

B.Tech Civil Engineering Syllabus Structure and Details (July 2020 onwards)

Course No.	Course Name	L	T	P	C	Course No.	Course Name	L	T	P	C
Semester I						Semester II					
UPH101	Engineering Physics	3	1	0	8	UCH201	Engineering Chemistry	3	1	0	8
UMA101	Engineering Mathematics-I	3	1	0	8	UMA201	Engineering Mathematics-II	3	1	0	8
UEE101	Basic Electrical Engineering	3	1	0	8	UCSE201	Programming for Problem Solving	4	1	0	10
UHSS101	English Communication	2	0	0	4	UCE201	Engineering Drawing and Computer Graphics	1	0	0	2
UME101	Engineering Workshop	1	0	0	2	UHSS201	Professional Ethics and Human Value	2	0	0	4
UPH171	Engineering Physics Lab	0	0	3	3	UCH271	Engineering Chemistry Lab	0	0	2	2
UEE171	Basic Electrical Engineering Lab	0	0	2	2	UCSE271	Programming for Problem Solving Lab	0	0	3	3
UHSS171	English Communication Practice	0	0	2	2	UCE271	Engineering Drawing and Computer Graphics Lab	0	0	4	4
UME171	Workshop Practice	0	0	4	4						
Contact Hours: 26		12	3	11	41	Contact Hours: 26		13	3	9	41
Semester III						Semester IV					
UMA301	Mathematics-III	3	0	0	6	UMA401	Numerical Methods and Computer Programming	3	0	0	6
UME302	Engineering Mechanics	3	0	0	6	UHSS401	Engineering Economics	3	0	0	6
UCE301	Surveying-I	3	0	0	6	UCE401	Surveying-II	3	0	0	6
UCE302	Fluid Mechanics	2	1	0	6	UCE402	Strength of Materials	3	0	0	6
UCE303	Engineering Geology	3	0	0	6	UCE403	Hydraulic Engineering	2	1	0	6
UCE304	Building Materials & Construction	3	0	0	6	UCE404	Concrete Technology	3	0	0	6
UCE371	Surveying-I Lab	0	0	2	2	UMA471	Numerical Methods and Computer Programming Lab	0	0	2	2
UCE372	Material Testing Lab	0	0	2	2	UCE471	Surveying-II Lab	0	0	2	2
UCE373	Fluid Mechanics & Hydraulics Lab	0	0	2	2	UCE472	Hydraulic Engineering Lab	0	0	2	2
UCE374	Engineering Geology Lab	0	0	2	2	UCE473	Concrete Technology Lab	0	0	2	2
UHSS371	Language Lab	0	0	2	2	UCE474	Civil Engineering Drawing	0	0	2	2
Contact Hours: 28		17	1	10	46	Total Contact Hours 28		17	1	10	46
Semester V						Semester VI					
UHSS501	Industrial Management and Entrepreneurship	3	0	0	6	UHSS601	Professional Communication	2	0	0	4
UCE501	Design of Concrete Structures	3	0	0	6	UCE601	Structural Analysis-II	2	1	0	6
UCE502	Transportation Engineering-I	2	1	0	6	UCE602	Transportation Engineering-II	2	1	0	6
UCE503	Structural Analysis-I	2	1	0	6	UCE603	Environmental Engineering-II	3	0	0	6
UCE504	Environmental Engineering-I	3	0	0	6	UCE604	Foundation Engineering	3	0	0	6
UCE505	Geotechnical Engineering	3	0	0	6	UCE605	Hydrology and Water Resources Engineering	2	1	0	6
UCE571	Transportation Engineering-I Lab	0	0	2	2	UCE671	Environmental Engineering-II Lab	0	0	2	2
UCE572	Environmental Engineering-I Lab	0	0	2	2	UCE672	Computer Aided Design	0	0	2	2
UCE573	Geotechnical Engineering Lab	0	0	2	2						
UCE591	Surveying Camp	0	0	2	2						
Total Contact Hours 26		16	2	8	44	Total Contact Hours 21		14	3	4	38
Semester VII						Semester VIII					
UCE701	Estimation & Costing	3	0	0	6	UCE801	Construction Engineering and Project Management	2	1	0	6
UCE702	Design of Steel Structures	3	0	0	6	UCE802	Prestressed Concrete	3	0	0	6
UCE711- UCE715	Elective-I	2	0	0	4	UCE811- UCE815	Elective-III	2	0	0	4
UCE716- UCE720	Elective-II	2	0	0	4	UCE816- UCE819	Elective-IV	2	0	0	4
UCE791	Major Project-I	0	0	8	8	UCE891	Major Project-II	0	0	8	8
UCE792	Industrial Training	0	0	2	2	UCE892	Grand Viva-Voce	0	0	2	2
Contact Hours: 20		10	0	10	30	Total Contact Hours: 20		9	1	10	30
Total Mandatory Credits: 316											

Semester I

Paper code: UPH101

Paper name: Engineering Physics

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

1. Mathematical Physics:

Vector and Scalar field, grad, divergence, curl, Laplacian, line integral, surface integral, volume integral, physical examples in the context of electricity and magnetism, Stokes theorem, Gauss theorem (No proof). [5]

2. Electrodynamics:

Gauss Law of electrostatics, Biot-Savart Law, Ampere's Law, Displacement current, Equation of Continuity, Maxwell's equations in differential and integral form, Maxwell's wave equation in free space, propagation of EM wave in free space, transverse nature of EM wave. [6]

3. Heat and thermodynamics:

Thermodynamic system and state variables, Heat & Work, Zeroth Law, 1st and 2nd laws of thermodynamics, Isothermal and adiabatic changes, Carnot theorem, Carnot engine, entropy, pyrometer. [5]

4. Wave and Oscillations:

- Transverse wave on a string, reflection and transmission of waves at boundary, impedance matching, standing waves and their eigen frequencies, acoustics waves and speed of sound.
- Simple harmonic motion, Damped oscillation-its differential equation, energy decay in a damped oscillation, Forced vibration, Resonance, Sharpness of resonance and quality factor. [8]

5. Introduction to Quantum Mechanics:

Wave-Particle duality, Black body radiation, Photoelectric effect, Compton effect, Uncertainty principle, wave function, the Schrodinger time dependent and time independent equations, application of Schrodinger equation for free particle in one dimensional infinite potential box. [6]

6. Optics and Optoelectronics:

- Huygens' Principle, superposition of waves and interference of light, Young's double slit experiment, Newton's rings, Diffraction, Single slit diffraction, grating.
- LASER: Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, properties of laser: monochromaticity, coherence, directionality and brightness, different types of laser: gas lasers (He-Ne) and solid state laser (Ruby), applications of laser in science, engineering and medicine.

- Light emitting diodes (LED): device structure, materials, characteristics and figures of merit. [10]

Books / References:

1. *Engineering Physics, Malik and Singh, Tata Mc Graw Hill*
2. *Engineering Physics, Naidu, Pearson*
3. *Engineering Physics, Gupta & Gaur, Dhanpat Rai*
4. *Quantum Mechanics, Ajay Ghatak S. Lokanathan, Trinity*
5. *Quantum Mechanics: A Text Book for undergraduates, Mahesh C Jain, TMH*
6. *Thermodynamics and kinetic theory of gases, W. Pauli, Dover Publications, 2010*
7. *Electromagnetic Theory, Prabir K. Basu & Hrishikesh Dhasmana, AneBooks*
8. *Introduction to Electrodynamics, David Griffiths*
9. *Electricity, magnetism and light, W. Saslow*
10. *Oscillations and waves in physics, Ian G. Main,*
11. *The physics of vibrations and waves, H.J. Pain,*
12. *Arthur Beiser, Concepts of Modern Physics (Sixth Edition), Tata McGraw-Hill Publication, New Delhi (1988).*

Paper Name: Engineering Physics Lab
Paper code: UPH171

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

List of experiments:

Experiment No 1: To determine the magnetic moment of a bar magnet and the horizontal component of the earth's magnetic field.

