation of variables.		
3	**Module 3:** ***Option-1:*** Transformations: Laplace transformation of elementary functions, Linearity, Shifting theorems, Laplace transform of derivatives and integrals, Inverse Laplace transform. Application for the solution of differential equations. Z-Transform: Definition, properties, Z-transform of some basic sequences, Theorems/Properties of Z-transforms: Linearity, Shifting theorems.		

4	**Module 4:** ***Option 2:*** **Probability and Statistics:** Probability space, Conditional probability and Bayes theorem. Discrete Random Variable, distribution function, probability mass function, expected value and variance. Continuous Random Variable, distribution function, probability density function, expectation and variance. Moments, moment generating function, characteristic function. Bivariate random variables, joint distribution functions, joint probability mass function and joint probability density function and their properties, independent random variables, conditional distributions (discrete and continuous). Covariance of random variables.		

****(Modules 1 and 2 are compulsory for all students. Additionally, students must select only one option from module 3)**

Text books:

1. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, Linear Programming and Network Flows, 4th Ed., Wiley.
2. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, S Chand Publishing, New Delhi, 12th Edition, 2004
3. George F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Education.
4. S. Ross, A First Course in Probability, 9th Ed., Pearson Education India, 2014.
5. J. Medhi, Statistical Methods – An Introductory Textbook, New Age International Publishers, 1992.
6. E. Kreyszig, Advanced Engineering Mathematics, 10th Ed., Wiley, 2015.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

Name of the Programme:	B. Tech in Computer Science and Engineering

Reference books:

1. E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 4th Ed., Wiley, 2013.
2. M. S. Bazaraa, H. D. Sherali and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, 3rd Ed., Wiley, 2013.
3. K. G. Murty, Linear Programming, Wiley, 1983.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
6. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
7. Murray R. Spiegel, Laplace transforms, Schaum's Outline, 1st Edition, McGraw-Hill
8. Dwight F. Mix, Fourier, Laplace, and z Transforms, International Kindle Paperwhite.

Semester:	3

Course Code:	UHS301
Course Title:	IKS (Indian Knowledge System)
Course Credit:	2 (L: 2 T: 0 P: 0)
Course objective:	This course aim is 1. To understand our rich culture and traditions of Indian knowledge system to students of various discipline. 2. To spread awakening about scientific and eternal knowledge of the Indian knowledge system. 3. To promote advance study and inter disciplinary research on all aspects of Indian knowledge system.
Pre-requisites:	
Course outcomes:*	At the end of the course, students will be able to gain insights into the concept of traditional knowledge and its relevance. They will also be able to understand and connect up the basics of Indian traditional knowledge with modern perspective and how to carry forward.

Unit/ Module no.	**Topic**
Module I	**Bhārātīya Civilization and Development of Knowledge System**
	-An Overview of Indian Knowledge System(IKS), -Importance of Ancient Knowledge –Definition of IKS –Classification Framework of IKS, -The Vedas, Indian Philosophical System, Different Schools of Philosophy, -Ancient Education System, the TakṢaśilā University, the Nālandā University, Governance, -Public Administration and Management System reference to Artha Sastra , Kautilyan State.
Module II	**Arts, Literature and Scholars**
	-Linguistics : Components of a Language – Panini's work on Sanskrit Grammar – Phonetics in Sanskrit and the role of Sanskrit in Natural Language Processing ,Art, Music, and Dance, Natarāja- -A Masterpiece of Bhārātīya Art, -Literature, Life and works of Agastya, Lopāmudrā, Ghosā, Vālmiki, Patañjali, Vedavyāsa, Kautilya ,Panini, Aryabhata.
Module III	**Engineering, Technology, and Architecture**

	-Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, -Engineering Science and Technology in the Vedic Age and Post-Vedic Records, -Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, -Marine Technology, and Bet-Dwārkā. -Concepts of Zero and Pi, Number System. Pythagoras Theorem and Vedic Mathematics.
Module IV	**Life, Environment, and Health**
	-Ethnic Studies, Health , Wellness & Psychology, Agriculture, Ecology and Environment, -Triguna System Body-Mind-Intellect-Consciousness Complex, – Āyurveda, Integrated Approach to Healthcare, Yoga, etc.

Text books:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2. History of Science in India Volume- 1, Part-1, Part-II, Volume VIII, by Sibaji Raha, et at. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et at. Sanskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012)
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Name of the Programme:	B. Tech in Electronics and Communication Engineering
Semester:	3

Course Code:	**UCH301**
Course Title:	**Environmental Science** **(Mandatory non-credit course/Audit Course)**
Course Credit:	**0** (L: 2 T: 0 P: 0)

Course objective:	
Pre-requisites:	
Course outcomes: *	

Unit/ Module no.	**Topic**	**Nos. of contact hour**	**Distribution of marks (out of 100)**
1	**Module 1:** General concept and ecosystem: Basic idea of environment and basic concepts related to perspectives. Man, society and environment and their inter relationship. Ecosystem, biotic and abiotic components. Open system, closed system, species, population, community. Ecological balance and consequence of change.	2	
2	**Module 2:**	3	

	Population dynamics and Environment: Mathematics of population growth and associated problems. Different types of resources, renewable, non-renewable and potentially renewable resources and effects of population growth on resources and environment. Environmental impact assessment.		
3	**Module 3:** Air pollution and Control: *3.1 Atmospheric composition and energy balance:* Different layers of atmosphere, tropopause, stratopause and mesopause. Conductive and Convective and Radiation heat transfer and concepts of blackbody. Global temperature model (Earth as black body and Earth's albedo) Greenhouse effect and it's consequence on global climate change, sea water level, agriculture and marine food. *3.2 Atmospheric dispersion of pollutants:* Atmospheric stability, Temperature and Radiation inversions, Adiabatic lapse rate and ambient lapse rate, maximum mixing depth, ventilation coefficient. *3.3 Air pollutants sources and biochemical effects:* Toxic chemicals in the air, suspended particulate matter, carbon dioxide, sulphur dioxide, oxides of nitrogen, lead, carbon monoxide. Primary and secondary pollutants, criteria pollutants, sulphuroussmog and photochemical smog. CFC and its impact on depletion of ozone layer. *3.4 Standards and Control measures:* Industrial commercial and residential air quality standard. Electrostatic precipitator, Cyclone separator, bag house, catalytic converter, scrubber (Venturi).	10	

4	**Module 4:** Water Pollution and Control: *4.1 Important parameters:* Effect of Oxygen demanding wastes, pathogens, nutrients, dissolved oxygen, Concepts of BOD and COD and BOD reaction rate constant. *4.2 Waste Water treatment:* Primary and secondary treatments (Activated sludge process, trickling filters, rotating biological contactor, oxidation ponds) and tertiary treatment. *4.3 Basics of ground water flow:* Aquifers, Hydraulic gradient and ground water flow.	5	
5	**Module 5:** Land Pollution: Municipal, Industrial, commercial, agricultural and hazardous solid wastes. Recovery and conversion methods. Waste management, land filling, incineration and composting.	2	
6	**Module 6:** Noise pollution: Definition of noise pollution, Concept of decibel (dB) and effects of noise pollution, noise classification and control of noise pollution.	2	

Text books:

1. Masters, G.M., "Introduction to Environmental Engineering and Science" Prentice – Hall of India Pvt. Ltd., 1991.
2. Nebel, B.J., "Environmental Science", Prentice – Hall Inc., 1987
3. Environmental Chemistry by A. K. De, New Age International.
4. Water Pollution and Management – Varshney C.K., New Age International.

Reference books:

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COURSE STRUCTURE

AND

SYLLABUS FOR

UNDERGRADUATE PROGRAMMES (B. Tech)

IN

FOOD ENGINEERING AND TECHNOLOGY

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

2ND YEAR: 3RD SEMESTER (JULY-DEC)

A. Theory Courses						
SN	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	UFE301	Principles of Food Processing and Preservation	2	1	0	3
2	UFE302	Food Chemistry	3	0	0	3
3	UFE303	Basic Microbiology	3	0	0	3
4	UME301	Basic Thermodynamics	2	1	0	3
5	UMA301	Engineering Mathematics-III	2	1	0	3
6	UHS301	Indian Knowledge System (IKS)	2	0	0	2
Total of A			**14**	**3**	**0**	**17**

B. Laboratory/Project/Seminar Courses						
SN	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
7	UFE371	Food Processing Lab	0	0	2	1
8	UFE372	Food Chemistry Lab	0	0	2	1
9	UHS371	Language Lab	0	0	2	1
Total of B			**0**	**0**	**6**	**3**

C. Audit/Non-credit Courses						
SN	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
10	UCH301	Environmental Science	2	0	0	0
Total of C			**2**	**0**	**0**	**0**
Grand Total (A+B+C)			**16**	**3**	**6**	**20**

