B.Tech in

Civil Engineering

Faculty of Engineering

Revised in June 2015

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Vision of the Institute

To be a global leader in the delivery of engineering education, transforming individuals to become creative, innovative, and socially responsible contributors in their professions.

Mission of the Institute:

- To provide best-in-class infrastructure and resources to achieve excellence in technical education,
- To promote knowledge development in thematic research areas that have a positive impact on society, both nationally and globally,
- To design and maintain the highest quality education through active engagement with all stakeholders –students, faculty, industry, alumni and reputed academic institutions,
- To contribute to the quality enhancement of the local and global education ecosystem,
- To promote a culture of collaboration that allows creativity, innovation, and entrepreneurship to flourish, and
- To practice and promote high standards of professional ethics, transparency, and accountability

Vision of the Department:

To excel in imparting quality education in Civil Engineering and moulding professionals to address the technological challenges and societal needs.

Mission of the Department:

- Foster professionally competent civil engineers through dedicated team effort, international academic collaborations and industrial exposure.
- Achieve excellence in research through advanced laboratory facilities, collaborative projects with academia and industries
- Provide life skills training; inculcate societal commitment through value based education and outreach programmes.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Achieve excellence in Civil engineering skills to engage in diverse career choices

PEO2: Develop attitude of lifelong learning through research, multidisciplinary studies and professional organisations

PEO3: Demonstrate the ability to function in a team environment along with leadership, communication and management skills.

PEO4: Exhibit sensitivity in serving the society as ethical and responsible professionals

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: Ability to solve problems related to structural/ geotechnical/ transportation/ environmental engineering

PSO2: Provide design details with specifications and estimates for systems like buildings and hydraulic structures.

PSO3: Apply concepts of construction engineering, management and sustainability in project environment

PROGRAM OUTCOMES (PO)

Engineering Graduates will be able to:

- **PO1: Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
- **PO2: Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles

of mathematics, natural sciences, and engineering sciences.

- **PO3: Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
- **PO4: Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- **PO5: Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
- **PO6: The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
- **PO7: Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
- **PO8: Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
- **PO9: Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
- **PO10: Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
- **PO11: Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- **PO12: Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Evaluation Pattern

50:50 (Internal: External) (All Theory Courses)

Assessment	Internal	External
Periodical 1 (P1)	15	
Periodical 2 (P2)	15	
*Continuous Assessment (CA)	20	
End Semester		50

80:20 (Internal: External) (Lab courses and Lab based Courses having 1 Theory hour)

Assessment	Internal	External
*Continuous Assessment (CA)	80	
End Semester		20

70:30(Internal: External) (Lab based courses having 2 Theory hours/ Theory and Tutorial)

Theory- 60 Marks; Lab- 40 Marks

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
*Continuous Assessment (Theory) (CAT)	10	
Continuous Assessment (Lab) (CAL)	40	
End Semester		30

65:35 (Internal: External) (Lab based courses having 3 Theory hours/ Theory and Tutorial)

Theory- 70 Marks; Lab- 30 Marks

Assessment	Internal	External
Periodical 1	10	
Periodical 2	10	
*Continuous Assessment (Theory) (CAT)	15	
Continuous Assessment (Lab) (CAL)	30	
End Semester		35

*CA – Can be Quizzes, Assignment, Projects, and Reports

Letter Grade	Grade Point	Grade Description
O	10.00	Outstanding
A+	9.50	Excellent
A	9.00	Very Good
B+	8.00	Good
B	7.00	Above Average
C	6.00	Average
P	5.00	Pass
F	0.00	Fail

Grades O to P indicate successful completion of the course

$$CGPA = \frac{\sum (C_i x Gr_i)}{\sum C_i}$$

Where

C_i = Credit for the i^{th} course in any semester

Gr_i= Grade point for the i^{th} course

Cr. = Credits for the Course

Gr. = Grade Obtained

Program Articulation Matrix

Course Code & Course Name	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
15 CVL102 (EM)	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-
15CVL112 Intro to civil	1					3	3		2				1	-	-
15CVL202 (FM)	3	3	1	-	-	-	-	-	-	-	-	-	3	-	-
15CVL203 (SM)	3	3	2	-	2	-	-	-	-	-	-	2	3	-	-
15CVL204 (Surveying)	3	3	1	-	1	1	1	-	1	-	-	-	3	-	-
15CVL212 Geology and soil mech	2	2	-	1	-	1	1	1	-	-	-	-	3	-	-
15CVL214 (SA)	3	3	1	1	-	-	-	-	1	1	-	1	3	-	-
15CVL221 (Hydraulics)	3	3	1	-	-	-	-	-	-	-	-	-	3	2	
15CVL301 (ASA)	2	3	-	-	3	3	-	-	-	-	-	1	3	-	-

15CVL302 (DCS)	3	3	3	-	2	-	-	-	2	1	-	2	3	-	-
15CVL303 Geotechnical	3	3	2	1	-	1	-	1	-	-	-	-	3	-	-
15CVL312 (Environmental 1)	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
15CVL 401 (ConstructionMannagement)	2	3	1	-	1	3	-	2	-	-	2	-	1		3
15CVL402 (Environmental 2)	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
15CVL450 (Foundation)	3	3	3	-	-	2	-	-	-	-	-	2	3	-	-
CVL453(Ground improvement)	3	2	2	1	1	-	-	-	1	1	-	-	-	3	-
CVL458(Water resource planning design)	3	2	1	1	3	1	-	-	1	1	1	1	-	-	3
15 CVL464 Advanced environmental	3	3	3	-	-	-	-	-	-	-	-	-	2	2	-
CVL474 (Ground improvement)	3	2	-	-	-	-	2	-	-	-	-	2	3	2	3
15CVL112 (CAD)	3	3	3	2	3	-	-	-	-	-	-	3		3	

15CVL281 (MT Lab)	2	1	-	-	-	-	-	-	3	3	-	-	3	-	-
15CVL 282 (Survey practical)	2	1	-	-	-	-	-	-	3	3	-	2	3	-	-
15CVL285(CM Lab)	1	-	-	3	-	-	-	-	3	3	-	1	1	1	1
15CVL286(FM Lab)	3	3	-	3	-	-	-	-	3	3	-	3	3	1	-
15CVL381(BD)	1	-	2	2	3	3	1	-	2	3	3	2	1	3	1
15CVL382(GE Lab	3	3	-	3	-	-	-	-	3	3	-	3	3	1	1
15CVL385(EE Lab)	1	-	-	2	-	-	-	-	3	3	-	-	2	-	-
15CVL386(Estimation)	3	3	-	1	1	1	-	3	3	1	1	3	3	3	1
15CVL481(Design and detailing)	3	2	2	3	3	2	-	-	3	3	3	-	3	3	1
CVL497(Seminar)	-	3	-	3	3	3	3	2	3	3	3	2	-	-	2

15ENG111 COMMUNICATIVE ENGLISH 2 0 2 3

OBJECTIVES: *To make the students communicate their thoughts, opinions, and ideas freely and naturally; to make them understand the different styles in communication; to make the students understand the aesthetics of reading and writing; to bring in a spirit of enquiry; to motivate critical thinking and analysis; to help them ruminate on human values.*

Unit 1

Reading: Different styles of communication – Reading Comprehension - critical thinking and analysis – Note-making – Any two pieces from the text.

Unit 2

Writing: Prewriting techniques - Kinds of paragraphs - basics of continuous writing.

Grammar & Usage: Parts of Speech, Tenses, Concord, Phrasal Verbs, Modal Auxiliaries, Modifiers (Workbook) - Any two pieces from the text.

Unit 3

Practical sessions (Listening & Speaking): Introduction to English pronunciation including minimal pairs and word stress – differences between British and American English – Listening comprehension and Note-taking - Any two pieces from the text.

Activities: Short speeches, seminars, quizzes, language games, debates, and discussions, Book Reviews, etc.

Text: *Language through Reading: Compilation by Amrita University for internal circulation*

Poems:

i. The Poplar Field by William Cowper
ii. Telephone Conversation by Wole Soyinka

Prose:

i. Higher Mathematics by R. K. Narayan
ii. Wings of Fire by Abdul Kalam (Part III.11)

Short Stories:

i. Best Investment I Ever Made by A. J. Cronin
ii. Death of an Indian by Krishna CharanDas

Language through Practice: Compilation by Amrita University for internal circulation

Outcomes:

CO 1: Demonstrate competency in all the four linguistic skills viz, listening, speaking, reading and writing.

CO 2: Apply different styles of communication in professional context.

CO 3: Take part in different planned & extempore communicative activities.

CO 4: Interpret and Discuss facts and information in a given context.

CO 5: Develop an appreciation for human values.

CO –PO Mapping:

	PO6	PO7	PO8	PO9	PO10	PO12
CO1					3	2
CO2				2	3	2
CO3					3	
CO4					3	
CO5			2			

15MAT111 CALCULUS AND MATRIX ALGEBRA 2 1 0 3

Unit 1

Calculus

Graphs: Functions and their Graphs. Shifting and Scaling of Graphs.

Limit and Continuity: Limit (One-Sided and Two-Sided) of Functions. Continuous Functions, Discontinuities, Monotonic Functions, Infinite Limits and Limit at Infinity.

Unit 2

Differentiation and its Applications: Derivative of a function, non- differentiability, Intermediate Value Property, Mean Value Theorem, Extreme Values of Functions, Monotonic Functions, Concavity and Curve Sketching, Integration: Definite Integrals, The Mean Value Theorem for definite integrals, Fundamental Theorem of Calculus, Integration Techniques.

Unit 3

Matrix Algebra

Review: System of linear Equations, linear independence

Eigen values and Eigen vectors: Definitions and Properties, Positive definite, Negative Definite and Indefinite Matrices, Diagonalization and Orthogonal Diagonalization, Quadratic form, Transformation of Quadratic Form to Principal axes, Symmetric and Skew Symmetric Matrices, Hermitian and Skew Hermitian Matrices and Orthogonal Matrices Iterative Methods for the Solution of Linear Systems, Power Method for Eigen Values and Eigen Vectors.

Outcomes:

CO1: Understand the basic concepts of functions, limits, continuity, derivatives and analyze them.

CO2: Apply the concept of differentiability to find the extreme values of the given function and analyze the derivatives to sketch the graph of the given function.

CO3: Recall the terms, facts and basic concepts of definite integrals and the techniques of obtaining antiderivatives.

CO4: Understand the notion of eigenvalues and eigenvectors, analyze the possibility of diagonalization and hence compute a diagonal matrix, if possible.

CO5: Apply the knowledge of diagonalization to transform the given quadratic form into the principal axes form and analyze the given conic section.

CO6: Understand the advantages of the iterative techniques and apply it to solve the system of

equations and finding eigenvectors.

CO –PO Mapping:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	1	3	1	-	-	-	-	-	-	-	-	0	-	-
CO3	3	0	0	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	0	-	-	-	-	-	-	-	-	0	-	-
CO5	2	3	1	-	-	-	-	-	-	-	-	0	-	-
CO6	3	0	0	-	-	-	-	-	-	-	-	0	-	-

TEXTBOOKS:

1. *'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.*
2. *'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, 2015, Tenth Edition.*

REFERENCE BOOKS:

1. *'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.*
2. *'Advanced Engineering Mathematics', by Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.*

15CSE100 COMPUTATIONAL THINKING AND PROBLEM SOLVING 3 0 2 4

Unit 1

Basics: Introduction, Information and data, Data encoding. Logic: Boolean logic, Applications of propositional logic.

Unit 2

Problem Solving and Algorithmic Thinking: Problem definition, Logical reasoning, Problem decomposition, Abstraction. Flowcharting, Name binding, Selection, Repetition, Modularization. Data organization: List and Arrays. Simple algorithms, comparison of performance of algorithms.

Unit 3

Problem Solving Techniques: Factoring and Recursion Techniques, Search and Sort techniques, Text processing and Pattern matching.

Outcomes:

CO1: Apply computational thinking principles and algorithmic building blocks to understand, define, and solve problems
CO2: Design algorithms and implement solutions for problems
CO3: Represent, organize, manipulate and interpret data
CO4: Trace computational states and analyse techniques/ strategies for given solutions

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	3	-	3	-	-	3	3	3	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	1	2	-	2	-	-	-	-	-	-	-	-	-

TEXTBOOKS:

1. *David Riley and Kenny Hunt, Computational Thinking for Modern Solver, Chapman & Hall / CRC, 2014*
2. *R. G. Dromey, "How to solve it by Computer", PHI, 2008*

15CHY100 CHEMISTRY 3 0 0 3

Unit 1

Chemical Bonding

Review of orbital concept and electronic configuration, electrovalency and ionic bond formation,

ionic compounds and their properties, lattice energy, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties. Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan's rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules - co- ordinate covalent compounds and their characteristics, molecular orbital theory for H2, N2, O2 and CO, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

Unit 2

Thermodynamic Parameters

Stoichiometry - mole concept, significance of balanced chemical equation - simple calculations - Conditions for occurrence of chemical reactions - enthalpy, entropy and free changes - spontaneity – Thermochemistry - heats of reactions - (formation, combustion, neutralization) - specific heats - variation of enthalpy change with temperature - Kirchhoff' relation (integrated form) - bond enthalpy and bond order
- Problems based on the above.

Kinetics

Review of molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions) - complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arrhenius equation and its significance, Michaelis Menden kinetics-enzyme catalysis.

Unit 3

Electrochemistry

Electrolytes - strong and weak, dilution law, Debye-Huckel theory, faraday's laws, origin of potential, single electrode potential, electrochemical series, electrochemical cells, Nernst equation and its application, reference electrodes - SHE, Ag/AgCl, Calomel.

Photochemistry

Photochemistry, laws of photochemistry - Stark-Einstein law, Beer-Lamberts law, quantum efficiency-determination, photochemical processes - Jablonsky diagram, internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo sensitization, photo polymerization.

Outcomes:

CO 1: Understand the fundamental concepts of chemistry to predict the structure and properties of engineering materials
CO 2: Develop analytical skills to evaluate the cause, feasibility and course of chemical reactions
CO 3:Design and apply the idea of cutting edge area of chemistry to solve engineering related problems

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-
CO3	-	-	2	1	-	-	-	-	-	-	-	-

REFERENCE BOOKS

Physical chemistry, Puri and Sharma Inorganic chemistry, Puri and Sharma

15PHY100 PHYSICS 3 0 0 3

Unit 1

Review of Classical Physics and dual nature of Waves /particle Review of Kinematics, Force, Newton's Laws, Linear Momentum, Work, Energy, Power, Angular Motion - Kinematics and Mechanics, Angular momentum Torque, Conservation laws (linear and angular).

Particle properties of waves: Photoelectric effect, quantum theory of light, X-ray diffraction, Compton effect, pair production. Wave properties of particles: Waves, De Broglie waves, Group velocity and phase velocity, uncertainty principle.

Unit 2

Atomic Structure and Quantum Mechanics

Atomic Structure: Various models of atom, Atomic Spectra, Energy Levels, Correspondence Principle, Nuclear Motion, Atomic Excitation, and Rutherford Scattering.

Quantum Mechanics: Introduction - wave equation - Schrodinger's equation (time dependent and independent) - expectation values, operators, Eigen value (momentum and energy) – 1D potential box (finite and infinite) - tunnel effect - harmonic oscillator.

Unit 3

Statistical Mechanics and Solid State Physics

Statistical Mechanics: Classical Distribution - Maxwell's Boltzmann-Molecular energies of an ideal gas - most probable speed. Quantum Statistics - Bose-Einstein and Fermi-Dirac. Applications - Black Body Radiation, Specific heat of solids, free electrons in metals, Electron energy.

Solid State Physics: Types of solids, Crystallography, Bonds- Ionics, Covalent, and Van der Waals, Band Theory and energies, Semiconductor Devices, and Superconductivity.

Outcomes:

CO1: Understand, Comprehend and acquaint with concepts of Modern Physics
CO2: Analyze and solve (idealized and quasi practical) physics problems pertaining to various concepts of Modern Physics
CO3: Apply concepts of Modern Physics to solve engineering problems that needs ideas from Modern Physics

CO –PO Mapping:

CO/ PO	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PO13	PSO 1	PSO 2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TEXTBOOK:

"Concept of Modern Physics", Arthur Beiser, Tata-McGraw Hill, edition.

REFERENCE BOOK:

"Principles of Physics" by Halliday, Resnick and Walker, 9th edition

15CHY181 CHEMISTRY LAB. 0 0 2 1

1. Acid base titration (double titration)
2. Complexometric titration (double titration)
3. Redox (permanganimetry) titration (double titration)
4. Conductometric titration
5. Potentiometric titration
6. Ester hydrolysis

Outcomes:

CO1:Develop analytical skills for the determination of water quality parameter

CO2:Understand the electrochemical principles of conductance and electrode potentials and its application in analytical science

CO3:Develop analytical skills in the determination of rates of chemical reactions and its application

CO4:Learn the basics of redox reaction and applying it for quantitative determination.

CO5:Create skills to convert basic chemical reactions to analytical application.

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12
CO1	3	3	1	-	-	-	-	-	-	-	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-
CO 3	3	3	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	1	-	-	-	-	-	-	-	-	-

15PHY181 PHYSICS LAB. 0 0 2 1

Young's Modulus – Non Uniform Bending Newton's Rings
Laser - Determination of Wavelength and Particle Size Determination Spectrometer
Carey Foster's Bridge

Rigidity Modulus - Tensional Pendulum Viscosity of Liquid by Stokes's method Ultrasonic Interferometer
Hysteresis – B H curve

Outcomes:

CO1: Prepare for the lab experiment and perform individually a wide spectrum of experiments.

CO2: Present experimental data in various appropriate forms like tabulation, and plots.

CO3: Analyze, Interpret and Summarize experimental results.

CO4: Communicate clearly understanding of various experimental principles, instruments/setup, and procedure.

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PO13	PSO1	PSO2	PSO3
CO1	-	1	-	-	1	-	-	-	2	1	-	-	-	-	-	-
CO2	-	2	-	2	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	3	1	-	-	-	-	-	1	1	-	-	-	-	-	-
CO4	-	-	-	-	1	-	1	-	1	3	-	-	-	-	-	-

15MEC180 WORKSHOP A 0 0 2 1

1. **Product Detailing Workshop**

Disassemble the product of sub assembly - Measure various dimensions using measuring instruments - Free hand rough sketch of the assembly and components
- Name of the components and indicate the various materials used - Study the functioning of the assembly and parts - Study the assembly and components
design for compactness, processing, ease of assembly and disassembly - Assemble the product or subassembly.

2. **Pneumatics and PLC Workshop**

Study of pneumatic elements - Design and assembly of simple circuits using basic pneumatic

elements - Design and Assembly of simple circuits using Electro-pneumatics.

Study of PLC and its applications - Simple programming using ladder diagrams.

3. Sheet Metal Workshop

Study of tools and equipments - Draw development drawing of simple objects on sheet metal (cone, cylinder, pyramid, prism, tray etc.) Fabrication of components using small shearing and bending machines - Riveting and painting practice.

4.(a) Welding Workshop

Study of tools and equipments - Study of various welding methods - Arc welding practice and demonstration of gas welding and cutting.

(b) Demo and practice Workshop

Fitting: Study of tools, practice in chipping, filing and making joints. Carpentry: Study of tools, planning practice and making joints

Outcomes:

CO1: Dismantle and assemble various products.

CO2: Design and simulate pneumatic and electro-pneumatic circuits.

CO3: Fabricate sheet metal objects.

CO4: Perform arc welding and soldering.

CO-PO Mapping:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	1	-	-	-	-	-	-	2	1	-	1
CO 2	2	2	1	-	1	-	-	-	2	1	-	1
CO 3	2	2	-	-	-	-	-	-	2	1	-	1
CO 4	2	1	-	-	-	-	-	-	2	1	-	1

REFERENCE:

Concerned Workshop Manual

15EEE180 WORKSHOP B 0 0 2 1

Part A - Electronics

Identification of electronic components (Passive and Active)

Study of measuring instruments (Voltmeter, Ammeter and Multimeter) Measurement and theoretical Verification of series and parallel combination of resistors and capacitors

Calibration of CRO and measurements of signal parameters (RMS, maximum value, peak value, time and frequency)

Calibration of function generator using CRO Soldering practice

Part B - Electrical

1. Study on power supply and protective devices
2. Study on tools and electrical accessories
3. Study on sources of light
4. Study on energy efficiency
5. Study on water pump
6. Study on house hold appliances:

a. Iron box
b. Fan
c. Refrigerator
d. Air conditioner

7. House wiring I – Glow an incandescent lamp using SPST switch
8. House wiring II – Glow a fluorescent lamp using SPST switch
9. House wiring III – Operate a fan and an incandescent lamp using two independent SPST switch
10. House wiring IV – Operate a fluorescent lamp and a 3 pin socket using two independent SPST switch
11. House wiring V – Staircase wiring
12. House wiring VI – Godown wiring

Outcomes:

CO1: Understand electrical safety measures and identify electrical tools, electronic components and their symbols.

CO2: Understand electric laws using simulation studies and detect failures in electrical and electronic circuits.

CO3: Build/Solder and test, residential wiring/Electronic circuits and measure electrical

parameters.

CO4: Estimate the materials required for wiring a building.

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	1	3	-	-	-	-	-	3	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	2	-	-	-	-	-

15MEC100 Engineering Drawing CAD I 2 0 2 3
(Pre-Requisite: Nil)

Objectives:

1. To develop drawings using Bureau of Indian Standards (BIS)
2. To communicate effectively through drawings
3. To enhance visualization skills, which will facilitate the understanding of engineering systems.

Keywords:

Coordinate system**,** Orthographic projections, Isometric projections

Contents:

Introduction, Drawing Instruments and their uses, Layout of the Software, standard tool bar/menus, navigational tools. Co-ordinate system and reference planes. Creation of 2 dimensional environment. Selection of drawing size and scale. Commands and Dimensioning.

Orthographic Projections: Introduction, Planes of projection, reference line. Projection of points in all the four quadrants. Projection of straight lines, Projection of Plane Surfaces, and Projection of Solids in first angle projection system.

Outcomes:

CO1: Understand the fundamental principles of first angle and third angle projections.

CO2: Dimension and label the drawings as per standards.

CO3: Construct the drawings by choosing appropriate line type.

CO4: Visualize and construct projections of line and lamina when inclined to one reference plane and both reference planes.

CO5: Visualize and construct solid entities in its simple position and when inclined to one reference plane. CO6: Construct the drawings using computer aided design and drafting software package

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	-	2	-	-	-	3	-	3	2	2	2
CO2	3	3	2	2	-	2	-	-	-	3	-	3	2	2	2
CO3	3	3	3	2	-	2	-	-	-	3	-	3	2	2	2
CO4	3	3	3	3	-	2	-	-	-	3	-	3	2	2	2
CO5	3	3	3	3	-	2	-	-	-	3	-	3	2	2	2
CO6	3	3	3	3	-	2	-	-	-	3	-	3	2	2	2

TEXTBOOK:

Bhat N. D. and Panchal V. M, "Engineering Drawing Plane and Solid Geometry" , 42e, Charoatar Publishing House, 2010

REFERENCES:

1. *James D. Bethune, "Engineering Graphics with AutoCAD", Pearson Education, 2014*
2. *K. R. Gopalakrishna, "Engineering Drawing", 2014, Subhas Publications*
3. *Narayan K. L. and Kannaiah P, Engineering Drawing, SciTech Publications, 2003*

15CUL101 CULTURAL EDUCATION I 2 0 0 2

Unit 1

Introduction to Indian Culture; Introduction to Amma's Life and Teachings; Symbols of Indian Culture.