Experiment No 2: To study the Hall Effect in semiconductor (Germanium Crystal) and then to calculate the Hall coefficient.

Experiment No 3: To Verify Stefan-Boltzmann law of thermal radiation by electrical method.

Experiment No 4: To determine the coefficient of thermal conductivity of a bad conductor (glass) by using Lee's Disc apparatus.

Experiment No 5: To study the variation of time period of a bar pendulum about different axes and determine the value of acceleration due to gravity (g) at the place.

Experiment No 6: To determine the wavelength of sodium light by measuring the diameters of Newton's Rings.

Experiment No 7: To determine the wavelength of Laser light by using diffraction grating.

Experiment No 8: To determine the grating element by using sodium vapour lamp.

Experiment No 9: To determine the value of Planck's constant with the help of vacuum phototube.

Experiment No 10: To study the current flowing through an external circuit by a potentiometer and determine the internal resistance of a standard cell.

Paper code: UMA101
Paper name: Engineering Mathematics-I
Total contact hours: 40

Credit: 8
L-T-P: 3-1-0

Module 1: Calculus-I (15hours)

Successive derivative, Leibnitz's Theorem, Tangent and Normal, Derivation of arc length (Cartesian and Polar coordinates), curvature, partial derivatives, homogeneous functions. Expansions of functions using Taylor's theorem

Beta and Gamma functions and their properties, applications of definite integrals.

Module 2: Sequences and Series (10 hours)

Convergence of sequence and series, tests for convergence (Comparison test, Ratio test, Cauchy's Root test), Fourier series, Change of intervals, Half range sine and cosine series.

Module 3: Multivariable Calculus (15 hours)

Differentiation of vector functions, scalar and vector field, gradient of a scalar function, directional derivatives, divergence, curl and their properties, integration of vector functions, line, surface and volume integral, Green's, Gauss's and Stoke's Theorems.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
7. B.S. Grewal, Higher Engineering Mathematics

Paper code: UHSS101
Paper name: ENGLISH COMMUNICATION
Total contact hours: 39

Credit: 4
L-T-P: 2-0-0

<p>Module 1: Vocabulary Building:</p> <p>1.1 Word Formation 1.2 Root words from foreign languages and their use in English 1.3 Understanding prefixes and suffixes to form derivatives 1.4 Antonyms and Synonyms, Functional Vocabulary, Idioms and Phrasal Verbs</p>	<p>Contact hours: 3</p>
<p>Module 2: Basic Writing Skills</p> <p>1.1 Sentence Structure 1.2 use of phrases and clauses in sentences 1.3 Importance of proper punctuation 1.4 Creating Coherence 1.5 Organizing Principles of paragraph in documents 1.6 techniques of writing precisely</p>	<p>Contact hours: 4</p>
<p>Module 3: Identifying Common Errors in Writing</p> <p>1.1 Subject-verb Agreement</p>	<p>Contact hours: 4</p>

1.2 Noun-pronoun agreement 1.3 Effective Principles of Sentence Structure 1.4 Misplaced Modifiers 1.5 Articles 1.6 Prepositions 1.7 Redundancies 1.8 Cliches	
Module 4: Nature and Style of Sensible Writing 1.1 Describing 1.2 Defining 1.3 Classifying 1.4 Providing examples or evidence 1.5 Writing Introduction and Conclusio	Contact hours: 4
Module 5: Business Writing 1.5 Letter Writing, Memo, Report 1.6 Email 1.7 CV, Resume	Contact hours: 4
Module 6: Oral Communication (The Unit involves interactive practice sessions in language Lab) 6.1 IPA Symbols, pronunciation, Intonation, Stress and Rhythm 6.2 Listening Comprehension 6.3 Common Everyday Situations: Conversation and dialogues 6.4 Communication at work place 6.5 Interviews 6.6 Formal Presentations	Contact hours: 4
Module 7: Learning Language through Literature 7.1 Novel: R.K. Narayan <i>The Guide</i> 7.2 Poem: John Keats <i>Ode to a Nightingale</i> and <i>Ode to a Gracian Urn</i>	Contact hours: 4

BOOKS RECOMMENDED:

- (1) Practical English Usage, Michael Swan, OUP,1995
- (2) Remedial English Grammar, F.T. Wood, Macmillan, 2007
- (3) On Writing Well, William Zinsser, Harper Resource Book, 2001
- (4) Study Writing, Liz Hamp-Lyons and Ben Heasley, CUP, 2006
- (5) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (6) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP

Paper code: UHSS171;

Paper name: English Communication Practice

Total contact hours: 40

Credit: 2

L-T-P-C: 0-0-2-2

Module 1 Listening Practices 1.1 Enhancing listening skills 1.2 Different types of listening 1.3 How to be a good listener 1.4 Barriers to Effective Listening	Contact hours: 3
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Module 2: Speaking Skills 2.1 The sounds of English 2.2 Benefits of Speaking 2.3 Self Development through Speaking Skills	Contact hours: 4
Module 3: Reading Skills 3.1 Definition 3.2 Kinds of reading 3.3 Critical Reading Practices 3.4 Reading Method 3.5 Reading Speed Skimming Scanning Active Reading	Contact hours: 4
Module 4: Writing Skills 4.1 Purpose 4.2 Importance of Style 4.3 Essay 4.4 Business Writing	Contact hours: 4
Module 5: Remedial English Grammar 5.1 Tense 5.2 Subject Verb agreement 5.3 Relative Clauses 5.4 Prepositions 5.5 Understanding voice changes	

BOOKS and Software RECOMMENDED:

- (1) Practical English Usage, Michael Swan, OUP,1995
- (2) Remedial English Grammar, F.T. Wood, Macmillan, 2007
- (3) On Writing Well, William Zinsser, Harper Resource Book, 2001
- (4) Study Writing, Liz Hamp-Lyons and Ben Heasley, CUP, 2006
- (5) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (6) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP
- (7) Study Skills in English, Michael J.Wallace, CUP]
- (8) Sky Pronunciation
- (9) Tense Buster
- (10) Business Writing

Paper code: UME101

Paper name: Engineering Workshop

Total contact hours: 12

Credits: 2

L-T-P: 1-0-0

Module 1: Carpentry shop

(2 hrs)

- i. Introduction with the shop
- ii. Various structure of wood and types of wood
- iii. Different types of tools, machine and accessories used in Carpentry shop
- iv. Safety Precautions in workshop

Module 2: Fitting Shop

(2 hrs)

- i. Introduction with the fitting shop
- ii. Various marking, measuring, cutting, holding and striking tools
- iii. Different Operations like chipping, filing, marking drilling etc.
- iv. Working principle of drilling machine, lapping dies etc.

Module 3: Welding Shop

(2 hrs)

- i. Introduction
- ii. Types of Welding, Arc Welding, Gas Welding, Gas Cutting
- iii. Welding of dissimilar materials, selection of welding rod material, size of rod and work piece
- iv. 3 Different types of flames
- v. Elementary symbolic Representation
- vi. Safety and precautions

Module 4: Machine Shop (2 hrs)

- i. Introduction
- ii. Study of Different types of Lathe machine, shaping machine, Drilling machine
- iii. Study of Different types of hand tools and machine tools and parts
- iv. Safety & precautions

Module 5 :Turning shop (2 hrs)

- i. Introduction
- ii. Various marking, measuring, cutting, holding, and string tools
- iii. Working principle of Drilling machine, tapping, dies, its uses
- iv. Safety precautions

Module 6: Electrical Shop (2 hrs)

- i. Introduction
- ii. Various terms and instruments used in electrical wiring
- iii. Study of different tools used in simple house wiring
- iv. Difference between ac and dc line

Suggested Text/Reference Books:

- (i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
- (ii) Roy A. Lindberg, “Processes and Materials of Manufacture”, 4th edition, Prentice Hall India, 1998.
- (iii) Rao P.N., “Manufacturing Technology”, Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Paper code: UME171

Paper name: Workshop Practice

Total contact hours: 36

Credits: 4

L-T-P: 0-0-4

Module 1: Carpentry shop (6 hrs)

- Demo of different wood working tools and machines
- Demo of different wood working processes
- Simple joints like T joints, Cross halving joint, dovetail joint etc.
- One simple utility job.