DETAILED SYLLABUS

UFE301: PRINCIPLES OF FOOD PROCESSING AND PRESERVATION

Code: UFE301
Credits: 03
L-T-P: 3-0-0

Introduction to food preservation – Objectives and needs of food preservation, Classifications of food on the basis of perishability, pH, moisture content, etc., Causes of quality deterioration and spoilage of perishable foods, wastage of foods, Principles of food preservation, Techniques of food preservation

Canning: Preservation principle of canning of food items, General process of canning of foods, Ascetic canning, Concepts in thermal destruction of microorganisms- D, Z, F, values, Thermal process time calculations for canned foods, Spoilage in canned foods

Water activity of food and its significance in food preservation; Dehydration and drying of food items; IMF; Low temperature preservation: cold storage, cold chain, freezing (including cryogenic freezing)

Preservation by fermentation; Curing and pickling, Hurdle technology, Non-thermal (e.g. high pressure processing) and other minimal processing technologies, Ionization radiation; Use of preservative in foods: chemical preservative, bio-preservatives, antibiotics, lactic acid bacteria

Suggested Readings:

1. Technology of Food Preservation by Desrosier & Desrosier
2. Food Processing and Preservation by G. Subbulakshmi, Shobha A. Udipi
3. Food Science by N. N Potter
4. Preservation of fruits and vegetables by Girdhari Lal

UFE302: FOOD CHEMISTRY

Code: UFE302
Credits: 03
L-T-P: 3-0-0

Moisture in foods: Importance of water in foods, Physical properties of water, types of water, water activity and shelf life of food. Distribution of water in various foods and moisture determination.

Carbohydrates: Nomenclature and classification, structure, Physical and chemical properties of carbohydrates –monosaccharides, disaccharides and polysaccharides (cellulose, starch, fructans, galactans, hemi-cellulose, pectic substances, carrageenan) and their functions; dietary fibre, changes in carbohydrates during processing.

Proteins: Classification, structure and properties of amino acids, structure of protein, physical and chemical properties of proteins. Modification of food proteins in processing and storage and its implications.

Lipids: Classification, structure, physical and chemical properties of fatty acids and fats. Lipids-simple & derived. Different types of fats, uses in food processing, food emulsions, fat replacers, importance of fats and oils in diet, introduction to hydrogenation and its importance, Changes during food processing.

Vitamins, Minerals, Pigments and Flavours: Sources, Functions, Deficiency diseases, Chemistry and stability of water and fat-soluble vitamins during processing, Chemical properties of minerals and their bioavailability, Enrichment and fortification. Natural pigments in foods and their retention in processed foods, Flavoring constituents in food, effects of processing and storage on pigments and flavors.

Suggested Readings:

1. Food science Chemistry & Experimental Foods Dr.M.Swaminathan
2. Food chemistry by Lillian Hoagland Meyer
3. Food Chemistry by Fennema
4. Basic Food Chemistry by Lee
5. Principles of Biochemistry by Lehninger
6. Food Chemistry Belitz, Grosch
7. Food Additives, S.N. Mahindru

UFE303: BASIC MICROBIOLOGY

Code: UFE303
Credits: 03
L-T-P: 3-0-0

History and Scope of Microbiology; Classification of Microorganisms – Bacteria, Fungi, Virus, Alga, Protozoa, Helminthic parasites; Microscopy - types of microscopes and their applications-simple and compound, bright field, dark field, fluorescence, phase-contrast and electron microscopes.

Structure and functions of microbial cell components: Bacteria and its endospore, virus, bacteriophage; Lysogenic and lytic cycle of bacteriophage; Life cycle of malarial and filarial parasites

Structure and functions of microbial cell components: Virus like agents, satellites, viroids and prions; Microbial nutrition uptake; Passive, and Active (Primary, Secondary, and group translocation mechanisms); Bacterial growth phases; Generation time (doubling time); Factors affecting microbial growth

Part 4: Natural transformation of elements: Contribution of microorganisms to Carbon, Nitrogen, Phosphorous and Sulphur cycles; Antimicrobial agents – Antibiotics: Types / categories, modes of action; Antibiotic resistance

Suggested Readings:

1. Essential Microbiology by Stuart Hogg, John Wiley and Sons
2. General Microbiology by Linda Bruslind, Oregon State University
3. Prescott's Microbiology by J. M. Willey, K. M. Sandman, and D. H. Wood

UME301: BASIC THERMODYNAMICS

Code: UME301
Credits: 03
L-T-P: 2-1-0

Paper Code: UME 301
Paper Name: Basic Thermodynamics
Total contact hours: 36 Hours

Course objectives:
The objectives of this course are to

- Provide basic knowledge of thermodynamic properties, cycles, energy principles, entropy and exergy analysis.
- Provide basic concepts and analytical approaches for solving various thermodynamic systems.
- Provide exposure to the actual thermodynamic process with the help of case studies and applications.

Module 1: Introduction and fundamental concepts
Thermodynamic systems and control volumes, properties of a system, states, thermodynamic equilibrium, processes and cycles; concept of temperature, and Zeroth law of thermodynamics.

Module 2: Energy transfer and first law of thermodynamics for closed systems
Energy and its forms; energy transfer by heat and work, and other types of work transfer; first law of thermodynamics, closed system undergoing a cycle and change of state; internal energy, enthalpy, and specific heats of ideal gases, solids and liquids.

Module 3: Properties of pure substances
Phase of a pure substance, phase change process of a pure substance, property diagrams, property tables, Mollier diagram.

Module 4: Energy analysis for control volumes
Conservation of mass, flow work, steady flow energy equation (SFEE), and applications of SFEE.

Module 5: Second law of thermodynamics
Thermal energy reservoirs, heat engine, refrigerator and heat pump, second law of thermodynamics; reversible and irreversible processes, Carnot cycle, thermodynamic temperature scales; concept of entropy, Clausius inequality, *Tds* relations, entropy change of solids, liquids and ideal gases, foundation of third law of thermodynamics.

Module 6: Exergy

Concept of exergy, reversible work, and irreversibility, second law efficiency, exergy change of a system.

Module 7: Thermodynamic cycles

Vapour power cycle (Rankine Cycle); Introduction to internal combustion engines; Air standard cycles (Otto, Diesel and Dual cycle).

Books / References:

1. Borgnakke, C. Sonntag, R.E. Fundamentals of Thermodynamics. John Wiley and Sons, 8th Edition, 2014.
2. Nag, P.K. Engineering Thermodynamics. Tata McGraw-Hill, 6th Edition, 2017.
3. Moran, M.J., Shapiro, H.N., Boettner, D.D. and Bailey, M.B., Principles of Engineering Thermodynamics. S.I. version, John Wiley and Sons, 8th Edition, 2015.
4. Cengel, Y. A. and Boles, M. A. Thermodynamics, an Engineering Approach. McGraw-Hill Education, 9th Edition, 2019.

Expected outcome of the course:

By the end of this course, students will be able to

- Explain basic thermodynamic properties, systems, cycles and processes.
- Explain the phase change process of pure substances and the use of steam tables and charts.
- Understand the foundations of heat, work, and energy.
- Understand the first law of thermodynamics and its application for closed and open systems.
- Illustrate the implications of the second law of thermodynamics through fundamental thermodynamic models, including heat engines, refrigerators, and heat pumps.
- Explain the concept of entropy, and also be able to determine the entropy change of open and closed systems undergoing various thermodynamic processes.
- Perform analysis and thermodynamics behind the vapour power cycle (Rankine Cycle), and air standard cycles.

UMA301: ENGINEERING MATHEMATICS

Code: UMA301
Credits: 03
L-T-P: 2-1-0

Course Objectives:

1. This course aims to develop a foundation in optimization theory of linear and nonlinear, convex, transportation, assignment, and integer programming. Enabling them to formulate, analyze, and solve the optimization problems across various disciplines.
2. This course aims to equip students with the understanding of PDEs to develop a strong foundation in classification and formulation of PDEs, analytical solutions and solution techniques of various PDEs.
3. This course aims to equip students with the understanding of fundamental concepts and various formulae of Laplace transforms, z-transformations and their applications.
4. In Probability and Statistics, students will learn the fundamental principles of probability, conditional probability, independence, and Bayes' theorem. They will be introduced to random variables, various discrete and continuous probability distributions and their properties.

Module 1:

Optimization: Classification and general theory of optimization, Linear programming (LP) - formulation and geometric ideas, simplex and revised simplex methods, duality and sensitivity, transportation, assignment, and integer programming problems, Nonlinear optimization, method of Lagrange multipliers.

Module 2:

Partial Differential Equations: First order partial differential equations, solutions of first order linear and non-linear PDEs, solution of second and higher order linear homogeneous and non-homogenous partial differential equations by complementary function and particular integral method, method of separation of variables.

Module 3:

Probability and Statistics:

Probability space, Conditional probability and Bayes theorem. Discrete Random Variable, distribution function, probability mass function, expected value and variance. Continuous Random Variable, distribution function, probability density function, expectation and variance. Moments, moment generating function, characteristic function.