Unit 2

Science and Technology in ancient India; Education in Ancient India; Goals of Life

- Purusharthas; Introduction to Vendanta and Bhagavat Gita.

Unit 3

Introduction to Yoga; Nature and Indian Culture; Values from Indian History; Life and work of Great Seers of India.

Outcomes:

CO1: Be introduced to the foundational concepts of Indian culture and heritage, will be able to understand the cultural ethos of Amrita Vishwa Vidyapeetham, and Amma‟s life a

CO2: Understand the foundational concepts of Indian civilization like purusharthas, law of karma, etc, which contributes towards personality growth.

CO3: Gain a positive appreciation of Indian culture, traditions, customs and practices

CO4: Imbibe spirit of living in harmony with nature, and principles and practices of Yoga

CO5: Get guidelines for healthy and happy living from the great spiritual masters

CO-PO Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO 2
CO1	-	-	-	-	-	-	-	2	-	1	-	3	-	-
CO2	-	-	-	-	-	-	1	1	3	2	-	3	-	-
CO3	-	-	-	-	-	-	1	2	3	1	-	3	-	-
CO4	-	-	-	-	-	-	3	3	3	3	-	3	-	-
CO5	-	-	-	-	-	-	1	1	3	3	-	3	-	-

TEXTBOOKS:

1. *The Glory of India (in–house publication)*
2. *The Mother of Sweet Bliss (Amma's Life & Teachings)*

15MAT121 VECTOR CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS 3 1 0 4

Unit 1

Vector Differentiation: Vector and Scalar Functions, Derivatives, Curves, Tangents, Arc Length, Curves in Mechanics, Velocity and Acceleration, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field. (Sections: 9.4, 9.5, 9.6, 9.9, 9.10, 9.11)

Vector Integration: Line Integral, Line Integrals Independent of Path. Green's Theorem in the Plane (Sections: 10.1, 10.2, 10.3, 10.4).

Unit 2

Surface Integral: Surfaces for Surface Integrals, Surface Integrals, Triple Integrals – Gauss Divergence Theorem, Stoke's Theorem. (Sections: 10.5, 10.6, 10.7, 10.9)

First Order Differential Equations: First Order ODE, Exact Differential Equations and Integrating Factors (Sections 1.1and 1.4).

Unit 3

Second Order Differential Equations: Homogeneous and non-homogeneous linear differential equations of second order (Review), Modelling: Free Oscillations, Euler-Cauchy Equations, Solution by Undetermined Coefficients, Solution by the Method of Variation of Parameters (Sections 2.1, 2.2, 2.4, 2.5, 2.6, 2.7, 2.10).

System of Order Differential Equations: Basic Concepts and Theory, Constant Coefficient systems – Phase Plane method, Criteria for Critical Points, Stability. (Sections 4.1 – 4.4).

Outcomes:

CO 1: Able to understand, and interpret the concepts.
CO 2: Able to apply the concept and understand them
CO 3: Able to understand and implement the concepts in application oriented problems.
CO 4: Able to understand and analyze the and apply the knowledge of diagonalization of matrices to transform the given quadratic form.
CO5: Able to understand the basic concepts and apply them in modeling the first order ODEs.
CO6: Able to understand and apply methods of undetermined coefficients and variation of parameters to solve second order ODEs.

CO –PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	1	3	1	-	-	-	-	-	-	-	-	1
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	2	3	1	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	-	-	-	-	-	-	-	-

TEXTBOOK:

'Advanced Engineering Mathematics', Erwin Kreyszig, John Wiley and Sons, Tenth Edition, 2015.

REFERENCE BOOKS:

1. *'Advanced Engineering Mathematics', Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.*
2. *'Calculus', G. B. Thomas Pearson Education, 2009, Eleventh Edition.*
3. *'Calculus', Monty J. Strauss, Gerald J. Bradley and Karl J. Smith, 3rd Edition, 2002.*

15CVL111 Introduction to Civil Engineering 1 0 0 1

Introduction to the various areas of Civil engineering - Simple concepts in each ofthe areas - Respective tasks performed by each specialty which contributes to aconstructedfacility.

Introduction to the Civil engineering undergraduate curriculum map - the relationshipbetween the courses in the curriculum.

Course Outcomes

CO1: Understand the relationship between the knowledge of basic science to civil engineering practice.

CO2: Illustrate the importance different component fields within civil engineering.

CO3: Visualize the importance of civil engineering practice in the most ethical manner for sustainable development.

Text/Reference Books:

1. ValdengraveOkumu, "An Introduction to Civil Engineering", Createspace Independent Publishers, 2014.
2. S. T. Mau and Sami Maalouf, "Introduction to Civil Engineering: A Student's Guide to Academic and Professional Success", Cognella, Inc; 2014
3. Bhavikatti.S.S., "Basic Civil Engineering", New Age International Publishers, 2010.
4. The National Building Code of India, BIS, (2017)
5. Code of ethics - www.ieindia.org

15CVL102 MECHANICS: STATICS AND DYNAMICS 2 1 0 3

Unit 1

Principles of statics: Introduction to vector approach – free body diagrams –forces in plane – forces in space – concurrent forces - resolution of forces –equilibrium of particle.

Statics of rigid bodies in two dimensions and three dimensions: Moment of a force about a point – moment of a force about an axis – moment of a couple – equivalent force couple system – rigid

body equilibrium – support reactions.

Unit 2

Applications of statics: Friction – contact friction problems. Analysis of trusses –method of joints – method of sections.

Properties of surfaces and solids - Centroid, Moment of inertia, Polar moment ofinertia, Mass moment of inertia, Product of inertia and Principal moment of inertia.

Unit 3

Dynamics: Rectangular and cylindrical coordinate system - Combined motion of rotation and translation - Newton's second law in rectilinear translation - D'Alembert'sprinciple - Mechanical vibration –Simple harmonic motion- Spring-mass model.

Course Outcomes

CO1: Able to analyze force systems in plane and also in space.

CO2: Able to solve two and three dimensional rigid body static equilibrium problems.

CO3: Able to determine the centroid of planes, center of gravity of masses and evaluate their moments of inertia.

CO4: Able to evaluate velocity and acceleration of a particle in rectangular and cylindrical coordinate systems and angular velocity of rigid bodies that are in plane motion.

CO5: Able to solve the problem related to bodies in dynamic Equilibrium and bodies undergoing forced and free vibration using the laws of kinetics

Text Books:

1. Beer, F. P. and Johnston, E. R., "Vector Mechanics for Engineers- Statics and Dynamics", 8/e, McGraw Hill International Book Co., 2008.

3. Shames, I. H, "Engineering Mechanics – Statics and Dynamics", 4/e, Prentice–Hall of India Pvt. Ltd., 2003.

References:

1. *Hibbeler, R. C., "Engineering Mechanics', 12/e, Pearson Education Pvt. Ltd., 2007.*
2. *Meriam, J. L., "Dynamics", 5/e, John Wiley & sons, 2003.*
3. *K. L. Kumar, "Engineering Mechanics", 3/e, Tata McGraw Hill, 2003.*

15CSE102 Computer Programming 3 0 0 3

Objectives:

1. The course intends to familiarize the students with the structured programming paradigm.
2. The course aims to provide necessary skills to students to apply the structured programming principles to solve problems

Contents:

Unit 1:

Introduction to C language: Structure of a C program, comments, Data types, variables, constants, data input and output statements, input assertions; expressions and evaluation. Functions: inter function communication, standard functions, scope. Selection: two way selection, multi-way selection. Repetition: concept of loop, loop invariant, pretest and posttest loops, initialization and updating, event and counter controlled loops. Recursion: recursive definition, recurivse solution, designing recursive functions, limitations of recursion.

Unit 2:

Files and streams, file input output, Arrays –1D numeric, searching and sorting, 2D numeric arrays, problems with matrices. Pointers: introduction, compatibility, arrays and pointers, Dynamic memory allocation, arrays of pointers, pointer arithmetic.

Unit 3:

Strings: fixed length and variable length strings, strings and characters, string input, output, array

of strings, string manipulation functions, sorting of strings. Enumerated types, Structres: structure vs array comparison, complex structures, structures and functions, Union, binary input output, command line arguments.

Outcomes:

CO1: Understand the structured programming constructs: data types (primitive and compound), control and recursion thereby to understand a given program

CO2: Understand and analyze a given program by tracing, identify coding errors and debug them

CO3: Apply structural programming constructs appropriately for given problem scenarios

CO4: Develop computer programs that implement suitable algorithms for problem scenarios and applications

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	1	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	3	2	-	-	-	-	-	-	-	-	-	-	-

TEXTBOOK:

Behrouz A. Forouzan and Richard F. Filberg, "Computer Science A structured programming approach using C", Third Edition, Cengage Learning, 2006.

REFERENCES:

1. Brian W. Kernighan, Dennis M. Ritchie, "The C Programming Language", Second Edition, Prentice Hall, 1988.
2. Eric S. Roberts, "Art and science of C", Addison Wesley, 1995.
3. Jeri Hanly and Elliot Koffman, "Problem solving and program design in C", Fifth Edition, Addison Wesley (Pearson), 2007.

15CSE180 Computer Programming Lab. 0 0 2 1

Objectives:

- The laboratory intends to provide hands-on experience on the structured programming paradigm.
- This laboratory facilitates students to apply the structured programming principles to solve problems

Contents:

Solving simple problems with operators, programs on conditional control constructs, programs on loops (while, do-while and for), programs using user-defined functions and library functions, programs on files, arrays (single and multi-dimensional), programs using DMA, programs on strings, structures.

Outcomes:

CO1: Develop solutions for problems systematically using structured logic approach.

CO2: Develop computer programs for a given problem scenario.

CO3: Make use of the programming constructs effectively while developing computer programs.

CO4: Develop modular solutions for a given scenario.

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	2	-	-	-	-	-	-	-	-	-	3	2
CO2	1	1	2	-	1	-	-	-	-	-	-	-	3	2
CO3	1	2	2	-	-	-	-	-	-	-	-	-	3	2
CO4	1	2	2	-	-	-	-	-	-	-	-	-	3	2

TEXT BOOKS/REFERENCES:

Behrouz A. ForouzanComputerand ScienceRichardAStructured ProgrammingF.Filberg, Approach"Third Edition, Cengage Learning, 2007.

15CVL112 ENGINEERING GRAPHICS – CAD 1 0 2 2

Section of Solids: Introduction, Section planes, Sectional views, apparent shapes and true shapes of sections of right regular prisms, cylinders, pyramids and cones.

Development of lateral surfaces: Introduction, Development of lateral surfaces of prisms, cylinders, pyramids and cones.

Isometric Projection: Introduction, Isometric scale, Isometric projection of prisms, pyramids, cylinders, cones

Orthographic views of three dimensional solids.

Building Drawing: Construction details – Masonry, Footings.

Development of Plan, Section and Elevation of Simple Residential building.

Course Outcomes

CO1: Construct the drawings using computer aided design and drafting software package.

CO2: Understand and apply the concepts of development of surfaces.

CO3: Visualize and construct solid entities and draw the projection of its sectioned surfaces for different sectional planes.

CO4: Interpret and draw the different types of projection like Isometric and orthographic

CO5: Develop a plan and draw its elevation and section for a simple residential building

TEXTBOOKS:

1. *Bhat N. D. and Panchal V. M., "Engineering Drawing Plane and Solid Geometry, 42e, Charoatar Publishing House, 2010*
2. *Dr.Balagopal T S Prabhu, Dr.K.Vincent Paul and Dr.C.Vijayan., "Building Design and Civil Engineering Drawing", Spades Publishers & Distributors, Calicut, 2012.*

REFERENCE BOOKS:

1. *James D. Bethune, "Engineering Graphics with AutoCAD", Pearson Education, 2014*
2. *K.R. Gopalakrishna, "Engineering Drawing", Subhas Publications,2014*
3. *Narayan K.L. and Kannaiah P, Engineering Drawing, SciTech Publications, 2003*

15CUL111 CULTURAL EDUCATION II 2 0 0 2

Unit 1

1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2

4. Who is a Wise Man?
5. A Ruler's Dharma
6. The Story of King Shibi

Unit 3

7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4

9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5

Patanjali'sAstanga -Yoga System for Personality Refinement

11. Examples of Heroism and Patriotism in Modern India

Outcomes:

CO1: Get an overview of India and her contribution to the world in the field of science and literature

CO2: Understand the foundational concepts of ancient Indian education system and practices associated with them

CO3 : Learn the important concepts of Vedas, Bhagavad-Gita and Yogasutras and their relevance to daily life

CO4 : Familiarize themselves with the inspirational characters and anecdotes from the epics and Indian history

CO5 : Gain a rational understanding of the underlying principles of Indian spirituality

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	-	1		3		
CO2							1	1	3	2		3		
CO3							1	2	3	1		3		
CO4							3	3	3	3		3		
CO5							1	1	3	3		3		

TEXTBOOKS:

Common Resource Material II (in-house publication)

Sanatana Dharma - The Eternal Truth (A compilation of Amma's teachings on Indian Culture)

15CVL201 Construction Materials 3 0 0 3

Unit 1

Commonly used building materials - relationship between material structure and properties. Masonry materials- stones, bricks, blocks; Refractory products; Timber and wood based products - Classification, properties, testing and selection criteria.

Unit 2

Binding materials (Lime, gypsum, cement) and Mortars - types, properties, tests.
Concrete – Aggregates – Mechanical and Physical properties and tests – Grading requirements – Water quality – Admixtures. Properties of concrete in fresh and hardened state – workability – segregation and bleeding – tests on workability and strength. Stress – strain characteristics and elastic properties – shrinkage and creep. Mix proportioning (B.I.S method) – nominal mixes.

Unit 3

Metals – Structural steel - properties and uses - sections – Reinforcing steel – use of Aluminium.
Bituminous materials – types and properties of asphalt, bituminous concrete.
Modern construction materials – Paints, Glass, Ceramics, Polymers and plastics, Adhesives, Composites and smart materials. Recycling of industrial waste as building materials.

Course Outcomes

CO1: Identify and characterize most common building materials.
CO2: Understand the manufacturing process and properties of bricks and cement.
CO3: Identify the methods for preservation of timber and metals
CO4: Design concrete mixes as per IS code.
CO5: Understand the use of modern construction materials.

TEXTBOOKS:

1. *Duggal, S. K., "Building Materials", New Age International Publishers, 2012.*
2. *Santhakumar.A. R., "Concrete Technology", Oxford University press, 2006.*

Reference books:

1. *Young. J. F. and Mindess, S., "The Science and Technology of Civil Engineering Materials", Prentice Hall, 1997.*
2. *Mehta, P. K. andMonteiro, P. J. M., "Concrete-Microstructure, Properties and Materials", Tata McGraw Hill, 2006.*
3. *Rangwala S. C, "Engineering Materials", Charotar Publishing House, 2011.*
4. *Shetty, M. S, "Concrete Technology-Theory and Practice", S. Chand & Co., New Delhi, 2009.*
5. *5.Gambhir, M. L. and Neha Jamwal, "Building Materials", Tata McGraw Hill, 2011.*

15CVL202 PRINCIPLES OF FLUID MECHANICS 2 1 0 3

Unit 1

Elementary concepts – properties - concept of gauge and absolute pressure, measurement of pressure using manometers of different types.
Hydrostatic force on plane and curved surface – center of pressure – lock gates - buoyancy and stability of submerged and floating bodies - metacentric height - period of oscillation**.**
Types of flow, definitions and explanations of unsteady, steady, non-uniform, laminar and turbulent flows.Ideal flow - rotational and irrotational, stream function, potential function. Path line, streak line and stream line – continuity equation – derivation, application of one dimensional steady flow – circulation and vorticity - Basic flow fields such as uniform flow, source, sink, doublet, vortex flow, spiral flow – superposed flows**.**

Unit 2

Derivation of Bernoulli's energy equation and Euler's equation, examples illustrating the use of energy equation. Flow meters - venturimeter, Orifice meter, nozzle, derivation of equations of discharge, pitot tubes – applications to flow measurements- notches and weirs.
Laminar flow through circular pipe – shear stress, pressure gradient, velocity profile, Hagen-poiseuille's equation, power calculations, laminar flow between parallel plates - Couette flow and Poiseuille flow.
Flow in closed conduits – friction loss and flow calculations, turbulent flow, Reynolds number, Darcy-Weisbach equation. Use of Moody's diagram, minor losses – pipe networks – pipes in parallel and series - equivalent length.

Unit 3

Boundary layer theory, boundary layer equation – Prandtl equation, Blasius solution, drags on flat plate, boundary layer separation and its control.
Dimensional Analysis, Similitude and Model Analysis: Methods of Dimensional Analysis – Rayleigh's method – Buckingham Pi-theorem – Hydraulic Similitude – model analysis – dimensionless numbers – Model testing of partially submerged bodies – Distorted models and scale effects.

Course Outcomes

CO1: Discuss the fundamentals of fluid mechanics and estimate its properties, measurements and behavior under various flow conditions.

CO2: Analyze the hydrostatic forces, conditions of buoyancy and stability of various floating bodies.

CO3: Apply mass, momentum and energy equations in the measurement of fluid flow.

CO4: Solve pipe network problems by considering major and minor losses.

CO5: Calculate laminar flow characteristics and boundary layer analysis using various methods.

CO6: Formulate dimensional analysis using various methods and apply the concept of similarities

TEXTBOOKS:

1. *Streeter Victor L and E. Benjamin Wylie, "Fluid Mechanics", Tata McGrawHill, 2010.*

2. *Modi P. N. and Seth S. M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Publishers & Distributors, 2013.*

REFERENCE BOOKS:

1. *Cengel and Cimbala, "Fluid Mechanics", Tata McGraw Hill Publishers, 2010.*
2. *Som S K, Gautam Biswas and Suman Chakrabarty, "Introduction to Fluid Mechanics and Fluid machines", Tata McGraw Hill Education Pvt. Ltd, 2013*
3. *N. N. Pillai, "Fluid Mechanics and Fluid Machines", Universities Press, 2008.*
4. *Subramanya K., "Theory and Applications of Fluid Mechanics", Tata McGraw Hill Publishing Co, 1993.*
5. *J. F. Douglas, J. M. Gasiorek and J. A. Swaffield., "Fluid Mechanics", Pearson Education, 2008.*
6. *White, Frank. M, "Fluid Mechanics", Tata McGraw Hill, 2011.*

15CVL203 SOLID MECHANICS 3 1 0 4

Unit 1

Stress and strain at a point – tension, compression and shear stresses – Hooke's law -Poisson's ratio - relationship between elastic constants – compound bars - thermal stresses – strain energy in tension, compression and shear - resilience – stresses due to impact and suddenly applied load. Different types of beam – statically determinate and indeterminate beams - shear force and bending moment diagrams - relationship between intensity of loading, shear force and bending moment.

Unit 2

Theory of simple bending - Stress distribution at a cross-section due to bending moment for statically determinate beams - flitched beams.
Shear stress distribution.
Unsymmetrical bending and Shear centre.
Torsion of circular solid and hollow shafts – combined bending moment and torsion on shafts – close coiled and open coiled helical springs
Complex stresses – principal stresses and principal planes- principal strains – graphical method.

Unit 3

Deflection of beams – double integration method – Macaulay's method – Area Moment method – Conjugate beam method – Strain energy approach.

Theory of columns – members subjected to axial load and bending moment – Euler's theory for long columns – assumptions and limitations – Rankine's formula.
Thin and thick cylinders – Lame's equation - compound cylinders.
Theories of failure and applications in design.

Course Outcomes

CO1: Ability to characterize and classify soils with reference to their characteristics and to evaluate their index and engineering properties

CO2: Analyse and evaluate permeability characteristics of soils

CO3: Ability to apply effective stress principles, estimate seepage through soils and determine stress distribution within a soil mass

CO4: Ability to evaluate compaction characteristics and interpret field compaction results with respect to compaction specifications

CO5: Ability to evaluate consolidation properties of soils and apply those properties to settlement problems frequently encountered in civil engineering

CO6: Ability to apply engineering science principles, using shear strength parameters, to analyse the response of soil under external loading

TEXTBOOKS:

1. Gere, J. M. and Goodno.B. J., "Mechanics of Materials", CL Engineering, 2012.
2. Beer, Johnston,DeWolf, Mazurek., "Mechanics of Materials", McGraw-Hill Education, 2013.

REFERENCE BOOKS:

1. Timoshenko, S. P., and Young, D. H., "Elements of Strength of Materials", East West Press, New Delhi, 2003.
2. Popov E. P., "Mechanics of Materials", Prentice Hall India, New Delhi, 2002
3. Crandall, S. H., Dahal, N. C., and Lardener, T. J., "An Introduction to Mechanics of Solids", McGraw Hill Books Co, 1985, 2nd Edition 2007
4. Nash W. A. "Strength of Materials", McGraw Hill Book Company, 2006

15CVL204 SURVEYING 3 1 0 4

Unit 1

Introduction - classification of surveys – reconnaissance - principle of working from whole to part – provision of control – conventional signs
Chain survey – instruments – principles of chain survey – field book – plotting – tie line and check line.
Compass survey – types of compass – types of bearings – dip and declination – local attraction – traversing – plotting - error of closure.
Plane table survey - two point problem – three point problem – errors in plane tabling.

Unit 2

Levelling – leveling instruments and its adjustments – fly leveling – booking - corrections for refraction and curvature – reciprocal leveling – longitudinal leveling and cross sectioning – contour surveying – definition – characteristics, methods and uses of contouring – plotting – areas and volumes – planimeter - Earthwork volume calculation.
Theodolite surveying – study of theodolite and its adjustments - measurement of horizontal angles - vertical angles – heights and distances – theodolite traverse – calculation of co-ordinates – corrections – traversing conditions for closure.

Unit 3

Minor instruments – hand levels – clinometer – Ceylon ghat tracer – hypsometer – pantagraph – ediograph – box sextant - telescopic alidade.
Curves – simple, transition and vertical curves - curve setting by various methods.
Tacheometric surveying – various methods – instrument constants – analytic lens – tangential system – direct reading tacheometer - subtense bar – trigonometric leveling. Total station - introduction to photogrammetry, remote sensing, global positioning systems, and Geographic information systems. EDM.
Introduction to Hydrographic surveying.

Course Outcomes

CO1: Determine and analyze the relative coordinates on a horizontal plane

CO2: Determination of area and volume using measurements along vertical coordinates

CO3: Analysis of horizontal and vertical coordinates using a theodolite.

