# Curriculum and Syllabus

(Applicable to students admitted during AY 2020-24)

# B. Tech Civil Engineering

# School of Engineering and Sciences

**Department of Civil Engineering**
**SRM University-AP, Andhra Pradesh**

**Curriculum**
**B. Tech Civil Engineering Curriculum**

| SEMESTER I | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| | | | | | |
| EGL 101 | Communicative English | 3 | 0 | 0 | 3 |
| PHY 101 | Engineering Physics | 3 | 0 | 0 | 3 |
| PHY 101L | Engineering Physics Lab | 0 | 0 | 2 | 1 |
| CHE 101 | Principles of Chemistry | 2 | 0 | 0 | 2 |
| CHE 101L | Principles of Chemistry Lab | 0 | 0 | 2 | 1 |
| MAT 112 | Single Variable Calculus | 3 | 0 | 0 | 3 |
| ENV 111 | Environmental Science | 2 | 0 | 0 | 2 |
| ENV 111 L | Environmental Science Lab | 0 | 0 | 2 | 1 |
| CSE 105 | Introduction to Programming Using C | 3 | 0 | 0 | 3 |
| CSE 105 L | Introduction to Programming Using C Lab | 0 | 0 | 2 | 1 |
| ISES 101 | Industry Specific Employability Skills | 1 | 1 | 0 | 1 |
| TOTAL | | 17 | 0 | 8 | 21 |

| SEMESTER II | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| | | | | | |
| ENG 115 | Engineering Mechanics | 3 | 0 | 0 | 3 |
| CSE 107 | Data Structures | 3 | 0 | 0 | 3 |
| CSE 107 L | Data Structures Lab | 0 | 0 | 2 | 1 |
| ECO 121 | Principles of Economics | 3 | 0 | 0 | 3 |
| MAT 121 | Multi variable Calculus | 3 | 0 | 0 | 3 |
| EGL 125<br>HIS 100 | **HS Elective**<br>Critical Thinking<br>Idea of India | 4<br>4 | 0<br>0 | 0<br>0 | 4<br>4 |
| ME 103 L | Mechanical Engineering Tools (Workshop) | 0 | 0 | 2 | 1 |
| ENG 105 | Engineering Graphics | 1 | 0 | 2 | 2 |
| CE 204 | Engineering Geology | 3 | 0 | 0 | 3 |
| CE 204 L | Engineering Geology Lab | 0 | 0 | 2 | 1 |
| ISES 102 | Industry Specific Employability Skills II | 1 | 1 | 0 | 1 |
| TOTAL | | 21 | 1 | 6 | 25 |

| SEMESTER III | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| | | | | | |
| CE 209 | Fluid Mechanics | 3 | 0 | 0 | 3 |
| CE 203 | Strength of Materials | 3 | 0 | 0 | 3 |
| CE 203 L | Strength of Materials Lab | 0 | 0 | 2 | 1 |
| CE 206 | Surveying | 3 | 0 | 0 | 3 |
| CE 206 L | Surveying Lab-I | 0 | 0 | 2 | 1 |
| MAT 131 | Differential Equations | 3 | 0 | 0 | 3 |
| CE 208 | Building Planning & Drawing using CAD | 3 | 0 | 0 | 3 |
| OE | Open Elective | 3 | 0 | 0/2 | 3/4 |
| ISES 201 | Industry Specific Employability Skills III | 1 | 1 | 0 | 1 |
| CSE 230 | Industry standard Coding Practice 1 | 0 | 0 | 4 | 1 |
| TOTAL | | 16 | 1 | 6 | 21/22 |

| SEMESTER IV | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| | | | | | |
| CE 201 | Concrete Technology | 3 | 0 | 0 | 3 |
| CE 201L | Concrete Technology Lab | 0 | 0 | 2 | 1 |
| CE 210 | Structural Analysis | 3 | 0 | 0 | 3 |
| CE 309 | Engineering Hydrology | 3 | 0 | 0 | 3 |
| CE 211L | Surveying Lab-II | 0 | 0 | 2 | 1 |
| MAT 221 | Probability and Statistics for Engineers | 3 | 0 | 0 | 3 |
| CE 209 L | Fluid Mechanics and Hydraulic Machinery Lab | 0 | 0 | 2 | 1 |
| CE 205 | Geotechnical Engineering - I | 3 | 0 | 0 | 3 |
| ISES 202 | Industry Specific Employability Skills IV | 1 | 1 | 0 | 1 |
| CSE 330 | Industry Standard Coding Practice 2 | 0 | 0 | 4 | 1 |
| TOTAL | | 16 | 1 | 12 | 20 |

| SEMESTER V | | | | | |
|---|---|---|---|---|---|
| Course Code | Course Name | L | T | P | C |
| | | | | | |
| CE 202 | Reinforced Concrete Design | 3 | 0 | 0 | 3 |
| CE 302 | Geotechnical Engineering- II | 3 | 0 | 0 | 3 |
| CE 302 L | Geotechnical Engineering Lab | 0 | 0 | 2 | 1 |
| CE 306 | Water Resources Engineering | 3 | 0 | 0 | 3 |
| CE 207 | Transportation Engineering | 3 | 0 | 0 | 3 |
| CE 308 | Environmental Engineering | 3 | 0 | 0 | 3 |
| CE 207 L | Transportation Engineering Lab | 0 | 0 | 2 | 1 |
| ISES 301 | Industry Specific Employability Skills V | 1 | 1 | 0 | 0 |
| CSE 331 | Industry Standard Coding Practice 3 | 0 | 0 | 4 | 1 |
| TOTAL | | 18 | 0 | 8 | 21 |

| SEMESTER VI | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| | | | | | |
| CE 310 | Estimation and Costing | 3 | 0 | 0 | 3 |
| TE | Technical Elective | 3 | 0 | 0 | 3 |
| CE 401 | Design of Steel Structures | 3 | 0 | 0 | 3 |
| CE 308 L | Environmental Engineering Lab | 3 | 0 | 0 | 3 |
| CE 303 | Construction Engineering and Management | 3 | 0 | 0 | 3 |
| CE 501 | Design Project | 0 | 0 | 4 | 2 |
| ISES 302 | Industry Specific Employability Skills VI | 1 | 1 | 0 | 0 |
| OE | Open Elective | 3 | 0 | 0/2 | 3/4 |
| TE | Technical Elective | 3 | 0 | 0 | 3 |
| TE | Technical Elective | 3 | 0 | 0 | 3 |
| **TOTAL** | | 18 | 0 | 6 | **24/25** |

| SEMESTER VII | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| | | | | | |
| TE | TE Elective | 3 | 0 | 0 | 3 |
| TE | TE Elective | 3 | 0 | 0 | 3 |
| TE | TE Elective | 3 | 0 | 0 | 3 |
| OE | HS Elective (Professional Ethics and Human Values) | 2 | 0 | 0 | 1 |
| OE | Open Elective | 3 | 0 | 0/2 | 3/4 |
| **TOTAL** | | 20 | 0 | 0 | **13/14** |

| SEMESTER VIII | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| | | | | | |
| CE 502 | Capstone Project | 0 | 0 | 24 | 12 |
| OE | Open Elective | 3 | 0 | 0/2 | 3/4 |
| | | **3** | **0** | **24** | **15/16** |
| **TOTAL** | | | | | |

# Category wise Credit Distribution

| Course Category | Category Code | No of Courses | Credits in curriculum |
|---|---|---|---|
| Humanities and Social Sciences | HS | 10 | 15 |
| Basic Sciences | BS | 10 | 22 |
| Engineering Sciences | ES | 14 | 25 |
| Professional Core | C | 22 | 51 |
| Professional Elective | TE | 6 | 18 |
| Open Elective | OE | 5 | 15/20 |
| Project | PR | 2 | 14 |
| | **Total** | **69** | **160/165** |

| LIST OF TECHNICAL ELECTIVES | | | |
|---|---|---|---|
| Course Code | Course Name | L-T-P | Credits |
| CE 401 | Design of Steel Structures | 3-0-0 | 3 |
| CE 402 | Advanced Environmental Engineering | 3-0-0 | 3 |
| CE 403 | Railway and Airport Engineering | 3-0-0 | 3 |
| CE 404 | Introduction to Structural Dynamics | 3-0-0 | 3 |
| CE 405 | Advanced Reinforced concrete design | 3-0-0 | 3 |
| CE 406 | Advanced Pavement Materials and Construction | 3-0-0 | 3 |
| CE 407 | Advanced Structural Analysis | 3-0-0 | 3 |
| CE 408 | Construction Materials | 3-0-2 | 4 |
| CE 409 | Sustainable Construction Methods | 3-0-0 | 3 |
| CE 410 | Green Buildings | 3-0-0 | 3 |
| CE 411 | Prestressed Concrete | 3-0-0 | 3 |
| CE 412 | Finite Element Methods | 3-0-0 | 3 |
| CE 413 | Bridge Engineering | 3-0-0 | 3 |
| CE 414 | Advanced Foundation Engineering | 3-0-0 | 3 |
| CE 415 | Ground Improvement Techniques | 3-0-0 | 3 |
| CE 416 | Designing with Geosynthetics | 3-0-0 | 3 |
| CE 417 | Advanced Traffic Engineering and Highway Design | 3-0-0 | 3 |
| CE 418 | Traffic Safety | 3-0-0 | 3 |
| CE 419 | Advanced Pavement Design and Management | 3-0-0 | 3 |
| CE 420 | Remote Sensing and GIS | 3-0-2 | 4 |
| CE 421 | Design and Drawing of Irrigation structures | 3-0-2 | 4 |
| CE 422 | Air Pollution: Measuring & Mitigation | 3-0-0 | 3 |
| CE 423 | Reservoirs & Dam Engineering | 3-0-0 | 3 |
| CE 424 | Environmental Geotechnics | 3-0-0 | 3 |
| CE 425 | Earth Retaining structures | 3-0-0 | 3 |
| CE 426 | Environmental System Management | 3-0-0 | 3 |
| CE 427 | Urban Transportation Planning | 3-0-0 | 3 |
| CE 428 | Soil Dynamics | 3-0-0 | 3 |
| CE 429 | Analysis and Design of Masonry Structures | 3-0-0 | 3 |
| CE 430 | Sustainable Practices in Highway and Pavement Engineering | 3-0-0 | 3 |
| CE 431 | Computer Methods in Civil Engineering | 3-0-0 | 3 |