Bivariate random variables, joint distribution functions, joint probability mass function and joint probability density function and their properties, independent random variables, conditional distributions (discrete and continuous). Covariance of random variables.

**(Modules 1 and 2 are compulsory for all students. Additionally, students must select only one option from module 3)

Course Outcomes:

1. By the end of the course, learners will develop the ability to formulate real-world problems as optimization models of linear and nonlinear programming, convex programming, transportation and assignment and analyze their structure to determine appropriate solution techniques.
2. By the end of this, students will be able to learn classical methods to solve PDEs. Also, develop a deep understanding of the fundamental concepts of partial differential equations, including their classifications and applications.
3. By the end of this, students will be able to learn the standard Laplace transform formulas and their derivations; Apply Laplace transforms to solve ordinary differential equations (ODEs) and partial differential equations (PDEs). Analyze applications in engineering, physics, and signal processing.
4. In Probability and Statistics, students will be able to apply the concept of probability to solve problems involving events, conditional probabilities, and independence. They will be able to understand different types of random variables and calculate their expected value, variance, and moments. Further, they will be able to identify and apply appropriate probability distributions to model real-world phenomena.

Texts Books:

1. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, Linear Programming and Network Flows, 4th Ed., Wiley.
2. Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, S Chand Publishing, New Delhi, 12th Edition, 2004
3. George F. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Education.
4. S. Ross, A First Course in Probability, 9th Ed., Pearson Education India, 2014.
5. J. Medhi, Statistical Methods – An Introductory Textbook, New Age International Publishers, 1992.
6. E. Kreyszig, Advanced Engineering Mathematics, 10th Ed., Wiley, 2015.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.

References:

1. E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 4th Ed., Wiley, 2013.
2. M. S. Bazaraa, H. D. Sherali and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, 3rd Ed., Wiley, 2013.
3. K. G. Murty, Linear Programming, Wiley, 1983.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
6. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.
7. Murray R. Spiegel, Laplace transforms, Schaum's Outline, 1st Edition, McGraw-Hill
8. Dwight F. Mix, Fourier, Laplace, and z Transforms, International Kindle Paperwhite.

UHS301: INDIAN KNOWLEDGE SYSTEM

Code: UHS301
Credits: 02
L-T-P: 2-0-0

UNIT -I: Bhārātīya Civilization and Development of Knowledge System

An Overview of Indian Knowledge System(IKS), Importance of Ancient Knowledge –Definition of IKS –Classification Framework of IKS, The Vedas, Indian Philosophical System, Different Schools of Philosophy, Ancient Education System, the TakṢaśilā University, the Nālandā University, Governance, Public Administration and Management System reference to Artha Sastra , Kautilyan State.

UNIT-II: Arts, Literature and Scholars

Linguistics : Components of a Language – Panini's work on Sanskrit Grammar – Phonetics in Sanskrit and the role of Sanskrit in Natural Language Processing ,Art, Music, and Dance, Natarāja- A Masterpiece of Bhārātīya Art, Literature, Life and works of Agastya, Lopāmudrā, Ghosā, Vālmiki, Patañjali, Vedavyāsa, Kautilya ,Panini, Aryabhata.

UNIT-III: Engineering, Technology, and Architecture

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet-Dwārkā. Concepts of Zero and Pi, Number System. Pythagoras Theorem and Vedic Mathematics.

UNIT-IV: Life, Environment, and Health

Ethnic Studies, Health, Wellness & Psychology, Agriculture, Ecology and Environment,Triguna System Body-Mind-Intellect-Consciousness Complex, Āyurveda, Integrated Approach to Healthcare, Yoga, etc.

Text books:

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,
2. History of Science in India Volume- 1, Part-1, Part-II, Volume VIII, by Sibaji Raha, et at. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et at. Sanskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012)
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

UCH301: ENVIRRONMENTAL SCIENCE

Code: UCH301
Credits: 0
L-T-P: 2-0-0

Module 1

General concept and ecosystem: Basic idea of environment and basic concepts related to perspectives. Man, society and environment and their inter relationship.

Ecosystem, biotic and a biotic component. Open system, closed system, species, population, community. Ecological balance and consequence of change. **2L**

Module 2

Population dynamics and Environment: Mathematics of population growth and associated problems. Different types of resources, renewable, non-renewable and potentially renewable resources and effects of population growth on resources and environment. Environmental impact assessment. **3L**

Module 3

Air pollution and Control:

3.1 Atmospheric composition and energy balance: Different layers of atmosphere, tropopause, stratopause and mesopause. Conductive and Convective and Radiation heat transfer and concepts of blackbody. Global temperature model (Earth as black body and Earth's albedo) Greenhouse effect and it's consequence on global climate change, sea water level, agriculture and marine food. **3L**

3.2 Atmospheric dispersion of pollutants: Atmospheric stability, Temperature and Radiation inversions, Adiabatic lapse rate and ambient lapse rate, maximum mixing depth, ventilation coefficient. **2L**

3.3 Air pollutants sources and biochemical effects: Toxic chemicals in the air, suspended particulate matter, carbon dioxide, sulphur dioxide, oxides of nitrogen, lead, carbon monoxide. Primary and secondary pollutants, criteria pollutants, sulphuroussmog and photochemical smog. CFC and its impact on depletion of ozone layer. **3L**

3.4 Standards and Control measures: Industrial commercial and residential air quality standard. Electrostatic precipitator, Cyclone separator, bag house, catalytic converter, scrubber (Venturi). **2L**

Module 4

Water Pollution and Control:

4.1 Important parameters: Effect of Oxygen demanding wastes, pathogens, nutrients, dissolved oxygen, Concepts of BOD and COD and BOD reaction rate constant. **2L**

4.2 Waste Water treatment: Primary and secondary treatments (Activated sludge process, trickling filters, rotating biological contactor, oxidation ponds) and tertiary treatment. **2L**

4.3 Basics of ground water flow: Aquifers, Hydraulic gradient and ground water flow. **1L**

Module 5

Land Pollution: Municipal, Industrial, commercial, agricultural and hazardous solid wastes. Recovery and conversion methods. Waste management, land filling, incineration and composting. **2L**

Module 6

Noise pollution: Definition of noise pollution, Concept of decibel (dB) and effects of noise pollution, noise classification and control of noise pollution. **2L**

References Books:

1. Masters, G.M., "Introduction to Environmental Engineering and Science" Prentice – Hall of India Pvt. Ltd., 1991.
2. Nebel, B.J., "Environmental Science", Prentice – Hall Inc., 1987
3. Environmental Chemistry by A. K. De, New Age International.
4. Water Pollution and Management – Varshney C.K., New Age International.

COURSE STRUCTURE

AND

SYLLABUS FOR

UNDERGRADUATE PROGRAMME (B. Tech.)

IN

INSTRUMENTATION ENGINEERING (IE)

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

COURSE STRUCTURE

Sl. No.	Course Code	Course Title	L	T	P	C	Department
1	UHS301	Indian Knowledge System (From Basket)	2	0	0	2	HSS
2	UCH301	Environmental Science (Audit)	2	0	0	0	CHE
3	UMA301	Engineering Mathematics-III	2	1	0	3	MATH
4	UIE301	Network Theory	3	1	0	4	IE
5	UIE302	Electronic Devices	3	0	0	3	IE
6	UIE303	Electrical Measurements and Instruments	3	0	0	3	IE
7	UIE304	Fundamentals of Instrumentation	3	0	0	3	IE
8	UIE371	Network Theory Lab	0	0	2	1	IE
9	UIE372	Electronic Devices Lab	0	0	2	1	IE
10	UIE373	Electrical Measurements and Instruments Lab	0	0	2	1	IE
		Total	**18**	**2**	**6**	**21**	

Detailed Syllabus

Course Title: Indian Knowledge System
Course Code: UHS301 **Credit: 2**

Total contact hours: 24 **L-T-P: 2-0-0**

UNIT -I: Bh$\bar{a}$r$\bar{a}$t$\bar{\imath}$ya Civilization and Development of Knowledge System

An Overview of Indian Knowledge System(IKS), Importance of Ancient Knowledge –Definition of IKS –Classification Framework of IKS, The Vedas, Indian Philosophical System, Different Schools of Philosophy, Ancient Education System, the Tak$\acute{S}$a$\acute{s}$il$\bar{a}$ University, the N$\bar{a}$land$\bar{a}$ University, Governance, Public Administration and Management System reference to Artha Sastra , Kautilyan State.