CO4: Application of minor instruments and advanced technologies in surveying

TEXTBOOKS:

1. *Kanetkar T. P. and Kulkarni S. V., "Surveying and Levelling", Vol. I & II, VidyarthiGrihaPrakashan, 2006.*
2. *Arora K. R., "Surveying", Vol. I & II, Standard Publishers, 2010.*

REFERENCE BOOKS:

1. *Bannister, A. and Baker, R., "Solving Problems in Surveying", Addison Wesley Longman, 1996.*
2. *R. Agor, "Textbook of Surveying and Levelling", Khanna Publishers,2012.*
3. *S. K Duggal, "Surveying", Vol. 1 & 2, McGraw Hill Education, 2013.*
4. *R. Subramanian, "Surveying and Leveling", Oxford University Press, 2012.*
5. *Pradip Kumar Guha, "Remote Sensing for the Beginner", Affiliated East West Press, 2003.*

15MAT204 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS **2 1 0 3**

Unit 1

Laplace Transform: Laplace Transforms, Inverse Transforms, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Unit Step Function, Second Shifting Theorem, Dirac's Delta Function. Differentiation and Integration of Transforms.

Unit 2

Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)

Fourier Series: Fourier series, Half range Expansions, Parseval's Identity, Fourier Integrals, Fourier integral theorem. Sine and Cosine Integrals. (Sections: 11.1 - 11.3)

Unit 3

Fourier Transforms: Sine and Cosine Transforms, Properties, Convolution theorem. (Sections: 11.1 -11.3, 11.7-11.9)

Partial Differential Equations: Basic Concepts, Modeling; Vibrating String, Wave Equation, Separation of Variables, Use of Fourier Series, Heat Equation; Solution by Fourier Series.

(Sections: 12.1-12.5)

Course Outcomes

15MAT204.CO1	Understand the concepts of Laplace and Fourier transforms and its properties to transform a function from time domain to the frequency domain.
15MAT204.CO2	Obtain the Laplace and Fourier transform and its inverse transform of impulsive, discontinuous and some complicated periodic signals.
15MAT204.CO3	Solve the initial value problems' using Laplace and Fourier transforms on signals arising by changing over to frequency domain.
15MAT204.CO4	Define the Fourier series for periodic functions and determine the Fourier coefficients
15MAT204.CO5	Understand the formation of partial differential equations and apply some standard methods to obtain its solutions.
15MAT204.CO6	Apply Fourier series technique to solve the heat, wave and Laplace equations.

TEXTBOOK:

Advanced Engineering Mathematics, E Kreyszig, John Wiley and Sons, Ninth Edition, 2012.

REFERENCE BOOKS:

1. *Advanced Engineering Mathematics by Dennis G. Zill and Michael R. Cullen, second edition, CBS Publishers, 2012.*
2. *Larry C. Andrews and Bhimson. K. Shivamoggi, The Integral Transforms for Engineers, Spie Press, Washington, 1999.*
3. *J. L. Schiff, The Laplace Transform, Springer, 1999.*

15CVL281 MATERIALS TESTING LABORATORY 0 0 2 1

1. Tension test on metals
2. Tensile test on thin wires – Mild steel and Copper
3. Compression test – Wood specimen and brick
4. Hardness test on Ferrous and non ferrous material - Rockwell Hardness test - Brinell Hardness test
5. Double shear test on mild steel rods
6. Deflection test on beams

7. Impact test on metal specimens – Izod and Charpy
8. Flexural test on timber beams
9. Test on helical Spring - Open coiled and close coiled
10. Fatigue test on metals

Course Outcomes

CO1: Analyse the various properties of materials under different loading conditions

CO2: Conduct experiments to validate physical behavior of material

CO3: Prepare laboratory reports on the interpretation of experimental results

15CVL282 SURVEY PRACTICE 1 0 2 2

1. Chain & Compass survey- Traversing and plotting of details
2. Plane table survey - two point & three point problems – traversing
3. Levelling - Plane of collimation & Rise and fall method
4. Levelling - Longitudinal & cross sectioning
5. Contour surveying
6. Theodolite surveying - Measurement of angles and traversing
7. Heights and distances by tacheometry and solution of triangles
8. (a) Total Station – Traversing and Area Calculation

(b) Area calculation using Planimeter.

9. Mapping using GPS
10. Study of Minor instruments
11. Study of modern survey instruments - Automatic levels, Electronic theodolite.

Course Outcomes

CO1: Have the ability to apply knowledge of mathematics, science, and engineering to understand the measurement techniques and equipment used in land surveying

CO2: Gain an appreciation of the need for lifelong learning through the discussion of recent changes in survey procedures and equipment and have the ability to use techniques, skills, and modern engineering tools necessary for engineering practice

CO3: Prepare survey reports by interpreting experimental results

CO4: Ability to function as a member of a team

15AVP201 /	**AMRITA VALUES PROGRAMME I /**	**1 0 0 1**
15AVP211	**AMRITA VALUES PROGRAMME II**	**1 0 0 1**

Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma's Life for the Modern World

Amma's messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma's guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

Lessons from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance - Relevance of Mahabharata for modern times.

Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

Message of the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of Kurukshetra War – The anguish of Arjuna – Counsel by Sri. Krishna – Key teachings of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda's Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji's life.

Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali's Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this

form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. Haritamritam' is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture through such positive initiatives will go a long way in nation development. In Amma's words "it is a big step in restoring the lost harmony of nature".

Benefits of Indian Medicinal Systems

Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

Traditional Fine Arts of India

India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is 'Únity in Diversity" and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

Science of Worship in India

Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

Outcomes:

CO1: Appreciate the significance of *Rāmāyaṇa* as an *itihāsa,* and important aspects of *Bālakāṇḍa*.

CO2: Understand the family values and ideal human relationships portrayed in the *Ayodhyakāṇḍa* and *Aranyakāṇḍa* of *Rāmāyaṇa*.

CO3: Understand *dharma* and its nuances, emphasizing its applicability in an individual's life through *Kishkindhakāṇḍa* and *Sundarakāṇḍa* of Ramayana.

CO4: Appreciate the triumph of *dharma* over *adharma* through *Yuddhakāṇḍa*of *Rāmāyaṇa*

CO5: Appreciate the spiritual values from *Rāmāyaṇa* in resolving personal and social conflicts through varied effective presentations of important episodes of the *Rāmāyaṇa*

CO-PO Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	-	-	-	-	-	2	2	3	3	3	-	3	-	-
CO2	-	-	-	-	-	3	3	3	3	2	-	3	-	-
CO3	-	-	-	-	-	3	2	3	3	3	-	3	-	-
CO4	-	-	-	-	-	3	-	3	3	3	-	3	-	-
CO5	-	-	-	-	-	3	-	3	3	2	-	3	-	-

15CVL211 BUILDING TECHNOLOGY 3 0 0 3

Unit 1

Occupancy classification of buildings - Essentials of National Building Code.
Loads on buildings; Foundations - deep and shallow foundations – introduction to mat and grillage foundations – caissons.
Superstructure - load bearing masonry - brick and stone masonry, arches, lintels, scaffolding, shoring; plastering and pointing.

Unit 2

Concrete construction – batching, mixing, conveying, placing, compacting, curing. Durability of concrete. Special concretes. Reinforced concrete - Form work - Prestressed concrete. Principles of prefabricated construction.
Roofs and Floors - flat and pitched roofs, floor types and finishes; Doors and windows
Damp and water proofing techniques. White washing, colour washing, painting and

distempering;

Unit 3

Tall buildings – structural systems – Steel and concrete framed construction - Vertical transportation, plumbing systems, electrical services
Thermal insulation of buildings - Natural and mechanical ventilation - Air conditioning. Principles of fire resistant construction. Acoustics - requirements for good acoustics - sound insulation.
Functional planning – Building development rules - Space planning of buildings – Design process – planning principles.

Course Outcomes

CO1: Suggest suitable type of foundation for given building and soil type.

CO2: Apply knowledge of construction techniques and procedures to acquire execution proficiency.

CO3: Apply engineering knowledge to select suitable structural systems and services for tall buildings.

CO4: Apply functional planning principles to analyze and evaluate residential building plans.

TEXTBOOKS:

1. *Arora. S. P. and Bindra.S. P., "Building Construction", Dhanpat Rai Publications, New Delhi, 2005.*
2. *Santha Kumar, A. R., "Concrete Technology", Oxford University Press, 2006.*

REFERENCE BOOKS:

1. *Rangwala S. C, "Building Construction", Charotar Publishing House, 2007.*
2. *National Building Code, Bureau of Indian Standards, 2005.*
3. *Neville.A. M. and Brooks.J. J.,"Concrete Technology", Pearson Education, 2004.*
4. *Punmia, "Building Construction", Laxmi Publications, 2009.*
5. *Subir K Sarkar and SubhajitSaraswati, "Construction technology", Oxford University Press, 2008.*

15CVL212 GEOLOGY AND SOIL MECHANICS 2 1 0 3

Unit 1

General geology – Weathering - Geological work of wind, rivers and oceans. Mineralogy.
Petrology - Three–fold classification of rocks and their characteristic features.
Structural geology - Types and classification of structures (Joints, Unconformities, Folds and faults) and their effect on civil engineering projects.
Geology in Civil Engineering - Tunnels, dams, reservoirs, bridges, runways, roads and buildings.
Physico-Mechanical properties of rock.Origin and formation of soils.

Unit 2

Soil structure and clay mineralogy – Adsorbed water – Mass- volume relationship – Relative density.Index Properties of Soils: Grain size analysis – Sieve and hydrometer methods – consistency limits and indices – I.S. Classification of soils.
Permeability: Soil water – capillary rise – flow of water through soils – Darcy's law - permeability – Factors affecting permeability – laboratory determination of coefficient of permeability – Permeability of layered systems.
Seepage through soils: Total, neutral and effective stresses – quick sand condition – Seepage through soils – Flownets: characteristics and uses.

Unit 3

Stress distribution in soils: Boussinesq's and Westergaard's theories for point loads and areas of different shapes – Newmark's influence chart.
Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties – Field compaction equipment - compaction control.
Consolidation: stress history of clay; e-p and e-log p curves – magnitude and rate of 1-D consolidation – Terzaghi's Theory.

Course Outcomes

CO1: Identify and classify rocks using basic geologic features and to apply those concepts on rock engineering projects and understand the role of geology in construction processes.

CO2: Ability to classify soils with reference to their characteristics and to evaluate their index and engineering properties.

CO3: Analyze and evaluate permeability characteristics of soils and estimate seepage through soils.

CO4: Analyze stress distribution in soil and relate compaction of soil to its properties.

CO5: Evaluate consolidation properties of soils and applythose properties to settlement problems frequently encountered in civil engineering.

TEXTBOOKS:

1. *Venkat Reddy, D., "Engineering Geology", Vikas Publishing House, 2010.*
2. *Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 2005.*

REFERENCE BOOKS:

1. *Blyth. F. G. H. and **M. H. De Freitas**, "Geology for Engineers", 7th Edition, Elsevier Science, 2006.*
2. *Parbin Singh., "Engineering and General Geology", S. K. Kataria and Sons, 2009.*
3. *Das, B. M., "Principles of Geotechnical Engineering", CL Engineering, 2013.*
4. *C. Venkataramiah, "Geotechnical Engineering", New Age International Publishers, 2006.*
5. *T. W. Lambe and Whitman, "Soil Mechanics", Wiley, 2008.*
6. *Manoj Dutta and Gulhati S. K, "Geotechnical Engineering", Tata McGraw Hill Publishers,2005.*

15CVL213 HYDRAULIC ENGINEERING 2 1 0 3

Unit 1

Impulse momentum principle – application – impact of jet-force exerted by a jet on normal, inclined and curved surfaces for stationary and moving cases – torque in rotating machines – jet propulsion.
Hydroelectric power: low, medium and high head plants - Power house components – Microhydel schemes. Turbines - classifications – construction and working of Pelton Wheel, Francis and axial flow reaction turbines - selection of turbines – draft tube.
Classification of pumps – Centrifugal pumps – types and working – characteristics. Reciprocating pumps - types and working – selection of pumps.

Unit2

Open channel flow - Comparison with pipe flow, Types of channels - Classification of flow, uniform flow – Uniform flow using chezy's and Manning's formulae - Most efficient channel section – Circular, Rectangular and Trapezoidal channel sections, open channel section for

constant velocity at all depths of flow. Specific energy and critical depth, Specific force curve, critical flow computation.
Non-uniform flow, Gradually Varied Flow, Dynamic equation for gradually varied flow, Different forms of the dynamic equation, Flow profiles in prismatic channels, integration of the varied flow equation - Computation of the length of the backwater curve and afflux. Rapidly Varied Flow- Hydraulic Jump, Hydraulic jump equations for a rectangular channel, Practical applications.

Unit 3

Rivers - their behaviour - Control and training. Design of stable channels in India - problem in India - Classification of irrigation canals, Canal alignment, Design procedure for an irrigation channel - Considerations for fixing longitudinal section of a channel - Cross sections of an irrigation channel, Maintenance of canals, Canals in alluvial soils – Regime Theory - Kennedy's and Lacey's Theories, Silting in canals, Scour and protection against scour. Canal lining - losses in irrigation canals, Advantages and disadvantages of lining, Types of lining. Water logging - Causes and preventive measures. Design of lined canals - irrigation canals - Kennedy'sTheory-Lacey's Theory.

Course outcomes

CO1: Apply the linear momentum principle to evaluate the forces exerted by the jet on inclined, curved and stationary bodies

CO2: Apply the principles of basic engineering to analyze and choosesuitable hydraulic machinery

CO3: Select most economical channel section and to analyze uniform flow.

CO4: Apply the principles of energy to analyze non-uniform flow conditions in open channel.

CO5: Design irrigation canal systems for field conditions

TEXTBOOKS:

1. *Modi P. N. and Seth S. M., "Hydraulics and Fluid Mechanics including Fluid Machines", Standard Book House, 2002.*
2. *Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, 2006.*

REFERENCE BOOKS:

1. *Chow V. T., "Open Channel Hydraulics", McGraw Hill, Inc. 1959.*
2. *Rajput R K,"Fluid mechanics and Hydraulic Machines", S Chand Publishers, 2008.*

3. *N. N.Pillai, "Fluid Mechanics & Fluid Machines", Universities Press, Third Edition, 2009.*
4. *K. Subramanya, "Flow in Open Channels", Tata McGraw Hill, 1997.*
5. *M. Hanif Chaudhry, "Open Channel Flow", Prentice Hall of India, 1994.*
6. *K. G. Rangaraju, "Flow Through Open Channels", Tata McGraw Hill, 1984.*
7. *Jagdish Lal, "Hydraulic Machines including Fluidics", Metropolitan Book Co, 2003.*
8. *P. N. Modi, "Irrigation, Water Resources, and Water Power Engineering", Standard Publishers Distributors, 2008.*

15CVL214 STRUCTURAL ANALYSIS 2 1 0 3

Unit 1

Statically indeterminate structures - degree of static and kinematic indeterminacies. Introduction to force and displacement methods of analysis.
Energy principles – Castigliano's theorems - Engessor's theorem - Maxwell Betti's theorem - Principle of least work – Method of virtual work (unit load method) - applications in statically determinate and indeterminate structures.
Analysis of Propped cantilever and fixed beams.

Unit 2

Cables – maximum tension – types of supports – forces in towers – suspension bridges with three and two hinged stiffening girders.
Theory of arches – Eddy's theorem – analysis of three hinged and two hinged arches – settlement and temperature effects.
Beams curved in plan – analysis of cantilever beam curved in plan – analysis of circular beams over simple supports.

Unit 3

Moving loads and influence lines – influence lines (IL) for statically determinate beams for reaction, SF and BM – effect of moving loads – concentrated and uniformly distributed loads – load position for maximum BM and SF - equivalent UDL.
IL for determinate structures – truss, arch and suspension bridge.

Course Outcomes

CO1: Categorize the structures and to select proper analysis method

CO2: Analyse the determinate and in determinate structures by applying the energy Principles

CO3: Calculate the internal forces in arch and cable structures by applying the basic engineering knowledge

CO4: Analyse the effect of moving loads on determinate and indeterminate structures

TEXTBOOKS:

1. *Devdas Menon, "Structural Analysis", Narosa Book Distributors Pvt Ltd, 2013.*
2. *S P Gupta and G S Pundit, "Theory of Structures", Vol. I & II, Tata McGraw Hill, 1999*

REFERENCEBOOKS:

1. *Wang C. K., "Intermediate Structural Analysis"Tata McGraw - Hill Education 2010.*
2. *Norris C. H, Wilbur J. B. and Utku. S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.*
3. *Sujit Kumar RoyandSubrataChakrabarty, "Fundamentals of Structural Analysis", S. Chand & Co., 2010.*
4. *S. B. Junnarkar and H. J. Shah, "Mechanics of Structures Vol. II", 20th Edition, Charotar Publishing House, 2008.*
5. *Reddy C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi, 2015.*
6. *L. S. Negi and R. S. Jangid, Structural Analysis, Tata McGraw Hill, 2003.*
7. *D S Prakash Rao, "Structural Analysis A Unified Approach", Universities Press (India) Ltd. , 1996.*

15MAT212 COMPLEX ANALYSIS AND NUMERICAL METHODS 2 1 0 3

Unit 1

Complex Numbers, Complex Plane, Polar Form of Complex Numbers. Powers and Roots, Derivative. Analytic Functions, Cauchy - Riemann Equations, Laplace Equation, Conformal mapping, Exponential Function, Trigonometric Functions, Hyperbolic Functions, Logarthims, General Power, Linear Fractional Transformation.

Unit 2

Complex Line Integral, Cauchy Integral Theorem, Cauchy Integral Formula, Derivatives of Analytic Functions. Power Series, Taylor Series and Maclaurin Series. Laurent Series, Zeros and

Singularities, Residues, Cauchy Residue Theorem, Evaluation of Real Integrals using Residue Theorem.

Unit 3

Numerical Methods: Solution of Equations by iteration methods. Interpolations. Numerical Integration and Differentiation. (Sections: 19.1-19.5)

Course Outcomes:

15MAT212.CO1	Understand and apply the Numerical methods like finding approximate solutions of equations interpolation, Numerical differentiation and integration.
15MAT212.CO2	Understand and analyze mapping in complex plane together with its geometry and properties.
15MAT212.CO3	Understand contour integration, understand and apply different methods to find the integrals of complex functions.
15MAT212.CO4	Study the series expansion of complex numbers and residue integration method and apply it to evaluate real integrals.

TEXTBOOK:

Advanced Engineering Mathematics, E Kreyszig, John Wiley And Sons, Ninth Edition, 2012.

REFERENCE BOOKS:

1. *S. Ponnusamy, Foundations of Complex Analysis, 2nd Edition, Narosa Publishing House, 2005.*
2. *R. Roopkumar, Complex Analysis, Pearson Education, 2014, Chennai.*

15CVL285 CONSTRUCTION MATERIALS LAB 0 0 2 1

1. Tests on cement - Fineness, Normal consistency, Initial and Final Setting times, Specific gravity, Compressive strength, Soundness
2. Tests on fine aggregate - Grain size distribution – Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Bulking & Absorption
3. Tests on coarse aggregate - Grain size distribution – Uniformity coefficient and fineness modulus, Specific gravity, Density, Void ratio, Absorption, Crushing & Impact values, Flakiness

& Elongation, Los Angel's Abrasion test
4. Test on fresh and hardened concrete
   (a) Workability test - Slump test, Compaction factor test, Flow table test, Vee-Bee Consistometer,
   (b) Use of water reducing admixtures
   (c) Compressive strength, Split tensile strength, Flexure test on beams, Modulus of elasticity
5. Tests on bricks – Crushing strength, water absorption and efflorescence
6. Basic tests on Bitumen.

Course Outcomes

CO1: Conduct the experiments to determine the properties of construction materials

CO2: Measure the fresh (using appropriate test method) and hardened stage properties of concrete experimentally

CO3: Prepare the laboratory reports on the interpretation of experimental results

15CVL286 HYDRAULIC ENGINEERING LAB. 0 0 2 1

1. Study of instruments: pressure gauge - piezometer – manometer - pressure transducers - pitot tubes - current meter.
2. Verification of Bernoulli's equation.
3. Determination of Coefficient of discharge for a small orifice by a constant head method.
4. Determination of Coefficient of discharge for an external mouth piece by variable head method.
5. Calibration of Triangular Notch
6. Determination of friction factor of pipes
7. Impact of jet on vanes
8. Calibration of Venturimeter, Orificemeter, rotameter and watermeter
9. Determination of metacentric height

10. Performance test on Pelton wheel turbine and Francis turbine.

11. Efficiency test on centrifugal pump and reciprocating pump.

12. Open channel flow: Manning's coefficient, specific energy curve, Tracing back water profiles/draw down profiles, Hydraulic jump parameters

Course Outcomes

CO1: Conduct experiments to understand the principles and working of different hydraulic machines like pumps and turbines

CO2: Examine and analyze fluid flow through various discharge and pressure measuring instruments

CO3: Prepare laboratory reports on the interpretation of experimental results.

15SSK221 SOFT SKILLS I 1 0 2 2

CO#	Course Outcomes	Programme Outcomes
1.	Soft Skills: At the end of the course, the students would have developed self- confidence and positive attitude necessary to compete and challenge themselves. They would also be able to analyse and manage their emotions to face real life situations.	PO8, PO9, PO10, PO12
2.	Soft Skills: At the end of the course, the students would hone their presentation skills by understanding the nuances of content creation, effective delivery, use of appropriate body language and the art of overcoming nervousness to create an impact in the minds of a target audience.	PO9, PO10, PO12
3.	Aptitude: At the end of the course, the student will have acquired the ability to analyze, understand and classify questions under arithmetic, algebra and logical reasoning and solve them employing the most suitable methods. They will be able to analyze, compare and arrive at conclusions for data analysis questions.	PO2, PO4
4.	Verbal: At the end of the course, the students will have the ability to dissect polysyllabic words, infer the meaning, inspect, classify, contextualise and use them effectively	PO10, PO12

5.	Verbal: At the end of the course, the students will have the ability to understand the nuances of English grammar and apply them effectively.	PO10, PO12
6.	Verbal: At the end of the course, the students will have the ability to identify, analyse and interpret relationship between words and use the process of elimination to arrive at the answer. They will also have the ability to judge, evaluate, summarise, criticise, present and defend their perceptions convincingly.	PO9, PO10, PO12

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								2	3	3		3
CO2									2	3		3
CO3		3		2								
CO4										3		3
CO5										3		3
CO6									3	3		3

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self-confidence: Characteristics of the person perceived, characteristics of the situation, characteristics of the perceiver. Attitude, values, motivation, emotion management, steps to like yourself, positive mental attitude, assertiveness.

Presentations: Preparations, outlining, hints for efficient practice, last minute tasks, means of effective presentation, language, gestures, posture, facial expressions, professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy, etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words.