Module 2: Fitting Shop (6 hrs)

- Demo of different fitting tools and machines and power tools
- Demo of different processes in fitting shop
- Squaring of a rectangular metal piece
- Making a V-block of metal piece
- One simple utility job.

Module 3: Welding Shop (6 hrs)

- Demo of different welding tools and machines
- Demo of Arc Welding, Gas Welding, Gas Cutter and rebuilding of broken parts with welding
- Any one Composite job involving lap joint welding process.

Module 4: Machine Shop (6 hrs)

- Demo of different machines and their operations
- Preferably prepare a simple job (e.g Turning operation etc)

Module 5 Turning shop (6 hrs)

- Demo of lathe machine, drilling machine
- One job related to plane and taper turning , threading and knurling
- One job related to drilling and tapping

Module 6 Electrical Shop (6 hrs)

- Demo of simple house wiring and use of tools

One job related to simple house wiring
Fittings of cut outs, fuses and other simple fittings etc.
Difference between Single phase wiring and three phase wiring

Paper code: UEE101
Paper name: Basic Electrical Engineering
Total contact hours: 40

Credit: 8
L-T-P: 3-1-0

Module 1: Contact hours: 2
Introduction: Sources of energy; General structure of electrical power systems, Power transmission and distribution via overhead lines and underground cables.

Module 2: Contact hours: 6
DC circuits: Definitions of active, passive, linear, non-linear circuits elements and networks, Kirchoff's laws, Nodal and mesh analysis, voltage and current sources, network theorems superposition. Thevenin's, Norton's, maximum power transfer, millman's, and reciprocity theorems, analysis of simple circuits with DC excitation.

Module 3: Contact hours: 8
Single phase AC circuits: generation of single phase sinusoidal EMF, instantaneous, average and effective value, form and peak factor, examples of other alternating waveforms and average and effective value calculations, concept of phasor and phasor diagrams, lagging and leading of phasors, pure resistive, inductive and capacitive circuits, power factor, complex power, R-L, R-C and R-L-C series circuits, parallel AC circuits, series and parallel resonance.

Module 4: Contact hours: 4
Three phase AC circuits: Generation of three phase EMF, delta and star connections, line and phase value of emf and current, solutions of simple 3-phase balance circuits with resistive and inductive loads, 3-phase power, comparison between 3-phase and 1-phase systems, applications of 3-phase systems.

Module 5: Contact hours: 5
Magnetic circuits: Ampere's circuital law, B-H curve, definition of mmf, flux, flux-density and reluctance, comparison between electric and magnetic circuits, series, parallel and series-parallel circuits and their solutions, energy stored in magnetic circuit, lifting magnets, electromagnetic induction, self and mutual inductance, hysteresis and eddy current losses.

Module 6: Contact hours: 5
Electrical machines: Introduction of electrical machines, classifications (DC and AC machines), transformers, technical specifications, reading of nameplate data, general applications (especially 1-phase and 3-phase induction motors).

Module 7: Contact hours: 5
Electrical measuring instruments: Classification of instruments, essentials of indicating type instruments – deflecting torque, controlling torque, damping, types of indicating instruments, MC and MI type ammeters and voltmeters, extension of range, use of shunts and multiplier, errors and compensation.

Module 8: Contact hours: 5
Electrical installations: Electrical wiring and type, fuse and its ratings, types of wires and cables, LT switch gears: MCB, ELCB, MCCB etc. Earthing and its importance. Electrochemical power sources: primary and secondary cells, classifications of secondary cells based on applications, Lead-acid cell, electrical characteristics of lead-acid cell, maintenance, charging methods of batteries.

Books / References:

- (i) D.P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
- (ii) D.C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
- (iii) B.L. Thereja, A.K. Thereja, "A Textbook of Electrical Technology", S.Chand

Paper code: UEE171

Paper name: Basic Electrical Engineering Lab
Total contact hours: 18

Credit: 2
L-T-P: 0-0-2

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, rheostat and wattmeter.
2. Make a measured resistance from a given rheostat
3. Verification of Kirchhoff's laws
4. Verification of Superposition theorem
5. Verification of Thevenin's theorem
6. Verification of Maximum Power Transfer theorem
7. Measurement of voltage, current, power and power factor in single phase AC circuits.
8. Measurement of lamp's filament resistance.
9. Wiring

Semester II

Paper code: UCH201

Paper name: Engineering Chemistry

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

UNIT:1 Molecular Structure and Quantum Mechanics: Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures. Molecular orbital and quantum mechanics: Schrodinger equation, Eigen function, orthogonal and orthonormal. (6L)

UNIT:2 Electrochemistry: Electrochemical Cells – EMF of a cell, Electrodes, reference electrodes, application of Nernst equation and related problems. Principle of fuel cell, lead acid battery. Corrosion and material oxidation (4L)

UNIT:3 Reaction dynamics and Thermodynamics: Reaction laws: rate and order; molecularity; first and second order kinetics; (Arrhenious equation) catalysis. Laws and applications of thermodynamics, 1st law and 2nd law, Carnot cycle and related problems. (8L)

UNIT:4 Instrumental Methods of Analysis: Introduction to sophisticated instrumental techniques for characterization of compounds, materials, metals such as Powder X-ray diffraction, surface area, IR, UV,-Vis, NMR, SEM, TEM and GCMS (3L)

UNIT:5 Structure, Reactivity of Organic Molecules and Synthesis of Drug Molecule: Concept of electron displacement and their applications, types of intermediate organic species, brief study of some addition, elimination and substitution reaction, cyclization and ring openings. Benzyne reaction, Chichibabin reaction, Hoffman Exhaustive reactions, few important name reactions, to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule. (5L)

UNIT:6 Polymerization: Concepts, classifications and industrial applications; polymerization processes, degree of polymerization (addition and condensation polymerization); preparation, structure and use of some common polymers: plastic (PE, PP, PVC, Bakelite), rubber (natural rubber, SBR, NBR), fibre (nylon 6,6; polyester); conducting and semiconducting polymers. (4L)

UNIT:7 Industrial Chemistry: Solid liquid and gaseous fuels; constituents of coal, carbonization of coal, coal analysis, proximate and ultimate analysis, classification of coal, petroleum, gasoline. Octane number, cetane number, aviation fuel, natural gas, water gas. (4L)

UNIT:8 Materials Engineering: Concept of nano-chemistry, new forms of carbon, S.W.C.N.T., M.W.C.N.T., Liquid crystals. (4L)

UNIT:9 Biochemistry: Carbohydrates, lipids, amino acids, proteins, Nucleic acid– DNA and RNA, Vitamins and hormones – sources and application. (2L)

Paper name: Engineering Chemistry Lab
Paper code: UCH271

Credit: 2
L-T-P: 0-0-2

Experiment-1: Aim of the experiment:To determine the coefficient of viscosity of the glycerol by using Ostwald's viscometer.

Experiment-2: Aim of the experiment:To determine the surface tension of the given liquid with respect to water at room temperature by using Stalagmeter.