UNIT-II: Arts, Literature and Scholars

Linguistics : Components of a Language – Panini's work on Sanskrit Grammar – Phonetics in Sanskrit and the role of Sanskrit in Natural Language Processing ,Art, Music, and Dance, Natar$\bar{a}$ja- A Masterpiece of Bh$\bar{a}$r$\bar{a}$t$\bar{\imath}$ya Art, Literature, Life and works of Agastya, Lop$\bar{a}$mudr$\bar{a}$, Ghos$\bar{a}$, V$\bar{a}$lmiki, Pata$\tilde{n}$jali, Vedavy$\bar{a}$sa, Kautilya ,Panini, Aryabhata.

UNIT-III: Engineering, Technology, and Architecture

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, Engineering Science and Technology in the Vedic Age and Post-Vedic Records, Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, Marine Technology, and Bet-Dw$\bar{a}$rk$\bar{a}$. Concepts of Zero and Pi, Number System. Pythagoras Theorem and Vedic Mathematics.

UNIT-IV: Life, Environment, and Health

Ethnic Studies, Health , Wellness & Psychology, Agriculture, Ecology and Environment,Triguna System Body-Mind-Intellect-Consciousness Complex, $\bar{A}$yurveda, Integrated Approach to Healthcare, Yoga, etc.

Text books:

1. Textbook on The Knowledge System of Bh$\bar{a}$rata by Bhag Chand Chauhan,
2. History of Science in India Volume- 1, Part-1, Part-II, Volume VIII, by Sibaji Raha, et at. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et at. Sanskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012)
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Course Title: Environmental Science (Audit)

Course Code: UCH301 **Credit: 0**
Total contact hours: 24 **L-T-P: 2-0-0**

Module 1 **(2 hrs.)**

General concept and ecosystem: Basic idea of environment and basic concepts related to perspectives. Man, society and environment and their inter relationship.
Ecosystem, biotic and a biotic component. Open system, closed system, species, population, community. Ecological balance and consequence of change.

Module 2 **(3 hrs.)**

Population dynamics and Environment: Mathematics of population growth and associated problems. Different types of resources, renewable, non-renewable and potentially renewable resources and effects of population growth on resources and environment. Environmental impact assessment.

Module 3

Air pollution and Control:

3.1 **Atmospheric composition and energy balance:** Different layers of atmosphere, tropopause, stratopause and mesopause. Conductive and Convective and Radiation heat transfer and concepts of blackbody. Global temperature model (Earth as black body and Earth's albedo) Greenhouse effect and it's consequence on global climate change, sea water level, agriculture and marine food. **(3 hrs.)**

3.2 **Atmospheric dispersion of pollutants:** Atmospheric stability, Temperature and Radiation inversions, Adiabatic lapse rate and ambient lapse rate, maximum mixing depth, ventilation coefficient. **(2 hrs.)**

3.3 **Air pollutants sources and biochemical effects:** Toxic chemicals in the air, suspended particulate matter, carbon dioxide, sulphur dioxide, oxides of nitrogen, lead, carbon monoxide. Primary and secondary pollutants, criteria pollutants, sulphurous smog and photochemical smog. CFC and its impact on depletion of ozone layer. **(3 hrs.)**

3.4 **Standards and Control measures:** Industrial commercial and residential air quality standard. Electrostatic precipitator, Cyclone separator, bag house, catalytic converter, scrubber (Venturi). **(2 hrs.)**

Module 4

Water Pollution and Control:

4.1 **Important parameters:** Effect of Oxygen demanding wastes, pathogens, nutrients, dissolved oxygen, Concepts of BOD and COD and BOD reaction rate constant. **(2 hrs.)**

4.2 **Waste Water treatment:** Primary and secondary treatments (Activated sludge process, trickling filters, rotating biological contactor, oxidation ponds) and tertiary treatment. **(2 hrs.)**

***4.3* Basics of ground water flow:** Aquifers, Hydraulic gradient and ground water flow. **(1 hr.)**

Module 5

Land Pollution: Municipal, Industrial, commercial, agricultural and hazardous solid wastes. Recovery and conversion methods. Waste management, land filling, incineration and composting. **(2 hrs.)**

Module 6

Noise pollution: Definition of noise pollution, Concept of decibel (dB) and effects of noise pollution, noise classification and control of noise pollution. **(2 hrs.)**

References Books:

1. Masters, G.M., "Introduction to Environmental Engineering and Science" Prentice – Hall of India Pvt. Ltd., 1991.
2. Nebel, B.J., "Environmental Science", Prentice – Hall Inc., 1987
3. Environmental Chemistry by A. K. De, New Age International.
4. Water Pollution and Management – Varshney C.K., New Age International.

Course Title: Engineering Mathematics -III
Course Code: UMA301 **Credit: 03**

Total contact hours: 36 **L-T-P: 2-1-0**

Module 1: Optimization

Classification and general theory of optimization; Linear programming (LP) - formulation and geometric ideas, simplex and revised simplex methods, duality and sensitivity, transportation, assignment, and integer programming problems; Nonlinear optimization, method of Lagrange multipliers, Karush-Kuhn-Tucker theory, convex optimization; Numerical methods for unconstrained and constrained optimization (gradient method, Newton's and quasi-Newton methods, penalty and barrier methods).

Module 3: Transformations

Laplace Transform: Laplace transformation of elementary functions, inverse Laplace transform, Linearity, Laplace transform of derivatives and integrals, shifting Theorems, Laplace transform of unit step Application to differential equations. Z-Transform: Definition, properties, Z-transform of some basic sequences, Z-transforms of some basic discrete functions, Shifting theorems.

Module 4: **Partial Differential Equations**

First order partial differential equations, solutions of first order linear and non-linear PDEs. Higher order: Solution to homogenous and non-homogenous linear partial differential equations, second and higher order by complimentary function and particular integral method, Method of separation of variables

Text Books:

1. M. S. Bazaraa, J. J. Jarvis and H. D. Sherali, Linear Programming and Network Flows, 4th Ed., Wiley, 2011.
2. N. S. Kambo, Mathematical Programming Techniques, Revised Ed., Affiliated East-West
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998. 1

Reference Books:

1. E. K. P. Chong and S. H. Zak, An Introduction to Optimization, 4th Ed., Wiley, 2013.
2. M. S. Bazaraa, H. D. Sherali and C. M. Shetty, Nonlinear Programming: Theory and Algorithms, 3rd Ed., Wiley, 2013.
3. D. G. Luenberger and Y. Ye, Linear and Nonlinear Programming, 4th Ed., Springer, 2016.
4. K. G. Murty, Linear Programming, Wiley, 1983.
5. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
9. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
10. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

Course code: UIE301 **Course name: Network Theory**
Credit: 4
Total contact hours: 48 **L-T-P: 3-1-0**

Course Objectives:

1) To provide the concepts of laws and theorems of electrical circuits for its analysis.
2) To familiarize the students with the behavior of networks under steady and transient conditions.
3) To introduce the principles of graph theory and two port networks.
4) To build the foundation on the principles and analysis of three phase circuits.

Contents:

Module 1: **Contact hours: 12**

Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems, Voltage and Current divide rule, Kirchoff's Voltage Law and Current Law, Independent & Dependent Sources, Source Conversion , Star-Delta Transformation, A.C fundamentals ,Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals-Average value and R.M.S value.

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, and Solution of problems.

Resonant Circuits: Series and Parallel circuits**,** Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams, Solution of Problems.

Module 2: **Contact hours: 12**

Circuit Transients: (using differential equation method**)** DC Transient in R-L & R-C circuits with and without initial charge, R-L-C circuits, AC transients in sinusoidal R-L, R-C, & R-L-C circuits, solution of problems

Laplace transforms: Introduction, Properties of Laplace Transform, Initial Value Theorem and Final Value Theorem, Inverse Laplace Transform, applications in circuit analysis, Partial Fractions expansion, Heaviside's Expansion Theorem, Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources.

Module 3: **Contact hours: 13**

Network equations: Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis. Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem and its application in three phase unbalanced circuit analysis. Solution of Problems with DC & AC sources.

Graph of Network: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality, solution of problems.

Module 4: **Contact hours: 11**

Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems with DC & AC sources.

Three phase circuits: Three phase balanced/ unbalanced voltage sources, analysis of three phase3-wire and 4-wire circuits with star and delta connected loads, balanced and unbalanced –phasor diagram of voltages & currents, power and power factor measurements in three phase circuit.

Text Books:

1. Engineering Circuit Analysis, W.H. Hayt, J.E. Kenmerly, S.M. Durbin, (TMH)
2. Fundamentals of Electric Circuits, C K. Alexander and Sadiko Mc Graw Hill
3. Network and Systems, D. Roychowdhury, (New Age International)

References Books:

4. Network and Systems, Ashfaq Husain, (Khanna Book Publisher)
5. Modern Netwok Analysis, F.M. Reza & S. Seely, McGraw Hill.
6. Circuit Theory: Analysis and Synthesis, Abhijit Chakrabarti, (Dhanpat Rai & Co.)