Listening skills: The importance of listening in communication and how to listen actively.

Prepositions, articles and punctuation: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving level I: Number system; LCM &HCF; Divisibility test; Surds and indices; Logarithms; Ratio, proportions and variations; Partnership;

Problem solving level II: Time speed and distance; work time problems;

Data interpretation: Numerical data tables; Line graphs; Bar charts and Pie charts; Caselet forms; Mix diagrams; Geometrical diagrams and other forms of data representation.

Logical reasoning: Family tree; Deductions; Logical connectives; Binary logic; Linear arrangements; Circular and complex arrangement; Conditionalities and grouping; Sequencing and scheduling; Selections; Networks; Codes; Cubes; Venn diagram in logical reasoning; Quant based reasoning; Flaw detection; Puzzles; Cryptogrithms.

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quantitative Aptitude by R. S. Aggarwal, S. Chand*
6. *Quantitative Aptitude – Abijith Guha, TMH.*
7. *Quantitative Aptitude for Cat - Arun Sharma. TMH.*

REFERENCES:

1. *Books on GRE by publishers like R. S. Aggrawal, Barrons, Kaplan, The Big Book, and Nova.*
2. *More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources www.the grammarbook.com - online teaching resources*

www.englishpage.com- online teaching resources and other useful websites.

15CVL301 ADVANCED STRUCTURAL ANALYSIS 2 10 3

Unit 1

Slope deflection method – application to the analysis of statically indeterminate beams with and without settlement of supports - rigid jointed plane frames with and without side sway - gable frames.
Analysis of continuous beams - theorem of three moments.

Sway and non-sway analysis by Moment distribution method and Kani's method.

Unit2

Approximate Methods of Analysis of Multistoried Frames: Analysis for vertical loads – substitute frames - loading conditions for maximum moments in beams and columns – portal method and cantilever method for lateral load analysis.

Unit 3

Matrix methods of structural analysis - stiffness and flexibility matrices for elements and structure- analysis of continuous beams, simple rigid jointed frames and plane trusses by stiffness and flexibility method.
Introduction to FEM.

Course Outcomes

CO1: Analyze continuous beam and frame using displacement method of analysis

CO2: Analyze continuous beam and frame using force method of analysis

CO3: Analyze the multistorey frames using approximate methods

CO4: Analyze beam, frame and truss using matrix method

TEXTBOOKS:

1. *Devdas Menon, "Structural Analysis", Narosa Book Distributers Pvt. Ltd, 2013.*
2. *Gupta S. P and G .S Pundit, "Theory of Structures", Vol. I & II, Tata McGraw Hill, 1999.*

REFERENCE BOOKS:

1. *Hibbeler, R. C., "Structural Analysis", Pearson, 2008.*
2. *Wang C. K., "Intermediate Structural Analysis" Tata McGraw - Hill Education 2010.*
3. *Norris C. H, Wilbur J. B. and Utku. S., "Elementary Structural Analysis", Tata McGraw Hill, 1991.*
4. *Sujit Kumar Roy and Subrata Chakrabarty, "Fundamentals of Structural Analysis" S.Chand& Co., 2010.*

5. *Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill, 2015.*

15CVL302 DESIGN OF CONCRETE STRUCTURES 3 1 0 4

Unit 1

Introduction to R.C structures – Review of basic material properties - Concrete and Reinforcing steel.Design philosophies - Working stress method (WSM), Ultimate load method (ULM), Limit state method (LSM). Design of Beams - singly and doubly reinforced rectangularand flanged sections. Serviceability requirements.Behaviour in Shear and Torsion; analysis and design with and without shear reinforcement.

Unit 2

Design for Bond: development length, splicing, curtailment.
Design of one-way slabs and two-way rectangular slabs (wall-supported) - as per IS 456: 2000.
Design of Compression Members: effective length, short columns subject to axial compression with and without uniaxial / biaxial eccentricities.

Unit 3

Introduction to slender columns. Design of isolated footing for axially loaded & eccentrically loaded columns, combined footing. Design of staircases.
Introduction to Prestessed concrete with simple examples.

Course Outcomes

CO1: Apply knowledge of material properties in understanding design philosophies and methodologies

CO2: Apply knowledge of design philosophies and basic structural analysis to design and analyze simple structural elements

CO3: Evaluate, analyze and design structural elements necessary for a simple building

TEXTBOOKS:

1. *Pillai S. U. and Menon D, "Reinforced Concrete Design", Tata McGraw Hill, 2009.*
2. *M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI learning, 2009.*

REFERENCE BOOKS:

1. *Park and Paulay, "Reinforced Concrete Structures", Wiley India (P) Ltd, 2010*
2. *Varghese P. C., "Limit State Design of Reinforced Concrete", PHI Learning, 2009.*
3. *P. Dayaratnam, "Design of Reinforced Concrete Structures", Oxford University Press, 2011.*
4. *Jain A. K., "Reinforced Concrete - Limit State Design", Nem Chand & Bros., 2009.*
5. *Sinha S. N., "Reinforced Concrete Design", Tata McGraw Hill, 2005.*
6. *BIS Codes (SP 23, SP 24, IS 456, IS 875, IS 10262, IS 800, SP 16, IS 883, IS 2750)*
7. *Arthur H Nilson, "Design of Concrete Structures", Tata McGraw-Hill Publications, 2005.*

15CVL303 GEOTECHNICAL ENGINEERING 3 1 0 4

Unit 1

Shear strength of soils: Mohr – Coulomb Failure theories – Types of laboratory strength tests – strength tests based on drainage conditions – Shear strength of sands – Critical Void Ratio – Liquefaction- shear strength of clays.
Soil Exploration: Need – Methods of soil exploration – Boring and Sampling methods – Field tests – Penetration Tests – Plate load test – Pressure meter – Planning of programme and preparation of soil investigation report.

Unit 2

Shallow Foundations: Types - choice of foundation – Location of depth – Safe Bearing Capacity – Terzaghi, Meyerhof, Skempton and IS Methods.
Safe bearing pressure based on N-value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – allowable settlements of structures – Settlement Analysis.
Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae – Pile load tests - Load carrying capacity of pile groups in sands and clays – Settlement of pile groups.
Well Foundations: Types – Components of well foundation – functions and design. Design Criteria – Sinking of wells – Tilts and shifts.

Unit 3

Earth Slope Stability: Infinite and finite earth slopes – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices, Bishop's Simplified method – Taylor's Stability Number.
Earth Pressure Theories: Rankine's theory of earth pressure – Earth pressure in layered soils – Coulomb's earth pressure theory – Culmann's graphical method.
Retaining Walls: Types of retaining walls – stability of retaining walls.

Course Outcomes

CO1: To understand the concepts and methods to Analyze the shear strength of soils and factors influencing it's magnitude.

CO2: To understand a site investigation program including subsurface exploration to evaluate soil behaviour and to obtain necessary design parameters.

CO3: Analyze the stability of natural/man-made slopes and retaining walls using slope stability and earth pressure theories considering varying in-situ material properties.

CO4: Understand and Estimate allowable bearing pressures and load carrying capacities of shallow foundation systems.

CO5: Understand and Estimate allowable bearing pressures and load carrying capacities of deep foundation systems

TEXTBOOKS:

1. *Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Pvt. Ltd, 2004.*
2. *Venkataramaiah. C., "Geotechnical Engineering", New Age International Publishers, 2006.*

REFERENCE BOOKS:

1. *Varghese, P. C., "Foundation Engineering", PHI Learning, 2009.*
2. *Das, B. M., "Principles of Foundation Engineering", CL Engineering, 2013.*

3. *Bowles, J. E., "Foundation Analysis and Design", Tata McGraw Hill, 1996.*

4. *Swami Saran, "Analysis and Design of Substructures", Oxford and IBH Publishing Company Pvt Ltd, 2008 .*

5. *Teng, W. C, "Foundation Design" , Prentice Hall, 1998.*

15ENV300 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY 3 0 0 3

Unit 1

State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity, Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People's action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil / land degradation / pollution

Unit 2

Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people's movements and activism,

Indigenous knowledge systems and traditions of conservation.

Unit 3

Common goods and public goods, natural capital / tragedy of commons, Cost benefit analysis of development projects, Environment Impact Assessment (EIA), Environment Management Plan (EMP), Green business, Eco-labeling, Problems and solutions with case studies.

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes / Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability, Traditional value systems of India, Significance of holistic value-based education for true sustainability.

Outcomes:

ENV300.1	CO1: Integrate facts and concepts from ecological, physical and social sciences to characterize some common socio-environmental problems.
ENV300.2	CO2: Develop simple integrated systems and frameworks for solving common interconnected socio-environmental problems.
ENV300.3	CO3: Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.
ENV300.4	CO4: Identify the ethical underpinnings of socio-environmental issues in general.

CO-PO Mapping:

CO Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ENV 300.1		1		1		2	3			2		1			
ENV 300.2	1		1				3			2		1			
ENV 300.3							3	2	1	2		1			
ENV 300.4							3	3		2		1			

15MAT214 PROBABILITY AND STATISTICS 2 1 0 3

Unit 1

Probability Concepts: Review of probability concepts - Bayes' Theorem.

Random Variable and Distributions: Introduction to random variable – discrete and continuous distribution functions - mathematical expectations – moment generating functions and characteristic functions. Binomial, Poisson, Geometric, Uniform, Exponential, Normal distribution functions (MGF, mean, variance and simple problems) – Chebyshev's theorem

Unit 2

Sampling Distributions: Distributions of Sampling Statistics, Chi-square, t and F distributions (only definitions and use). Central Limit Theorem.

Theory of estimation: Point Estimation, Unbiased estimator - Maximum Likelihood Estimator - Interval Estimation.

Unit 3

Testing of Hypothesis: Large and small sample tests for mean and variance – Tests based on Chi-square distribution.

Course Outcomes:

15MAT214.CO1 Understand the basic concepts of probability and probability modeling

15MAT214.CO2	Gain knowledge about statistical distributions and their properties
15MAT214.CO3	Get in-depth knowledge about statistical distributions and their real time applications.
15MAT214.CO4	Understand some approximation theorems on probability and distributions.
15MAT214.CO5	Know the importance of estimating the parameters of probability models.
15MAT214.CO6	Ability to make decisions under uncertainties using statistical testing of hypotheses.

TEXTBOOK:

Douglas C. Montgomery and George C.Runger, Applied Statistics and Probability for Engineers, (2005) John Wiley and Sons Inc.

REFERENCE BOOKS:

1. *J. Ravichandran, "Probability and Random Processes for Engineers", First Edition, IK International, 2015.*
2. *Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers and Keying Ye, Probability and Statistics for Engineers and Scientists, 8th Edition (2007), Pearson Education Asia.*
3. *Sheldon M Ross, Introduction to Probability and Statistical Inference, 6th Edition, Pearson.*
4. *A. Papoulis, and Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", Fourth Edition, McGraw Hill, 2002.*

15CVL381 BUILDING DRAWING 1 0 2 2

Part A

Detailed drawing of components
• Footings
• Roof trusses
• Reinforced Concrete staircase
From given line sketch and specification, develop working drawings of:
• Single storied residential building with flat and tiled roof
• Public buildings like office, dispensary, post office, bank etc.
• Factory building with trusses

Part B (Computer aided drafting)

Preparation of drawings as per building development rules.

- Residential building - flat and pitched roof, economic domestic units, cottages, bungalows
- Public building – small public utility shelters, dispensaries, banks, schools, offices, libraries, hostels, restaurants, commercial complexes, factories etc.
- Preparation of site plans and service plans as per Building Rules.

Course Outcomes

CO1: Prepare the drawing for building components.

CO2: Prepare the plan, elevation sectional view of the residential, commercial and public building from the line sketch

CO3: Plan the building according to the given requirements and according to the site condition and prepare the detailed sketch (manually and using IT tool) of the residential, public and commercial building in the required format

TEXTBOOKS:

1. Balagopal T S Prabhu, "Building Design and Civil Engineering Drawing", Spades Publishers, 2008.
2. Shaw, Kale and Patki, "Building Drawing", Tata McGraw Hill, 2009.

REFERENCE BOOKS:

1. *SP 7:2005, National Building Code of India.*
2. *G. MuthuShoba Mohan, "Principles of Architecture", Oxford University Press, 2006.*
3. *Crosbie, M. J. and Callender, J. H., "Time-Saver Standards for Architectural Design Data", McGraw-Hill,1997.*
4. *Sham Tickoo, "Autodesk Revit architecture 2010 for architects and building designers", Dreamtech Press, 2010.*

15CVL382 GEOTECHNICAL ENGINEERING LAB. 0 0 2 1

1. Specific gravity of coarse and fine-grained soils
2. Grain size analysis
3. Atterberg's limits and indices
4. Determination of field density

(a) sand replacement method
(b) core cutter method

5. Determination of coefficient of permeability

(a) Constant head method;
(b)Variable head method

6. Consolidation test
7. Compaction test

(a) IS light compaction test
(b) IS heavy compaction test

8. California Bearing Ratio test
9. Direct shear test

10. Triaxial shear test
11. Unconfined compressive strength test & Laboratory vane shear test
12. Demonstration of Plate Load & Standard Penetration Tests

Course Outcomes

CO1: Conduct experiments to find the index and engineering properties of different types of soil

CO2: Prepare laboratory reports on the interpretation of experimental results

CO3: Assess the strength parameters of soil using various field tests

15SSK321 SOFT SKILLS II 1 0 2 2

CO#	Course Outcomes	Programme Outcomes
1.	Soft Skills: At the end of the course, the students will have the ability to communicate convincingly and negotiate diplomatically while working in a team to arrive at a win-win situation. They would further develop their inter-personal and leadership skills.	PO9, PO10, PO11, PO12
2.	Soft Skills: At the end of the course, the students shall learn to examine the context of a Group Discussion topic and develop new perspectives and ideas through brainstorming and arrive at a consensus.	PO10, PO11, PO12
3.	Aptitude: At the end of the course, students will be able to identify, recall and arrive at appropriate strategies to solve questions on geometry. They will be able to investigate, interpret and select suitable methods to solve questions on arithmetic, probability and combinatorics.	PO2, PO4
4.	Verbal: At the end of the course, the students will have the ability to relate, choose, conclude and determine the usage of right vocabulary.	PO10, PO12
5.	Verbal: At the end of the course, the students will have the ability to utilise prior knowledge of grammar to recognise structural instabilities and modify them.	PO10, PO12
6.	Verbal: At the end of the course, the students will have the ability to comprehend, interpret, deduce and logically categorise words, phrases and sentences. They will also have the ability to theorise, discuss, elaborate, criticise and defend their ideas.	PO9, PO10, PO12

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	3	3	2	3
CO2	-	-	-	-	-	-	-	-	-	3	2	2
CO3	-	3	-	2	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	3
CO5	-	-	-	-	-	-	-	-	-	3	-	3
CO6	-	-	-	-	-	-	-	-	3	3	-	3

Professional grooming and practices: Basics of corporate culture, key pillars of business etiquette. Basics of etiquette: Etiquette – socially acceptable ways of behaviour, personal hygiene, professional attire, cultural adaptability. Introductions and greetings: Rules of the handshake, earning respect, business manners. Telephone etiquette: activities during the conversation, conclude the call, to take a message. Body Language: Components, undesirable body language, desirable body language. Adapting to corporate life: Dealing with people.

Group discussions: Advantages of group discussions, structured GD – roles, negative roles to be avoided, personality traits to do well in a GD, initiation techniques, how to perform in a group discussion, summarization techniques.

Listening comprehension advanced: Exercise on improving listening skills, grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving level III: Money related problems; Mixtures; Symbol based problems; Clocks and calendars; Simple, linear, quadratic and polynomial equations; special equations; Inequalities; Functions and graphs; Sequence and series; Set theory; Permutations and combinations; Probability; Statistics.

Data sufficiency: Concepts and problem solving.

Non-verbal reasoning and simple engineering aptitude: Mirror image; Water image; Paper folding; Paper cutting; Grouping of figures; Figure formation and analysis; Completion of incomplete pattern; Figure matrix; Miscellaneous.

Spacial aptitude: Cloth, leather, 2D and 3D objects, coin, match sticks, stubs, chalk, chess board, land and geodesic problems etc., related problems.

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*

2. *Adair. J., (1986),"Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Quick Maths – Tyra.*
6. *Quicker Arithmetic – Ashish Aggarwal*
7. *Test of reasoning for competitive examinations by Thorpe.E. TMH*
8. *Non-verbal reasoning by R. S. Aggarwal, S. Chand*

REFERENCES:

1. *Books on GRE by publishers like R. S. Aggrawal, Barrons, Kaplan, The Big Book, and Nova*
2. *More Games Teams Play, by Leslie Bendaly, McGraw Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources*

www.the grammarbook.com - online teaching resources
www.englishpage.com- online teaching resources and other useful websites.

15CVL390/ 15CVL490 LIVE-IN-LAB. 3 cr

This initiative is to provide opportunities for students to get involved in coming up with technology solutions for societal problems. The students shall visit villages or rural sites during the vacations (after 4th semester or sixth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth or seventh semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

Course Outcomes

CO1: Understand the problems faced by rural communities in India: Service to society

CO2: Study, observe, and interact with rural populations while living in rural communities and gain a better understanding of challenges in various areas

CO3: Undertake experiential learning opportunities, by taking theory into practice

CO4: Generate innovative solutions, thereby facilitating critical and collaborative problem

solving abilities

15CVL311 DESIGN OF STEEL STRUCTURES 3 1 0 4

Unit 1

Introduction to structural steel sections, material property, geometric properties, classes of sections, stresses, residual temperature stresses in rolled steel sections, loads. Types of design - rigid, semi rigid. Limit state design method – basic concepts, partial safety factors, load combinations, deflection limitations as per IS:800.Analysis and design of bolted and welded connections to resist direct force and moment.Design of tension members - single and double angle ties.

Unit 2

Plastic behaviour of structural steel – shape factor – plastic hinge concept – collapse load – methods of plastic analysis – plastic design of beams and portal frames. Local buckling of plates – stiffened edges.Compression members: Axially and eccentrically loaded compression members - built up columns - lacings and battens - design of column bases.
Analysis and design of laterally restrained & unrestrained simple & compound beams - Design for flexure, shear, deflection, and bearing.

Unit 3

Industrial roofs:Introduction to steel roof systems-various elements - loads - wind analysis – design of plane roof trusses – design of roofing elements and purlins – wind bracings - Gusset connections.Introduction to cold-formed steel structures (Light gauge steel sections).

Course Outcomes

CO1: Able to design the connections considering load combinations and deflection Limitations

CO2: Will be able to identify and design the suitable ties for tension members

CO3: Analyze the plastic behavior of structural steel and design of beams and portal Frames

CO4: Able to design a compression and built up members incorporating flexure, shear, deflection and bearing

CO5: Analyze and develop report for design of structural steel roof sections.

TEXTBOOKS:

1. *Subramanian N, "Design of Steel Structures", Oxford University Press, 2008.*
2. *Duggal, S. K., "Limit State Design of Steel Structures", Tata McGraw Hill, 2010.*

REFERENCE BOOKS:

1. *Ramchandra and Gehlot, "Limit State Design of Steel Structures", Scientific Publishers, 2010.*
2. *Dayaratnam P, "Design of Steel Structures", S. Chand & Co., 2003.*
3. *Arya and Ajmani, "Design of Steel Structures", Nem Chand Brothers, 2007.*
4. *BIS codes (IS 800-2007, IS 875-1987-Parts I, II, III, SP:6 – Part 1 to 6).*
5. *Edwin Gaylord, "Design of Steel Structure", Tata McGraw Hill Publishing Company Limited,2010.*
6. *Emil Smith and Robert Scanlan, "Wind Effects on Structures". Wiley-Interscience, 1986.*

15CVL312 ENVIRONMENTAL ENGINEERING I 2 1 0 3

Unit 1

Water Supply Systems: Need for protected water supply - objectives of water supply system. Factors affecting per capita consumption, fire demand, fluctuations in rate of consumption - population forecasting - Design periods for water supply components.

Intake Works and Transportation: Intakes- types, location, requirements and features. Transportation of water - Types of conduits - relative merits, selection, joints, hydraulic design, and cross-connected parallel pipe to increase capacity - pipe laying and testing.

Quality and Analysis of Water: Impurities in raw water - causes - effects / significance - analysis - tests - Bacteriology of water, bacteriological analysis - Water borne diseases -

Standards of water quality.

Unit 2

Treatment of Water – Conventional Treatment flow charts - Principles of coagulation, flocculation and sedimentation - Design principles of - Flash mixer – Design and drawing (Detailed sketch) of Flocculator and Sedimentation tank.

Filtration - Principles of Filtration - Classification. Constructional and operational features of slow sand filters and rapid sand filters - Design criteria. Design and drawing (Detailed sketch) of slow sand filters and rapid sand filters.

Disinfection - methods and disinfectants - Disinfection devices – Chlorination, other methods. Miscellaneous treatment methods - aeration, taste and odour control, iron and manganese removal, water softening, fluoridation and defluoridation and demineralization - Residue Management.

Unit 3

Distribution of Water: Distribution network - Requirements of distribution system - Analysis by Hardy Cross method – Equivalent Pipe method – Computer application. Service reservoirs - functions, classification - Service reservoir design. Waste detection and prevention - Metered and unmetered water supplies. Necessity of pumping in water supply - classification and brief description of types of pumps - selection of pump - calculation of head, horsepower - economical diameter of pumping main.

Plumbing and Pumping: Drainage layout - plumbing components - traps and fittings - water seal - plumbing systems - choice - Principles governing drainage - plumbing design, IS Code provisions. Water supply of buildings - service connection to buildings.

Course Outcomes

CO1: To analyze and estimate the water quantity for domestic purpose

CO2: To analyze the water quality parameters from different sources and design the water treatment plant

CO3: To design of water supply scheme and distribution network

TEXTBOOK:

1. *Birdie G.S and Birdie J. S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010.*

REFERENCE BOOKS:

1. *Garg S. K, "Environmental Engineering", Vol. I, Khanna Publishers, 2004 .*
2. *Duggal, K. N., "Elements of Environmental Engineering", S Chand & Co. Ltd., 2007.*
3. *Mark J. Hammer and Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd.,2008.*
4. *Sawyer and McCarty, "Chemistry for Environmental Engineering", Tata McGraw-Hill, 2003.*

15CVL385 ENVIRONMENTAL ENGINEERING LAB. 0 0 2 1

1. Determination of solids (total, dissolved, organic, inorganic and settleable) in water
2. Determination of turbidity and the optimum coagulant dose
3. Determination of alkalinity and pH of water
4. Determination of hardness and chlorides in water
5. Determination of iron and manganese in water
6. Determination of sulphates and sulphides in water
7. Determination of D.O
8. Determination of available chlorine in bleaching powder and the chlorine dose required to treat the given water sample
9. Determination of coliforms in water
10. Determination of B.O.D and C.O.D

Course Outcomes

CO1: To analyze the physical water quality parameters by conducting experiments for given sample. Prepare laboratory reports on the interpretation of experimental results with corresponding drinking water standard

CO2: To analyze the chemical water quality parameters by conducting experiments for given sample. Prepare laboratory reports on the interpretation of experimental results with corresponding drinking water standard

CO3: To analyze the waste water quality parameters by conducting experiments for given sample. Prepare laboratory reports on the interpretation of experimental results with corresponding waste water discharge standard.