Experiment-3: Aim of the experiment:To identify acid radicals by dry and wet tests.

Experiment-4: Aim of the experiment:To identify basic radicals by dry and wet tests

Experiment-5: Aim of the experiment:Preparation of standard solution of Na_2CO_3

Experiment-6: Aim of the experiment:Preparation of standard solution of oxalic acid.

Experiment-7: Aim of the experiment:Determination of strength of H_2SO_4 by titrating with 0.1 N Na_2CO_3

Experiment-8: Aim of the experiment:Determination of strength of NaOH by titrating with 0.1 N HCl

Experiment-9: Aim of the experiment:Redox Titration KMnO_4 Vs $\text{H}_2\text{C}_2\text{O}_4$

Experiment-10: Aim of the experiment:Introduction to sophisticated instruments like FT-IR, UV-Visible and GC

Text/Reference Books:

1. S. Chawla, *A Text Book of Engineering Chemistry*, Dhanpat Rai Publishing Co.
2. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Co.
3. Atkins, *Physical Chemistry*, Oxford.
4. J. D. Lee, *Concise Inorganic Chemistry*, Blackwell Science.
5. V.R. Gowariker, N.V. Viswanathan, J. Sreedhar, *Polymer Science*, New Age International Publisher.
6. A.K. Chandra, *Introductory Quantum Chemistry*, 4th Edition, McGraw-Hill
7. S.K. Ghosh *Advanced General Organic Chemistry (A Modern Approach) (Set I & II)* NCBA Publisher, New Delhi, 2009
8. B. Viswanathan, P. S. Raghavan, *Practical Physical Chemistry*, Viva
9. Dr. S. Rattan, *Experiments in Applied Chemistry*, S. K. Kataria & Sons.

Paper code: UMA201

Paper name: Engineering Mathematics-II

Total contact hours: 40

Credit: 8

L-T-P: 3-1-0

Module –1: Matrices

(10 hours)

Inverse and rank of a matrix, rank-nullity theorem, System of linear equations, Symmetric, skewsymmetric and orthogonal matrices, Determinants, Eigenvalues and eigenvectors, diagonalisation of matrices, Cayley-Hamilton Theorem.

Module-2: First order ordinary differential equations

(10 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree, equations solvable for p, equations solvable for x and y, and Clairaut's form.

Module -3: Ordinary differential equations of higher orders

(8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation, System of linear differential equations.

Module -4: Probability and Statistics

(12 hours)

Probability spaces, conditional probability, independence; Discrete and continuous random variables and their properties, Independent random variables; Expectation of Discrete and continuous random variables, Moments, mean and variance.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

Reference /Text Books

1. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.
2. V. Krishnamurthy, V.P. Mainra and J.L. Arora, *An introduction to Linear Algebra*, Affiliated East-West press, Reprint 2005.

3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
8. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
9. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
10. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
11. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
12. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.

Paper code: UCSE201

Paper name: Programming for Problem Solving

Total contact hours: 75

Credit: 10

L-T-P: 4-1-0

Module 1: Introduction to Programming

Contact hours: 10

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm.

Flowchart/ Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Module 2: Arithmetic expressions and precedence

Contact hours: 7

Module 3: Conditional Branching and Loops

Contact hours: 8

Writing and evaluation of conditionals and consequent branching

Iteration and loops

Module 4: Arrays

Contact hours: 7

Arrays (1-D, 2-D), Integer arrays and Strings

Module 5: Basic Algorithms

Contact hours: 8

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module 6: Function

Contact hours: 8

Functions (including using built in libraries), Parameter passing in functions, call by value,

Passing arrays to functions: idea of call by reference

Module 7: Recursion

Contact hours: 5

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Module 8: Structure**Contact hours: 6**

Structures, Defining structures and Array of Structures

Module 9: Pointers**Contact hours: 8**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Module 10: File handling**Contact hours: 8****Books / References:**

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Paper code: UCSE271**Paper name: Programming for Problem Solving Lab****Total contact hours: 45****Credit: 3****L-T-P: 0-0-3**

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:**Lab1:** Familiarization with programming environment**Tutorial 2:** Variable types and type conversions:**Lab 2:** Simple computational problems using arithmetic expressions**Tutorial 3:** Branching and logical expressions:**Lab 3:** Problems involving if-then-else structures**Tutorial 4:** Loops, while and for loops:**Lab 4:** Iterative problems e.g., sum of series**Tutorial 5:** 1D Arrays: searching, sorting:**Lab 5:** 1D Array manipulation**Tutorial 6:** 2D arrays and Strings**Lab 6:** Matrix problems, String operations**Tutorial 7:** Functions, call by value:**Lab 7:** Simple functions**Tutorial 8 and 9:** Numerical methods (Root finding, numerical differentiation, numerical integration):**Lab 8 and 9:** Programming for solving Numerical methods problems**Tutorial 10:** Recursion, structure of recursive calls**Lab 10:** Recursive functions**Tutorial 11:** Pointers, structures and dynamic memory allocation**Lab 11:** Pointers and structures**Tutorial 12:** File handling:**Lab 12:** File operations**Paper code: UCE201****Paper name: Engineering Drawing and Computer Graphics****Total contact hours: 12****Credit: 2****L-T-P: 1-0-0****Module 1: Theory of Lettering and Plane Curves****Contact hours: 2**

Essentials of lettering, Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Module 2: Theory of Projection of Points, Lines and Plane Surfaces Contact hours: 2

Introduction to orthographic projection - principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module 3: Theory of Projection of Solids

Contact hours: 2

Introduction to the concepts and description of methods of drawing projections of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Module 4: Theory of Projection of Sectioned Solids and Development of Surfaces

Contact hours: 2

Introduction to the concepts and description of sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

Module 5: Theory of Isometric and perspective projections

Contact hours: 2

Principles of isometric projection – Introduction to the concepts and description of isometric scale – Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones-combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Module 6: Basics of AutoCAD

Contact hours: 2

Introduction to AutoCAD, Basics of AutoCAD: applicability and capability, DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES.

Books / References:

1. *Bhatt N.D. and Panchal V.M., —Engineering Drawingll, Charotar Publishing House, 50th Edition, 2010.*
2. *Basant Agarwal and Agarwal C.M., —Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.*
3. *Venugopal K. and Prabhu Raja V., —Engineering Graphics, New Age International (P) Limited, 2008.*
4. *Natrajan K.V., —A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 2009.*
5. *Gopalakrishna K.R., —Engineering Drawing (Vol. I&II combined), Subhas Stores, Bangalore, 2007.*
6. *N S Parthasarathy And Vela Murali, —Engineering Graphics, Oxford University, Press, New Delhi, 2015.*
7. *Shah M.B., and Rana B.C., —Engineering Drawing, Pearson, 2nd Edition, 2009.*

Paper code: UCE271

Paper name: Engineering Drawing and Computer Graphics Lab

Total contact hours: 48

Credit: 4

L-T-P: 0-0-4

Module 1: Lettering and drawing plane curves

Contact hours: 8

Lettering, Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

Module 2: Drawing projection of points, lines and plane surfaces

Contact hours: 8

Drawing orthographic projection - Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes – Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Module 3: Drawing projection of solids

Contact hours: 8

Drawing projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

Module 4: Drawing projection of sectioned solids and development of surfaces

Contact hours: 8

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.

Module 5: Drawing isometric and perspective projections

Contact hours: 8

Drawing isometric projections – isometric scale –Isometric projections of simple solids and truncated solids – Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions – Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Module 6: AutoCAD practice

Contact hours: 8

Familiarization of AutoCAD application software, Use of DRAW tools, MODIFY tools, TEXT, DIMENSION, PROPERTIES.