Course Outcome: At the end of the course students will able to:

1) Discuss fundamental knowledge of DC circuits and Magnetically Coupled Circuit.
2) Understanding the concept of resonant circuit.
3) To understand the fundamentals of Transient and steady state analysis and use of Laplace transform in network problems
4) Use Network theorems in circuit analysis and also, understand graph theory
5) Understand two port network analysis and the concept of three phase circuits.

Course code: UIE302 **Course name: Electronic Devices**

Credit: 3 **L-T-P: 3-0-0**

Total contact hours: 36

Course Objective:

1. To introduce the basics of electronic materials
2. To provide the concepts of semiconductor devices and their fabrication.
3. To provide knowledge on semiconductor device applications

Contents:

Module 1: Review of atomic Structure **Contact hours: 5**

Introduction, Early ideas on atomic structure, Wave particle duality, Quantum mechanics, Schrodinger's wave equation, Solution of Schrodinger's wave equation, Statistical mechanics.

Module 2: Introduction to electronic materials: **Contact hours: 7**

Introduction, The bonding of atoms, The crystalline state, Crystal defects, Lattice vibrations and phonons, Energy bands in solids-Metals, Insulators and Semiconductors, Semiconducting Materials- Types of Semiconductors, Equilibrium concentrations of electrons and holes inside the energy band, Fermi level and Energy distribution of carriers inside the bands, temperature dependence of carrier concentrations in an extrinsic semiconductor, Dielectrics, Superconductivity.

Module 3: Carrier Transport in Semiconductors: **Contact hours: 5**

Introduction, The drift of carrier in an electric field, Variation of mobility with temperature and doping level, Conductivity, Impurity band conduction, The Hall effect, Nonlinear conductivity, Carrier flow by diffusion, Einstein relations

Module 4: P-N Junction: **Contact hours: 7**

Introduction, Description of P-N junction action, abrupt junction, linearly graded junction, diffused junction, Electrical breakdown in junctions, P-N junction diodes-I-V characteristics, Other types of diodes- Zener diode, LED, Photodiode, Solar cell etc., Applications of P-N junction diode- Half-wave, Full-wave, Bridge rectifiers, Clipping and clamping circuits etc.

Module 5: Bipolar Junction Transistor and Field Effect Transistors: **Contact hours: 7**

BJT- Basic working principle, Input and Output Characteristics, Ebers-Moll Model, JFET- Basic working principle, I-V Characteristics, pinch off voltage, parameters, MOS capacitor, MOSFET- Basic working principle, Transfer and Output Characteristics.

Module 6: Fabrication of Semiconductor Devices: **Contact hours: 5**

Wafer preparation, oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.

Text Books:

1. G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson,2014.
2. D. Neamen, D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education

References Books:

1. S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.
2. C.T. Sah, "Fundamentals of solid state electronics," World Scientific Publishing Co. Inc, 1991.
3. Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ. Press, 2011.
4. Colinge, J.P. and Colinge, C.A. *Physics of Semiconductor Devices,* Kluwer Academic Publishers, 2002

Course Outcome: At the end of this course students will be able to

1. Understand the Physics behind the Electronic Materials
2. Acquire knowledge about basics of semiconductors and their electrical conduction mechanism.
3. Understand the mathematical models and operating principles of basic semiconductor devices including p-n junction diode, bipolar junction transistors and field effect transistors.
4. Acquire knowledge about fabrication process of semiconductor devices and sensors

COURSE NAME: ELECTRICAL MEASUREMENTS AND INSTRUMENTS

COURSE CODE: UIE303 **L.T.P**: 3.0.0 **COURSE CREDIT**: 3

TOTAL CONTACT HOURS: 36

Course Objective:

1. To familiarize about the basic principle of working of electromechanical instruments.
2. To explain the operation, construction and other features of different electromechanical instruments used for electrical measurements.
3. To familiarize about the different methods used for the measurement of inductance, capacitance, resistance and frequency.

SYLLABUS

Module 1: Measurement of Voltage and Current. Contact hours: 9

Introduction to Electrical Instruments: Operating forces, constructional details, types of support, control systems and damping systems. Galvanometers: construction, basic principle and applications of D'Arsonval, ballistic and vibration galvanometer, errors and compensation. Voltmeters and Ammeters: construction, basic principle, errors and compensation, application and comparison of moving coil, moving iron meters, dynamometer type, electrostatic type, thermal type and rectifier type. Extension of range and calibration of voltmeter and ammeter.

Module 2: Measurement of Power and Energy Contact hours: 6

Electrodynamometer type wattmeter: theory, errors and compensation, calibration and testing. Measurement of power in three phase circuits. Single Phase Induction type energy meter: theory, errors and compensation, calibration and testing.

Module 3: Potentiometers and Instrument Transformers Contact hours: 7

DC potentiometer: basic circuit, standardization, laboratory type (Crompton's), applications of DC potentiometers. AC potentiometer: construction and theory of Drysdale (polar type) type and Gall-Tinsley (coordinate) type. Applications of AC potentiometer. Instrument Transformers: C.T and V.T: construction, theory and phasor diagram.

Module 4: Measurement of Resistance Contact hours: 7

Measurement of medium resistance: Wheatstone bridge method, series and shunt type ohmmeter, ammeter-voltmeter method and substitution method. Measurement of low resistance: Kelvin's double bridge method. Measurement of high resistance: direct deflection methods, loss of charge method. Measurement of earth resistance: megger and fall of potential method.

Module 5: Measurement of Impedance Contact hours: 7

Measurement of inductance: Maxwell's bridge, Hay's bridge, Anderson's bridge, Owen's bridge Masurement of capacitance: De Sauty's and Schering bridge. Measurement of mutual inductance: Campbell's bridge. Measurement of frequency: Wien's bridge. Errors in A.C. bridge methods and their compensation

Text Books:

1. E.W.Golding & F.C.Widdis, 'Electrical Measurements & Measuring Instruments', H. Wheeler & Co.

2. A.K. Sawhney, 'Electrical & Electronic Measurements and Instrumentation', Dhanpath Rai & Co (P) Ltd.

3. J.B. Gupta, 'A Course in Electronic and Electrical Measurements and Instrumentation', S.K. Kataria & Sons, Delhi.

Reference Books:

1. P. Purkait, B. Biswas, S. Das, C. Koley, 'Electrical and Electronics Measurements and Instrumentation,' McGraw Hill Education (India) Private Limited, 2013.

2. J. Amarnath S. Kamakshaiah, P. Krishna Murthy, 'Electrical Measurements and Measuring Instruments' Dramtech Publisher, 2019.

Course Outcomes (CO):

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

1. Interpret the conceptual framework on different measuring instruments like Galvanometers, PMMC, MI, Electrostatic, dynamometer, AC & DC Potentiometers
2. Learn about the construction, working, application, calibration, testing, identification of error etc. of different electrical instruments (electromechanical types) which are used for current, voltage, power and energy measurements.
3. Know about the different techniques or methods used for measurement of resistance (low, medium, high and earth resistance), capacitance, inductance (self and mutual) and frequency.

Course code: UIE304 **Course name: Fundamentals of Instrumentation**

Total contact hours: 36 **L-T-P: 3-0-0**
Credit: 3

Course Objectives:

1. To familiarize students with the basics of Instrumentation, measuring instruments and the different classes of instruments for measurements.
2. To introduce about the sensors, transducers, standards, and notion of signal conditioning for measurements and the design of measuring system.
3. To provide the knowledge on static and dynamic characteristics of measuring instruments and the response of instruments under time and frequency domains.
4. To expose the students about the different types of errors, the sources of errors and the calibration of instruments.

Course Contents:

Module 1: **Contact hours: 8**

Introduction to measurement system. Typical applications of instrumentation systems. Functional elements of a measurement system. Classification of instruments. Introduction to Sensors and Transducers, Notion of Signal Conditioning.

Module 2: **Contact hours: 7**

Introduction to measurements. SI Units - Base and Derived Units, CGS Units, Definition of standards. International standards. Primary standards. Secondary standards. Working standards, Standards used for measurement of resistance, inductance, capacitance, current, voltage and frequency.

Module 3: **Contact hours: 9**

Measurement Errors. Types of errors: Human Error. Systematic Error, Gross Errors. Limiting Errors. Statistical analysis of measurement data. Probable Errors. Propagation of uncertainties. Error estimates from the Normal Distribution. Curve Fitting – Method of Least Squares. Chi-Square test.

Module 4: **Contact hours: 8**

Static characteristics of measurement system. Loading Effects on measurement. Dynamic characteristics of measurement system. Step-response and Frequency response of first and second order system

Module 5: **Contact hours: 4**

Testing and calibration: Primary calibration. Secondary calibration. Direct calibration. Indirect calibration. Routine calibration. Calibration of ammeter and voltmeter. Traceability. Measurement reliability.