| LIST OF OPEN ELECTIVES SEMESTER III | | | | | |
|---|---|---|---|---|---|
| **Course Code** | **Course Name** | **L** | **T** | **P** | **C** |
| CE 408 | Construction Materials | 3 | 0 | 2 | 4 |
| CE 409 | Sustainable Construction Methods | 3 | 0 | 0 | 3 |
| CE 410 | Green Buildings | 3 | 0 | 0 | 3 |
| ECE 418 | Machine Learning | 3 | 0 | 2 | 4 |
| EEE 422 | Optimization Techniques | 3 | 0 | 0 | 3 |
| ME 418 | Introduction to Electric Vehicles | 3 | 0 | 0 | 3 |
| IDEA 102 | Design Thinking | 3 | 0 | 0 | 3 |
| MAT 305 | Introduction to Science and Technology | 4 | 0 | 0 | 4 |
| PSY 111 | Psychology for Everyday Living | 4 | 0 | 0 | 4 |
| PSY 116 | Neuro Linguistic Programming - Level I | 3 | 0 | 0 | 3 |
| BIO 112 | Basic Microbiology | 4 | 0 | 0 | 4 |
| PHY 223 | Introduction to Quantum Computations | 3 | 1 | 0 | 4 |
| HIS 005 | Introduction to Gender | 3 | 0 | 0 | 3 |
| ECO 251 | Indian Economy | 4 | 0 | 0 | 4 |
| EGL 167 | Code Name Language | 4 | 0 | 0 | 4 |
| TLC 101 | Cognitive Learning Theories | 2 | 1 | 0 | 3 |
| EEE 305 | Advanced Control Systems | 3 | 0 | 0 | 3 |
| EEE 305 L | Advanced Control Systems lab | 0 | 0 | 2 | 1 |
| MAT 307 | Combinatorics and graph theory | 4 | 0 | 0 | 4 |
| PHY 301 | Atomic and Molecular Physics | 3 | 0 | 0 | 3 |
| COM 101 | Business Organization and Management | 3 | 0 | 0 | 3 |
| COM 107 | Finance for Engineering | 3 | 0 | 0 | 3 |
| JOU 001 | Media through the ages: From print to social | 3 | 0 | 0 | 3 |
| IDEA 104 | Dream Discover Disrupt | 3 | 0 | 0 | 3 |
| MAN 001 | Mandarin | 3 | 0 | 0 | 3 |

# SEMESTER-I

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| EGL 101 | Communicative English | HS | 3 | 0 | 0 | 3 |

### UNIT I: RHETORIC AND PUBLIC SPEAKING
Rhetoric, Critical thinking and public speaking, thinking outside the box, how to deliver a speech, Fundamentals of persuasion.

### UNIT II: NON-VERBAL COMMUNICATION
Nonverbal communication, Spatial distance, Eye contact and appearances, Eye contact and appearances.

### UNIT III: COMMUNICATION AND THE MEDIA
Persuasion and the media, Radio, television, film, Social media and the internet, How the media sells the ideas, images, products, Informative/scientific speeches and research, Heart of the speech, powerful narratives, Power of narrative.

### UNIT IV: SMALL GROUP COMMUNICATION
Leadership, conflict and persuasion in group, Leadership, conflict and persuasion in group, Moment of Inertia by analytical method, Group problem solving, learning to say no.

### TEXTBOOKS
1. Communication: Principles for a Lifetime. Beebe, Beebe and Ivy, Sixth Edition, Pearson Publishing.

### REFERENCE BOOKS/OTHER READING MATERIAL
2. Qualitative Communication Research Methods (2011) Bryan C. Taylor and Thomas R. Lindlof. Sage Publications, New Delhi, India, 3rd Edition
3. The Fundamentals of Small Group Communication (2008) Scott A. Myers and Carolyn M. Anderson. Sage Publications, New Delhi, India.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 101 | Engineering Physics | BS | 2 | 0 | 0 | 2 |

**UNIT I: INTRODUCTION TO VECTOR ALGEBRA**
Introduction to vectors, scalar and vector product, Gradient of a scalar field, Divergence and Curl of vector fields and their physical significance, Gauss and Stokes theorems, Coordinate systems – introduction to Cartesian system, Spherical and Cylindrical coordinate systems.

**UNIT II: ELECTROSTATICS**
Coulomb's law and electric field, Gauss Law, Electric Potential, Potential Energy, Conductors under Electrostatic Equilibrium, Capacitors.

**UNIT III: DIELECTRICS AND POLARIZATION**
Introduction to Electric Dipole and dipole Moment, Potential and field due to electric dipole, Polarization in dielectrics, Modification of Gauss's Law in terms of electric displacement, Electric Susceptibility and dielectric constant, Bound charges.

**UNIT IV: MAGNETO STATICS**
Magnetic force and cyclotron, Biot-Savart Law for magnetic fields, Biot-Savart Law for magnetic fields, Ampere's circuital law, Equation of Continuity, Magnetization in Materials.

**UNIT V: INTRODUCTION TO ELECTRODYNAMICS**
Introduction to time-varying fields, Faraday's law of induction, Generalization of Ampere's law, Maxwell's equations, Derivation of wave equation, Planar Waves in free space.

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 101 L | Engineering Physics Lab | BS | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**
1. Revisions of Vernier caliper and Screw Gauge measurement methods.
2. Plotting experimental data in graphs and error analysis.
3. To determine the moment of inertia of a flywheel
4. (a) Measurement of time period for a given compound
5. pendulum with different lengths.
6. (b) To determine radius of gyration of a given pendulum.
7. Verification of Stefan`s Law.
8. Measurement of specific heat capacity of any given material.
9. Verify of Hooke's law and to determine spring contact for given spring combinations.
10. To determine the rigidity modulus of steel wire by torsional oscillations.
11. To calculate Young's modulus of a given material by deflection method.
12. a) To measure the capacitance as a function of area and distance between the plates.
13. b) To determine the dielectric constant of different dielectric materials.
14. (a) Measurement of the induced voltage impulse as a function of the velocity of the magnet.
15. b) Calculation of the magnetic flux induced by a falling magnet as a function of the velocity of the magnet.
16. a) To study the magnetic field along the axis of a current carrying circular loop.
17. b) To study the dependency of magnetic field on the diameter of coil.
18. (a) To investigate the spatial distribution of magnetic field between coils and determine the spacing for uniform magnetic field.
19. b) To demonstrate the superposition of the magnetic fields of the two individual coils.
20. Study of B-H-Curve
21. To study permeability curve of a given material.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Physics for Scientist and Engineers, Ninth edition (2017) - Raymond A. Serway, John W. Jewett (Publisher - Cengage India Private Limited)).
2. Physics laboratory manuals.

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** |
| CHE 101 | Principles of Chemistry | BS | 2 | 0 | 0 | 2 |

**UNIT I: CHEMICAL BONDING**

Ionic, covalent, and metallic bonds. Theories of bonding: Valence bond theory, Nature of covalent bond, sigma ($\sigma$) bond, Pi($\pi$) bond, Hybridization: Types of hybridizations, sp2, sp3, sp3d, d2sp3, Shapes of molecules (VSEPR Theory):$BeCl2,CO2,BF3,H2O,NH3,$ $CH4,PCl5,XeF2,SF6,XeF4,$ Molecular orbital theory: Linear combination of atomic orbitals (LCAO Method), Bond order, homo($H2,O2,N2$) and hetero nuclear diatomic molecules($NO,CO$), Non-covalent interactions: Vander Waals interactions, Dipole-ipole interactions, and hydrogen bonding.

**UNIT II: PHASE RULE AND KINETICS**

Phase rule: Introduction, Definition of the terms used in phase rule with examples, Application of phase rule to water system, Sulphur system and lead-silver system, Kinetics: Order and molecularity of reactions, zero order, first order and second order reactions.

**UNIT III: WATER TECHNOLOGY**

Standards for drinking water, Methods of Treatment of water for domestic and industrial purposes: Sedimentation, Coagulation, Filtration, Sterilization. Break point chlorination, Determination of Hardness of water by EDTA method. Demineralization of water, Softening of water: Lime-soda Process, Ion exchange process, Zeolite process, Boiler Troubles: Priming, Foaming, Scale. Sludge, Corrosion, Caustic Embrittlement.

**UNIT IV: POLYMER CHEMISTRY**

Classification of polymers: Natural and synthetic, Thermoplastic and Thermosetting. Degree of polymerization, Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic), Condensation and copolymerization. Properties of polymers: Tg, Tactility, Molecular weight average, number average and poly dispersity index, Molecular weight average, number average and poly dispersity index.

**UNIT V: ELECTROCHEMISTRY**

Arrhenius theory of electrolytic dissociation. Classification of electrolytes; degree of Dissociation of acids, Dissociation constant of weak acids. Concept of Ph and pOH, buffer solutions, Solubility product, common ion effect indicators and theory of acid base indicator, Conductance of solutions-specific, molar and equivalent conductance, Variation of molar conductance with dilution for strong and weak electrolytes, Migration of ions-Kohlrausch's law of independent migration of ions. Ostwald's dilution law; Nernst equation for single electrode and electrochemical cells.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**

1. Bahl and B. S. Bahl, G. D. Tuli, Essentials of physical chemistry, S Chand Publication,2014, ISBN: 8121929784.P.W. Atkins, T.L. Overton, J.P. Rourke, M.T. Weller and F.A. Armstrong Shriver andAtkins' Inorganic Chemistry, 5th Ed., Oxford University Press, London, 2010, ISBN 978-1-42-921820-7.