Paper code: UHSS201

Paper name: Professional ethics and human values

Total contact hours: 40

Credit: 4

L-T-P-C: 2-0-0-4

<p>Module 1: Engineering Ethics Senses of ‘engineering ethics’ – variety of moral issues – types of inquiry – moral dilemmas – moral autonomy – Kohlberg’s theory – Gilligan’s theory – consensus and controversy – professions and professionalism – professional ideals and virtues – theories about right action – self-interest – customs and religion – uses of ethical theories</p>	<p>Contact hours: 4</p>
<p>Module 2: Engineering as Social Experimentation Engineering as experimentation – engineers as responsible experimenters – codes of ethics – a balanced outlook on law – the challenger case study</p>	<p>Contact hours: 4</p>
<p>Module 3: Responsibility for safety Safety and risk – assessment of safety and risk – risk benefit analysis – reducing risk</p>	<p>Contact hours: 4</p>
<p>Module 4: Responsibilities and Rights Collegiality and loyalty – respect for authority – collective bargaining – confidentiality – conflicts of interest – occupational crime – professional rights – employee rights – intellectual property rights – discrimination</p>	<p>Contact hours: 4</p>
<p>Module 5: Global issues Multinational corporations – environmental ethics – computer ethics – weapons development – engineers as managers – consulting engineers – engineers as expert witnesses and advisors – moral leadership – sample code of conduct</p>	<p>Contact hours: 4</p>

TEXTBOOKS/REFERENCES:

1. Mike Martin and Roland Schinzinger, "*Ethics in Engineering*", McGraw Hill, New York, 1996.
2. Charles D Fleddermann, "*Engineering Ethics*", prentice Hall, New Mexico, 1999.
3. LauraSchlesinger, "*How Could You Do That: The Abdication of Character, Courage, and Conscience*", Harper Collins, New York, 1996.
4. Stephen Carter, "*Integrity*", Basic Books, New York, 1996.

Semester III

Paper Code: UMA301
Paper Name: Engineering Mathematics-III
Total contact hours: 40

Credit: 8
L-T-P: 3-1-0

Module 1:Complex Variable

Contact hours:10

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithm) and their properties, Complex integration, Cauchy's Theorem, Residues.

Module 2:Transformations

Contact hours: 16

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 3: Partial Differential Equations

Contact hours:10

First order: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.

Books / References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
8. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
9. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
10. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
11. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

Paper Code: UME302
Paper Name: Engineering Mechanics
Total contact hours: 44

Credit: 6
L-T-P: 3-0-0

Module 1: Forces and Moments

Contact hours: 12

Force, Moment and Couple, Resultant of forces, Forces in space. Equilibrium, FBD, General equations of equilibrium, Brief introduction to vector approach.

Module 2: Friction

Contact hours: 8

Introduction to dry friction. Laws of friction, friction of simple machines- inclined planes, Screw jacks.

Module 3: Basic Structural Analysis

Contact hours: 6

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams;

Module 4: Center of gravity and moment of inertia

Contact hours: 8

Center of gravity of axes, volume and composite bodies: Area moment of inertia and mass moment of inertia for plane figures and bodies.

Module 5: Kinetics of rigid bodies

Contact hours: 10

Plane motion, force, mass, acceleration, work and energy. Impulse and momentum, rotational motion, centrifugal force, torque, angular motion and acceleration, angular momentum, Virtual work.

Books / References:

1. Engineering Mechanics: S Timoshenko & D H Young. McGraw Hill Int.
2. Engineering Mechanics: R S Khurmi. S Chand & Co.
3. Engineering Mechanics: R K Bansal. Laxmi Publication (P) Ltd
4. Engineering Mechanics: K L Kumar. McGraw Hill Publishing Co.
5. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
6. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
7. R.C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.

Paper Code: UCE301
Paper Name: Surveying-I
Total contact hours: 38

Credit: 6
L-T-P: 3-0-0

Module 1: Introduction to Surveying

Contact hours: 5

Classification, principles, types, propagation of errors.

Module 2: Chain and Tape Survey

Contact hours: 5

Distance measurement, errors and corrections.

Module 3: Compass Survey

Contact hours: 5

Instruments, adjustment, angular measurement, latitude and departure, compass traversing.

Module 4: Elevation Measurement

Contact hours: 6

Instruments, adjustments, levelling – principles, long section, cross section, reciprocal levelling, trigonometric levelling, effect of curvature and refraction.

Module 5: Theodolite**Contact hours: 5**

Details of instrument, adjustments, angular measurement – horizontal and vertical, Traversing.

Module 6: Contouring**Contact hours: 6**

Characteristics, methods & uses.

Module 7: Plane Table Surveying**Contact hours: 6**

Equipments, principles, operation, methods, errors, advantages and disadvantages.

Books / References:

1. Surveying (Vol I & II) by B.C. Punmia, Laxmi Publications.
2. Surveying by Dr. A. M. Chandra.
3. Surveying (Vol I & II) by P.B. Shahani.
4. Surveying and Levelling (Vol I & II) by T.P. Karnatkar
5. Surveying by Arrora, Standard Book House.
6. Surveying by Kulkarni

Paper Code: UCE302**Credit: 6****Paper Name: Fluid Mechanics I****L-T-P: 2-1-0****Total contact hours: 34****Module 1: Basic Concepts and Definitions****Contact hours: 6**

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.

Module 2: Fluid Statics**Contact hours:****10** Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Pressure gauges, Buoyancy and stability of floating bodies.**Module 3: Fluid Kinematics****Contact hours: 8**

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; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Module 4: Fluid Dynamics**Contact hours: 10**Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, 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.**Books / References:**

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House.
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Paper Code: UCE303
Paper Name: Engineering Geology
Total contact hours: 35

Credit:6
L-T-P: 3-0-0

Module 1: Earth science

Contact hours: 6

The earth: Origin, age and internal structure of the earth. Geology, sub divisions of geology, scope of engineering geology.

Module 2: Mineralogy

Contact hours: 6

Properties of minerals, Crystallography.

Module 3: Physical geology

Contact hours: 7

Rock weathering, engineering importance of rock weathering, Geological work, geological work of wind, running water and glacier. Rocks, classification and formation of igneous, sedimentary and metamorphic rocks, texture and structure of rocks.

Module 4: Structural Geology

Contact hours: 8

Folds, part of folds, causes of folding, classification of folds, Engineering consideration, Faults, parts of folds, causes of faults, classification of faults, Engineering consideration, Joints, master joints, Engineering consideration. Earthquake, Causes, classification and intensity of Earthquakes, Engineering consideration. Landslides, classification and effects of landslide, Engineering consideration.

Module 5: Civil Engineering Geology

Contact hours: 8

Role of geology in the field of engineering, building stones, stones used as building materials, Dams and reservoirs-Classification of dams, structural features of dam site, geology of reservoirs, silting up of reservoirs. Geological time scale Indian rocks groups. Processes of formation of economic mineral deposits, distribution of economic minerals in India, Geophysical exploration.

Books/References:

1. Engineering and General Geology by Prabin Singh, S.K. Kataria and Sons, New Delhi.
2. A text Book of Geology by P.K. Mukherjee., The world Press Private Limited, 37 'A' College Street, Calcutta.
3. Physical and Engineering Geology by S.K. Garg, Khanna Publishers Delhi..
4. Introduction to Physical Geology by A.K. Dutta, H.R. Dutta '68' Circular Road, Ranchi , Bihar.
5. A Test Book of Mineralogy by E.S. Dana, Wiley Eastern Ltd., New Delhi.