Text Books:

1. John P. Bentley: Principles of measurement systems, 3rd edition, Addison Wesley Longman, 2000.

2. Doeblin, E.O. : " Measurement System Application and Design", 4th Edition, McGraw Hill Higher Education Co.,1989.

3. B C Nakra and K K Chaudhry: Instrument measurement and analysis, 3rd edition, Tata McGraw Hill Education Pvt. Ltd., 2009.

4. A K Sawhney: A course on electrical and electronic measurements and instrumentation, Dhanpat Raj & Co, 2005.

Reference Books:

1. James W. Dally, William F. Riley, Kenneth G. McConnell, Instrumentation for Engineering Measurements, Wiley, 2nd Edition, 1993.
2. Robert B. Northrop, Introduction to Instrumentation and Measurements, Taylor and Francis (CRC) Publisher, 2nd Edition, 2005.

Course Outcomes: After completion of this course the Students will be able to

1. Learn the basics of measurement systems, their classifications and fundamental design.

2. Evaluate the quality of a measuring instrument based on different types of static and dynamic characteristics.

3. Differentiate various types of errors observed during measurements and know their causes as well as the preventive techniques.

4. Evaluate the time, frequency responses of measuring instruments and conduct the calibration of such instruments.

Course code: UIE371 **Course name: Network Theory Lab**
Credit: 1 **Total contact hours: 2 hours per week**

L-T-P: 0-0-2

Course Objective:

1. To enable the students to understand various theorems and to learn their practical applications**.**
2. To impart knowledge about the transient response of electrical circuits of different loads
3. To introduce the 3 phase analysis and synthesis by using star, delta connections.

LIST OF EXPERIMENTS:

1. To verify the Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL) for the given electrical circuit.
2. To verify Superposition Theorem using NI-Multisim and verify the results theoretically.
3. To verify the Thevenin's Theorem using NI- Multisim Software and verify the results theoretically.
4. To verify the Norton's Theorem using NI-Multisim Software and verify the results theoretically.
5. To verify Maximum Power transfer Theorem, and plot graph of

a) Efficiency (ήR) v/s RL (Load Resistance).
b) Load Power (PL) v/s RL (Load Resistance).
6. To study the Transient Response/Analysis of a RC Series circuit.
7. To study the Transient Response/Analysis of a RL Series circuit.
8. To study Resonance in RLC series Circuit.
9. To study Resonance in parallel RLC Circuit.
10. To measure input and output impedance of a given two port network. (To calculate and verify Z parameters of a two port Network).
11. To calculate and verify 'Y' parameters of two-port network.
12. To study the properties of delta-star connection. Also, verify the results theoretically.

Course Outcome: At the end of this course students will be able to

1. Design and analyze electrical circuits based on various network theorems.

2. Analyze the transient response of RL, RC and RLC circuits.

3. Evaluate the Z and Y parameters of electrical circuits based on two-port network concept.

Course code: UIE372 **Course name: Electronic Devices Lab**
Credit: 1 **L-T-P: 0-0-2** **Total contact hours: 24**

Course Objective:

1. To familiarise students with basic electronic devices
2. To provide knowledge for design and analysis of electronic devices

List of Experiments:

1) I-V Characteristics of P-N Junction Diode
   i. To plot the Forward and Reverse bias I-V Characteristics of a P-N Junction diode.
   ii. To calculate static and dynamic resistance.
2) I-V Characteristics of Zener diode
   i. To plot I-V characteristics of a Zener diode in both forward and reverse directions.
   ii. To find Zener breakdown voltage in the reverse bias direction for voltage regulation.
3) Half-Wave and Full-Wave Diode Rectifier

   Rectify the ac signal and then find out ripple factor as well as % of regulation of half wave and full wave rectifier

   i. With
   ii. Without filter.
4) Positive and Negative Clipping Circuit
   i. To design a positive clipping circuit with positive biasing of 1V and observe its output waveforms
   ii. To design a positive clipping circuit with negative biasing of 1V and observe its output waveforms
   iii. To design a negative clipping circuit with positive biasing of 1V and observe its output waveforms
   iv. To design a negative clipping circuit with negative biasing of 1V and observe its output waveforms

5) Positive and Negative Clamper Circuit
   i. To design a positive clamper circuit with positive biasing of 1V and observe its output waveforms
   ii. To design a positive clamper circuit with negative biasing of 1V and observe its output waveforms
   iii. To design a negative clamper circuit with positive biasing of 1V and observe its output waveforms
   iv. To design a negative clamper circuit with negative biasing of 1V and observe its output waveforms
6) I-V characteristics of BJT CE, CB configuration
   i. To plot input and output characteristics for the CE configuration of BJT
   ii. To find β of the given transistor and also its input and output Resistances
   iii. To plot input and output characteristics for the CB configuration of BJT
   iv. To find α of the given transistor and also its input and output Resistances

7) I-V characteristics of JFET
   i. To plot transfer and output characteristics of JFET
   ii. To find drain resistance (r_d) and transconductance (g_m) of the given JFET
8) I-V characteristics of MOSFET
   i. To plot transfer and output characteristics of MOSFET
   ii. To find drain resistance (r_d), threshold voltage (V_{th}) and transconductance (g_m) of the given MOSFET
9) Frequency response of BJT CE, CB, CC configuration
   i. To measure the voltage gain of a CE, CB, CC amplifier
   ii. To draw the frequency response curve of the CE, CB, CC configuration of BJT
10) Frequency response of JFET
   i. To obtain the frequency response of the common-source JFET
   ii. To find the Bandwidth of JFET
11) Frequency response of MOSFET
   i. To obtain the frequency response of the common-source MOSFET
   To find the Bandwidth of MOSFET

Course Outcome: At the end of this course students will

1. Learn P-N junction diode and Zener diode characteristics
2. Learn design and analysis of diode rectifier, clipper and clamper
3. Learn BJT characteristics in different configurations
4. Learn FET characteristics

COURSE NAME: ELECTRICAL MEASUREMENTS AND INSTRUMENTS LABORATORY

COURSE CODE: UIE373 **L.T.P**: 0.0.2 **COURSE CREDIT**: 1

Course Objectives:

1. To familiarize the use of different electrical instruments.
2. To familiarize with the methods used for measurement of unknown inductance, capacitance, resistance and frequency.
3. To familiarize with methods used for calibration of electrical instruments.

LIST OF EXPERIMENTS

1. Familiarization on the different passive and active components/devices/equipment, etc.
2. To determine the value of unknown resistance (medium range) with the help of Wheatstone bridge.
3. To determine the value of low resistances using Kelvin's Bridge method.
4. To determine the value of unknown capacitance with the help of De-Sauty's Bridge.
5. To determine the value of unknown capacitance with the help of Schering Bridge. Also determine the dissipation factor of the capacitor.
6. To determine the value of unknown inductance with the help of Maxwell Inductance Bridge.
7. To determine the value of unknown inductance with the help of Maxwell Inductance Capacitance Bridge. Also determine the quality factor of the inductor.
8. To determine the value of unknown inductance with the help of Hay's Bridge.
9. To measure unknown frequency using Wien's Bridge method.
10. To determine the power absorbed by a load using wattmeter.
11. To calibrate analog ammeter using potentiometer method.
12. To calibrate analog voltmeter using potentiometer method.
13. To measure earth resistance using megger

Course Outcomes (CO):

After the completion the course students will able to

1. Demonstrate the use of different electrical instruments.
2. Measure unknown inductance, capacitance, resistance (low, medium, high) and earth resistance).
3. Calibrate analog ammeter and voltmeter.

COURSE STRUCTURE

AND

SYLLABUS FOR

UNDERGRADUATE PROGRAMMES (B. Des)

IN DESIGN

2nd year (Semester III)

(APPLICABLE FROM AY 2024-2025 ADMITTED BATCH ONWARDS)

CENTRAL INSTITUTE OF TECHNOLOGY KOKRAJHAR

COURSE STRUCTURE OF BACHELOR OF DESIGN

SEMESTER III

Sl. No.	Course Code	Course Name	L	T	P	C
01.	UHS301	Indian Knowledge System	2	0	0	2
02.	UMD301	Multimedia Design Fundamentals	2	0	0	2
03.	UMD302	Storyboarding and Script Writing	2	0	0	2
04.	UMD303	2D Animation Techniques	2	0	0	2
05.	UMD304	Photography and Videography	2	0	0	2
06.	UMD371	Multimedia Design Fundamentals Lab	0	0	2	1
07.	UMD372	Storyboarding and Script Writing Lab	0	0	4	2
08.	UMD373	2D Animation Techniques Lab	0	0	4	2
09.	UMD374	Photography and Videography Lab	0	0	4	2
10.	UMD375	Clay Modeling Lab	0	0	2	1
11.	UMD391	Design Studio – III (2D Animation)	0	0	4	2
	Contact Hours: 30		**10**	**0**	**20**	**20**

COURSE CONTENTS

SEMESTER – 3

Course Title: Indian Knowledge System **L-T-P-C: 2-0-0-2**

Course Code: UHS301

Course Objective:

The objectives of this course are:

1. To understand our rich culture and traditions of Indian knowledge system to students of various discipline.
2. To spread awakening about scientific and eternal knowledge of the Indian knowledge system.
3. To promote advance study and inter disciplinary research on all aspects of Indian knowledge system.