2. Atkins, P.W.; de Paula, J. Physical chemistry, 8th ed., 2006 Oxford University Press. ISBN0-19-870072-5

   B. R. Puri, L. R. Sharma & M. S. Pathania, Principles of Physical Chemistry, 46th Ed.,2013, Vishal   Publication Company.

3. F.W. Billmeyer, Text Book of Polymer Science, 3rd Ed., John Wiley & Sons, New York,2003.

4. J. Bard and L.R. Faulkner, Electrochemical methods –Fundamentals and applications, 2nd Ed., John Wiley and Sons, 2001.

5. Jain P.C. & Monika Jain, Engineering Chemistry, Dhanpat Roy & Sons, 2015.

## SEMESTER-I

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CHE 101 L | Principles of Chemistry Lab | BS | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**
1. Volumetric titration of HCl vs NaOH.
2. Conductometric titration of HCl vs NaOH.
3. Standardization of potassium permanganate by Oxalic acid.
4. Iodometric Determination of Ascorbic Acid (Vitamin C)
5. Determination of hardness of water by EDTA method.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Estimation of iron content of the given solution using potentiometer.
8. Determination of sodium and potassium by flame photometry.

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENV 111 | Environmental Science | BS | 2 | 0 | 0 | 2 |

Commented [oS1]:

**UNIT I: ENVIRONMENTAL CRISIS AND SUSTAINABLE DEVELOPMENT**
Need for environmental science studies Fundamentals of ENV – Atmosphere, lithosphere, hydrosphere, biosphere. Global environmental crisis and its causes, Man-Environment relationship & Interaction, Ecological footprint, Sustainable development.

**UNIT II: ECOSYSTEMS**
Ecosystem - Structure and functions of an ecosystem, Energy flow in an ecosystem, biomass flow in an ecosystem, food chain and web Ecological Succession, Ecological pyramid, Water cycle, Carbon cycle, Sulphur cycle, Nitrogen cycle, Forest ecosystems: tropical rain forest, coniferous forests, tundra forests, temperate forests, Grasslands and desert ecosystems, Aquatic ecosystems: Freshwater zones, streams, rivers, state of rivers in India, wetlands, Zones in ocean, ocean activities, coastal zones, Estuaries, Mangroves.

**UNIT III: RENEWABLE AND NON-RENEWABLE RESOURCES**
Energy resources: Global energy crisis, energy sources, energy needs, global energy consumption, Renewable and Non-renewable energy sources: Hydropower, Solar, tidal, wind, energy, Bioenergy, coal, natural gas, Energy resources: fossil fuel vs renewable fuels, peak oil, conventional and unconventional oil, oil price determination, Environmental implications of Energy use: India and world, Energy use pattern – national and global, Water availability, Water for irrigation, water situation in India.

**UNIT IV: BIODIVERSITY**
Significance of biodiversity, Current state of biodiversity: National and global, Causes of biodiversity loss, Biological hotspots, aquatic biodiversity, Endangered species and endemic species of India, Biodiversity conservation: Seed banks, botanical gardens, marine biodiversity protection, national and international efforts.

**UNIT V: ENVIRONMENTAL POLLUTION AND CONTROL**
Types of Environmental Pollution Air pollution: Sources, effects, and control Air standards Air pollution in India and the world Sources of air pollution Outdoor & Indoor air pollution Point source, mobile, area source.
Effects of air pollution:
Smog, urban heat island, ozone layer depletion, acid rain.
Controlling air pollution:
Emission regulation, e-cars
Water pollution: Sources & effects Water Quality standards Water pollutants, eutrophication, thermal

pollution, bio-magnification Wastewater treatment, Methods of water purification.

Soil pollution: Sources, causes and effects Control of soil pollution: Air purging, phytoremediation, and bio-remediation.

Solid waste management, Types and sources of solid wastes, Hazardous waste, and electronic wastes, Recycling, and management of solid wastes (4Rs), Sanitary landfills and leachate management.

Noise pollution: Sources, effects, and control Air quality standards with respect to noise.

Introduction to Climate change: Impact of climate change, IPCC assessment, Carbon footprint, carbon sequestration, carbon trade, carbon credits, Kyoto protocol, Montreal protocol, Paris agreement. COVID-19: Environmental aspects.

**TEXTBOOKS / REFERENCE BOOKS / OTHER READING MATERIAL:**

1. R. Rajagopalan (2016). Environmental Studies (3rd edition), Oxford University Press.
2. Deeksha Dave, S.S. Katewa (2012). Textbook of Environmental Studies (2nd edition), Cengage.
3. W. Cunningham, M. Cunningham (2016). Principles of Environmental Science (8th Edition), McGraw-Hill.
4. KL Rao (1979). India's water wealth. Orient Black Swan.
5. Saadat, S., Rawtani, D., & Hussain, C. M. (2020). Environmental perspective of COVID-19. Science of The Total Environment, 138870.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENV 111 L | Environmental Science Lab | BS | 0 | 0 | 2 | 1 |

**WATER QUALITY**
1. Turbidity and pH of water.
2. Total suspended solids and total dissolved solids.
3. Measurement of Alkalinity & Acidity.
4. Dissolved oxygen measurement Using Winkler Method & Biochemical Oxygen Demand.
5. Hardness of Water.
6. Iron concentration in water
7. Determination of Chemical Oxygen Demand.

**AIR QUALITY**
8. Measurement of noise at different sources using Sound Level Meter.
9. Monitoring and analysis of Particulate Matter $PM_{10}$ in ambient air.
10. Monitoring and analysis of Particulate Matter $PM_{2.5}$ in ambient air.
11. Sampling and analysis of Nitrogen dioxide in ambient air.

**SOLID WASTE MANAGEMENT**
12**.** Physical characteristics of Solid wastes – Biodegradable and non-degradable wastes
Determination of Moisture Content (MC), Total Solids (TS), Total Volatile Solids (TVS) and Ash Content(AC) in solid waste.

**ENERGY RESOURCES**
13. Salt water fuel cell

**TEXTBOOKS / REFERENCE BOOKS / OTHER READING MATERIAL**
1. APHA and AWWA (2017): Standard Methods for the Examination of Water and Wastewater. American Public Health Association (APHA), 23rd Ed,
1. Washington, D.C., USA.
2. Grasshoff, K., Kremling, K., & Ehrhardt, M. (Eds.). (2009). Methods of seawater analysis. John Wiley & Sons.
3. IS 5182 (Part 23): 2006. https://law.resource.org/pub/in/bis/S02/is.5182.23.2006.pdf
4. IS:10158-1982 Indian Standard Methods of Analysis of Solid Wastes https://law.resource.org/pub/in/bis/S02/is.10158.1982.html.

5. Park, S., SenthilKumar, B., Kim, K., Hwang, S. M., & Kim, Y. (2016). Saltwater as the energy source for low-cost, safe rechargeable batteries. Journal of Materials Chemistry A, 4(19), 7207-7213.

## SEMESTER-I

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 112 | Single Variable Calculus | BS | 3 | 0 | 0 | 3 |

**UNIT I: SEQUENCES AND SERIES**
Sequences, series, Sum of a series, Geometric series, p-series, Comparison test, root test, ratio test.

**UNIT II: LIMITS AND CONTINUITY**
Limit of a function at a point, one sided limits, Continuity, Limits involving infinity.

**UNIT III : DIFFERENTIATION**
Derivative at a point, Derivative as a function, Product Rule, Quotient Rule, Chain Rule, Implicit Differentiation, Rolle's Theorem, Mean Value Theorem.

**UNIT IV: APPLICATIONS OF DERIVATIVES**
Maxima and minima, Monotonic functions and first derivative test, Related rates, Concavity and curve sketching, Optimization problems, Newton's Method, Taylor and MacLaurin Series.

**UNIT V: INTEGRATION**
Area as a limit of finite sums, Definite and indefinite integral, Fundamental Theorem of Calculus, Integration by substitution and integration by parts, Area between curves, Arc length.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Thomas' Calculus, 14th Edition, (2018) – J. Hass, C. Heil, M. Weir, Pearson Education.
2. Introduction to Real Analysis, Fourth Edition (2014) – R. Bartle, D. Sherbert, John Wiley and Sons.
3. Calculus and Analytic Geometry, Ninth Edition (2017) – G. Thomas, R. Finney, Addison Wesley.

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 105 | Introduction to Programming Using C | ES | 3 | 0 | 0 | 3 |

## UNIT I: INTRODUCTION

1. Computer systems, hardware and software. Problem solving: Algorithm / Pseudo code, flowchart, program development steps.
2. Computer languages: Machine, symbolic and high-level languages.
3. Creating and Running Programs: Writing, editing (any editor), compiling (gcc), linking and executing in Linux environment.
4. Structure of a C program, identifiers.
5. Basic data types and sizes. Constants, Variables.
6. Arithmetic, relational and logical operators, increment and decrement operators.
7. Conditional operator, assignment operator, expressions.
8. Type conversions, Conditional Expressions.
9. Precedence and order of evaluation, Sample Programs.

## UNIT II

10. **SELECTION & DECISION MAKING:** if-else, null else, nested if, examples.
11. Multi-way selection: switch, else-if, examples.
12. **ITERATION:** Loops - while, do-while and for, break, continue
13. Initialization and updating, event and counter controlled loops and examples.
14. **ARRAYS:** Concepts, declaration, definition, storing and accessing elements.
15. One dimensional, two dimensional and multidimensional arrays.
16. Array operations and examples.
17. Character arrays.
18. String manipulations.