REFERENCES:

Standard method for the examination of water and waste water, 2005, APHA,AWWA, WPCF Publication.

15CVL386 ESTIMATION AND VALUATION PRACTICE 1 0 2 2

1. Introduction - Types of estimate - plinth area method - cubic rate method - unit rate method - bay method - approximate quantity from bill method - comparison method - cost from materials and labour - preparation of detailed estimate
2. Preparation of detailed estimate using Centre line method
3. Preparation of detailed estimate using Long wall - short wall method
4. Preparation of detailed estimate for R.C.C Structures.
5. Preparation of detailed estimate for Steel Structures.
6. Preparation of detailed estimate for roads
7. Preparation of detailed estimate for sanitary and water supply works
8. Specifications - Detailed specifications for common building materials and items of work as per I.S specifications - Preparation of conveyance statement - Calculation of quantities of materials for items of work - Analysis of rate for items of works required for civil engineering works - Preparation of abstract of estimate of civil engineering works.
9. Valuation - types of values – concept of time-value of money - sinking fund - years purchase - Depreciation - obsolescence - valuation of real property - valuation of land - lease and lease hold property.

Course Outcomes

CO1: Prepare a detailed estimate of quantity and cost for different items of work in a building

CO2: Analyze the rate of items of work based on material and workmanship

CO3: Describe various principles and methods of valuation to evaluate the cost of building

CO4: Prepare an estimate and abstract for the various items of work of a building

TEXTBOOKS:

1. *Chakraborti, M., "Estimation, Costing, Specification and Valuation in Civil Engg", Chakraborti, 2008.*
2. *B. N. Dutta "Estimating& Costing in Civil Engineering Theory and Practice", UBS Publishers & Distributors Limited, 2008.*

REFERENCE BOOKS:

1. *Kohli, D. D and Kohli, R. C, "A text book of Estimating and Costing (Civil)", S. Chand & Company Ltd., 2004.*
2. *IS: 1200 – 1974 – Parts 1 to 25, Methods of Measurement of Building and Civil Engineering Works, Bureau of Indian Standards, New Delhi.*
3. *Standard Data Books of Central Public Works Departments and Public Work Department of States.*

15CVL313 TRANSPORTATION ENGINEERING I 2 1 0 3

Unit 1

Highway Engineering: Introduction to Transportation Systems and Study of System Characteristics; Salient features of first, second, third and fourth road development plans in India - planning surveys and master plan preparations.
Classification of Roads; Highway Planning; Geometrical Design – Road Cross Sections, Sight Distance and Applications, Super elevation, Horizontal and Vertical Alignment.

Unit 2

Pavement Materials, Design, Construction & Maintenance: Pavement Materials – Aggregate and Bitumen Characteristics and Testing, Bituminous Mix Design - Marshall Mix Design; Pavement Design – Design Elements and Loads. Design of flexible and rigid pavements – CBR method and guidelines of IRC method. Pavement Construction and maintenance – related equipment.

Unit 3

Traffic engineering and control: Introduction - Road user, vehicle and traffic characteristics - Speed and volume studies - Principles of design of at-grade intersections - Simple layouts - Objectives, classification and uses of traffic signs and road markings. Classification of transport technologies - intermodal co-ordination - ITS and automated highways.

Course Outcomes

CO1: Design of various highway elements

CO2: Understand and apply various design procedures of pavements

CO3: Application of different traffic engineering characteristics in urban transportation system design

TEXTBOOKS:

1. *Khanna S K and Justo C E G., "Highway Engineering", Nem Chand and Bros, 2011.*
2. *Kadiyali, L. R., "Traffic Engineering and Transportation Planning", Khanna, Publishers, 2008.*

REFERENCE BOOKS:

1. *Papacostas, C S, and Prevedouros. P. D, "Transportation Engineering and Planning", Prentice Hall, 2009.*
2. *Chandola, S.P., "A Text Book of Transportation Engineering", S Chand & Co. Ltd., 2001.*

15CVL314 WATER RESOURCES AND IRRIGATION ENGINEERING 3 1 0 4

Unit 1

Introduction - hydrologic cycle – catchment - stream patterns - description of the basin - hydrometeorology - constituents and vertical structure of atmosphere - general circulation -

transitory systems - meteorological observations - formation of precipitation, types of precipitation, forms of precipitation, climate and weather seasons in India, rainfall variations, measurement, presentation of rainfall data, mean precipitation, abstractions from precipitation, evapotranspiration, runoff, hydrograph – concepts, assumptions and limitations of unit hydrograph. Ground water- aquifer types - flow of ground water – well hydraulics - types of wells - other sources of ground water. Irrigation - total planning concept - water requirements of crops - command area – duty - delta. Irrigation efficiency-irrigation requirement of crops.

Unit 2

Reservoir planning - site investigation - zones of storage - Reservoir yield - Estimation of Reservoir Capacity - Reservoir Sedimentation - Reservoir losses and control - Life of Reservoir. Diversion head works - Types of diversion works - location of canal head works - components of head works - weir and barrages – causes of failure of weirs on permeable foundation and their remedies - criteria for the design of weirs and barrages – Design of impervious floor for subsurface flow - Bligh's creep theory – Khosla's theory design procedure.
Dams - Types of dams and their selection - Gravity dam, arch dam, buttress dam, earth dams. Gravity dam - analysis and design. Spillways - Different types and suitability – Energy dissipation structures below spillway.

Unit 3

Canal Regulation structures - intake structures, canal falls - canal regulators - canal escapes - Tank irrigation - Surplussing arrangements in minor irrigation tanks - Metering flumes - canal outlets – outlet works through dams and river intakes - cross drainage works - types and selection of type of cross drainage works.
Design and detailing of surplus weir, canal regulator and canal drop.

Course Outcomes

CO1: To understand the hydrologic basis of water resources by exploring and quantifying the major hydrological processes.
CO2: To conduct the reservoir planning and analysis of operational performance indices.
CO3: To understand the analysis, design and operational aspects of water storage, diversion and regulation structures.
CO4: To explore the different irrigation methods, and quantification of crop water requirements and irrigation efficiencies.

TEXTBOOKS

1. *Garg, S. K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers, 2006.*

2. *P. N Modi, Irrigation, Water Resources, and Water power Engineering, Standard Book House, 2014.*

REFERENCES:

1. *Linsley.R. K.et.al., Water Resources Engineering, McGraw-Hill International Edition, 1996.*
2. *VenTe Chow et.al, Applied Hydrology, McGraw -Hill Book Co, New York, 1988.*
3. *K. Subramanya, Engineering Hydrology, Tata McGraw - hill publishers, New Delhi, 2008.*
4. *Mays.L. W. Water Resources Handbook, McGraw – Hill International Edition, 1996*
5. *Singh V.P, Elementary hydrology, Prentice Hall, Englewood Cliffs, New Jersey, 1992.*

15SSK331 SOFT SKILLS III 1 0 2 2

CO#	Course Outcomes	Programme Outcomes
1.	Soft Skills: At the end of the course, the students will have the ability to prepare a suitable resume (including video resume). They would also have acquired the necessary skills, abilities and knowledge to present themselves confidently. They would be sure-footed in introducing themselves and facing interviews.	PO9, PO10, PO12
2.	Soft Skills: At the end of the course, the students will have the ability to analyse every question asked by the interviewer, compose correct responses and respond in the right manner to justify and convince the interviewer of one‟s right ca positive attitude and courteous communication.	PO8, PO9, PO10, PO12
3.	Aptitude: At the end of the course, students will be able to interpret, critically analyze and solve logical reasoning questions. They will have acquired the skills to manage time while applying methods to solve questions on arithmetic, algebra, logical reasoning, and statistics and data analysis and arrive at appropriate conclusions.	PO2, PO4
4.	Verbal: At the end of the course, the students will have the ability to understand and use words, idioms and phrases, interpret the meaning of standard expressions and compose sentences using the same.	PO10, PO12

5.	Verbal: At the end of the course, the students will have the ability to decide, conclude, identify and choose the right grammatical construction.	PO10, PO12
6.	Verbal: At the end of the course, the students will have the ability to examine, interpret and investigate arguments, use inductive and deductive reasoning to support, defend, prove or disprove them. They will also have the ability to create, generate and relate facts / ideas / opinions and share / express the same convincingly to the audience/ recipient using their communication skills in English.	PO9, PO10, PO12

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1									3	3		2
CO2								2	3	3		2
CO3		3		2								
CO4										3		3
CO5										3		3
CO6									3	3		3

Team work: Value of team work in organisations, definition of a team, why team, elements of leadership, disadvantages of a team, stages of team formation. Group development activities: Orientation, internal problem solving, growth and productivity, evaluation and control. Effective team building: Basics of team building, teamwork parameters, roles, empowerment, communication, effective team working, team effectiveness criteria, common characteristics of effective teams, factors affecting team effectiveness, personal characteristics of members, team structure, team process, team outcomes.

Facing an interview: Foundation in core subject, industry orientation/knowledge about the company
professional personality, communication skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

Syllogisms, critical reasoning: A course on verbal reasoning. Listening comprehension advanced: An exercise on improving listening skills.

Reading comprehension advanced: A course on how to approach advanced level of reading, comprehension passages. Exercises on competitive exam questions.

Problem solving level IV: Geometry; Trigonometry; Heights and distances; Co- ordinate geometry; Mensuration.

Specific training: Solving campus recruitment papers, national level and state level competitive examination papers; Speed mathematics; Tackling aptitude problems asked in interview; Techniques to remember (In mathematics). Lateral thinking problems. Quick checking of answers techniques; Techniques on elimination of options, estimating and predicting correct answer; Time management in aptitude tests; Test taking strategies.

TEXTBOOKS:

1. *A Communicative Grammar of English: Geoffrey Leech and Jan Svartvik. Longman, London.*
2. *Adair. J., (1986), "Effective Team Building: How to make a winning team", London, U.K: Pan Books.*
3. *Gulati. S., (2006) "Corporate Soft Skills", New Delhi, India: Rupa & Co.*
4. *The Hard Truth about Soft Skills, by Amazone Publication.*
5. *Data Interpretation by R. S. Aggarwal, S. Chand*
6. *Logical Reasoning and Data Interpretation – Niskit K Sinkha*
7. *Puzzles – Shakuntala Devi*
8. *Puzzles – George J. Summers.*

REFERENCES:

1. *Books on GRE by publishers like R. S. Aggrawal, Barrons, Kaplan, The Big Book, and Nova.*
2. *More Games Teams Play, by Leslie Bendaly, McGraw-Hill Ryerson.*
3. *The BBC and British Council online resources*
4. *Owl Purdue University online teaching resources www.the grammarbook.com - online teaching resources*

www.englishpage.com- online teaching resources and other useful websites.

15CVL401 CONSTRUCTION MANAGEMENT 3 1 0 4

Unit 1

Construction management environment - Construction activities and sequence. Construction planning - Network scheduling - Bar chart, linked bar chart, work-breakdown structures, activity-on-arrow diagrams - event based networks. Critical path method.PERT network analysis.

Unit 2

Network compression - Time-cost study. Resource management. Introduction to Precedence networks.Construction procedure – contracts – types – bidding process – contract conditions - specifications – quality management principles.Construction safety and Engineering ethics.

Unit 3

Materials management - inventory control.Transportation model and application for distribution of materials.Construction equipment - selection factors - planning of equipment – equipment for excavation, transport, hoisting, piling, and concrete construction.Introduction to project management softwares.

Course Outcomes

CO1: Apply knowledge of network scheduling techniques to identify critical activities.

CO2: Apply knowledge of construction procedures in assessing different contract option.

CO3: Assess quality and safety aspects in project environment.

CO4: Take decisions on inventory and transportation of construction materials.

CO5: Select appropriate equipment for various construction activities.

TEXTBOOKS:

1. *Kumar NeerajJha, "Construction Project Management", Pearson Education, 2011.*
2. *R. L. Peurifoy and Schexnayder, "Construction Planning, Equipment, and Methods", Tata McGraw Hill, 2010.*

REFERENCE BOOKS:

1. *Gahlot, P. S. and Dhir, B. M., "Construction Planning and Management", New Age International, 2012.*

2. *Jerome D. Wiest, Ferdinand K. Levy, "A Management guide to PERT / CPM", PHI Learning, 2009.*

3. *L.S. Srinath, "PERT and CPM - Principles and Applications", Affiliated to East West Press, 2001.*

4. *Shrivastava. U. K., 'Construction Planning and Management', Galgothia Publications Pvt. Ltd, New Delhi, 2013.*

5. *Chitkara, K. K. "Construction Project Management - Planning, Scheduling and Control", Tata McGraw-Hill Publishing Co., 2010.*

15CVL402 ENVIRONMENTAL ENGINEERING II 2 1 0 3

Unit1

Domestic Waste Water System: Importance and scope of sanitary engineering – Sewerage system – classification – relative merits and situations for adoption. Sources of wastewater – Quantity - fluctuations in flow and their significance. Storm runoff estimation. Factors affecting storm water drainage – empirical and rational methods – time of concentration.

Waste Water Pipe Hydraulics: Hydraulics of waste water flow – Hydraulic element charts – Design Criteria – construction procedure – Testing and maintenance – Shapes and materials of sewers – Sewer appurtenances – Design of storm water line – surface drains for storm water.

Characteristics: Wastewater characteristics and significance – Decomposition – cycles of decomposition – Dissolved oxygen – Biochemical Oxygen Demand – Formulation – Test for 5 day BOD – significance and limitations – Relative stability – Sewage sampling – population equivalent of industrial effluents – Effluent disposal standards.

Unit 2

Waste Water Treatment – Primary Treatments: Objectives – Selection of unit operation and process – Principle and Design of Preliminary Treatments: Screens, skimming tank – types, grease traps – grit chamber - proportional flow weir – Principle and Design of Primary Treatments settling tanks – Types – Design of sedimentation tanks.

Secondary Treatment Processes: Biological process – object, principles of action – Suspended culture systems – Attached culture systems – Activated sludge process and its types – Design of conventional activated sludge process – Oxidation / stabilization ponds – aerobic and facultative ponds, Trickling Filters (conventional and high rate) .

Sludge characteristics – Weight volume relationship, sludge conditioning, dewatering, sludge digestion – process and parameters. Design and Drawing (Detailed sketch) of Septic Tank, IS Code provisions – Methods of septic tank effluent disposal – Testing soil permeability for determination of area.

Unit 3

Disposal of Waste Water: Disposal on water – conditions favoring – standards and criteria for dilution – pollution and self-purification of streams – oxygen sag curve and stages of self-purification – Disposal on land – criteria methods of broad irrigation – subsurface irrigation – sewage sickness of soil.

Solid Waste Management: Solid waste management – causes, effects and control measures of urban and industrial wastes.

Sustainable Development: Sustainable development – Environmental Protection Acts – Introduction to EIA and ISO 14000.

Course Outcomes

CO1: Analyze and estimate the waste water quantity from residential area

CO2: Analyze the waste water quality parameters from different sources

CO3: Design and estimate the cost for a typical waste water collection schemes

CO4: Analyze , design and estimate a typical domestic sewage treatment plant

TEXTBOOK:

1. *Birdie G. S and Birdie J. S, "Water Supply and Sanitary Engineering", Dhanpat Rai & Sons, 2010.*

REFERENCE BOOKS:

1. Garg S. K, "Environmental Engineering", Vol. II, Khanna Publishers, 2004.

2. Duggal, K. N., "Elements of Environmental Engineering", S Chand & Co. Ltd., 2007.

3. Mark J. Hammer and Mark J. Hammer Jr., "Water and Waste Water Technology", Prentice Hall of India Pvt. Ltd., 2008.

4. Metcalf and Eddy, "Waste Water Engineering Treatment, Disposal & Reuse", Tata McGraw Hill, 2003.

15CVL481 STRUCTURAL DESIGN AND DETAILING 0 0 2 1

Design drawing and detailing of RC elements / structures – preparation of detailed design documents, schedules of structural elements and reinforcement details (structural drawing).

- Framed structure
- Retaining walls
- Water tanks

Design and detailing of steel elements / structures

- Built-up columns and Column bases
- Roof trusses and joints including purlins
- Gantry girder

Computer aided analysis and design

- Multi-storey frame analysis for dead, live and wind loads - Applications.
- Design of Reinforced concrete Beams, Columns – Footings – Steel beams – columns – Trusses

Course Outcomes

CO1: Design and detailing of RC elements/ structures manually and using softwares.

CO2: Design and detailing of Steel elements/ structures manually and using softwares

CO3: Preparation of detailed design documents for Reinforced Concrete and Steel Structures

TEXTBOOKS:

1. *N. Krishna Raju, "Structural Design and Drawing – Reinforced Concrete and Steel", Universities Press, 2005.*
2. *M. L. Gambhir, "Design of Reinforced Concrete Structures", PHI Learning, 2009.*

***REFERENCE BOOKS**:*

1. *D. Krishnamoorthy, "Structural Design & Drawing Vol. I & II", CBS Publishers, 2012.*
2. *Karve, Shah, "Illustrated Design of R. C. Buildings (G+3)", Standard Publishers Distributors, 2008.*
3. *SP: 34-1987, "Handbook on Concrete Reinforcement and Detailing", BIS.*

15CVL403 TRANSPORTATION ENGINEERING II 2 1 0 3

Unit 1

Railway Engineering: Components and Geometrical Design of Railways – Horizontal Curves, Radius, Super elevation, Cant Deficiency, Transitional Curves, Different types of Gradients, Grade Compensation, Points and Crossings and their Design; Signaling & Interlocking ; Layout of Railway Station and Yards.

Unit2

Tunnel Engineering: Tunnel Alignment and Grade, Size and Shape of Tunnels, Tunneling methods in Soft Soils and Hard Rocks – Modern methods and equipment for tunneling; Ventilation of Tunnels; Lining of Tunnels.

Airport Engineering: Location and Spacing of Airports; Geometrical Design Considerations – Taxiways, Runways and Aprons; Runway Orientation – Wind rose Diagram; Terminal Area Planning, Airport Drainage.

Unit3

Docks and Harbour Engineering: Definition of Terms; Basic Planning Principles; General Layout and Basic Operational Aspects, Requirements and Classification of Harbours, Ports and Docks; Navigational Facilities; Inland Water Transport.

Course Outcomes

CO1: Understand the role of different components of a railway network

CO2: Design the geometric elements of a railway track

CO3: Understand the various methods of tunnel construction

CO4: Assess the suitable location for an airport and design the landing area

CO5: Understand the various elements within the harbor

TEXTBOOKS:

1. *Satish Chandra and M. M Agarwal, "Railway Engineering", Oxford university Press,2009.*
2. *Rangwala, "Airport Engineering", Charotar Publishing House, 2011.*

REFERENCE BOOKS:

1. *Arora and Saxena, "Railway Engineering", Dhanpat Rai Publications, 2011.*
2. *R Srinivasan, "Harbour, Dock and Tunnel Engineering", Charotar Publishing House, 2012.*
3. *Dr. S. Seetharaman, "Tunnel and Airport Engineering", Umesh Publications, 2012.*
4. *Khanna S K, Arora, M G and Jain S S., "Airport Planning and Design", Nem Chand and Bros, 2009.*
5. *Chandola, S. P., "A Text Book of Transportation Engineering", S. Chand &Co., 2001.*
6. *Subramanian, K. P., "Highway, Railway, Airport and Harbour Engineering, Scitech Publications, 2010.*
7. *Oza, H. P and Oza, G. H., "Dock and Harbour Engineering", Charotar Book House, 2011.*

15CVL491 PROFESSIONAL PROJECT 0 1 2 2

The objective of this course is to impart and improve the design capability of the student. This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of a RC structure, Design of a waste water treatment plant, Design of a foundation

system, Design of traffic intersection etc. The design problem can be allotted to a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and complete set of drawings which follow the design.

Course Outcomes

CO1: Able to understand the problem and develop/design the solution(s) by applying the engineering concepts in an identified project work.

CO2: Capacity to effectively plan, work and manage the time bound tasks by applying the knowledge and understanding of engineering and management principles as a responsible individual.

CO3: Ability to maintain professional ethics and further communicate the findings amongst their team and to the review committee.

CO4: Able to learn the skill of documenting and presenting the work done (planning, analysis, design and detailing) with proper given format following up the schedule prepared.

CO5: Capability to use their engineering skills for the betterment of society and to engage themselves in life-long learning in the perspective of technological advancements.

15CVL495 PROJECT PHASE I 2 cr

The student is expected to start the initial planning and preparation for the final year project. They have to identify their team, project advisor and, plan the objectives, scope, methodology and the work schedule. A detailed literature review is also expected in this phase.

Course Outcomes

CO1: Students will be able to apply engineering concepts in investigation of the project identified and design solutions using available or developed tools.

CO2: Ability to manage one's own and the teams work by applying the knowledge and understanding of engineering and management principles.

CO3: Ability to maintain professional ethics and further communicate the findings amongst their team and to the review committee

CO4: Ability to work effectively as a team member as well as individual and be able to lead the team when the situation warrants.

CO5: Students should be able to use their engineering skills for the betterment of society and to engage themselves in life long learning in the perspective of technological advancements

15CVL499 PROJECT PHASE II 10 cr

The student is expected to work on a topic in the field of Civil Engineering which could involve theoretical and/or fabrication and/or experimental and/or computational work. Evaluation will be done at the mid-course, as well as at the end of the semester.

Course Outcomes

CO1: Capability to understand the problem and develop/design the solution(s) by applying the engineering concepts in an identified project work.

CO2: Ability to effectively plan, work and manage the time bound tasks by applying the knowledge and understanding of engineering and management principles as a responsible individual.

CO3: Ability to maintain professional ethics and further communicate the findings amongst their team and to the review committee.

CO4: Ability to work effectively as a team member as well as individual and be able to lead

the team when the situation warrants.

CO5: Capability to use their engineering skills for the betterment of society and to engage themselves in life-long learning in the perspective of technological advancements.

ELECTIVES

STRUCTURAL ENGINEERING

15CVL438 STRUCTURAL DYNAMICS AND SEISMIC DESIGN 2 1 0 3

Unit 1

Introduction to structural dynamics – importance of structural dynamics - types and sources of dynamic loads - distinguishing features of a dynamic problem – methodology for dynamic analysis – types of structural vibration - basic terminology.
Single Degree of Freedom**:** Linear systems: Equation of motion - components of vibration system - natural frequency - viscous damping - response to undamped and damped free and forced vibration - response to support motion – principle of accelerometers and displacement meters.

Unit 2

Two Degrees of Freedom: Equations of motion - Eigen value problem - free vibration response – forced vibration response to harmonic excitation - response to support motion - modal analysis.