Paper code:UCE304

Paper Name: Building material & construction

Total contact hours: 42

Credit: 6
L-T-P: 3-0-0

Module 1:

Contact hours: 07

Functions of buildings and structure in general. Loads on buildings as per IS 875, IS 1893 and NBC. Functional requirements of buildings and necessity of byelaws. [2 Hrs]

Role of materials in construction. [1.5 Hrs]

Concrete as a material, its ingredients and Concrete Production Process including prefabrication, modular coordination. [3.5 Hrs]

Module 2:

Contact hours: 14

Cement: Hydration of cement, Chemical reaction, Structure of cement paste, Consistency and setting. Lime and supplementary cementations materials. [2 Hrs]

Fresh Concrete: Role of aggregates and water in fresh concrete, workability Test for workability Role of admixtures, Segregation and bleeding. [4 Hrs]

Strength of concrete: Role of porosity, w/c ratio, Role of aggregate, aggregate –mortar interface, Tensile strength, Modulus of elasticity and their tests. NDT [5 Hrs]

Durability and long term performance of concrete, Role of mineral admixture, w/c ratio and cement content. Sulphate attack, corrosion of rebar etc, IS 456 requirements. [3 Hrs]

Module 3:

Contact hours: 11

Cement, aggregate and water selection for concrete. Mix design of concrete. [5 Hrs]

Bricks and mortar and their properties, brick and other masonry construction, Selection of bricks/masonry units and mortar for masonry. Requirements of walls and types of walls. Masonry design requirements as per IS 1905. [6 Hrs]

Module 4:

Contact hours: 10

Metals with reference to Structural Steel: Structure and its role in properties of steel. Strengthening mechanism in metals. Behaviour in service and corrosion. Uses of metals in civil engineering. [4 Hrs]

Plastics and Polymers in construction, admixture paints, sealants and adhesives. Water proofing materials. [2 Hrs]

Timber and plywood and glasses. [2 Hrs]

Typical roof construction and foundations, plastering pointing and damp proofing. [2 Hrs]

Books/References:

1. Building Materials And Constrution By G C Sahu, Mc Graw Hill Education (I) Pvt Ltd.
2. Building Materials By Varghe P.C., Phi Learning Pvt.
3. Building Materials By S S Bhavikatti, Vikas Publishing House.

Paper Code: UCE371

Paper Name: Surveying-I Lab

Total contact hours: 33

Credit: 2

L-T-P: 0-0-2

Lab Experiments:

- | | |
|---|------------------|
| 1. Chain Surveying | Contact hours: 6 |
| 2. Compass: Traversing | Contact hours: 6 |
| 3. Levelling: Observation using Dumpy level and staff, Fly levelling, Reciprocal levelling. | Contact hours: 9 |
| 4. Theodolite: measurement of angles, traversing | Contact hours: 6 |
| 5. Plane Table Surveying. | Contact hours: 6 |

Paper Code: UCE372

Paper Name: Material Testing Lab

Total contact hours: 26

Credit: 2

L-T-P: 0-0-2

Lab Experiments:

- | | |
|---|------------------|
| 1. Gradation of coarse and fine aggregates | Contact hours: 2 |
| 2. Different corresponding tests and need/application of these tests in design and quality Control. | Contact hours: 2 |
| 3. Tensile Strength of materials & concrete composites | Contact hours: 2 |
| 4. Compressive strength test on aggregates | Contact hours: 2 |
| 5. Tension I - Elastic Behaviour of metals & materials | Contact hours: 2 |
| 6. Tension II - Failure of Common Materials | Contact hours: 2 |
| 7. Concrete I - Early Age Properties | Contact hours: 2 |
| 8. Concrete II - Compression and Indirect Tension | Contact hours: 2 |

9. Compression – Directionality	Contact hours: 2
10. Torsion test	Contact hours: 2
11. Hardness tests (Brinell’s and Rockwell)	Contact hours: 2
12. Tests on closely coiled and open coiled springs	Contact hours: 2
13. Concrete Mix Design as per BIS	Contact hours: 2

Paper Code: UCE373
Paper Name: Fluid Mechanics & Hydraulics Lab
Total contact hours: 20

Credit: 2
L-T-P: 0-0-2

Lab Experiments:

1. Stability of Floating Body	Contact hours: 2
2. Verification of Bernoulli’s Theorem	Contact hours: 2
3. Venturi meter	Contact hours: 2
4. Orifice meter	Contact hours: 2
5. Pitot Tube	Contact hours: 2
6. Flow Visualization	Contact hours: 2
7. Vortex Flow	Contact hours: 2
8. Losses in Pipes	Contact hours: 2
9. Pipes in Series	Contact hours: 2
10. Pipes in parallel.	Contact hours: 2

Paper Code: UCE374
Paper Name: Engineering Geology Lab
Total contact hours: 24

Credit: 2
L-T-P: 0-0-2

Lab Experiments:

1. Study of physical properties of minerals.	Contact hours: 2
2. Study of different group of minerals.	Contact hours: 2
3. Study of Crystal and Crystal system.	Contact hours: 2
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.	Contact hours: 2
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, hyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.	Contact hours: 2
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shales and its varieties.	Contact hours: 2
7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.	Contact hours: 2
8. Study of topographical features from Geological maps. Identification of symbols in maps.	Contact hours: 2

Paper code: UHSS371;
Paper name: Language Lab
Total contact hours: 40

Credit: 2
L-T-P-C: 0-0-2-2

Module 1: Pronunciation Skills 1.1 Introduction of English Speech sounds 1.2 Vowel sounds, diphthongs and thriphthongs 1.3 IPA Symbols 1.4 Transcription	Contact hours: 3
Module 2: Workshop on Business Writing 2.1 Vocabularies used in Business Writing 2.2 Successful Letters 2.3 Successful E-mails 2.4 Resume 2.5 Report Writing	Contact hours: 4
Module 3: Remedial Grammars 3.1 Tense and subject-verb agreement 3.2 Relative Clauses 3.3 Prepositions 3.4 Prepositions	Contact hours:4
Module 4: Public Speaking Skills and Presentation Skills	Contact hours: 4

BOOKS and Software RECOMMENDED:

- (1) Soft Skills, S. Hariharan, N.Sundararajan, S.P.Shanmugapriya MJP Publishers, Chennai
- (2) Communication Skills, Sanjay Kumar and PushpLata, OUP, 2011
- (3) Exercises in Spoken English, Parts-I-III, CIEFL, Hyderabad, OUP
- (4) Business Writing
- (5) Sky Pronunciation
- (6) Tense Buster

Semester IV

B.Tech Civil Engineering Syllabus Details

Semester IV

Paper code: UMA401

Paper name: Numerical Methods with Computer Programming

Total contact hours: 40

Credit: 6

L-T-P: 3-0-0

Module 1: Transcendental and Polynomial Equations

Contact Hours:10

Methods of iteration for finding solution of algebraic and transcendental equations: Newton Raphson Method, Regula-Falsi Method, Bisection Method, Secant Method. Solution of linear simultaneous equations by Gauss Elimination Method & Gauss Siedal Method.

Module 2: Interpolation and Extrapolation

Contact Hours:10

Difference table, Newton's Forward and Backward interpolation formulae, Lagrange's Interpolation Formula.

Module 3: Numerical Differentiation & Integration

Contact Hours:10

Numerical differentiation; Numerical Integration, Trapezoidal, Simpson's Rules and Gaussian Quadrature Formula.

Module 4: Numerical Solution of Ordinary Differential Equations

Contact Hours:10

Euler method, Modified Euler Method, Runge - Kutta Method and Milne's Predictor – Corrector Method.