## UNIT III: MODULAR PROGRAMMING

19. Functions – Basics.

20. Parameter passing.
21. Storage classes extern, auto, register, static, scope rules.
22. User defined functions, standard library functions.
23. Passing 1-D arrays, 2-D arrays to functions.
24. Recursive functions - Recursive solutions for Fibonacci series.
25. Towers of Hanoi.
26. C Pre-processor.
27. Header files.

**UNIT IV: POINTERS**
28. Concepts, initialization of pointer variables.
29. Pointers as function arguments, passing by address.
30. Dangling memory, address arithmetic.
31. Dangling memory, address arithmetic.
32. Pointers to pointers.
33. Pointers and multi-dimensional arrays.
34. Dynamic memory management functions.
35. Command line arguments.
36. Command line arguments.

**UNIT V**
37. Structures - Declaration, definition and initialization of structures, accessing structures.
38. Nested structures, arrays of structures.
39. Structures and functions, pointers to structures, self-referential structures.
40. Unions.
41. Typeset, bit-fields.
42. Program applications.
43. Bit-wise operators: logical, shift, rotation, masks.
44. **FILE HANDLING**: Concept of a file, text files and binary files, formatted I/O.
45. I/O operations and example programs.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. The C programming Language by Dennis Richie and Brian Kernighan.
2. Problem Solving and Program Design in C, Hanly, Koffman, 7th ed, PEARSON.
3. Programming in C, Second Edition Pradip Dey and Manas Ghosh, OXFORD Higher Education.
4. Programming in C, A practical approach Ajay Mittal PEARSON.
5. Programming in C, B. L. Juneja, Anith Seth, Cengage Learning.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 101 L | Introduction to Programming Using C Lab | ES | 0 | 0 | 2 | 1 |

**LIST OF SESSIONS:**
1.     Basic C programs
       a. Calculation of the area of triangle.
       b. Find the largest of three numbers using ternary operator.
       c. Swap two numbers without using a temporary variable.
       d. Find the roots of a quadratic equation.
       e. Takes two integer operands and one operator form the user, performs the operation and then prints the result.

2.    a. Find the sum of individual digits of a positive integer and find the reverse of the given number.
       b. Generate the first n terms of Fibonacci sequence.
       c. Generate all the prime numbers between 1 and n, where n is a value supplied by the user.
       d. Print the multiplication table of a given number n up to a given value, where n is entered by the user.
       e. Decimal number to binary conversion.
       f. Check whether the given number is Armstrong number or not.

3. a. Interchange the largest and smallest numbers in the array.
    b. Sorting array elements.
    c. Addition and multiplication of 2 matrices.

4.  a.  Function to find both the largest and smallest number of an array of integers.

     b. Liner search.

     c. Replace a character of string either from beginning or ending or at a specified location.

5.  a. Reading a complex number.

b. Writing a complex number.

c. Addition of two complex numbers.

d. Multiplication of two complex numbers.

6. a. Concatenate two strings.

   b. Append a string to another string.

   c. Compare two strings.

   d. Length of a string.

   e. Find whether a given string is palindrome or not.

7. a. Illustrate call by value and call by reference.

   b. Reverse a string using pointers.

   c. Compare two arrays using pointers.

8. a. To find the factorial of a given integer.

   b. To find the GCD (greatest common divisor) of two given integers.

   c. Towers of Hanoi.

9. File Operations (File copy, Word, line and character count in a file).

10. Command line arguments (Merge two files using command line arguments).

**SEMESTER-I**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 101 | Industry Specific Employability Skills | HS | 1 | 1 | 0 | 1 |

**UNIT I: QUANTS**
Speed calculations, Time and Distance, Problems on Trains, Boats and Streams, Races And Games, Escalator Problems, Time and Work , Chain Rule, Pipes and cistern, Simplification , surds and indices, Square roots and cube roots, Functions.

**UNIT II: REASONING**
Number Series, Alphabet series, Odd Man Out, Missing number, Wrong number, Analogies, Mathematical Operations, Calendars, Clocks, Cryptarithmetic, Identification of Cross-Variable Relation, Sudoku.

**UNIT III**: **VERBAL**
Basic sentence structure: Nouns, Pronouns, Adjectives, Parts of speech, Degree of comparison, Articles, conditionals and sentences (kinds), Verb tense, Sentence formation, Paragraph formation, Change of voice, Change of speech, Synonyms, Antonyms.

**UNIT IV: COMMUNICATION SKILLS**
Self-Introduction, Presentations, Email Etiquette.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Mitchell S. Green – 2017, Know Thyself: The Value and Limits of Self-Knowledge.
2. Debbie Hindle, Marta Vaciago Smith - 2013 , Personality Development: A Psychoanalytic Perspective.
3. Lani Arredondo - 2000, Communicating Effectively.
4. Patsy McCarthy, Caroline Hatcher - 2002, Presentation Skills: The Essential Guide for Students.

5.  Martha Davis, Elizabeth Robbins Eshelman, Matthew McKay - 2008, Time Management and Goal Setting: The Relaxation and Stress.
6.  Arun Sharma –  How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
7.  RsAgarwal,A Modern Approach to Verbal and Non Verbal Reasoning,S.Chand Publications.
8.  Verbal Ability and Reading comprehension-Sharma and Upadhyay.
9.  Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
10. GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition.
11. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.
12. English Grammer and composition – S.C. Gupta.
1.  12.R.S. Agarwal – Reasoning.
13. Reasoning for competitive exams – Agarwal.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENG 115 | Engineering Mechanics | ES | 3 | 0 | 0 | 3 |

**UNIT I: STATICS OF PARTICLES AND RIGID BODIES**
Forces on particles, Resolution of forces, Free body diagrams, Equilibrium of particles, Equilibrium of particles (Numerical Problems), Forces in a plane, Forces in space, Forces in space (Numerical Problems), Forces in space (Numerical Problems), Force equivalence, Force equivalence (Numerical Problems), Rigid body equilibrium, Rigid body equilibrium (Numerical Problems), Rigid body equilibrium (Numerical blems).

**UNIT II: FRICTION**
Laws of friction, dry friction, Wedge friction, rolling friction, Belt friction, Belt friction, Screw friction.

**UNIT III: ANALYSIS OF TRUSSES AND CENTROIDS**
 Types of loads, type of supports, reaction, Simple trusses, method of joints,  Method of joints, Method of sections (Numerical Problems), Method of Joints (Numerical Problems), Method of Joints (Numerical Problems), Center of gravity-lines, areas, Volumes, Determination of centroid-integration  Method, Determination of centroid-integration method (Numerical Problems).

**UNIT IV: MOMENT OF INERTIAS OF SURFACE AND VOLUMES**
  Determination of moment of inertia using area integration method, Determination of moment of inertia using area integration method, Determination of moment of inertia using area integration method, Analytical method, radius of gyration, Polar moment of inertia, Moment of inertia of different sections.

**UNIT V: DYNAMICS**

Rectilinear motion, Projectile motion, Newtons second law of motion, Alembert's principle , Work, energy, Impulse momentum, Impact/collision of elastic bodies, Oblique impact, Curvilinear motion.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Ferdinand. P. Beer. E, Russell Johnston Jr., David Mazurek, Philip J Cornwell, Vector Mechanics for Engineers: Statics and Dynamics, McGraw - Hill, New Delhi, 10th Edition, 2013.
2. R.K.Bansal, Engineering Mechanics, Laxmi Publications Ltd, 2005.
3. Meriam J.L and Kraige L.G., Engineering Mechanics, Volume I - statics, Volume II - dynamics, John Wiley & Sons, New York,7th Edition, 2012.
4. Timoshenko, Young, Engineering Mechanics, Tata Mc-Graw Hill Book Company, 5th Edition, New Delhi.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 107 | Data Structures | ES | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION TO DATA STRUCTURES**
Introduction to data structures, Abstract Data Type (ADT) representation and implementation, Time and space requirements of algorithms, Array ADT, representing polynomials, Sparse matrices using arrays and their operations, Implementation of double linked list various operation using C, Stacks and Queues: Representation and application, implementation of stack and queue operations using C.

**UNIT II: LINKED LISTS**
Single linked lists, Implementation of link list, various operation using C, double linked list, circular list and applications.

**UNIT III: TREES**
Tree terminology, Binary tree, Binary search tree, Infix to Post fix conversion, Postfix expression evaluation, AVL Tree, Complete Binary Tree representation.

**UNIT IV: GRAPHS**
Graph terminology, Representation of graphs, Path matrix, BFS (breadth first search), Implementation of BFS using C, DFS (depth first search), Implementation of DFS using C, Topological sorting, Shortest path algorithms, Priority Queues : Heap Structures, binomial heaps, leftist heaps.

**UNIT V: SORTING AND SEARCHING TECHNIQUES**
Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort, Heap sort, Radix sort and Implementation, Linear and binary search methods, implementation.

**TEXT BOOKS /REFERENCE BOOKS /OTHER READING MATERIAL**
1. "Data Structure -- A Pseudo code approach with C" by Richard R. Gilberg & Behrouz A. Forouzan, 2nd edition, 2011. Cengage Learning. Imprint: Thomson Press (India) Ltd.
2. Data Structures Using C" by Aaron M. Tanenbaum, Yedidvah Langsam, and Moshe J. Augenstein. Pearson Publishers, 2019.
3. Data structures and Algorithm Analysis in C, Mark Allen Weiss, Pearson publications, Second Edition Programming in C. P. Dey and M Ghosh, Second Edition, Oxford University Press.
4. Fundamentals of data structure in C" by Horowitz, Sahani & Anderson Freed, Computer Science Press
5. G. A. V. Pai: "Data Structures &amp; Algorithms; Concepts, Techniques &amp; Algorithms" Tata McGraw Hill.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 107 L | Data Structures Lab | C | 3 | 0 | 0 | 3 |

**Week 1 & 2:**
 **Simulate the following operations**
a. Conversion of infix expression to postfix expression.
b. Evaluation of expressions.
c.        Assignment-1: Tower of Hanoi is a mathematical puzzle where we have three rods and n disks. The objective of the puzzle is to move the entire stack to another rod, obeying the following simple rules:
i.        Only one disk can be moved at a time.
ii.        Each move consists of taking the upper disk from one of the stacks and placing it on top of another stack i.e. a disk can only be moved if it is the uppermost disk on a stack.
iii.        No disk may be placed on top of a smaller disk
iv.        You can choose to use the function move (4, 1, 3, 2), where 4 represents the number of disks. 1 represents disks on source shaft, 3 represents the destination shaft which holds the disks after the move and finally 2 represents the intermediate support shaft – temporary storage. Write a C program to simulate the given problem and: Perform the algorithmic complexity analysis for the solution you propose.