Earthquake Resistant Design: Elements of Engineering Seismology - Indian Seismicity – faults – seismic waves – earthquake intensity and magnitude – earthquake ground motion - behaviour of structures in the past Earthquakes – basic terminology.

Earthquake Response: Linear systems: Earthquake ground motion – response spectrum - response history analysis

Unit 3

IS codal provisions for the determination of lateral loads – modal analysis. Soil liquefaction – soil-structure interaction effects.

Design Concepts: Seismic Design Concepts - design spectrum - Earthquake Resistant Design of simple framed structures – IS:1893codal provisions - ductile detailing of Reinforced Concrete frames as per IS:13920.

Course Outcomes

CO1: Design and detailing of RC elements/ structures manually and using softwares

CO2: Design and detailing of Steel elements/ structures manually and using softwares

CO3: Preparation of detailed design documents for Reinforced Concrete and Steel Structures

TEXTBOOKS:

1. *Mario Paz, "Structural Dynamics", Springer, 2007.*
2. *Pankaj Agarwal, Manish Shrikhande, "Earthquake Resistant Design of Structures", PHI Learning, 2009.*

REFERENCE BOOKS:

1. *Anil K Chopra, "Dynamics of Structures: Theory and Applications to Earthquake Engineering", Pearson Education, 2008.*
2. *Duggal. S. K., "Earthquake Resistant Design of Structures", Oxford University Press, 2013.*
3. *IS:1893 - (Part I), Criteria for Earthquake Resistant structures-General Provisions and Buildings*
4. *IS:13935 – Repair and Seismic strengthening of buildings*
5. *IS:4326 - Earthquake Resistant Design and Constructions of buildings*
6. *IS:13920 – Ductile detailing of RC Structures subject to Seismic forces*

CONSTRUCTION TECHNOLOGY AND MANAGEMENT

15CVL441 ARCHITECTURAL SCIENCE 2 1 0 3

Unit 1

Principles of architectural design: Factors influencing architectural development – characteristic features of style – historic examples – creative principles. Principles of architectural composition – Unity – balance – proportion – scale – rhythm – harmony – Accentuation and contrast.

Organising principles in architecture – Symmetry – hierarchy – axis – linear – concentric, radial – and asymmetric grouping – primary and secondary masses. Role of colour, texture, shapes/

forms in architecture.
Architectural space and mass, visual and emotional effects of geometric forms; activity space and tolerance space. Forms related to materials and structural systems. Architecture as part ofthe environment.

Unit2

The Thermal Environment: Climatic elements: climate graph – comparison and classification of climates. Earth's thermal balance. Thermal balance of human body – thermal comfort indices – comfort zone.

Thermo physical properties of building materials: resistance and transmittance – sol - air temperature - solar gain factor. Heat flow through buildings – thermal transmittance of structural elements - periodic heat flow.
Design criteria for control of climate – passive and active building design – passive approach. Active systems – low energy cooling.

Unit3

The Luminous Environment: Types of visual tasks – principles of day lighting – evaluation of lighting by windows, skylights – artificial lighting – illumination requirements – lamps and luminaries – coefficient of utilisation – flood lighting of building exteriors.

The Sonic Environment: Physics of sound – airborne and structure borne propagation – behavior of sound in free field and enclosures – design criteria for spaces – acoustical defects – sound reduction, sound insulation and reverberation control.

Course Outcomes

CO1: Apply knowledge of architectural design principles to critically evaluate building form and space

CO2: Apply knowledge of thermo-physical properties of materials in evaluating heat flow through buildings Evaluate quality of indoor climate based on thermal comfort indices and suggest control methods

CO3: Evaluate the natural and artificial lighting of indoor spaces

CO4: Apply knowledge of behavior sound in free field and enclosures to analyze acoustical features

TEXTBOOKS:

1. *Francis D. K. Ching., "Architecture – Form, Space and Order", John Wiley & Sons, Inc., 2007*

2. *Steven V. Szokolay., "Introduction to Architectural Science - The Basis of Sustainable Design", Elsevier, 2007.*

REFERENCE BOOKS:

1. *Muthu Shobha Mohan, "Principles of architecture", Oxford University Press, 2006.*

2. *Koenigseberger, "Manual of Tropical housing and Building – Climatic Design", Universities Press, 2010.*

3. *Bureau of Indian standards, Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987*

4. *Narasimham V., "An Introduction to Building Physics", Kabeer Printing Works, Chennai, 1974.*

5. *Krishnan, "Climate Responsive Architecture", Tata McGraw Hill, 1999.*

GEOTECHNICAL ENGINEERING

15CVL450 ADVANCED FOUNDATION ENGINEERING 2 1 0 3

Unit 1

Foundation on expansive soils: Introduction to expansive soil - Clay mineralogy and mechanism of swelling - Identification of expansive soils - Swelling potential, swelling pressure, free swell - Free swell index - Classification of expansive soil - Tests for swell pressure (IS code method) - Prediction of swell pressure from index properties - Damages in buildings on expansive soils - Elimination of swelling- Environmental solutions such as soil replacement techniques and lime columns - Principles of design of foundations in expansive soil deposits - Structural solutions such as provision of rigid foundation, under reamed piles, T Beams as strip footing for walls etc. (basic aspects).

Unit 2

Soil dynamics and Machine foundations: Introduction to soil dynamics - Soil behavior under dynamic loads - Difference between static and dynamic load behavior of soil - Dynamic soil properties - Free vibrations and forced vibrations - Types of machines - Types of machine

foundations - Vibration analysis of a machine foundation - General design criteria for machine foundations - Design criteria for foundation for reciprocating machines (IS specifications) - Design procedure for block foundation for a reciprocating machine (IS code method) - Vibration isolation and control.

Unit 3

Special foundations: Introduction to shell foundations - Structural form and efficiency - Different types of shell foundations - General principles of geotechnical design of shell foundations and soil-structure interaction.
Special features of the foundations for water tanks, silos, chimneys and transmission line towers. Foundations for marine structures - Design principles.

Course Outcomes

CO1: Understand the problems posed by expansive soils and select the most appropriate foundation solution for expansive soils.

CO2: Use theory of vibrations to find the behavior of soil under dynamic loading and design machine foundations under different loads and soil conditions.

CO3: Knowledge of advanced topics concerned with analysis and design in foundation engineering.

CO4: Have a sense of engineering judgement to solve geotechnical design problems Independently

TEXTBOOKS:

1. *Varghese P.C., "Foundation Engineering", Prentice-Hall of India Private Ltd, 2009.*
2. *Swami saran, "Soil dynamics and Machine Foundations", Galgotias, 2012.*

REFERENCE BOOKS:

1. *Ninan P Kurian, "Design of Foundation Systems", Narosa Publishers, 2009*
2. *Shamsher Prakash, "Soil Dynamics", McGraw Hill, 1981.*
3. *Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall, 2003.*

4. *Joseph E. Bowles, "Foundation Analysis & Design", Tata McGraw Hill, 1996.*

5. *Coduto, "Geotechnical Engineering Principles and Practices", PHI, New Delhi, 2010.*

6. *Srinivasalu and Vaidyanathan, "Handbook of Machine Foundations", Tata McGraw Hill, 2004.*

7. *Swami Saran, "Analysis and Design of Substructures", Oxford & IBH, 2008.*

15CVL453 GROUND IMPROVEMENT TECHNIQUES 2 1 0 3

Unit 1

Objective of ground improvement - In-situ ground improvement methods - Introduction to soil improvements without the addition of many material - surface compaction – compaction piles in sand - impact compaction/dynamic compaction of sands – vibratory compaction in sand- vibroflotation in sand – explosions in sand - Terra probe method- replacement process - vibroflotation in clays - preloading techniques - sand drains - stone columns - introduction to soil improvement by thermal treatment- introduction to biotechnical stabilization.

Unit2

Introduction to soil improvement by adding materials - lime stabilization – Mechanism - optimum lime content - lime fixation point - effect of lime on physical and engineering properties of soil - lime column method - stabilization of soft clay or silt with lime – stabilization with cement -suitability for soils - effect on properties of soils. Grouting – types - desirable characteristics of grouts - grouting methods-grouting pressure -grouting materials - grouting technology - permeation grouting - compaction grouting - soil fracture grouting - jet grouting - application and limitations - slab jacking, grouted columns - application to dams.

Unit 3

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types - reinforcing materials - Reinforced earth retaining walls - reinforced embankments - soil nailing.
Geosynthetics – Types - general applications - types of geotextiles and geo-grids - physical and strength properties of geotextiles and geogrids - behaviour of soils on reinforcing with geotextiles and geogrids - design aspects with geotextiles and geogrid.

Course Outcomes

CO1: Evaluate the various ground improvement techniques using mechanical methods such as compaction, vibroflotation, preloading etc

CO2: Analyze the various types of soil stabilization techniques such as lime stabilization, cement stabilization, grouting etc.

CO3: Examine the importance of reinforcing materials in ground improvement such as soil nailing and geo-synthetics

TEXTBOOKS:

1. *Purushothama Raj. P., "Ground Improvement Techniques", University Science Press, 2009.*
2. *Swami Saran., "Reinforced soil and its engineering applications", I. K. International Pvt Ltd, 2010*

REFERENCE BOOKS:

1. *Moseley and Kirsch, "Text Book on Ground Improvement", Spon Press, 2004.*
2. *Shashi K. Gulhati and Manoj Dutta, "Geotechnical Engineering", Tata McGraw-Hill, 2005.*
3. *Boweven R., "Text Book on Grouting in Engineering Practice", John Wiley and Sons, 1981.*
4. *Jewell R.A., "Soil reinforcement with geotextiles – Special Publication 123", CIRIA Special Publication, Thomas Telford, 1996.*
5. *Donald H. Gray and Robbin B. Sotir, "Text Book on Biotechnical & Soil Engineering Slope Stabilization", Wiley International, 1996.*
6. *Korener, "Construction & Geotechnical Methods in Foundation Engineering", McGraw Hill, 1986.*
7. *NiharRanjan Patra, "Ground Improvement Techniques", Vikas Publishing House, 2012.*

WATER RESOURCES ENGINEERING

15CVL456 REMOTE SENSING AND GIS 2 1 0 3

Unit1

Introduction, Basic concepts and principles of remote sensing; Definition components of remote sensing- energy sensor, interacting body – active and passive remote sensing – platforms - EMR interaction with earth surface material, radiance, irradiance, incident, reflected, absorbed and transmitted energy – reflectance – specular and diffused reflection surfaces – spectral signature – spectral signature curves – EMR interaction with water, soil and earth surface. Application; Meteorology, land use, networking, hydrological studies, soil studies and coastal zone analysis.

Unit2

Photogrammetry; Aerial and Terrestrial; photo interpretation. Sensors; Radar imaging; colour scanners; thematic mapper.
Geographic information system – components of GIS – hardware, software and organisational context – data – spatial and non-spatial maps – types of maps – projection - types of projection – data input- digitiser, scanner, editing – raster and vector data structures – comparison of raster and vector data structure.

Unit 3

Analysis using raster and vector data – retrieval, reclassification, overlaying, buffering - data output – printers and plotters. Open source softwares.
GIS and remote sensing applications – urban applications – water resources – urban analysis – watershed management – resources information system – hazard mitigation.

Course Outcomes

CO1: Understand and analyse the principles and components of remote sensing and EMR.

CO2: Schematize the process of data acquisition of satellite images and their characteristics

CO3: Understand the principals and components of Photogrammetry and Thematic maps

CO4: To visualize the Remote sensing digitally with digital image processing techniques.

CO5: To understand the concepts and fundamentals of GIS.

CO6: To Employ Remote sensing and GIS applications in different civil engineering applications.

TEXTBOOKS:

1. *Lillesand, Kiefer and Chipman, "Remote Sensing and Image Interpretation", Wiley student edition, 2013.*
2. *M. Chandra and S.K. Gosh, "Remote Sensing and GIS", Alpha Science, 2006.*

REFERENCES:

1. *Anji Reddy, "Remote sensing and Geographical systems", B S Publications, 2012.*
2. *L R A Narayana, "Remote Sensing and its applications", Universities Press, 1999*
3. *J. V. S. Murthy, "Watershed management", New Age International, 1998.*
4. *Wurbs, R. A., and James, W.P., "Water Resources Engineering". PHI Learning, 2009.*
5. *M G Srinivas (Edited by), "Remote sensing applications", Narosa Publishing House, 2001.*
6. *Burrough P A., "Principles of GIS for land resource assessment", Clarendon Press, 1994.*
7. *Michael N. Demers, "Fundamentals of geographic information system", Wiley student edition, 2012.*

15CVL458 Water Resources Systems Planning and Design 3 0 0 3

Unit 1

Water systems engineering –scope and approach.
Issues and the systems planning approach- water system dynamics- water resource development alternatives – Water systems planning objectives- Constraints and Criteria – Economic and Econometric principles
Hydrologic input analysis, Demand analysis, System elements & Subsystem planning - Stochastic planning and management - Design and management issues.

Unit 2

Optimization methods and their application in W.R. systems. Linear programming and Dynamic programming models. Problem formulation for W.R systems – Multi objective planning – Large scale system analysis- Case studies.

Unit 3

Ground water system planning – Conjunctive surface and G.W development- Hierarchical approach- Water quality management planning- Regional planning- Policy issues.

Course Outcomes

CO1: To understand the water resources systems and express it using mathematical models.

CO2: To formulate and solve various optimization models of water resources planning and management problems.

CO3: To understand the advantages and limitations of various types of modeling methods and algorithms used in water resources planning and management.

CO4: To use the simulation and optimization models for planning and management decision making.

Text book:

Jain, "Water Resources Systems Planning & Management: Developments in Water Science"**,** Elsevier Science, 2006.

Reference books:

1. S K Jain, V P Singh, "Water Resources Systems Planning and Management", Elsevier Science, 2003
2. M. C. Chathurvedi , "Water Resources Systems: Planning & Management", Tata Mc Garw Hill Publications, 1988.
3. Louks D P et.al, "Water Resources System Planning & Analysis", Prentice Hall., 1981.
4. Maass. A. et.al., "Design Water Resources Systems", MacMillan, 1968.
5. Goodman. A.S. and Major. D.C., "Principles of Water Resources Planning", Prentice Hall, 1984.

TRANSPORTATION ENGINEERING

15CVL471 TRAFFIC ENGINEERING AND MANAGEMENT 2 1 0 3

Unit 1

Introduction - Objectives and scope of traffic engineering - Components of road traffic: vehicle,

driver and road - Road user and vehicle characteristics and their effect on road traffic - Traffic manoeuvre - Traffic Stream Characteristics - Relationship between Speed, Flow and Density. Objectives, methods, equipment, data collection, analysis and interpretation (including case studies) of (a) Speed and delay, (b) Origin and destination, (c) Parking, (d) Accident and other studies.

Unit 2

Design, Regulation and Management of Traffic Engineering Facilities: Control of traffic movements through time sharing and space sharing concepts - Design of channelising islands, T, Y, skewed, staggered, roundabout, mini-roundabout and other forms of at-grade crossings including provision for safe crossing of pedestrians and cyclists - Grade separated intersections: Warrants and design features - Bus stop location and bus bay design - Road lighting - Regulations on vehicles, drivers and traffic - Planning and design of traffic management measures: one-way streets, reversible lanes and roadways, turn regulation, transit and carpool lanes - Planning and design of pedestrian facilities – Traffic calming.

Unit 3

Traffic Control Devices and Environmental Control: Different methods of signal design - Redesign of existing signals including case studies - Signal coordination - Air and Noise pollution of different transport modes – Visual impacts - Impacts on land development - Technological approaches to improving environment.

Course Outcomes

CO1: Understand the components of a road traffic and their characteristics

CO2: Explain the requirement and process of conducting traffic surveys

CO3: Design different types of unsignalized and grade separated intersections

CO4: Explain the various alternatives for effective traffic management

CO5: Analysis and Design of signalized intersections

CO6: Explain the detrimental effect of traffic on environment and measures to alleviate it

TEXTBOOKS:

1. *Elena S. Prassas, Roger P. Roess, William R. McShane, "Traffic Engineering", Pearson, 2010.*

2. *Kadiyali, L. R., "Traffic Engineering and Transport Planning", Khanna Publishers, 2007.*

REFERENCE BOOKS:

1. *O' Flaherty C. A., "Traffic Planning and Engineering", Elsevier India, 2006.*
2. *Fred L. Mannering, Scott S. Washburn, and Walter P. Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley, 2011.*
3. *Pignataro, L., "Traffic Engineering - Theory and Practice", Prentice Hall, 1973.*
4. *Institute of Transportation Engineers, "Transportation and Traffic Engg. Hand Book", 6th edition, 2009.*
5. *IRC-SP41, Guidelines for the Design of At-Grade Intersections in Rural and Urban Areas, 1994.*
6. *Leonard Evans, "Traffic Safety", Science Serving Society, 2004.*
7. *Michael, A. P. Taylor, William Young, and Peter W. Bonsall, "Understanding Traffic Systems", Ashgate Publishing, 2000.*
8. *Mike Slinn, Paul Matthews, Peter Guest, "Traffic Engineering Design - Principles and Practice", Butterworth-Heinemann, 2005.*

SCIENCE ELECTIVES

15CHY239 COMPUTATIONAL CHEMISTRY AND MOLECULAR MODELLING 3 0 0 3

Unit 1

Introduction: Stability, symmetry, homogeneity and quantization as the requirements of natural changes - Born - Haber cycle – Energetic – kinetics - Principles of spectra.

Computational techniques: Introduction to molecular descriptors, computational chemistry problems involving iterative methods, matrix algebra, Curve fitting.

Molecular mechanics: Basic theory - Harmonic oscillator – Parameterization - Energy equations - Principle of coupling - Matrix formalism for two masses - Hessian matrix - enthalpy of formation -

enthalpy of reactions.

Introduction to Quantum mechanics - Schrodinger equation - Position and momentu - MO formation - Operators and the Hamiltonian operator - The quantum oscillator - Oscillator Eigen value problems - Quantum numbers - labeling of atomic electrons.

Unit 2

Molecular Symmetry: Elements of symmetry - Point groups - Determination of point groups of molecules.

Huckel's MO theory: Approximate and exact solution of Schrodinger equation - Expectation value of energy - Huckel's theory and the LCAO approximation - Homogeneous simultaneous equations - Secular matrix - Jacobi method - Eigen vectors: Matrix as operator - Huckel's coefficient matrix - Wheeland's method - Hoffmann's EHT method - Chemical applications such as bond length, bond energy, charge density, dipole moment, Resonance energy.

Unit 3

Self consistent fields: Elements of secular matrix - Variational calculations - Semi empirical methods - PPP self consistent field calculation - Slater determinants - Hartree equation - Fock equation – Roothaan - Hall equation - Semi empirical models and approximations.

Ab-initio calculations: Gaussian implementations – Gamess - Thermodynamic functions - Koopman's theorem - Isodesmic reactions, DFT for larger molecules - Computer aided assignments/mini projects with softwares - Introduction to HPC in Chemical calculations.

Molecular modelling software engineering - Modeling of molecules and processes - Signals and signal processing in Chemistry - QSAR studies and generation of molecular descriptors - Applications of chemical data mining - Familiarization with open source softwares useful for molecular modeling - Introduction to molecular simulation - M.D. simulation.

Course Outcome

CO01: Get to understand the structure of molecules using symmetry.

CO02: Understanding Quantum mechanical approach to calculate the energy of a system.

CO03: Applying mathematical knowledge and quantum mechanical approach in finding out the characteristics- reactivity, stability, etc., of the molecule.

CO04: To get a brief idea about molecular mechanics based chemical calculations.

CO05: To get an idea about general methodology of molecular modeling.

TEXTBOOKS:

1. *Ramachandran, G Deepa and K Namboori, "Computational Chemistry and Molecular Modeling*

- Principles and Applications", Springer-Verlag, Berlin, Heidelberg, 2008, ISBN-13 978-3-540-77302-3.

2. *Donald W Rogers, "Computational Chemistry Using PC", Wiley, (2003).*
3. *Alan Hinchliffe, "Chemical Modeling from atoms to liquids", Wiley, (2005).*

REFERENCES:

1. *James B Forseman and Aeleen Frisch-Gaussian, "Exploring Chemistry with Electronic Structure Method", Inc., Pittsburgh, PA, 2nd edition, (2006).*
2. *A C Philips, "Introduction to Quantum mechanics", Wiley, (2003).*
3. *Wolfram Koch, Max C. Holthausen, "A Chemist's guide to Density Functional Theory", Wiley, VCH, 2nd edition, (2001).*

15CHY241 ELECTROCHEMICAL ENERGY SYSTEMS AND PROCESSES 3 0 0 3

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air, zinc-silver oxide batteries; lithium primary cells - liquid cathode, solid cathode and polymer electrolyte types and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: ARM (alkaline rechargeable manganese) cells, Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultra thin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Reserve batteries and Fuel cells: Reserve batteries - water activated, electrolyte activated and thermally

activated batteries - remote activation - pyrotechnic materials. Fuel Cells:Principle, chemistry and functioning - carbon, hydrogen-oxygen, proton exchange membrane (PEM), direct methanol (DMFC), molten carbonate electrolyte (MCFC) fuel cells and outline of biochemical fuel cells.

Electrochemical Processes: Principle, process description, operating conditions, process sequence and applications of Electroforming – production of waveguide and plated through hole (PTH) printed circuit boards by electrodeposition; Electroless plating of nickel, copper and gold; Electropolishing of metals; Anodizing of aluminium; Electrochemical machining of metals and alloys.

Course Outcomes

CO01: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics

CO02: Learn the application of the electrochemical principles for the functioning and fabrication of industrial batteries and fuel cells

CO03: Acquire knowledge in solving numerical problems on applied electrochemistry

CO04: Analysis and practical problem solving in fabrication of batteries and fuel cells

CO05: Application of concepts and principle in industrial electrochemical processes

CO06: Evaluation of comprehensive knowledge through problem solving

TEXTBOOKS:

1. *Derek Pletcher and Frank C. Walsh, "Industrial Electrochemistry", Blackie Academic and Professional, (1993).*
2. *Dell, Ronald M Rand, David A J, "Understanding Batteries", Royal Society of Chemistry, (2001).*

REFERENCES:

1. *Christopher M A, Brett, "Electrochemistry – Principles, Methods and Applications", Oxford University, (2004).*
2. *Watanabe T, "Nano-plating: microstructure control theory of plated film and data base of plated film microstructure", Elsevier, Oxford, UK (2004).*
3. *Kanani N, "Electroplating and electroless plating of copper and its alloy", ASM International, Metals Park, OH and Metal Finishing Publications, Stevenage, UK (2003).*
4. *Lindon David, "Handbook of Batteries", McGraw Hill, (2002).*
5. *Curtis, "Electroforming", London, (2004).*
6. *Rumyantsev E and Davydov A, "Electrochemical machining of metals", Mir, Moscow, (1989).*

15CHY243 FUELS AND COMBUSTION 3 0 0 3

Course Objectives: To provide the basic knowledge about fuels, rocket propellants and explosives.