Course Outcome:

At the end of the course, students will be able to gain insights into the concept of traditional knowledge and its relevance. They will also be able to understand and connect up the basics of Indian traditional knowledge with modern perspective and how to carry forward.

Unit/ Module no.	Topic
Module I	**Bhārātīya Civilization and Development of Knowledge System**
	– An Overview of Indian Knowledge System (IKS), – Importance of Ancient Knowledge –Definition of IKS –Classification Framework of IKS, – The Vedas, Indian Philosophical System, Different Schools of Philosophy, – Ancient Education System, the TakSaśilā University, the Nālandā University, Governance, – Public Administration and Management System reference to Artha Sastra, Kautilyan State.
Module II	**Arts, Literature and Scholars**
	– Linguistics: Components of a Language – Panini's work on Sanskrit Grammar – Phonetics in Sanskrit and the role of Sanskrit in Natural Language Processing, Art, Music, and Dance, Natarāja- – A Masterpiece of Bhārātīya Art, – Literature, Life and works of Agastya, Lopāmudrā, Ghosā, Vālmiki, Patañjali, Vedavyāsa, Kautilya, Panini, Aryabhata.
Module III	**Engineering, Technology, and Architecture**

	– Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Metallurgy, – Engineering Science and Technology in the Vedic Age and Post-Vedic Records, - Iron Pillar of Delhi, Rakhigarhi, Mehrgarh, Sindhu Valley Civilization, – Marine Technology, and Bet-Dwārkā. – Concepts of Zero and Pi, Number System. Pythagoras Theorem and Vedic Mathematics.
Module IV	**Life, Environment, and Health**
	– Ethnic Studies, Health, Wellness & Psychology, Agriculture, Ecology and Environment, – Triguna System Body-Mind-Intellect-Consciousness Complex, – Āyurveda, Integrated Approach to Healthcare, Yoga, etc.

TEXT BOOKS:

1. Textbook on *The Knowledge System of Bhārata* by Bhag Chand Chauhan.
2. History of Science in India Volume- 1, Part-1, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

REFERENCE BOOK:

1. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et at. Sanskrit Bharati (2006).
2. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
3. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Course Title: Multimedia Design Fundamentals **L-T-P-C: 2-0-2-3**
Course Code: UMD301 / 371

Class Hours/week	2	2
Expected weeks	12	12
Total hours of classes	24	24

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of multimedia project design and development. Students will learn the fundamentals of multimedia design, the various stages of a multimedia project, multimedia authoring tools and their applications, roles and responsibilities of a multimedia development team, important ethical considerations, copyright issues, drafting of project proposals and working with clients.

Course Outcome:

By the end of this course, students will be able to:

1. Understand and implement the process of multimedia project planning and execution.
2. Select appropriate multimedia authoring tools for different project requirements.
3. Develop skills in designing and producing multimedia content.
4. Work effectively in a multimedia production team and manage project resources efficiently.
5. Address legal, ethical and professional issues in multimedia production and distribution.

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Unit – 1**	Need for Multimedia, Present and Future Market Potential.	1 / 0
2	**Unit – 2**	Dimensions of Multimedia – Functionality, Aesthetics, Content and Usability.	2 / 0
3	**Unit – 3**	Multimedia Product Possibilities.	1 / 0
4	**Unit – 4**	Understanding Authoring Tools – Types of Authoring Tools, Important Features.	2 / 0
5	**Unit – 5**	Multimedia Skills, Building an Efficient Team, Role of Multimedia Producer, Writer, Interface Designers, Audio and Video Specialist, Multimedia Programmer.	2 / 4
6	**Unit – 6**	Stages of creating a Multimedia Project – Planning and Costing, Designing and Producing, Design Aesthetics - Interface Design, Graphical User Interface, Target Audience, Social Media, Designing for the World Wide Web, Testing, Delivery.	16 / 20

TEXT BOOK:

3. Tay Vaughan, *Multimedia: Making It Work*, Ninth Edition, Tata Mc-Graw Hill Education, 2014.

REFERENCE BOOK:

4. Jennifer Coleman Dowling, *Multimedia Demystified*, First Edition, Mc-Graw Hill, 2012.

5. Ze-Nian Li and Mark S. Drew, *Fundamentals of Multimedia*, First Edition, Eastern Economy Edition, PHI Learning Pvt. Ltd.

Course Title: Storyboarding and Script Writing **L-T-P-C: 2-0-4-4**
Course Code: UMD302 / 372

Class Hours/week	2	4
Expected weeks	12	12
Total hours of classes	24	48

Course Objective:

The course aims to equip students with fundamental and advanced techniques in storyboarding and scriptwriting, essential for multimedia communication, animation, film, and game design. It focuses on visual storytelling, narrative structure, character development, and cinematic language, enabling students to translate ideas into compelling visual narratives. Through hands-on exercises and industry-standard tools, students will learn to create professional-quality scripts and storyboards for diverse media formats.

Course Outcome:

1. Demonstrate expertise in producing storyboards of a high standard for a variety of media productions.
2. Develop engaging scripts with well-structured plots, characters, and dialogues.
3. Translate scripts into visual narratives through effective storyboarding techniques.
4. Use composition, shot sequencing, and cinematography techniques in their work.
5. Make use of digital storyboarding software and technologies that are industry standard

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Unit – 1** **Visual Storytelling & Storyboards**	▪ Elements of a story. ▪ Explore industries that use storyboards. ▪ Advantages of storyboarding. ▪ Interactive Storyboarding. ▪ Designing of Storyboard exercise. ▪ Explore storyboards for multimedia. Examples of the difference between "showing" and "telling" discussed. *Lab - 1*: Research companies that use storyboard artists. What type of storyboards does these companies create? What is the role of the storyboard artist?	4 / 4
2	**Unit – 2** **Origins of Storyboards & Aspect Ratios**	▪ Historical development of the storyboard. ▪ Where storyboards fit in the visual storytelling process. ▪ History of aspect ratios and how to calculate them. ▪ Difference between pan & scan and letterboxing. *Lab - II*, Storyboard a Memory: Write a scene based on the concept developed in class that illustrates the principles of showing versus telling.	4 / 4

3	**Unit – 3** **Fundamentals of the Shot**	▪ The difference between scenes and shots. ▪ How to visualize a scene in terms of framing, angles and movement. ▪ How to illustrate camera and character movement using directional arrows. *Lab - III*, Storyboard a Memory: Create thumbnails for storyboard. Begin layouts for storyboards of Memory script.	4 / 4
4	**Unit – 4** **From Script to Final Storyboard**	▪ The function of the shooting script, shot list, and overhead diagram. ▪ Camera and character movement. ▪ Psychological impact of camera angles, framing and movement. ▪ Define the storyboard approach from thumbnails to roughs to final storyboards. ▪ Three act - Individual scene. *Lab - IV*, Storyboard a Memory: Continue development of storyboards for Memory script.	4 / 8
5	**Unit – 5** **Drawing the Human Form and Composition**	▪ Drawing the human figure without a model. Proportion and line of action in figure drawing. Rendering the figure in perspective. ▪ Drawing the figure in motion. *Lab - V*, Mystery & Suspense Storyboard: Create a visual script for story. Determine how to make the mysterious figure mysterious. Final storyboard presentation.	4 / 12
6	**Unit – 6** **Layout and Perspective**	▪ Review one-point, two-point, and three-point perspective.	4 / 16

REFERENCE BOOKS:

1. Chawdhary, Nirmal Kumar, *How to write film screenplay*, Kanishka publishers, distributers, New Delhi- 110002, 2009, ISBN 978-81-8457-112-7.
2. Rubenstein, Paul Max, Martin Jo Maloney, *Writing For the Media, Film Television, Video And Radio*, Prentive Hall, Englewood Clifts, New Jersey 07632, 1988, ISBN: 0-13-971508-7-01.
3. Whitaker, Harold, John Halas, Updated by Tom Sito, *Timing for Animation*, Focal Press Elsevier, New York & Singapore, 2009 ISBN: 978-0-240-52160-2.
4. Cristiano, Giuseppe. *Storyboard design course: Principles, practice, and techniques: the ultimate guide for artists, directors, producers, and scriptwriters*. Barron's, 2007.
5. Tumminello, Wendy. "*Exploring storyboarding*." (No Title) (2005).
6. Hart, John. *The Art of the Storyboard: A filmmaker's introduction*. Routledge, 2013.
7. Simon, Mark. *Storyboards: motion in art*. Routledge, 2012.
8. Madden, Mark, Paul WH Chung, and Christian W. Dawson. "*Cartoons beyond clipart: A computer tool for storyboarding and storywriting*." Computers & Education 52.1 (2009): 188-200.