**Week 3 & 4:**
Simulate the following tasks:
a. Implementation of the following operations: enqueue, dequeue and finding an element.
i. Linear Queue using arrays.
ii. Circular queue arrays.
iii. Priority queue singly linked list.

b. Assignment-2: The "4-Queens Problem" consists of placing four queens on a 4 x 4 chessboard so that no two queens can capture each other. That is, no two queens are allowed to be placed on the same row, the same column, or the same diagonal (both primary and secondary diagonals). Write a C program to simulate the given problem and perform the algorithmic complexity analysis for the solution you propose.

### Week 5 & 6:

Demonstrate the following though simulation:
a.     Create a singly linked list and perform the following operations:
i.      Add an element at the end of the list
ii.     Delete an element from the beginning of the list
iii.    Find the middle element of the list
iv.     Search the given key form the list
v.      Polynomial addition using linked list
vi.     Sparse matrix operations using linked list
b.      Assignment-3: Let us consider a small but busy airport with only one run-way (shown in figure). In each time unit, one plane can land or one plane can take off, but not both. Planes arrive ready to land or to take off at random times, so at any given unit of time, the runway may be idle or a plan may be landing or taking off, and there may be several planes waiting either to land or take off. We therefore need two queues, called landing and takeoff, to hold these planes. It is better to keep a plane waiting on the ground than in the air, so a small airport allows a plane to take off only if there are no planes waiting to land. Hence, after receiving requests from new planes to land or take off, our simulation will first service the head of the queue of planes waiting to land, and only if the landing queue is empty will it allow a plane to take off. We shall wish to run the simulation through many units of time, and therefore, we embed the main action of the program in a loop that runs for cur-time (denoting current time) from 1 to a variable end-time. Simulate the given scenario using and write the output for different inputs.

### Week 7 & 8:

Write code to perform the following operations:
a. Develop a code to test whether the given tree is binary tree or not.
b. Implementation of Binary tree traversals techniques – pre-order, in-order, and post-order.
c. Implementation of AVL tree and its operations.
d. Assignment-4: Given a mathematical expression, evaluate it using appropriate tree structure.

### Week 9 & 10:

Write the codes to perform the following tasks
A Implementation of Graph traversals techniques: i) BFS and ii) DFS.
b. Assignment-5: The Dijkstra's algorithm is an algorithm that gives the shortest path between two given vertices of a graph. In this problem we are given a directed graph with each edge having a non-negative weight. Thus, a solution requires a path of many other that costs least. We can think of the problem as like this: think graph G as a map of the airline routes, each node of the graph as the cities and the weights on each edge as the cost of flying from one city to another city. The solution we have to find a routing from a city v to city w such that the total cost is minimum.

Write a C program to simulate the given problem. That is find the shortest path between node A and node F in the given graph.

## Week 11 & 12:

Implementation of the following algorithms:
a. Linear search.
b. Binary search.
c. Implementation of Bubble sort algorithm.
d. Implementation of Selection sort algorithm.
e. Implementations of Merge sort algorithm.

## Week 13 & 14:

a. Implementation of Insertion sort algorithm.
b. Implementation of quick sort algorithm.
c. Assignment-6: Suppose you work at college library. You are in the middle of a quiet afternoon when suddenly a shipment of 3928 different books arrives. The books have been dropped of in one long straight line, but they are all out of order, and the automatic sorting system is broken. To make matter worse, classes will start tomorrow, which means that first thing in the morning, students will show up in droves looking for these books. How can you get them all sorted in time.?
Simulate the given scenario using C code. Perform the algorithmic time complexity analysis for the solution you propose. Also give the space complexity.

## Week 15:

Our Text editor will allow us to read a file into memory i.e., it is stored in the buffer. We consider each line of text to be a string and buffer will be a list of these lines. we shall then devise editing commands that will do list operations on lines in buffer and will do string operations on characters in a single line. Here are few commands;
a.      R – Read the text file
b.      W – Write to text file
c.      I – Insert a new line
d.      D – Delete the current line
e.      P – Previous line (back up one line in buffer)
f.      B – Go to first line of buffer
g.      E – Go to last line of buffer
h.      Q – Quit the editor
Tasks we do are:
a)      Receiving a command from user
b)      Get Command () – this function gets the command from user
c)      Do Command () – this function performs the command
Now we have to perform the command for example if the command is 'b' we have to go beginning of buffer; if it is 'n' we must move to next line. All these commands can be performed using switch case statement. Using the switch case statements, we check for the command and specify the functions to perform the appropriate task.
Reading and Writing Files:
a. Reads the file contents of input file into buffer stopping at the end of file. Here we use some functions List Empty (), Clear List (), Create List (), Insert List (), see the code in the book for better understanding.
b. Searching for a String: Here we search for a string from user and informs the user if the

target is found or not.

c. Changing one string to another: Here we change the string that the user wants to replace from the existing string. If the string is not found user will be informed that string is not found. If found, we should replace the old string with the new string.

Perform the algorithmic complexity analysis for the solution you propose.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**

1. https://www.youtube.com/watch?v=YstLjLCGmgg
2. Data Structures and Program Design in C by Robert Kruse, C L Tondo, Bruce Leung and Shashi Mogalla. For pseudocode, refer the following pages 98 to 105.
3. Online Reference: https://www.youtube.com/watch?v=xFv_Hl4B83A
4. Data Structures and Program Design in C by Robert Kruse, C L Tondo, Bruce Leung and Shashi Mogalla. For pseudocode, refer the following pages 139 to 150
5. Data Structures and Program Design in C by Robert Kruse, C L Tondo, Bruce Leung and Shashi Mogalla. For pseudocode, refer the following pages 510 to 514
6. Data Structures and Program Design in C by Robert Kruse, C. L. Tondo , Bruce Leung and Shashi Mogalla. For pseudocode, refer the following pages 302 to 312.
7. Online resources: Use the following link to get a better understanding on the problem. https://www.youtube.com/watch?v=PgBzjlCcFvc
8. https://www.programiz.com/dsa/quick-sort

**NOTE: -**

1. The assignments can be performed in groups (not more than 4 in a group).
2. Deliverables: A report containing the following
 a. Title of the problem/program
 b. Problem statement and Objective(s) of the problem
 c. Working code, without errors.
 d. Output written for different input cases.
 e. Conclusion: Algorithmic complexity and the problem you faced during the learning to execution stage.

**SEMESTER-II**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ECO 121 | Principle of Economics | HS | 3 | 0 | 0 | 3 |

**UNIT I: CONSUMER BEHAVIOR**
Definition; Scope and method of economics; the economic problem, Science of economics; the basic competitive model; prices, Science of economics; the basic competitive model; prices, Concept of Demand and supply, Equilibrium of market, The concept of elasticity, The concept of elasticity, Consumer Surplus, Application of consumer surplus, Budget constraints, Utility Analysis: Ordinal and cardinal utility analysis, Utility Analysis: Ordinal and cardinal utility analysis, Applying theory of Labour.

**UNIT II: PRODUCER THEORY AND MARKET**
Theory of Production, Theory of Production, Theory of Cost: concepts and definition; types, Short run and long run cost curves, Structure of Market, Perfect competition, Monopoly, Monopolistic competition.

**UNIT III: MACRO ECONOMIC ISSUES**
GDP- definition and concepts, Measurement of National Income: Different methods, Consumption function, Investment, Demand for money, Supply of Money, Inflation, Unemployment.

**UNIT IV: INTERNATIONAL TRADE**
Balance of payments, International trade, Trade balance, The foreign exchange markets.

## UNIT V
Feature of the Indian Economy, Inclusive Growth, relevance for the Indian Economy, Sustainable Development.

## TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL
1. Principles of microeconomics, N. Gregory Mankiw, Publisher: Cengage Learning fifth edition.
2. Principles of Economics, Case Karl E, Fair Ray C; Oster Sharon M, Publisher: Pearson tenth edition.
3. Economics, Samuelson P A and Nordhus W D; Publisher: McGraw-Hill Irwin.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 121 | Multi Variable Calculus | BS | 3 | 0 | 0 | 3 |

## UNIT I: VECTORS AND THE GEOMETRY OF SPACE
Three-dimensional coordinate system, distance, spheres, Vectors, Dot product, properties, vector projection, Cross Product, triple scalar, or box product, Lines and Planes, Extra examples.

## UNIT II: PARTIAL DERIVATIVES
Functions of several variables, Graphical software, Limits and continuity in several variables, Partial derivatives, The Chain Rule, Directional derivative, Directional derivative, Extra exercises, heat equation, wave equation, Laplace equation in two and three dimensions.

## UNIT III: EXTREME VALUES
First derivative test for local extreme values, Second derivative test, saddle points, Hessian, Lagrange Multipliers, Further examples.

## UNIT IV: INTEGRATION IN TWO DIMENSIONS
Double integrals over rectangles, Double integrals over general regions, Fubini's Theorem, Further examples of double integrals, Area, Integration using Polar Coordinates.