Course Outcomes

CO01: Understand the types of fuels and variation in their properties

CO02: Able to analyze the fuel content

CO03: Obtain knowledge in identifying a proper fuel as per the requirement

CO04: Ability to know the preparation and working of propellants and explosives

Skill: This course enables the student to gain skill in identifying fuel, analyzing and categorize the application of it.

Unit 1

Fuels - Solid fuels - Classification, preparation, cleaning, analysis, ranking and properties - action of heat, oxidation, hydrogenation, carbonization, liquefaction and gasification.

Liquid fuels – Petroleum - origin, production, composition, classification, petroleum processing, properties, testing - flow test, smoke points, storage and handling.

Secondary liquid fuels - Gasoline, diesel, kerosene and lubricating oils. Liquid fuels - refining, cracking, fractional distillation, polymerization. Modified and synthetic liquid fuels. ASTM methods of testing the fuels.

Unit 2

Gaseous fuels - Types, natural gas, methane from coal mine, water gas, carrier gas, producer gas, flue gas, blast furnace gas, biomass gas, refinery gas, LPG - manufacture, cleaning, purification and analysis. Fuels for spark ignition engines, knocking and octane number, anti knock additives, fuels for compression, engines, octane number, fuels for jet engines and rockets.

Flue gas analysis by chromatography and sensor techniques.

Unit 3

Combustion: Stochiometry, thermodynamics. Nature and types of combustion processes - Mechanism - ignition temperature, explosion range, flash and fire points, calorific value, calorific intensity, theoretical flame temperature. Combustion calculations, theatrical air requirements, flue gas analysis, combustion kinetics – hydrogen - oxygen reaction and hydrocarbon - oxygen reactions.

Rocket propellants and Explosives - classification, brief methods of preparation, characteristics; storage and handling.

TEXTBOOK:

Fuels and Combustion, Samir Sarkar, Orient Longman Pvt. Ltd, 3rd edition, 2009.

REFERENCE:

1. *Fuels - Solids, liquids and gases - Their analysis and valuation, H. Joshua Philips, Biobliolife Publisher, 2008.*
2. *An introduction to combustion: Concept and applications - Stephen R Turns, Tata Mc. Graw Hill, 3rd edition, 2012.*
3. *Fundamentals of Combustion, D P Mishra, 1st edition, University Press, 2010*
4. *Engineering Chemistry - R. Mukhopadhyay and Sriparna Datta, Newage International Pvt. Ltd, 2007.*

15CHY244 GREEN CHEMISTRY AND TECHNOLOGY 3 0 0 3

Objectives

1. Understand the principles of green chemistry and its contribution to the development of sustainable products
2. Possess knowledge of the migration from a hydrocarbon-based economy to carbohydrate-based economy
3. Evaluate the deficiencies of traditional process and acknowledge the invent of new processes
4. Distinctly map the culmination of academic research to industrial chemistry

Course Outcomes

CO01: Understand the evolving concept of Green Chemistry and its application to the manufacture of sustainable products

CO02: Appreciate the need for Renewable energy and Feed stock along with carbon sequestration through the fundamentals of Green Chemistry Techniques

CO03: Develop a coherence to evaluate systematic deficiencies in traditional Chemical science process and products

CO04: Undertake a purposeful Journey through the microscopic domain of academic research to the macroscopic domain of Industrial chemistry

Unit 1

Our environment and its protection, chemical pollution and environmental regulations, environmental chemistry, pollution prevention strategies, challenges to the sustainability of chemical industry, Pollution Prevention Act 1990, USA, Green Chemistry and its 12 principles, toxicity of chemicals, material safety data sheet (MSDS), concept of zero pollution technologies, atom economy, functional toxicity vs non-

functional toxicity, alternative solvents, energy minimization, microwave and sonochemical reactions, renewable feed stock, carbon dioxide as a feed stock.

Unit 2

Greener strategies of the synthesis of ibuprofen synthesis, teriphthalic acid etc. phase behaviour and solvent attributes of supercritical CO2, use of supercritical carbon dioxide as a medium chemical industry, use of ionic liquids as a synthetic medium, gas expanded solvents, superheated water, etc. Synthesis of various chemicals from bio mass, polycarbonate synthesis and CO2 fixation, green plastics, green oxidations, etc.

Unit 3

Processes involving solid catalysts – zeolites, ion exchange resins, Nafion/silica nano composites and enhanced activity. Polymer supported reagents, green oxidations using TAML catalyst, membrane reactors. Green chemistry in material science, synthesis of porous polymers, green nanotechnology.

REFERENCES:

1. *Hand Book of Green Chemistry and Technology; by James Clarke and Duncan Macquarrie; Blakwell Publishing.*
2. *Anastas, P. T., Warner, J. C. Green Chemistry: Theory and Practice, Oxford University Press Inc., New York, 1998.*
3. *Matlack, A. S. Introduction to Green Chemistry Marcel Dekker: New York, NY, 2001.*

15CHY245 INSTRUMENTAL METHODS OF ANALYSIS 3 0 0 3

Unit 1

Error Analysis and Sampling: Accuracy - Precision - Classification of Errors - Minimization of errors - Standard deviation - Coefficient of variance - F-test - t-test - Significant figures. Sampling - Basis of sampling, Sampling and physical state - Safety measures of sampling.

Separation Techniques: Brief out line of column, paper and thin layer chromatography - Ion exchange methods - principle and application – HPLC.

Unit 2

Gas chromatography - principle and applications – gel chromatography.

Electroanalytical techniques: Potentiometry - Potentiometric titration - determination of equivalence

point - acid base, complexometric, redox and precipitation titrations - merits and demerits. Voltammetry - Cyclic voltammetry - basic principle and application - Polarography - introduction - theoretical principles - migration current - residual current - half wave potential - instrumentation - analytical applications.

Unit 3

Spectro-chemical techniques: UV-VIS spetrophotometry - principle - Beer's Law application - photometric titration - single and double beam spectrophotometer - instrumentation of IR - sample handling - IR applications - H - NMR - Instrumentation and applications - principle - instrumentation - applications of atomic absorption spectroscopy.

Thermal and Diffraction techniques: Principles and applications of DTG - DTA - DSC - X-ray - Electron Diffraction Studies - SEM, TEM.

Course Outcome

CO01: To develop an understanding of principle and working of the range of instrumental methods in analytical chemistry

CO02: To provide an understanding and skills in contemporary methods of separation and appropriate selection of instruments for the successful analysis of chemical compounds

CO03: To impart skills in the scientific method of planning, conducting, reviewing, reporting experiments and problem solving in chemical analysis.

TEXTBOOKS:

1. *Willard H W, Merritt J R, "Instrumental Methods of Analysis", 6th edition, Prentice Hall, (1986).*
2. *Skoog Douglas A, West Donald, "Fundamentals of Analytical Chemistry", 7th edition, New York Addison, Wesley, (2001).*

REFERENCES:

1. *"Vogel's Textbook of Quantitative Chemical Analysis", 5th edition, ELBS, (1989).*
2. *Kaur. H, "Instrumental Methods of Chemical Analysis", Goel Publisher, (2001).*

15CHY331 BATTERIES AND FUEL CELLS 3 0 0 3

Course Objective: To provide sound knowledge on the application of electrochemistry in energy storage systems.

Course Outcome

CO01: Understand the fundamental concepts of electrochemistry through electrode potential and reaction kinetics

CO02: Learn the application of the electrochemical principles for the functioning and fabrication industrial batteries and fuel cells

CO03: Analysis of practical problem solving in fabricating batteries and fuel cells

CO04: Evaluation of comprehensive knowledge through problem solving

Unit 1

Background Theory: Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2

Batteries: Primary batteries: The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Secondary batteries: Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 3

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspectsof the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Fuels for Fuel Cells: Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

TEXTBOOKS:

1. *Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry, (2001).*
2. *M. Aulice Scibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India (2006).*

REFERENCES:

- *Kanani N, 'Electroplating and electroless plating of copper and its alloy', ASM International, Metals Park, OH and Metal Finishing Publications,Stevenage, UK (2003).*
- *Curtis, 'Electroforming', London, (2004).*
- *F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA, (2005).*
- *G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL, (2003).*

15CHY332 CORROSION SCIENCE 3 0 0 3

Unit 1

Basic principles: Free energy concept of corrosion - different forms of corrosion - Thermodynamic & Kinetic aspects of corrosion: The free energy criterion of corrosion possibility - Mechanism of Electrochemical corrosion - Galvanic and Electrochemical series and their significance.

Corrosion Control: Materials selection - metals and alloys - metal purification - non metallic - changing medium.

Unit 2

Anodic and cathodic protection methods - Coatings - metallic and other inorganic coatings - organic coatings - stray current corrosion - cost of corrosion control methods.

Corrosion protection by surface treatment: CVD and PVD processes - Arc spray - Plasma spray - Flame spray.

Corrosion Inhibitors: Passivators - Vapour phase inhibitor.

Unit 3

Stress and fatigue corrosion at the design and in service condition - control of bacterial corrosion.

Corrosion protection: Automobile bodies – engines – building construction.

Course Outcome:

CO01: Development of skill in identifying the nature and type of corrosion

CO02: Understanding the mechanism of various types of corrosion

CO03: Analysing the problem and find out a solution to combat corrosion in any sort of environment.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	1	2	-	-	-	-	-	-	-	-	-	-	3	1	-	-
CO2	-	3	1	2	-	-	-	-	-	-	-	1	1	2	-	-
CO3	-	3	3	3	2	3	3	-	-	-	-	1	3	2	3	-

TEXTBOOKS:

1. *Fontana and Mars G, "Corrosion Engineering", 3rd edition, McGraw Hill, (1987).*
2. *Uhlig H H and Reviees R W, "Corrosion and its Control", Wiley, (1985).*

REFERENCES:

1. *ASM Metals Handbook, "Surface Engineering", Vol. 5, ASM Metals Park, Ohio, USA, (1994).*
2. *ASM Metals Handbook, "Corrosion", Vol. 13, ASM Metals Park, Ohio, USA, (1994).*
3. *Brain Ralph, "Material Science and Technology", CRC Series, Boston, New York.*

15PHY230 ADVANCED CLASSICAL DYNAMICS 3 0 0 3

Unit 1

Introduction to Lagrangian dynamics

Survey of principles, mechanics of particles, mechanics of system of particles, constraints, D'Alembert's principle and Lagrange's equation, simple applications of the Lagrangian formulation, variational principles and Lagrange's equations, Hamilton's principles, derivation of Lagrange's equations from Hamilton's principle, conservation theorems and symmetry properties.

Unit 2

Central field problem

Two body central force problem, reduction to the equivalent one body problem, Kepler problem, inverse square law of force, motion in time in Kepler's problem, scattering in central force field, transformation of the scattering to laboratory system, Rutherford scattering, the three body problem.

Rotational kinematics and dynamics

Kinematics of rigid body motion, orthogonal transformation, Euler's theorem on the motion of a rigid body.

Unit 3

Angular momentum and kinetic energy of motion about a point, Euler equations of motion, force free motion of rigid body.

Practical rigid body problems

Heavy symmetrical spinning top, satellite dynamics, torque-free motion, stability of torque-free motion - dual-spin spacecraft, satellite maneouvering and attitude control - coning maneuver - Yo-yo despin mechanism - gyroscopic attitude control, gravity-gradient stabilization.

Course Outcomes

CO1 - Able to use the Lagrangian formalism to solve simple dynamical system

CO2- Able to understand Hamiltonian formalism and apply this in solving dynamicalsystems

CO3- Able to apply Lagrangian formalism in bound and scattered states with specific reference to Kepler's laws and Scattering states

CO4- Able to solve problems in the Centre of Mass frame and connect it to Laboratory Frame of Reference

CO5- Understand and solve problems in rigid body rotations applying of Euler's equations.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	1	0	0	0	0	0	0	0	1	0	0	0
CO2	3	3	1	1	0	0	0	0	0	0	0	1	0	0	0
CO3	3	3	3	1	0	0	0	0	0	0	0	1	0	0	0
CO4	3	3	3	1	0	0	0	0	0	0	0	2	0	0	0
CO5	3	3	3	2	0	0	0	0	0	0	0	2	0	0	0

TEXTBOOKS:

1. H. Goldstein, Classical Mechanics, Narosa Publishing House, New Delhi, 1980, (Second Edition)

2. H. Goldstein, Charles Poole, John Safko, Classical Mechanics, Pearson education, 2002 (Third Edition)
3. Howard D. Curtis, Orbital Mechanics for Engineering Students, Elsevier, pp.475 - 543

4. Anderson John D, Modern Compressible flow, McGraw Hill.

REFERENCE BOOKS:

1. D. A. Walls, Lagrangian Mechanics, Schaum Series, McGraw Hill, 1967.

2. J. B. Marion and S. T. Thornton, Classical dynamics of particles and systems, Ft. Worth, TX: Saunders, 1995.

15PHY238 ELECTRICAL ENGINEERING MATERIALS 3 0 0 3

Unit 1

Conducting materials: The nature of chemical bond, crystal structure Ohm's law and the relaxation time, collision time, electron scattering and resistivity of metals, heat developed in a current carrying conductor, thermal conductivity of metals, superconductivity.

Semiconducting materials: Classifying materials as semiconductors, chemical bonds in Si and Ge and it's consequences, density of carriers in intrinsic semiconductors, conductivity of intrinsic semiconductors, carrier densities in n type semiconductors, n type semiconductors, Hall effect and carrier density.

Unit 2

Magnetic materials: Classification of magnetic materials, diamagnetism, origin of permanent, magnetic dipoles in matter, paramagnetic spin systems, spontaneous magnetization and Curie Weiss law, ferromagnetic domains and coercive force, anti ferromagnetic materials, ferrites and

it’s applications.

Unit 3

Dielectric materials: Static dielectric constant, polarization and dielectric constant, internal field in solids and liquids, spontaneous polarization, piezoelectricity.

PN junction: Drift currents and diffusion currents, continuity equation for minority carriers, quantitative treatment of the p-n junction rectifier, the n-p-n transistor.

Course Outcomes

CO1: To understand the nature of interaction between atoms in crystalline solid materials that determines their dielectric, magnetic and electrical properties.

CO2: Analyze the relation between the macroscopic dielectric constant and the atomic structure of an insulator.

CO3: Fundamental concepts of magnetic fields required to illustrate the magnetic dipoles. This forms the basis to understand the magnetic properties of dia, para, ferro, antiferro and ferri magnetic materials.

CO4: Fundamentals concerned with conduction mechanism in metals and superconductors.

CO5: Understand the basics for classification of materials based on its conductivity, nature of chemical bonds in Si and Ge, carrier density, energy band structure and conduction mechanism in intrinsic and extrinsic semiconductors.

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	1	1											1	-
CO2	2	2	2										1	-
CO3	2	2	2										2	-
CO4	2	2	2										2	-
CO5	2	2	2					2					1	-

TEXTBOOK:

A J Decker, “Electrical Engineering materials”, PHI, New Delhi, 1957.

REFERENCES:

1. A J Decker, “Solid State Physics”, Prentice Hall, Englewood Cliffs, N J 1957.

2. C Kittel, “Introduction to solid state Physics”, Wieley, New York, 1956 (2nd edition).

3. Allison, Electronic Engineering materials and Devices, Tata Mc Graw Hill

4. F K Richtmyer E H Kennard, John N Copper, “Modern Physics”, Tata Mc Graw Hill, 1995 (5th edition).

15PHY248 PHYSICS OF LASERS AND APPLICATIONS 3 0 0 3

Unit 1

Review of some basic concepts and principle of laser.

Introduction to light and its properties: Reflection, refraction, interference, diffraction and polarization. Photometry – calculation of solid angle. Brewster’s law. Snell’s law and, its analysis.

Introduction to LASERS: Interaction of radiation with matter - induced absorption, spontaneous emission, stimulated emission. Einstein’s co-efficient (derivation). Active material. Population inversion – concept and discussion about different techniques. Resonant cavity.

Unit 2

Properties of LASERS

Gain mechanism, threshold condition for PI (derivation), emission broadening - line width, derivation of FWHM natural emission line width as deduced by quantum mechanics - additional broadening process: collision broadening, broadening due to dephasing collision, amorphous crystal broadening, Doppler broadening in laser and broadening in gases due to isotope shifts. Saturation intensity of laser, condition to attain saturation intensity.

Properties – coherency, intensity, directionality, monochromaticity and focussibility. LASER transition – role of electrons in LASER transition, levels of LASER action: 2 level, 3 level and 4 level laser system.

Unit 3

Types of LASERS

Solid state LASER: (i) Ruby LASER – principle, construction, working and application. (ii) Neodymium (Nd) LASERS. gas LASER: (i) He-Ne LASER - principle, construction, working and application. (i) CO2 LASER - principle, construction, working and application.

Liquid chemical and dye LASERS. Semiconductor LASER: Principle, characteristics, semiconductor diode LASERS, homo-junction and hetero-junction LASERS, high power semi conductor diode LASERS.

Applications in Communication field:

LASER communications: Principle, construction, types, modes of propagation, degradation of signal, analogue communication system, digital transmission, fiber optic communication.

Applications of LASERS in other fields:

Holography: Principle, types, intensity distribution, applications. laser induced fusion. Harmonic generation. LASER spectroscopy. LASERS in industry: Drilling, cutting and welding. Lasers in medicine: Dermatology, cardiology, dentistry and ophthalmology.

Course Outcomes

CO 1- Understand, Comprehend and acquaint with concepts of NanoPhysics
CO2- To familiarize the material's property changes with respect to the dimensional confinements.
CO3- Acquire knowledge on the modern preparation process and analysis involved in the nanomaterial's research
CO4- To learn about the technological advancements of the nano-structural materials and devices in the engineering applications

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2												
CO2	2	3												
CO3				3										
CO4						3	2					1		

REFERENCES:

1. William T Silfvast, “Laser Fundamentals”, Cambridge University Press, UK (2003).
2. B B Laud, “Lasers and Non linear Optics”, New Age International (P) Ltd., New Delhi.
3. Andrews, “An Introduction to Laser Spectroscopy (2e)”, Ane Books India (Distributors).
4. K R Nambiar, “Lasers: Principles, Types and Applications”, New Age International(P) Ltd., New Delhi.
5. T Suhara, “Semiconductor Laser Fundamentals”, Marcel Dekker (2004).

15PHY532 ASTROPHYSICS 3 0 0 3

Unit 1

Historical introduction: Old Indian and western – astronomy - Aryabhatta, Tycho Brahe, Copernicus, Galileo - Olbers paradox - solar system – satellites, planets, comets, meteorites, asteroids.

Practical astronomy - telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.

Celestial mechanics - Kepler’s laws - and derivations from Newton’s laws.

Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

Unit 2

Stellar astronomy: H-R diagram, color-magnitude diagram - main sequence - stellar evolution

– red giants, white dwarfs, neutron stars, black holes - accretion disc - Schwartzchild radius - stellar masses Saha–Boltzman equation - derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables - Novae and Super novae. Binary and multiple star system - measurement of relative masses and velocities. Interstellar clouds - Nebulae.

Unit 3

Galactic astronomy: Distance measurement - red shifts and Hubble's law – age of the universe, galaxies – morphology - Hubble's classification - gravitational lens, active galactic nuclei (AGNs), pulsars, quasars.

Relativity: Special theory of relativity - super-luminal velocity - Minkowski space - introduction to general theory of relativity – space - time metric, geodesics, space-time curvature. Advance of perihelion of Mercury, gravitational lens.

Cosmology: Comic principles, big bang and big crunch – cosmic background radiation - Nucleo-synthesis - plank length and time, different cosmic models - inflationary, steady state. Variation of G. anthropic principle.

COURSE OUTCOMES (CO):

After completion of the course students should be able to

CO1: Get a broad knowledge of scientific and technical methods in astronomy and astrophysics.
CO2: Apply mathematical methods to solve problems in astrophysics.
CO3: Develop critical/logical thinking, scientific reasoning and skills in the area of modern astrophysics.

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3											1		
CO2	2	2												
CO3	1	2												

REFERENCES:

1. "Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.
2. William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977
3. Bradley W.Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.
4. Bradley W.Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison-Wesley Publishing Company,1996
5. 'Stellar Astronomy' by K. D Abhayankar.
6. 'Solar Physics' by K. D Abhayankar.

HUMANITIES ELECTIVES

15ENG230 BUSINESS COMMUNICATION 1 0 2 2

Course Objectives

To introduce business vocabulary
T o introduce business style in writing and speaking
To expose students to the cross-cultural aspects in a globalised world
To introduce the students to the art of persuasion and negotiation in business contexts

Course Outcomes

CO1	Familiarize and use appropriate business vocabulary and etiquettes in verbal communication in the professional context
CO2	Understand organizational structures, pay structures and performance assessments
CO3	Apply language skills in drafting various business documents and other necessary communications in the business context
CO4	Understand and address cross cultural differences in the corporate environment
CO5	articipate in planned and extempore enactments of various business situations

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO 3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1										3		2
CO2									1		1	
CO3										3		
CO4						2						
CO5									2			

Syllabus

Unit 1:

Business Vocabulary - Writing: Drafting Notices, Agenda, and Minutes - Reading: Business news, Business articles

Unit 2:

Writing: Style and vocabulary - Business Memorandum, letters, Press Releases, reports – proposals – **Speaking**: Conversational practice, telephonic conversations, addressing a gathering, conducting meetings

Unit 3:

Active Listening: Pronunciation – information gathering and reporting **- Speaking**: Cross-Cultural Issues, Group Dynamics, negotiation & persuasion techniques

Activities

Case studies & role-plays

Books recommended:

1. Jones, Leo & Richard Alexander. *New International Business English*. CUP. 2003.
2. Horner, David & Peter Strutt. *Words at Work*. CUP. 1996.
3. Levi, Daniel. *Group Dynamics for Teams*. 3 ed. Sage Publications India Pvt. Ltd. New Delhi, 2011.
4. Owen, Roger. *BBC Business English*. BBC. 1996.
5. Henderson, Greta Lafollette & Price R Voiles. *Business English Essentials*. 7th Edition. Glencoe / McGraw Hill.
6. Sweeney, Simon. *Communicating in Business*. CUP. 2000.