Course Title: 2D Animation Techniques **L-T-P-C: 2-0-4-4**

Course Code: UMD303 / 373

Class Hours/week	2	4
Expected weeks	12	12
Total hours of classes	24	48

Course Objective:

The course aims to introduce students to the fundamental principles of 2D animation, focusing on traditional and digital animation techniques. It will equip students with the skills to create 2D animation using industry-standard tools. The course emphasizes the principles of animation, timing, movement, and expressive storytelling to develop a strong foundation in 2D animation.

Course Outcomes:

1. Understand and apply the 12 principles of animation in their projects.
2. Utilize industry-standard 2D animation software.
3. Design and animate objects, backgrounds, and characters for short animated sequences.
4. Demonstrate an understanding of timing, spacing, and movement to enhance animation quality.
5. Produce a short 2D animated film or sequence as a final project.

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Unit – 1** **Introduction to 2D Animation**	History and evolution of 2D animation, Traditional vs Digital animation, Overview of the animation production pipeline, Introduction to 2D Animation Software. *Lab – I,* 2D / Digital Animation software experience	4 / 4
2	**Unit – 2** **Principles of Animation**	Squash & stretch, anticipation, timing & spacing, Overlapping action and follow-through, Arcs, exaggeration, appeal, and secondary action. *Lab – II*, Understanding of Principle animation with productive assignments.	8 / 10
3	**Unit – 3** **Drawing for Animation**	Character construction and posing, Expression and body language, Gesture drawing for animation. *Lab – III*, Understanding of Poses, Drawing a character's facial expressions and dialogues. Develop skills in expression changes and lip-syncing concept or movement.	2 / 10
4	**Unit – 4** **Traditional and Digital 2D Animation Techniques**	Working with vector and bitmap-based animations, Rigging and cut-out animation techniques, Perspective and depth in 2D Animation, Lighting and Colour schemes, Key frame and in-between techniques, Animation concept on timing frame by frame. *Lab – IV*, Explore various form of animation techniques.	4 / 8
5	**Unit – 5** **Storyboarding & Animatics**	Storyboarding techniques and panelling, Timing and pacing in animatic, Sound integration and synchronization. *Lab – V*, Implementation of basic Storyboard for the animation production.	2/ 4
6	**Unit – 6** **Final Production Knowledge**	▪ Preproduction – Concept development & storyboarding. ▪ Production – Character animation, background & effects. ▪ Postproduction – Editing, sound editing and rendering. *Lab – VI*, Production knowledge and final outcomes.	4 / 12

REFERENCE BOOKS:

1. *History of Animation*- Wikipedia, the free encyclopaedia 6-2-2010 p 1-15.
2. Thomas, Frank and Ollie Johnston, *The Illusion of life Disney Animation*, Walt Disney production, New York, NY 10011, Revised Edition of Disney Animation, Popular Edition 1984 ISBN 0-7868-6070-70.
3. "*Principle of Traditional Animation applied to 3D computer Animation*" pixer son Rofael California In ACM Computer Graphics (21) 4th July 1987Rubenstein, Paul Max, Writing for Media, Prentice Hall, Englewood Cliffs, New Jersey 07632, 1988. ISBN 0- 13-971508-8.
4. "*Cartoon Animation with Preston Blair*", by Preston Blair, Revised Edition, Walter Forster Publishing, 2020.

Course Title: Photography and Videography **L-T-P-C: 2-0-4-4**
Course Code: UMD304 / 374

Class Hours/week	2	4
Expected weeks	12	12
Total hours of classes	24	48

Course Objective:

To equip students with fundamental and advanced skills in photography and videography, covering camera techniques, composition, lighting, editing, and storytelling for creative visual expression.

Course Outcomes:

By the end of this course, students will be able to:

1. Use camera settings, exposure, and composition for high-quality visuals.
2. Apply lighting and camera movements for cinematic impact.
3. Perform colour correction, retouching, and audio integration.
4. Plan, shoot, and edit engaging photo and video narratives.

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Unit – 1** **Introduction to Photography & Videography**	▪ Photography: History, Types, and Importance. ▪ Videography: Basics, Evolution, and Role in Media. ▪ Camera & Equipment Overview: Both Photo & Video.	4 / 8
2	**Unit – 2** **Exposure Triangle & Camera Settings**	▪ Photography: Understanding Aperture, Shutter Speed, and ISO. ▪ Videography: Frame Rate, Resolution, and White Balance.	4 / 8
3	**Unit – 3** **Composition, Framing & Shot Types**	▪ Photography: Rule of Thirds, Leading Lines, Depth of Field. ▪ Videography: Shot Types (Wide, Medium, Close-Up), Camera Angles.	4 / 8
4	**Unit – 4** **Lighting & Camera Movements**	▪ Photography: Natural vs. Artificial Lighting, Golden Hour, Shadows. ▪ Videography: Three-Point Lighting, Light Modifiers, Indoor vs. Outdoor Lighting. ▪ Camera Movements in Videography: Pan, Tilt, Zoom, Dolly, Handheld vs. Stabilized.	4 / 6
5	**Unit – 5** **Advanced Techniques & Audio in Videography**	▪ Photography: HDR, Long Exposure, and Low-Light Photography (20 min). ▪ Videography: Slow Motion, Timelapse, and Cinematic Look (20 min). ▪ Audio for Videography: Microphone Types, Sound Recording, and Noise Reduction.	4 / 6
6	**Unit – 6** **Photo & Video Editing**	▪ Photography Editing: Cropping, Exposure, Colour Correction, Retouching, Effects. ▪ Videography Editing: Cuts, Transitions, Colour Grading, Adding Music & Sound Effects.	4/12

REFERENCE BOOKS:

1. Wells, Liz, *Photography*, ISBN 978-0-415-46087-3.
2. Kobre, Kenneth, *Photo journalism*, Focal Press, IBSN 978-0-7506-8593-1
3. Millerson Gerold, *Television Production*, Focal Press.
4. Zettl, Herbert, *Handbook of Television Production*, Cengage Learning India Private Limited, Alps Building Ist Floor, 56-Janpath, New Delhi-110001, Reprint 2008 ISBN: 13 : 978-81-315-0508-3.
5. Belavady Vasuky, *Video Production*, Oxford Publication.

Course Title: Clay Modeling **L-T-P-C: 0-0-2-1**
Course Code: UMD375

Class Hours/week	2
Expected weeks	12
Total hours of classes	24

Course Objective:

The objective of this course is to introduce students to the fundamentals of clay modeling, helping them develop hands-on sculpting skills, understand form and structure, and express their creative ideas through three-dimensional designs.

Course Outcomes:

1. *Understand Basic Techniques* – Students will learn essential clay modeling techniques such as shaping, carving, and texturing.
2. *Develop 3D Visualization Skills* – Students will be able to translate their 2D sketches into three-dimensional clay models.
3. *Enhance Creativity and Expression* – Students will explore various forms and figures, improving their ability to express ideas through clay.
4. *Create Detailed Clay Models* – Students will gain proficiency in sculpting realistic and abstract models with refined details and finishing.

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Study of two dimensional space**	Carved, Modelled, Perforated, Mobile.	4
2	**Dimensional organizational possibilities**	Various methods of joining such as interlocking, pasting etc.	4
3	**Knowledge of 3D**	Paper, Card board, Wood block.	4
4	**Clay Preparation with Various materials**	Wire, Clay, Plasticine, Plaster of Parries, Metal sheets, Plastic, Foam, Thermocol, String, Gums and adhesives, Wax, Found objects, etc.	4
5	**Design Prototype**	A Co-ordinated series and basic design problems with analytical approach	4
6	**Colour treatment**	Colour should be introduced at various stages of experiments.	4

TEXTBOOKS / REFERENCES:

1. *Clay: the history and evolution of humankind's relationship with Earth's most primal element*, Suzanne Staubach.
2. *Clay: a studio handbook*, Vince Pitelka.
3. *The Figure in Clay: Contemporary Sculpting Techniques by Master Artists*, By Suzanne J. E. Tourtillott.
4. *Clay Tobacco Pipes*, By Eric G. Ayto.

Course Title: Design Studio – III (2D Animation) **L-T-P-C: 0-0-4-2**
Course Code: UMD391

Class Hours/week	4
Expected weeks	12
Total hours of classes	48

MODULE	TOPIC	COURSE CONTENT	HOURS
1	**Project – 1**	**Project based on following contents:** Line of action, Poses making, Story contents develop, Acting & posing.	12
2	**Project – 2**	**Project based on following contents:** Traditional Animation, Stop motion, Clay Animation, Paper cut animation.	12
3	**Project – 3**	**Project based on following contents:** 2D Character and background design, 2D digital animation concept.	12
4	**Project – 4**	**Final design based project report**.	12

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