## UNIT V: INTEGRATION IN THREE DIMENSIONS
Triple Integrals in rectangular coordinates, Volume, average value.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL:**
1. Thomas' Calculus, 14th Edition, (2018) – J. Hass, C. Heil, M. Weir, Pearson Education.
2. Introduction to Real Analysis, Fourth Edition (2014) – R. Bartle, D. Sherbert, John Wiley and Sons.
3. Calculus and Analytic Geometry, Ninth Edition (2017) – G. Thomas, R. Finney, Addison Wesley.
4. Differential and Integral Calculus, vol. II, (1961) – R. Courant, Blackie & Son Ltd., London and Glasgow.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ME 103 L | Mechanical Engineering Tools | ES | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**
1. Step fitting of two metal plates using fitting tools.
2. Drilling & Tapping for generating hole and internal thread on a metal plate.
3. Simple turning of cylindrical surface on MS rod using lathe machine tool.
4. Plumbing of bathroom/kitchen fitting using various plumbing components and tools.
5. Butt joint of two metal plates using arc welding process.

6. Lap joint of two metal plates overlapping on one another using arc welding process.
7. T-joint of a metal plate at perpendicular direction over another plate using arc welding process.
8. MIG welding of metal plates.
9. Cross halving joint of two wooden pieces at perpendicular direction.
10. Dovetail halving joint of two wooden pieces in the shape of dovetail.
11. To make circular shapes, grooving in wood piece using wood turning lathe.
12. To make duster from wooden piece using carpentry tools.
13. To make rectangular shaped tray using GI sheet.
14. To make geometrical shape like frustum, cone and prisms using GI sheet.

15. To make bigger size scoop using GI sheet. To forge chisel from MS rod using black smithy.

**REFERENCES**
1. Lab Manual
2. Kannaiah.P and Narayanan.K.C, "Manual on Workshop Practice", Scitech Publications, Chennai, 1999.
3. Gopal.T.V, Kumar.T, and Murali.G, "A first course on workshop practice – Theory, Practice and Work Book", Suma Publications, Chennai, 2005.

## SEMESTER-II

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ENG 105 | Engineering Graphics | ES | 1 | 0 | 2 | 2 |

**UNIT I: PROJECTION OF POINTS, LINES, PLANES, SOLIDS**
Projection of points, Projection of lines, Projection of planes, Projection of solids, Use of software tool to create projections.

**UNIT II: SECTIONS AND DEVELOPMENTS**
Sections of solids, True shape of the section, Development of surfaces of sectioned solids, CAD exercises.

**UNIT III: ISOMETRIC VIEWS**
Isometric projections of simple and truncated solids, Isometric to orthographic and vice versa, Perspective projection, CAD exercises.

**UNIT IV: GEOMETRIC DIMENSIONING AND TOLERANCES**
GD and T rules and concepts, Geometric characteristics and modifiers, Fourier transform, bode plot, bandwidth, Datums and datum references, CAD exercises.

**UNIT V FREE HAND SKETCHING AND CAD**

Free hand sketching of real objects, Free hand sketching of multiple views from pictorial views, CAD exercises, Assignments of 2D and 3D drawings.

**TEXT BOOKS**

Bhatt, N.D, Engineering Drawing,  Charotar Publishers, 2014.

**REFERENCE BOOKS/OTHER READING MATERIAL**

1.  Bhatt, N.D, Machine Drawing,  Charotar Publishers, 2014.
2.  Venugopal, K. and Prabhu Raja, V., Engineering Graphics, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
3.  Narayanan,  K.  L.  and  Kannaiah,  P., Engineering  Graphics, Scitech Publications, Chennai, 1999.

**SEMESTER-II**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 204 | Engineering Geology | C | 2 | 0 | 0 | 2 |

**UNIT I: INTRODUCTION**
Definition, introduction and Scope of Geology for Civil Engineers and concerned organizations, Branches of Geology with their importance, definitions, Origin of the earth and different theories, Physical properties of Minerals- megascopic, Chemical Properties of Minerals, use of Instruments like SEM, XRD in mineral identification.

**UNIT II: PETROLOGY**
De Rock cycle, Specific Gravity of Rocks, determination, Co Concept of Hot Spring and Geysers, Characteristics of different Types of Magma, hoI Igneous Petrology- Different Classifications of Igneous Rocks. Detailed Study of Igneous Rocks- Granite, Gabbro, Basalt, Pegmatite, Rhyolite or Tuff, Felsite, and their Engineering Aspects, Ho Sedimentary Petrology, classification and study of some examples like Sand stone, Limestone, Shale, Conglomerate, Breccia, Mudstone, Co Metamorphic Petrology- Agents and Types of Metamorphism, Metamorphic Grades, Mineralogical Composition, Structures & Textures of Rocks, Schistosity, gneissocity.

**UNIT III: PHYSICAL GEOLOGY**
The weathering concept, types of weathering, Geological agents, erosion, denudation, waterfall, gorges, River meandering, oxbow lake, Uti Glacial deposits, solifluction deposits, Mud flows, Uti Desert landforms, Coastal deposits.

**UNIT IV: STRENGTH BEHAVIOUR OF ROCKS**
Concept of Rock Deformation & Tectonics, Stress and Strain in Rocks, Dip and Strike. Inliers and Outliers, Fold- Types and nomenclature, Criteria for their recognition in the field, Faults- Classification, recognition in field, effects on Outcrops, Joints - Types, Stresses responsible, Geotechnical importance, Unconformity- Types, Stresses responsible, Geotechnical importance.ng.

**UNIT V: GEOLOGICAL HAZARDS**
Rock instability and Slope Movement Concept of Sliding Blocks. Different Controlling Factors. Types of Land Slides. Prevention, Pe Land slides and its causes and Consequences, examples, Factors Controlling Ground Water, Capacity of Rock. Pervious and Impervious Rocks. Lowering of Water Table and Subsidence, Earthquake: Magnitude and Intensity of Earthquake. Seismic Sea Waves. Revelation from Seismic Records of Structure of Earth, Volcanoes. Types of Volcanic Eruption.

**UNIT VI: ROCK MASSES AS CONSTRUCTION MATERIAL**
Main Features that affects the Quality of Rock Engineering and Design. Effect of alteration and weathering, B Basic Element and Structures of Rock those are relevant In Civil Engineering areas, Rock Quality Designation. Rock Mass Description.
**UNIT VII: GEOLOGY OF DAM AND RESERVOIR SITE**

Eo Geological Considerations for selecting dams, reservoirs, Gg Different types of Rocks and their Special Features, Precautions to counteract Unsuitable Conditions, Gg Significance of discontinuities on the dam site and treatment  to be given to such Structures.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Engineering and  General Geology, by Parbin Singh, 2013, S.K.Kataria & Sons, 109, Prakash mahal, Opposite Delhi Medical association, Dayarganj, New Delhi-110002.
2. An introduction to Geology, by P.K.Mukharjee, 1990, The World Press Private LTD, 37A, College Street, Calcuuta-700073.
3. Physical and Engineering Geology, S.K.Garg, Dayarganj, New Delhi-110002.
4. A Text of Geology, by G.B.Mahapatra, 2012, C.B.S.Publishers and Distributors Pvt. Ltd., C.B.S.Plaza,  4819/XI, Prahlad Street, Dayarganj, New Delhi-110002.
5. Engineering Geology, by P.Purushothama Raj, 2014, Sri Krishna Hitech Publishing .Company Pvt. Ltd., plot No.14, Lakshmi Kanthammal,  1st street, Rajiv Nagar, Vanagaram, Chennai-600077.

**SEMESTER-II**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 204 L | ENGINEERING GEOLOGY Lab | C | 0 | 0 | 2 | 1 |

**The list of experiments for practical session:**
**I. Mineralogy:  Megascopic Identification of Minerals based on the physical Properties**
1. Quartz.

2. Feldspar (Orthoclase)/Pink.

3. Calcite.

4. Mica.

5. Graphite.

6. Barytes.

7. Asbestos.

8. Garnet.

9. Talc.

10. Bauxite.

**II.  Petrology: Megascopic Identification of Igneous Rocks**
11. Granite.
12. Basalt.
13. Pegmatite.
14. Gabbro.
15. Dolerite.


**Megascopic Identification of Sedimentary Rocks**

16. Sand Stone.

17. Lime Stone.

18. Shale.

19. Breccia.

20. Conglomerate.

**Megascopic Identification of Metamorphic Rocks**

21.Slate.

22.Schist (mica & Chlorite schists).

23.Gneiss (Hornblende gneiss).

**III. Structural Geology: Study of Plans & Sections**
24. Study of Structural Geology Models.
25. Determination of Strike and Dip of a bed by using Clino and Brunton Compass.

26. Determination of Strike and Dip of a bed by using Clino and Brunton Compass.

27.Strike and Dip problems.

28 .Study of Geological map and identification  of different lithounits.

29. Preparation of Geological  Sections (Longitudinal & Cross Sections) for determination of thickness of beds.

30. Resistivity meter (wenner and Schlumberger methods)  in ground water exploration.

**SEMESTER-II**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 102 | Industry Specific Employability Skills II | HS | 1 | 1 | 0 | 1 |

**UNIT I**
Percentages, profit and loss, SI and CI, Time and work, Average and progression.

**UNIT II**
Time – speed and distance, Number system and arrangements.

**UNIT III**
Ratio and proportions, Mixtures and Alligation, Direction problems, Direction problems, coding and decoding, Number series and Alphabet series.

**UNIT IV**
Antonyms, synonyms, odd words, Idioms and phrasal verbs, same word with different part of speech.

**UNIT V**
Word analogy. Sentence completion, Text completion, Sentence equivalence.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Arun Sharma –  How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. RsAgarwal,A Modern Approach to Verbal and Non Verbal Reasoning,S.Chand Publications.
3. Verbal Ability and Reading comprehension-Sharma and Upadhyay.
4. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
5. GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition.
6. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.