Text/Reference Books:

1. *S.S. Sastry, Introductory Methods of Numerical Analysis, PHI learning Pvt Ltd.*
2. *M.K Jain, S.R.K Iyengar and R.K Jain, Numerical Methods for Scientific and Engineering computation, New Age International Publishers.*
3. *E. Balagurusamy, Numerical Method, Tata McGraw Hill Publication.*
4. *Xavier: C Language and Numerical Methods.*
5. *Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.*
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.*

Paper code: UHSS 401

Paper name: Engineering Economics

Total contact hours: 40

Credit: 6

L-T-P: 3-0-0

Unit:1

Definition of Economics, Consumer behaviour, Utility analysis and demand analysis, Kinds of Demand, Law of Demand and Law of Supply, Elasticity of Demand: Types and Measurement, Scope of Economics including economics of environment and e-commerce.

Unit:2

Market forms-Perfect and Imperfect markets, Features of Perfect competition, Monopoly and Monopolistic competition, Price and output determination under Perfect Competition, Monopoly, Monopolistic and Oligopoly etc. Concept of Production function, Cost Analysis, Estimation of cost function-Profit and Break Even Analysis.

Unit:3

National Income, GNP and NNP, Per-Capita Income, Theory of Production, Concepts of Production, Production function, Law of variable proportions and Law of Return to scale, Source of Public Revenue-Tax Revenue and Non-Tax Revenue, Direct and Indirect Tax, Inflation and Deflation. Banking-Definition-Types and function of Bank. Concept of Investment Analysis.

Unit:4

Features of Indian Economy, Economic Reforms in India-Concept of Economic Liberalization, Privatization and Globalization, Unemployment Problem in India-Types, Causes, remedial measures and recent employment generation scheme of Government of India.

Unit:5

International Trade, Gains from International Trade, The World Trading Environment and Multinational Corporations, BPO etc. Function and Role of IMF, World Bank and WTO. Concept of Stock Exchange Market and Market for Securities.

Text/Reference Books:

1. Samuelson, P. A. and W. D. Nordhaus, *Economics*, McGraw Hill, New York.
2. Mishra, Sasmita (2009), *Engineering Economics and Costing*, Prentice Hall of India Pvt. Limited.
3. Sarma, G. and Debnath, A., *Engineering Economics*, Kalyani Publishers, New –Delhi.
4. Dwivedy, D. N. (6th ed), *Managerial Economics*, Vikas Publishing House.
5. Mishra, R, *Engineering Economics*, University Science Press, New Delhi.
6. Datt & Sundharam (latest edition), *Indian Economy*, S. Chand Publication, New Delhi.
7. Misra & Puri (latest edition), *Indian Economy*, Himalaya Publishing House.
8. Ahmed, A and Begum, G, *Engineering Economics*, Chandra Prakesh, Guwahati

Paper code: UCE 401

Paper name: Surveying-II

Total contact hours: 40

Credit: 6

L-T-P: 3-0-0

Tacheometry:

Principles, Stadia and Tangential methods, Error and Precision in Tacheometry.

Contact Hours: 06

Curves:

Classification, setting out of circular curve and transition curve.

Contact Hours: 06

Triangulation:

Triangulation systems, Intervisibility, Signals, satellite stations, computations and adjustments.

Contact Hours: 06

Calculation of Area and Volumes:

Different methods, Trapezoidal, Prismoidal rules.

Contact Hours: 06

Photogrammetry:

Principles, application, types, relief, Flight planning.

Contact Hours: 06

Remote Sensing:

Introduction, definitions, Remote sensing systems, advantages over conventional system, energy interaction in the atmosphere, Indian remote sensing satellite series and their characteristics

Contact Hours: 06

GIS & GPS:

Introduction to GIS, Components of GIS, advantages, function of GIS, Raster and vector data, advantages and disadvantages, global positioning system.(GPS), Introduction, definitions, GPS receivers, antenna, advantages of GPS.

Contact Hours: 04

Text/Reference Books:

1. *Surveying (Vol II & III)* by B.C. Punmia , Laxmi Publication.
2. *Surveying (Vol I & II)* by K.R. Arora , Standard Book House.
3. *Plane Surveying* by A.M. Chandra , Newage International.
4. *Higher Surveying* by A.M. Chandra ,Newage International
5. *Fundamentals of Remote Sensing* by G. Joseph, Universities Press, 2003.
6. *GIS – A Computing Perspective* by Michael W. CRC Press, 2004.
7. *Geographic Information Analysis* by O'sullivan David, John Wiley & Sons, 2003.

Paper code: UCE 402**Paper name: Strength of Materials****Total contact hours: 37****Credit: 6****L-T-P: 3-0-0****Simple stresses and Strains****Contact Hours: 06**

Stress, strain, type of stresses, stress-strain curve, elastic limit, Hooke's law, factor of safety, elastic constants, bars of varying sections, bars of composite sections, elongation due to self-weight, bars of uniform strength, complementary shear stresses

Complex stresses**Contact Hours: 04**

Stresses on inclined plane, stresses on inclined plane due to two perpendicular stresses, ellipse of stresses, Mohr's circle, stresses on inclined plane due to normal and shear stresses, principal plane, principal stresses and strains.

Bending moments and Shear forces**Contact Hours: 08**

Beam – deflection, type of loads, type of supports, SF and BM, sign convention, SF and BM diagrams for cantilever, simple supported and overhanging beams, relationship between rate of loading, SF and BM.

Stresses in beams**Contact Hours: 04**

Theory of bending, assumptions, neutral axis and moment of resistance, bending stresses in symmetrical sections, section modulus, composite beams, shear stresses in beams.

Torsional stresses in shafts**Contact Hours: 03**

Analysis of torsional stresses, power transmitted, combined bending and torsion, equivalent bending moment and torque.

Combined Bending and Direct Stresses**Contact Hours: 03**

Combined bending and direct Stresses, resultant stresses for rectangular column subjected to eccentric load, limit of eccentricity for no tension.

Cylindrical Shells**Contact Hours: 03**

Thin cylinders and spherical shells, stresses, strains and volumetric changes.

Column and Struts**Contact Hours: 03**

Failure of columns, slenderness ratio, short and long columns, crippling load, Euler's theory, Rankine's formula, Straight line and parabolic formula.

Deflection of beams**Contact Hours: 03**

Relationship among curvature, slope and deflections, slope and deflection for cantilever and simply supported beams, Macaulay's method.

Text/Reference Books:

1. *Strength of Materials* by G.H.Ryder, ELBS & Macmillan.
2. *Strength of Materials* by R. S. Khurmi.
3. *Strength of Materials* by Bansal.

Paper code: UCE 403

Paper name: Hydraulic Engineering

Total contact hours: 35

Credit: 6

L-T-P: 2-1-0

Laminar Flow

Contact Hours: 02

Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.

Turbulent Flow

Contact Hours: 03

Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.

Boundary Layer Analysis

Contact Hours: 03

Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Dimensional Analysis and Hydraulic Similitude

Contact Hours: 02

Dimensional homogeneity, Rayleigh method, Buckingham's Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

Introduction to Open Channel Flow

Contact Hours: 02

Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

Uniform Flow

Contact Hours: 02

Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient " n ". Most economical section of channel. Computation of Uniform flow, Normal depth.

Non-Uniform Flow

Contact Hours: 02

Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Measurement of Discharge and Velocity – Venturi Flume, Standing Wave Flume, Parshall Flume, Broad Crested Weir. Measurement of Velocity- Current meter, Floats, Hot-wire anemometer. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile by graphical, numerical and analytical approaches. Direct Step method, Graphical Integration method and Direct integration method.

Hydraulic Jump

Contact Hours: 06

Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges. Dynamics of Fluid Flow- Momentum principle, applications: Force on plates, pipe bends, moments of momentum equation.

Flow through Pipes

Contact Hours: 05

Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

Computational Fluid Dynamics**Contact Hours: 04**

Basic equations of fluid dynamics, Grid generation, Introduction to in viscid incompressible flow, Boundary layer flow as applicable to C.F.D. Hydro informatics: Concept of hydro informatics –scope of internet and web based modeling in water resources engineering.