15ENG233 TECHNICAL COMMUNICATION 1 0 2 2

Course Objectives:

To introduce the students to the elements of technical style

To introduce the basic elements of formal correspondence

To introduce technical paper writing skills and methods of documentation

To improve oral presentation skills in formal contexts

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

CO1	Understand and use the basic elements of formal correspondence and methods of documentation
CO2	Learn to edit technical content for grammatical accuracy and appropriate tone and style
CO3	Use the library and internet recourses for research purposes
CO4	Demonstrate the ability to communicate effectively through group mock-technical presentations and other activities

Mapping of course outcomes with program outcomes:

PO/PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1										3				
CO2										3				
CO3				1										
CO4									3	3				

Syllabus:

Unit 1

Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style- graphical Representation

Unit 2

Different kinds of written documents: Definitions - descriptions- instructions-recommendations- manuals - reports – proposals; Formal Correspondence: Letter Writing including job applications with Resume

Unit 3

Technical paper writing: Library research skills- documentation style - document editing – proof reading - formatting

Practice in oral communication: Practice in Oral communication and Technical presentations

References

1. Hirsh, Herbert. L "Essential Communication Strategies for Scientists, Engineers and Technology Professionals". II Edition. New York: IEEE press, 2002
2. Anderson, Paul. V. "Technical Communication: A Reader-Centred Approach". V Edition. Harcourt Brace College Publication, 2003
3. Strunk, William Jr. and White. EB. "The Elements of Style" New York. Alliyan & Bacon, 1999.
4. Riordan, G. Daniel and Pauley E. Steven. "Technical Report Writing Today" VIII Edition (Indian Adaptation). New Delhi: Biztantra, 2004.

15HIN101 HINDI I 1 0 2 2

To teach Hindi for effective communication in different spheres of life:- Social context , Education, Research & Media.

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

CO1 Gain knowledge about the nature and culture of Hindi language
CO2 Understand the structural aspects of Hindi language
CO3 Apply the knowledge of the grammatical structures to communicate in Hindi
CO4 Analyse the social significance of modern literature.
CO5 Develop the ability to translate a given text to Hindi

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1									**2**	**3**				
CO2									**2**	**3**				
CO3									**2**	**3**				
CO4										**3**				
CO5									**2**					

Syllabus

Unit-1

Introduction to Hindi Language, -National Language, Official Language, link Language etc.. S
Introduction to Hindi language , Devanagari script and Hindi alphabet.
Shabda Bhed , Roopanthar ki Drishti se- Bhasha – Paribhasha aur Bhed - Sangya - Paribhasha Aur Bhed- Sangya ke Roopanthar- kriya.

Unit-2

Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender& number - General vocabulary for conversations in given context –understanding proper pronunciation – Conversations, Interviews, Short speeches.

Unit -3

Poems – Kabir Ist 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada

Unit- 4

Letter writing – personal and Formal –Translation from English to Hindi

Unit- 5

Kahani –Premchand : Kafan , Abhilasha, Vidroh, Poos ki rath, Juloos

Text Books :

1. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand ; Diamond Pub Ltd. New Delhi
2. Vyavaharik Hindi Vyakaran ,Anuvad thaha Rachana : Dr. H. Parameswaran, Radhakrishna publishing House,New Delhi
3. Kamtha Prasad Guru : Hindi Vyakaran, Best Book pub House, New Delhi
4. Poetry : Kavya Ras-Ed: T.V. Basker- Pachouri Press; Mathura

15HIN111 HINDI II 1 0 2 2

Appreciation and assimilation of Hindi Literature - both *drishya* and *shravya* - using the best specimens provided as anthology.

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

CO1	Understand the grammatical structures of Hindi
CO2	and the post modern trends of literature
CO3	e critical thinking and writing skills
CO4	and analyse different literary and audio-visual material
CO5	undamental knowledge of Hindi in formal and informal writing

Mapping of course outcomes with program outcomes:

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1									**1**	**2**				
CO2									**1**	**2**				
CO3									**1**	**2**				
CO4										**3**				
CO5									**1**	**2**				

Syllabus:

Unit -1

Kavya Tarang;-Dhumil ke Anthim Kavitha[Poet-Dhumil],Dhabba[Poet-Kedarnath Singh],Proxy[Poet-Venugopal],Vakth[Poet-Arun Kamal],Maachis[Poet-Suneeta Jain].

Unit -2

Communicative Hindi - Moukhik Abhivyakthi

Unit -3
Audio- Visual –Media in Hindi – Movies like Tare Zameen par , Paa, Black etc., appreciation and evaluation . News reading and presentations in Radio and TV channels in Hindi .

Unit -4

Gadya Manjusha – Budhapa , Kheesa, Sadachar ka Thavis
Unit -5

Translation: Theory and Practice - Letter writing: Formal and Personal – Introduction to Hindi Software.

Text Books:

1. Kavay Tarang : Dr. Niranjan , Jawahar Pusthakalay , Mathura.
2. Gadya Manjusha: Editor: Govind , Jawahar Pusthakalay , Mathura
3. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand ; Diamond Pub Ltd. New Delhi
4. Kamtha Prasad Guru : Hindi Vyakaran, Best Book pub House, New Delhi
5. 5.Poetry : Kavya Ras-Ed: T.V. Basker- Pachouri Press; Mathura

15HUM239 PSYCHOLOGY FOR EFFECTIVE LIVING 2 0 0 2

Course Objectives

1. To help students acquire the basic knowledge of behavior and effective living
2. To create an awareness of the hazards of health compromising behaviours
3. To develop and strengthen the tools required to handle the adversities of life

Course Outcome

CO 1: Understand the basic concepts of Behavioral Psychology
CO 2: Demonstrate self reflective skills through activities
CO 3: Apply the knowledge of psychology to relieve stress
CO 4: Analyse the adverse effects of health compromising behaviours.
CO 5: Evaluate and use guided techniques to overcome and cope with stress related problems.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1						1
CO2						2	3		3	3		
CO3						3	3	2	1		3	2
CO4						2	2	3				1
CO5						1	2				1	1

Syllabus

Unit 1

SELF AWARENESS & SELF MOTIVATION
Definition of motivation-Maslow's hierarchy of motivation-Self-analysis through SWOT and Johari window - Importance of self-esteem and Enhancement of self-esteem-techniques and Strategies for self-motivation.

Unit 2

THE NATURE AND COPING OF STRESS
Definition of stress, stressors, eustress, distress-PTSD-stress among college students- stress assessment-coping with stress-progressive muscle relaxation-RET-guided imagery-bio feedback-religious and spiritual way of coping with stress

Unit 3

APPLICATION OF HEALTH PSYCHOLOGY
Health compromising behaviors-smoking and alcoholism-biological and psychological effects of addiction-deaddiction-behavior modifications-CBT in handling problem behavior-cancer risks-AIDS.

Text Book(s)

V.D.Swaminathan&K.V.Kaliappan, Psychology for Effective living-An introduction to Health

Reference(s)

1.S.Sunder. (2002). Textbook of Rehabilitation,2nd edition,Jaypee Brothers,New Delhi.

2.Weiben&Lloyd. (2004). Psychology applied to Modern Life,Thompson Learning,Asia Ltd.

15HUM240 PSYCHOLOGY FOR ENGINEERS 2 0 0 2

Course Objectives

1. To strengthen the fundamental knowledge of human behavior
2. To strengthen the ability to understand the basic nature and behavior of humans in organizations as a whole
3. To connect the concepts of psychology to personal and professional life

Course Outcome

CO 1: Understand the fundamental processes underlying human behavior such as learning, motivation, individual differences, intelligence and personality.

CO 2: Apply the principles of psychology in day- to- day life for a better understanding of oneself and others.

CO 3: Apply the knowledge of Psychology to improve study skills and learning methods

CO 4: Apply the concepts of defense mechanisms to safeguard against abusive relationships and to nurture healthy relationships.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3	3		3	2		1
CO2						3	3	2	3	3	1	2
CO3										2	1	
CO4							3		2	2		2

Syllabus

Unit 1

PSYCHOLOGY OF ADOLESCENTS

Psychology-definition-scope-adolescence-characteristics-developmental tasks-physical and psychological changes-interests-family relationships-emotions-peer pressure-positive and

Negative effects of peer pressure-types of friends-choice of friends

Unit 2

LEARNING, MEMORY AND STUDY SKILLS

Definitions-Classical conditioning-Operant conditioning-Insight learning-reinforcement-its principles and its effects-role of reward and punishment in learning-forgetting-causes-techniques for improving study skills-Mnemonics-Intelligence-Emotional and social intelligence

Unit 3

ATTENTION & PERCEPTION

Definition-types of attention-span of attention-division of attention- factors determining attention-perception-difference between sensation and perception-laws of perception-errors in perception-illusion and hallucination

Text Book(s)

S.K.Mangal General Psychology,Sterling Publishers Pvt.Ltd.2007

Reference(s)

1.Elizabeth B. Hurlock, Developmental Psychology - A Life span approach,6th edition
2.Cliffordm Organ, Richard King, John Scholper, Introduction to Psychology, Tata McGraw Hill, Pvt Ltd 2004.

15HUM244 UNDERSTANDING SCIENCE OF FOOD AND NUTRITION 1022

Course Objectives:

- To introduce the significance of food, nutrients, locally available food resources, synergic food combinations, good cooking methods and importance of diversity in foods
- To understand nutritional imbalances and chronic diseases associated with the quality of food.
- To gain awareness about the quality of food - Organic food, genetically modified food, adulterated food, allergic food, , food poisoning and food safety.
- To understand food preservation processing, packaging and the use of additives.

Course Outcome:

CO1: Acquire knowledge about the various food and food groups
CO2: Understand nutritional imbalances and chronic diseases prevailing among different age groups.
CO3: Understand the significance of safe food and apply the food safety standards
CO4: Demonstrate skills of food processing, preservation and packaging methods with or without additives

CO5: Evaluate the quality of food based on the theoretical knowledge of Food and Nutrition

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1		1	1			1	2	1	1	1	1	3
CO 2		1	1			1	1	1	1	1	1	3
CO 3		1	1			1	1	1	1	1	1	3
CO 4		1	1			1	1	1	1	1	1	3
CO 5		1	1			1	2	1	2	1	1	3

1. **UNIT I: FOOD AND FOOD GROUPS:** Introduction to foods, food groups, Identifying locally available foods and plant nutrients. Nutrients and its variety. Cooking methods, effects of cooking on nutritive value of foods, while preparation and preservation of foods, cooking utensils & instruments. Synergy between foods, Do and Don'ts while cooking. Science behind foods.Food allergies, food poisoning, food safety standards.

2. **UNIT II: NUTRIENTS AND NUTRITION:** Nutrition through life cycle, RDA intake for all age groups. Nutrition in disease – Malnutrition (under & over), other diseases. Adulteration of foods & Food additives. Packaging and labeling of foods, certification, logo & symbols.

3. **UNIT III: INTRODUCTION TO FOOD BIOTECHNOLOGY:** Future foods- Organic foods and genetically modified foods, Fortification of foods, bio fortification of foods, value addition of foods, functional foods, nutraceuticals, weaning foods/supplementary. Processing and preservation of foods, applications of food technology in daily life, and your prospects associated with food industry – Nanoparticles, biosensors, advanced research.

Reference Books:

- C. Gopalanetal, **Nutritive Value of Indian Foods**, National Institute of Nutrition, Indian Council of Medical Research, Hyderabad, 2017.
- B.SriLakhmi, **Dietetics**, New age international, 2015.
- N, ShakuntalaManay, M. Shadaksharaswamy, **Foods Facts and Principles**, New Age International, New Delhi, 2008.
- Sumati.RMudamri, and M.V.Rajagopal, **Fundamental of foods, Nutrition and DietTherapy**, New Age International, New Delhi, 2008.

15MAL101 MALAYALAM I 1 0 2 2

Course Objectives:

To teach Malayalam for effective communication in different spheres of life:- Social context , Education, Research & Media

Course Outcome : After the completion of the course the student will be able to:

CO1	Understand and inculcate philosophical thoughts and practices
CO2	Understand and appreciate the post modern trends of literature.
CO3	Analyse the literary texts and comprehend the cultural diversity of Kerala
CO4	Distinguish the different genres in Malayalam literature
CO5	Demonstrate the ability to effectively communicate in Malayalam

CO-PO Mapping Mapping of course outcomes with program outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO2	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO3	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO4	-	-	-	-	-	-	-	-	**-**	**3**	-	-
CO5	-	-	-	-	-	-	-	-	**1**	**1**	-	-

Unit 1

Ancient poet trio:*Adhyatmaramayanam,LakshmanaSwanthanam (Lines: valsasoumitre… mungikidakayal),*Ezhuthachan -Medieval period classics – *Jnanappana(Lines: kalaminnu… vilasangalingane*),Poonthanam.

Unit 2
Modern Poet trio: *EnteGurunathan,* VallatholNarayanaMenon- Critical analysis of the poem.

Unit 3
Short stories from period 1/2/3:*Poovanpazham*-VaikaomMuhammedBasheer-Literary & Cultural figures of Kerala and about their literary contributions.
Unit 4

Literary Criticism: *BharathaParyadanam-VyasanteChiri*–Ithihasa studies-KuttikrishnaMararu-Outline of literary Criticism in Malayalam Literature-Introduction to KuttikrishnaMararu& his outlook towards literature &life.

Unit 5
Error-freeMalayalam: **1**.Language; **2**.Clarity of expression; **3**.Punctuation-Thettillatha
Malayalam – Writing-**a**. Expansion of ideas; **b**.PrecisWriting; **c**. Essay Writing; **d**.Letter writing; **e**.RadioSpeech;**f**.Script/Feature/Script
Writing;**g**.NewsEditing;**h**.Advertising;**i.**Editing;j.EditorialWriting;**k**.Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. Prof. PanmanaRamachandranNair(Edited),*Thunjanpadhanangal*, Current Books, 2012.
2. Prof. G.Balakrishnan Nair,.*JnanappanayumHarinamaKeerthanavum*, N.B.S, 2005.
3..Dr. M.N.Karasseri,*BasheerintePoonkavanam*, D.C.Books, 2008.
4 Prof. M.N.Vijayan, *MarubhoomikalPookkumbol*,D.C.Books, 2010.
5..Prof. M.ThomasMathew,*LavanyanubhavathinteYukthisasthram*, Kerala Sahitya Academy, 2006.
6. Dr. .M.Leelavathy,*KavithaSahityacharitram*, Kerala Sahitya Academy, 1996.
7. ThayattuSankaran, *VallatholNavayugathinteKavi*,VallatholVidyapeetham

15MAL111 MALAYALAM II 1 0 2 2

Course Objectives

- To appreciate the aesthetics and understand the cultural implications in Malayalam Literature
- To enhance creative thinking in Malayalam
- To equip the students to read and write effectively in Malayalam
- To acquire pronunciation skills

Course Outcome:

After the completion of the course the student will be able to:

CO1	Understand the different cultural influences in linguistic translation
CO2	Identify and appreciate the Romantic elements of modern literature
CO3	Analyze the genre of autobiographical writing
CO4	Critically evaluate the significance of historical, political and socio cultural aspects in literature
CO5	Demonstrate good writing skills in Malayalam

CO-PO Mapping Mapping of course outcomes with program outcomes:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO2	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO3	-	-	-	-	-	-	-	-	**2**	**3**	-	-
CO4	-	-	-	-	-	-	-	-	**-**	**3**	-	-
CO5	-	-	-	-	-	-	-	-	**1**	**1**	-	-

Unit1

Ancient poet trio: *Kalayanasougandhikam,(Lines: kallummarangalum… namukkennarikavrikodara*

),KunjanNambiar - Critical analysis of his poetry-Ancient Drama: *Kerala Sakunthalam* (Act 1), Kalidasan (Transilated by Attor Krishna Pisharody).

Unit 2
Modern/romantic/contemporary poetry: *Manaswini*, Changampuzha Krishna Pillai –Romanticism – modernism.

Unit 3
Anthology of short stories from period 3/4/5: *NinteOrmmayku*, M.T.Vasudevan Nair-literary contributions of his time.

Unit 4
Partof an autobiography/travelogue: *KannerumKinavum*, Chapter: Valarnnuvarunnoratmavu, V.T.Bhattathirippadu-Socio-cultural literature-historical importance.

Unit 5
Error-free Malayalam-**1**.Language; **2**.Clarity of expression; **3**.Punctuation-Thettillatha Malayalam-Writing-**a**.Expansion of ideas;**b**.PrécisWriting;**c.** Essay Writing; **d**.Letter writing;**e**.RadioSpeech;**f**.Script/Feature/ScriptWriting;**g**.NewsEditing;**h.**Advertising;**i**.Editing; **j**.EditorialWriting;**k**.Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

1. Prof.P.K.NarayanaPillai.,(SahityaPanchanan), *Vimarsanathrayam,* Kerala Sahitya Academy,2000.

2. Prof.M.P. SankunniNair.,*ChathravumChamaravum,* D.C.Books, 2004.

3.Prof.M.K.Sanu, *Changampuzha: Nakshatrangalude Snehabhajanam*,N.B.S.,1989.

4. Prof.S.GupthanNair,*AsthiyudePookkal*, D.C Books.2005.

5. Prof. PanmanaRamachandranNair,*ThettillathaMalayalam,Sariyumthettum etc*., D.C.Book, 2006.

6. Prof.M. Achuthan, *Cherukatha-Innale, innu*, National Book Stall, 1998.

7. Prof.N.KrishnaPillai,*KairaliyudeKatha*,National Book Stall, 2001.

15TAM101 TAMIL I 2 0 0 2

Course Objectives

- To introduce the students to different literature- Sangam literature, Epics, Bhakthi literatureandmodern literature.
- To improve their ability tocommunicate with creative concepts, and also to introduce them to the usefulness of basicgrammaticalcomponents in Tamil.

Course Outcomes

CO 1: To understand the Sangam literature
CO 2: To understand the creative literature
CO 3: To understand the literary work on religious scriptures
CO 4: To improve the communication and memory skills
CO 5: To understand the basic grammar components of Tamil language and their usage and applications.
CO 6: Understand creative writing aspects and apply them.

CO-PO Mapping

PO/PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			-	-	-	-	-	-	2	2	-	-
CO2			-	-	-	-	-	-	2	2	-	-
CO3			-	-	-	-	-	-	2	2	-	-
CO4			-	-	-	-	-	-	2	2	-	-
CO5			-	-	-	-	-	-	2	2	-	-
CO6			-	-	-	-	-	-	2	2	-	-

Syllabus

Unit1

The history ofTamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum,
ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35.
Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi, periyāraittuṇakkōṭal, viḻippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.
Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7, 8), maṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūṟṟu ayaṟkūṟṟu

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṇi payaṉpāṭu. - Karuttu parimārṟam - viḷampara moḻiyamaippu – pēccu - nāṭakam paṭaippu - ciṟukatai, katai, putiṉam paṭaippu.

Textbooks:

- http:/Www.tamilvu.trg/libirary/libindex.htm.
- http:/Www.tunathamizh.tom/2013/07/blog0post_24.html
- Mu.Varatarācaṉ "tamiḻ ilakkiya varalāṟu" cāhitya akaṭemi papḷikēṣaṉs, 2012
- nā.Vāṉamāmalai "paḻaṅkataikaḷum, paḻamoḻikaḷum" niyū ceñcuri puttaka veḷiyīṭṭakam, 1980,2008
- nā.Vāṉamāmalai, "tamiḻar nāṭṭuppāṭalkaḷ" niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006
- poṉ maṇimāṟaṉ "aṭōṉ tamiḻ ilakkaṇam "aṭōṉ papḷiṣiṅ kurūp, vañciyūr, tiruvaṉantapuram, 2007.

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15TAM111 **TAMIL II** **2 0 0 2**

Course Objectives

- To learn the history ofTamilliterature.
- To analyze different styles of Tamil Language.
- To strengthen thecreativity in communication, Tamilbasicgrammar and use of computer on Tamil Language.

Course Outcomes

CO 1: Understand the history of Tamil literature.
CO 2: Apply practical and comparative analyses on literature.
CO 3: Understand thinai literature, literature on justice, Pathinenkeelkanaku literature.
CO 4: Understand the tamil scholars' service to Tamil language and society.
CO 5: Understand components of Tamil grammar and its usage
CO 6: Understand creative writing aspects and apply them

CO-PO Mapping

PO/PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			-	-	-	-	-	-	2	2	-	-
CO2			-	-	-	-	-	-	2	2	-	-
CO3			-	-	-	-	-	-	2	2	-	-
CO4			-	-	-	-	-	-	2	2	-	-
CO5			-	-	-	-	-	-	2	2	-	-
CO6			-	-	-	-	-	-	2	2	-	-

Syllabus

Unit 1

The history ofTamilliterature: Nāṭṭupuṟap pāṭalkaḷ, kataikkaḷ, paḻamoḻikaḷ - ciṟukataikaḷ tōṟṟamum vaḷarcciyum,
ciṟṟilakkiyaṅkaḷ: Kaliṅkattup paraṇi (pōrpāṭiyatu) - mukkūṭaṟ paḷḷu 35.
Kāppiyaṅkaḷ: Cilappatikāram – maṇimēkalai naṭaiyiyal āyvu maṟṟum aimperum – aiñciṟuṅ kāppiyaṅkaḷ toṭarpāṉa ceytikaḷ.

Unit 2

tiṇai ilakkiyamum nītiyilakkiyamum - patiṉeṇkīḻkkaṇakku nūlkaḷ toṭarpāṉa piṟa ceytikaḷ - tirukkuṟaḷ (aṉpu, paṇpu, kalvi, oḻukkam, naṭpu, vāymai, kēḷvi, ceynaṉṟi, periyāraittuṇakkōṭal, viḻippuṇarvu pēṉṟa atikārattil uḷḷa ceytikaḷ.
Aṟanūlkaḷ: Ulakanīti (1-5) – ēlāti (1,3,6). - Cittarkaḷ: Kaṭuveḷi cittar pāṭalkaḷ (āṉantak kaḷippu –1, 4, 6, 7, 8), maṟṟum akappēy cittar pāṭalkaḷ (1-5).

Unit 3

tamiḻ ilakkaṇam: Vākkiya vakaikaḷ – taṉviṉai piṟaviṉai – nērkkūṟṟu ayaṟkūṟṟu

Unit 4

tamiḻaka aṟiñarkaḷiṉ tamiḻ toṇṭum camutāya toṇṭum: Pāratiyār, pāratitācaṉ, paṭṭukkōṭṭai kalyāṇacuntaram, curatā, cujātā, ciṟpi, mēttā, aptul rakumāṉ, na.Piccaimūrtti, akilaṉ, kalki, jī.Yū.Pōp, vīramāmuṉivar, aṇṇā, paritimāṟ kalaiñar, maṟaimalaiyaṭikaḷ.

Unit 5

tamiḻ moḻi āyvil kaṇiṉi payaṉpāṭu. - Karuttu parimāṟṟam - viḻampara moḻiyamaippu – pēccu - nāṭakam paṭaippu - ciṟukatai, katai, putiṉam paṭaippu.

Text Books / References

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Mu.Varatarācaṉ “tamiḻ ilakkiya varalāṟu” cāhitya akaṭemi papḷikēṣaṉs, 2012
nā.Vāṉamāmalai “paḻaṅkataikaḷum, paḻamoḻikaḷum” niyū ceñcuri puttaka veḷiyīṭṭakam, 1980,2008
nā.Vāṉamāmalai, “tamiḻar nāṭṭuppāṭalkaḷ” niyū ceñcuri puttaka veḷiyīṭṭakam 1964,2006
poṉ maṇimāṟaṉ “aṭōṉ tamiḻ ilakkaṇam “aṭōṉ papḷiṣiṅ kurūp, vañciyū