# SEMESTER-III

**SEMESTER-III**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 209 | Fluid Mechanics | C | 3 | 0 | 0 | 3 |

**UNIT I: PROPERTIES OF FLUID AND FLUID STATICS**
Properties of Fluid; Fluid Continuum; Newtonian and Non - Newtonian fluids, Vapour pressure, Compressibility and Elasticity; Surface Tension and Capillarity, Fluid Statics: Variation of static pressure; Pascal's Law; Atmospheric, Absolute and gauge pressure, Pressure measurement by manometers; Pressure on plane surfaces and curved surfaces, Buoyant Force and Centre of Buoyancy; Stability of submerged bodies and floating bodies, Metacenter and metacentric height, Numerical Problems.

**UNIT II: KINEMATICS AND DYNAMICS OF FLUID FLOW**
Kinematics of Fluid Flow: Methods of describing fluid motion; Classification of flows, Laminar and turbulent flows, Three, two and one dimensional flows; Irrotational and rotational flows, Equation for acceleration; Convective acceleration; Local acceleration; Continuity equation, Velocity potential and stream function; Vortex flow – free vortex and forced vertex flow, Dynamics of Fluid Flow: Euler's equation of motion; Bernoulli's equation, Energy correction factor; Momentum principle; Applications of momentum equation.

**UNIT III: MEASUREMENT OF FLOW THROUGH PIPES AND ORIFICES**
Measurement of flow through Pipes – methods and various devices, Discharge through Venturi meter; Discharge through orifice meter, Numerical problems, Measurement of velocity by Pitot tube. Determination of coefficients for an orifice. Numerical problems, Flow through large rectangular orifice; Flow through submerged orifice, Classification of mouthpieces.

**UNIT IV: FLOW THROUGH NOTCHES AND WEIRS**
Flow through rectangular channels, Flow through triangular and trapezoidal notches and weirs, Cippoletti Weir; End contractions, Velocity of approach; Broad crested weir.

**UNIT V: FLOW THROUGH PIPES, LAMINAR AND TURBULENT FLOWS**
Flow through Pipes: Energy losses in pipelines, Numerical problems, Darcy–Weisbach equation; Minor losses in pipelines, Concept of equivalent length, Hydraulic power transmission through a pipe; Pipes in series and parallel, Laminar Flow: Relation between shear and Pressure Gradients in Laminar Flow, Reynold's experiment; Critical velocity; Steady laminar flow through a circular pipe, Laminar Flow between Parallel Plates, Laminar flow in pipes, Turbulent flow in pipes. Numerical problems.

**TEXTBOOKS**

1. S K Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid machines, Tata McGraw Hill Education.
2. R. W. Fox, P. J.Pritchard, A. T Mcdonald, Introduction to Fluid Mechanics, John Wiley
3. F. M White, Fluid Mechanics, Tata McGraw Hill Education.

**REFERENCE BOOKS/OTHER READING MATERIAL**
1. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing Company.
2. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

## SEMESTER-III

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 203 | Strength of Materials | C | 3 | 0 | 0 | 3 |

### UNIT I: SIMPLE STRESSES AND STRAINS

Introduction, Basic concepts, Simple stresses and strains; Elasticity and plasticity; Types of stresses and strains; Hooke's law; Stress-strain diagrams, Working stress; Factor of safety; Lateral strain; Volumetric strain and Poisson's ratio; Elastic moduli; Elastic constants for isotropic materials, Statically determinate and indeterminate problems, Bars of varying section–composite bars; Temperature stresses, Strain energy; Resilience – Gradual, sudden, impact and shock loadings.

### UNIT II: SHEAR FORCE AND BENDING MOMENT

Introduction to types of beams, supports and loadings; Shear force and bending moment, Cantilever, simply supported and overhanging beams subjected to point loads, UDL, uniformly varying loads and combination of these loads, Point of contra flexure – Relation between S.F.,B.M and rate of loading at a section of a beam, Couple and their combinations.

### UNIT III: FLEXURAL STRESSES

Theory of simple bending and assumptions, Derivation of bending equation: $M/I = f/y$ E/R, Neutral axis; Determination bending stresses, Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections, Design of simple beam sections.

### UNIT IV: SHEAR STRESSES

Derivation of formula; Shear stress distribution, rectangular, circular, triangular, I, T angle sections, built up beams, shear center.

### UNIT V: TORSION IN CIRCULAR SHAFTS

Introduction; Pure torsion; Assumptions; derivation of torsion equation for circular shafts, torsional rigidity and polar modulus, power transmitted by a shaft, power transmitted by a shaft.

### TEXTBOOKS

1. Strength of materials, S. Ramamrutham and R. Narayanan, Dhanpat Rai publishers.
2. A textbook of strength of materials, R. K. Bansal, 5th Ed., Laxmi publications.
3. Strength of materials, B. C. Punmia, Ashok K. Jain and Arun K. Jain, Laxmi publications.

**REFERENCE BOOKS**
1. Elements of strength of materials, S. P. Timoshenko and D. H. Young, 5th Ed., East-West press.
2. Mechanics of materials, Ferdinand P. Beer, E. Russell Johnston and Jr. John T. DeWolf, 3rd Ed., Tata McGraw-Hill.

3. Mechanics of materials, Russel C. Hibbeler, 9th Ed., Pearson publications.

**SEMESTER-III**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 203 L | Strength of Materials Lab | C | 3 | 0 | 0 | 3 |

**LIST OF PRACTICAL EXPERIMENTS**
1. Tensile test on Mild steel rod.
2. Compression test of Concrete cubes and cylinders.
3. Test on open coil and closed coil Helical springs.
4. Izod & charpy impact test.
5. Torsion test on Graded steels.
6. Deflection test on beams of different materials using Maxwell reciprocal theorem.
7. Double shear test on metallic materials.
8. Rockwell &Brinell hardness test of metallic materials.
9. Bend test of metallic rods.
10. Fatigue testing of materials under notched and unnotched conditions.
11. Comparison of mechanical properties of Unhardened, Quenched and tempered specimen.
12. Strain measurement on rods and beams.
13. Study on photo elasticity.
14. Buckling analysis.
15. Creep Test.

**SEMESTER-III**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | **L** | **T** | **P** | **C** |
| CE 206 | Surveying | C | 3 | 0 | 0 | 3 |

## UNIT I: INTRODUCTION TO SURVEYING

Principles, Linear, Angular and graphical methods, Survey Stations, Survey lines - Ranging, bearing of survey lines, Leveling.

Plane table Surveying, Principles of Leveling - booking and reducing levels; differential, reciprocal, profile Leveling and cross-sectioning. digital and Auto level, Errors in Leveling;

Contouring: Characteristics, methods, uses; areas and Volumes.

Triangulation and Trilateration (6 hours): Theodolite Survey: Instruments, Measurement of horizontal and vertical angle horizontal and vertical control- methods - Triangulation - network - Signals. Baseline - Choices - instruments and accessories - extension of baselines - Corrections- Satellite station - reduction to centre - intervisibility of height and distances - Trigonometric Leveling - Axis Single Corrections.

## UNIT II: CURVES

Elements of simple and compound curved - Method of setting out - Elements of Reverse Curve - Length of curve - Elements of transition curve - Vertical Curves.

## UNIT III: MODERN FIELD SURVEYS

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station - Accessories - Advantages and applications, Field Procedure for total station survey.
6. Errors in Total Station Survey; Global Positioning Systems - Segments, GPS measurements, errors and biases, Surveying with PS, Co-Ordinate transformation, accuracy considerations.

## UNIT IV: PHOTOGRAMMTRY SURVEYING

Introduction, Basic Concepts, Perspective geometry of aerial photography, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension of.

photographic mapping - aerial triangulation, radial triangulation, methods; Photographic mapping - mapping using paperprints, mapping using stereoplotting instruments, mosaics, map substitutes

## UNIT V: REMOTE SENSING

Introduction - Electromagnetic spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: Platforms and sensors; Visual image interpretation; digital image processing

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**

1. 1.Madhu, N, SAhithi Kumar, R and Sathesh obi, Advanced Surveying: Total Station, IS and Remote Sensin, Pearson India, 2006.
2. B.C.Punmia, Ashok Kumar Jain, Arunkumar, Surveying Vol-I & Vol-II, Laxmi Publications (P) Ltd, 22, Golden House, Darya Ganj, New Delhi-110002
3. Manoj, K, Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
4. Bhavikatti, S.S. , Surveying and levelling, Vol. I and II, K. International, 2010.
5. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
6. Anji Reddy, M., Remote Sensing and Geographical information system, B.S. Publications, 2001.
7. Arora, K.R., Surveying, Vol-I. II and III, Standard Book House, 2015.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 206 L | Surveying Lab - I | C | 3 | 0 | 0 | 3 |

**I. CHAIN SURVEYING**
1. Introduction to chain surveying.
2. Direct ranging by Chain surveying.
3. Indirect Ranging by Chain surveying.
4. Area Calculation by chain surveying.
5. Widening of the Road by chain surveying.

**II. COMPASS SURVEYING**
6. Area Calculation by Compass Surveying.
7. Inaccessible points by compass surveying.

**III. PLANE TABLE SURVEYING**
8. Radiation Method by plane table surveying.
9. Intersection Method by plane table surveying.
10. Traversing by plane table surveying.

**IV. DUMPY LEVEL SURVEYING**
11. Simple Levelling
12. Differential Levelling
13. Profile levelling
14. Longitudinal and Cross Section of a Road
15. Reciprocal Levelling

**V. THEODOLITE SURVEYING**
16. Introduction to Theodolite
17. Repetition
18. Reiteration
19. Measurement of vertical Heights

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**

1. Pravesh Saini, 2018 Laboratory Manual, Surveying , by, Government Engineering College, Ajmer.
2. B.Suresh,2019,  Surveying Laboratory Manual, , Institute of Aeronautical Engineering (Autonomous) Dundigal, Hyderabad - 500 043
3. K.G. Reddy, 2018,  Surveying  Laboratory Manual, JNTU, Hyderabad.