Text/Reference Books:

1. *Hydraulics and Fluid Mechanics*, P.M. Modi and S.M. Seth, Standard Book House.
2. *Theory and Applications of Fluid Mechanics*, K. Subramanya, Tata McGraw Hill.
3. *Open channel Flow*, K. Subramanya, Tata McGraw Hill.
4. *Open Channel Hydraulics*, Ven Te Chow, Tata McGraw Hill.
5. *Burnside, C.D., "Electromagnetic Distance Measurement," Beekman Publishers, 1971.*

Paper code: UCE 404**Paper name: Concrete Technology****Credit: 6****Total contact hours: 31****L-T-P: 2-1-0****Cement and Admixtures****Contact Hours: 05**

Types of Portland cement, hydration, setting and hardening process, special hydraulic cements, Admixtures, accelerators, and retarders, air-entraining agents, plasticizer and super-plasticizers.

Aggregates**Contact Hours: 04**

Shape & texture, bond, strength, specific gravity, bulk-density and moisture content of aggregates, bulking of sand, deleterious substances in aggregates, alkali-aggregate reaction, sieve-analysis and grading curves, fineness modulus, practical grading, gap grades aggregates.

Fresh Concrete**Contact Hours: 04**

Rheological aspects such as workability-flow ability, compatibility & mobility of concrete, factors affecting workability and lab determination, segregation, bleeding & laitance.

Strength of Concrete**Contact Hours: 05**

Compressive strength and factors affecting it, behaviours of concrete under various stress states, testing of hardened concrete-cube and cylinder test, Platen effect, flexure test, non-destructive testing such as rebound hammer, USPV, core-cutting stress-strain relation and modulus of elasticity, shrinkage, creep of concrete and its effect.

Durability of Concrete**Contact Hours: 04**

Corrosion of reinforcing bars, sulphate attack, frost action, deterioration by fire, concrete in seawater, acid attack, and carbonation.

Mix Design**Contact Hours: 05**

Basic consideration-cost, workability, strength and durability grading, method of mix design, acceptance criteria for concrete.

Advances in Construction Materials**Contact Hours: 04**

Higher strength concrete, fibre-reinforced concrete, concrete containing polymers, heavy weight and light weight concrete, mass concrete, blended concrete, Ferro-cements & its applications.

Text/Reference Books:

1. *Concrete, Structure, Properties and Materials* by P.K. Mehta , Prentices-Hall, Inc., New Jersey, USA.
2. *Properties of Concrete* by A.M. Neville, Longman U.K.
3. *Concrete Technology* by M.L. Gambhir , Tata McGraw Hill.
4. *Testing of Concrete in Structures* by J.H. Bungey, Surrey Univ Press, New York.
5. *Concrete Technology: Theory and Practice* by M.S. Shetty, S. Chand Publishing, Ram Nagar, New Delhi..

Paper code: UMA471**Paper name: Numerical Methods with Computer Programming Lab****Credit: 2**

List of Experiments

1. Program to find a root of a nonlinear equation using the Method of Bisection.
2. Program to find a root of a nonlinear equation using the Method of Regula-Falsi method.
3. Program to find the root of a nonlinear equation using the Newton-Raphson method.
4. Program to find the root of a nonlinear equation using the Secant Method.
5. Program to construct Lagrange's interpolation polynomial method.
6. Program to evaluate a definite integral by Trapezoidal rule
7. Program to evaluate a definite integral by Simpson's 1/3 rule.
8. Program to evaluate a definite integral by Simpson's 3/8 rule.
9. Program to find the solution of initial value problem using Euler's method.
10. Program to find the solution of initial value problem using improved Euler's method.
11. Program to find the solution of initial value problem using Modified Euler's method.
12. Program to find solution of initial value problem using fourth order Runge Kutta method.
13. Program to find solution of initial value problem using third order Runge Kutta method.
14. Program for solving ordinary differential equation by Milne method.

Text/ Reference Books

1. *Introductory Methods of Numerical Analysis: S.S. Sastry, PHI learning Pvt Ltd.*
2. *Numerical Methods for Scientific and Engineering computation: M.K Jain, S.R.K Iyengar and R.K Jain, New age Inter-national Publishers.*
3. *Numerical Method: E. Balagurusamy, Tata McGraw Hill Publication.*
4. *Xavier: C Language and Numerical Methods.*

Paper code: UCE 471**Paper name: Surveying-II Lab****Total contact hours: 40****Credit: 2****L-T-P: 0-0-2**

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|---|--------------------------|
| 1. To determine the constants K and C of a tacheometer. | Contact Hours: 04 |
| 2. To determine the height and distance of an object by tacheometric surveying. | Contact Hours: 04 |
| 3. To set out circular curves by offsets from tangents. | Contact Hours: 04 |
| 4. Setting out circular curve by offsets from chords produced. | Contact Hours: 04 |
| 5. Setting out circular curve by Rankine's method of deflection distances. | Contact Hours: 04 |
| 6. Setting out circular curve by two theodolite method. | Contact Hours: 04 |
| 7. Triangulation survey with the help of a satellite station. | Contact Hours: 04 |
| 8. To determine the area and volume for a given plot of land. | Contact Hours: 04 |
| 9. To determine the area using a GPS device. | Contact Hours: 04 |
| 10. To perform survey using remote sensing software's. | Contact Hours: 04 |

Paper code: UCE 472**Paper name: Hydraulic Engineering Lab****Total contact hours: 20****Credit: 2****L-T-P: 0-0-2**

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|---|--------------------------|
| 1. Flow Visualization | Contact Hours: 02 |
| 2. Boundary Layer | Contact Hours: 02 |
| 3. Laminar flow through pipes | Contact Hours: 02 |
| 4. Major losses / Minor losses in pipe | Contact Hours: 02 |
| 5. Uniform Flow | Contact Hours: 02 |
| 6. Velocity Distribution in Open channel flow | Contact Hours: 02 |

7. Venturi Flume
8. Flow under Sluice Gate
9. Gradually Varied Flow
10. Hydraulic Jump

Contact Hours: 02
Contact Hours: 02
Contact Hours: 02
Contact Hours: 02

Paper code: UCE 473

Paper name: Concrete Technology Lab

Total contact hours: 18

Credit: 2
L-T-P: 0-0-2

1. Testing of Cement

Normal consistency of cement, fineness of cement by sieving, initial and final setting time of cement, specific surface test on cement, soundness of cement.

Contact Hours: 05

2. Testing of Aggregates

Sp. Gr. and water absorption of fine aggregate, Sp. Gr. and water absorption of coarse aggregate, Particle size distribution and fineness modulus, Bulking of Fine Aggregates, Bulk Density, Silt Content, Flakiness Index, Elongation Index, Percentage Elongation

Contact Hours: 05

3. Test on Concrete

Workability Tests: Slump test, Compaction Factor test, Flow table test

Contact Hours: 04

4. Test for Strength of concrete

Compressive Test, Flexural Test.

Contact Hours: 04

Paper code: UCE 474

Paper name: Civil Engineering Drawing

Total contact hours: 20

Credit: 2
L-T-P: 0-0-2

1. Residential Buildings, Industrial building, Public building, Signs and symbols of building materials, Single Storied Residential Buildings (pitched roof) -Type II, Double Storied Residential Building with Flat Roof -Type III.

Contact Hours: 06

2. Bond in Brick Masonry (orthographic and isometric), Bonds in Stone Masonry.

Contact Hours: 04

3. Doors, windows and ventilators; Arches and Lintels; Timber joints and Trusses.

Contact Hours: 04

4. Stair cases.

Contact Hours: 02

5. Simple drawings of above topics on computer Graphics (Auto-CAD).

Contact Hours: 04