4. Surveying-1, Laboratory Manual, 2018 by AURORA'S TECHNOLOGICAL AND RESEARCH INSTITUTE Uppal, Parvathapur, JNTUK.

5. B.C.Punmia, Ashok Kumar Jain, Arunkumar, Surveying Vol-I & Vol-II, Laxmi Publications (P) Ltd, 22, Golden House, Darya Ganj, New Delhi-110002.

**SEMESTER-III**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 131 | Differential Equations | BS | 3 | 0 | 0 | 3 |

**UNIT I: FIRST ORDER DIFFERENTIAL EQUATIONS**
Classification of ODEs (Linear, Non-linear, Exact, Separable, Geometric meaning of $y' = f(x, y)$, Direction Fields, Numerical methods for solving ODEs, Euler's Method, Integrating Factor, Bernoulli Equations, Initial Value Problem, Existence and Uniqueness, Picard's method, Modelling (Free falling object, Radioactivity, RL-circuit).

**UNIT II: SECOND AND HIGHER ORDER LINEAR ODES**
Homogeneous Linear ODEs, Modelling of Free Oscillations of a Mass-Spring System, Euler-Cauchy Equations, Non-homogeneous ODEs, Variation of Parameters, Modelling (Forced Oscillations, Electric Circuits).

**UNIT III: SYSTEM OF ODES**
Modelling Engineering problems (Electric Network, Mixing problem in two tanks etc.) as systems of ODEs, Wronskian, Phase-Plane Method, Critical Points & Stability, Qualitative Methods for Nonlinear Systems, Nonhomogeneous Linear Systems of ODEs.

**UNIT IV: SERIES SOLUTIONS OF ODES**
Introduction to power series method, Legendre's equation & polynomials, Frobenius Method, Bessel's Equations & Functions.

**UNIT V: LAPLACE TRANSFORMS**
Laplace transforms of standard functions, Shifting Theorems, Transforms of derivatives and integrals, Unit step function, Dirac's delta function, Inverse Laplace transforms, Convolution theorem (without proof)., Application: Solutions of ordinary differential equations using Laplace transforms.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Willaim Boyce and Richard DiPrima, Elementary Differential Equations and Boundary Value Problems, 11th Edition, Wiley-India.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley-India.

3. Mary L. Boas, Mathematical Methods in Physical Sciences, 3rd Edition, Wiley-India.
4. G. F. Simmons, Differential Equation with Applications and Historical Notes, TATA McGraw Hill.
5. S. Vaidyanathan, Advanced Applicable Engineering Mathematics, CBS Publishers.

## SEMESTER-III

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 201 | Industry Specific Employability Skills III | HS | 1 | 1 | 0 | 1 |

### UNIT I
Percentages, profit and loss, SI and CI, Time and work, Average and progression.

### UNIT II
Time – speed and distance, Number system and arrangements.

### UNIT III
Ratio and proportions, Mixtures and Alligation, Direction problems, Direction problems, coding and decoding, Number series and Alphabet series.

### UNIT IV
Antonyms, synonyms, odd words, Idioms and phrasal verbs, same word with different part of speech.

### UNIT V
Word analogy. Sentence completion, Text completion, Sentence equivalence.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Arun Sharma –  How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. RsAgarwal,A Modern Approach to Verbal and Non Verbal Reasoning,S.Chand Publications.
3. Verbal Ability and Reading comprehension-Sharma and Upadhyay.
4. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
5. GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition.
6. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.

**SEMESTER-III**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 230 | Industry Standard Coding Practice 1 | C | 0 | 0 | 4 | 1 |

**UNIT I**
Problem Solving with - Basic coding practices, Expression Evaluation, Operators Usage, Expressions, Control Structures, Loop & Iterations for all test case scenarios.

**UNIT II**
Problem Solving using time efficient logics, linear list data, Array problems, 2D Arrays and Matrix Data for all test case scenarios.

**UNIT III**
Problem Solving with - Pointers & Memory referencing, String Handling, functions for all test case scenarios.

**UNIT IV**
Problem Solving with - parameter passing, Recursions, Recursion Analysis, Structures and unions, Enumerations & Memory allocation for all test case scenarios.

**UNIT V**
Problem solving with - String manipulations. Lists, display patterns, strings, matrix, tuples, dictionaries, modules, packages, exception handling using Python.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Problem solving with C++ -9e- Walter Savitch – Pearson.
2. The complete Reference C, Fourth Edition – Herbert Schildt – MC Graw Hill.
3. Programming in Python 3, A complete introduction to Python language - 2e - Mark Summerfield – Addison-Wiley.

# SEMESTER-IV

**SEMESTER-IV**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 201 | Concrete Technology | C | 3 | 0 | 2 | 4 |

**UNIT I: OVERVIEW OF CONCRETE AND CONSTRUCTION MATERIALS**
Nature and advantages of concrete, Overview of various construction materials, Overview of Cement, Overview of fine and coarse aggregates, Properties of water, Role of chemical and mineral admixtures.

**UNIT II: CEMENT**
Manufacture and composition of cement, Modified portland cements, Specifications and tests for portland cements, Chemistry of hydration, Properties of hydration products, Microstructure and properties of hydrated cement paste, Blended cements, fly ash and slag, Effect of fly ash and slag on properties of fresh and hardened concrete.

**UNIT III: WATER, AGGREGATES AND ADMIXTURE**
Water quality, Classifications and properties of aggregates, Non standard aggregates, Use of chemical admixture, Water reducing admixture, Admixture for set control.

**UNIT IV: PROPERTIES OF CONCRETE, CURING CONDITIONS AND MIX DESIGN**
Workability and properties of fresh concrete, Factors influencing workability, setting of concrete and tests for fresh concrete, finishing of concrete and role of curing temperature, Tests for compressive strength, Quality assessment of concrete and other methodologies, Fundamentals of mix design, Mix design as per BIS Method.

**UNIT V: DURABILITY AND SPECIAL CONCRETES**
Permeability of concrete, Physical attack, Chemical attack-carbonation, Sulphate attack and chloride attack, High strength concrete, Self-compacting concretes, Lightweight concretes and other concretes.

**TEXT BOOKS**

1. Shetty, M. S., and Jain, A K., "Concrete Technology: Theory and Practice", 8th Edition, S,chand publications., New Delhi, 2019.
2. Nevelli, A.M., "Properties of Concrete", – 5th Ed, Prentice Hall Publishers, 2012.
3. Gambhir, M.L., "Concrete Technology", Tata Mc Graw Hill Publishers – 2012.

**REFERENCE BOOKS/OTHER READING MATERIAL**

1. Mindess, Sidney., Young, J.F., Darwin, D., "Concrete", Pearson Education, 2003.

**SEMESTER-IV**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 201 L | Concrete Technology Lab | C | 0 | 0 | 2 | 1 |

**I. PROPERTIES OF CEMENT**

1. Type of cement.
2. Setting behavior of cement.
3. Specific gravity and fineness of cement.
4. Soundness of cement.
5. Identification of grade cement.

**II. AGGREGATES**

6. Classification of aggregates.
7. Sieve analysis of fine aggregates.
8. Specific gravity, water absorption of fine aggregates.
9. Bulking and packing density of fine aggregates.
10. Sieve analysis of coarse aggregates.
11. Specific gravity, water absorption of coarse aggregates.
12. Flakiness and elongation index of aggregates.

**III. PROPERTIES OF FRESH CONCRETE**

13. Preparation of fresh concrete
14. Workability of concrete
15. Air content of concrete
16. Compaction factor of concrete
17. Flow table measurements

**IV. PROPERTIES OF HARDENED CONCRETE**

18. Preparation of concrete molds.
19. Density of concrete.
20. Strength of the concrete.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Properties of Concrete – AM Nevelli – 5th Ed, Prentice Hall Publishers, 2012.
2. Concrete Technology – M. S. Shetty – S Chand Co., Publishers – 2018.
3. Concrete Technology – M. L. Gambhir – Tata Mc Graw Hill Publishers – 2012.

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 210 | Structural Analysis | C | 3 | 0 | 0 | 3 |

### UNIT I: INTRODUCTION: REVIEW OF BASIC CONCEPTS IN MECHANICS
Introduction, Different types of structures, Loads on the structural system, Static Equilibrium, Constitutive Relations and Compatibility Conditions, Static Indeterminacy of Structures, Symmetry and Antisymmetry, Tutorial.

### UNIT II: ANALYSIS OF STATICALLY DETERMINATE STRUCTURES
Internal Force on a System, Review of Axial Force, Bending Moment and Shear Force Diagram, Analysis of Truss: Method of Joints, Analysis of Truss: Method of Sections, Examples, Tutorial.

### UNIT III: CABLES
Introduction to Cable systems, The General Cable Theorem, Application of the General Cable Theorem for Distributed Loading, Arches and suspension cables, three hinged arches and suspension cables, Examples, Tutorial.

### UNIT IV: DEFLECTION OF STRUCTURES
Moment Area Method, Conjugate Beam Method, Principle of Virtual Work, Strain Energy Method, Bending Deflection Due to Temperature Variation, Maxwell-Betti Law of Reciprocal Deflections, Examples, Tutorials.

### UNIT V: INFLUENCE LINES
Introduction: Variable Loadings, Construction of Influence Lines using Equilibrium Methods, Use of Influence Lines, Müller-Breslau Principle, Examples, Tutorial.

### TEXT BOOKS
1. R.C. Hibbeler, Structural Analysis, Pearson Education.

2. C.S. Reddy, Basic Structural Analysis, Tata McGraw Hill.
3. C.H. Norris, J.B. Wilbur, S.Utku, Elementary Structural Analysis, Tata McGraw Hill.

**REFERENCE BOOKS/OTHER READING MATERIAL**
1. L. S. Negi and R. S. Jangjid, Structural Analysis, Tata Mc. Graw.
2. D.S. Prakash Rao, Structural analysis: Unified approach, Universities Press.

**SEMESTER-IV**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 309 | Engineering Hydrology | C | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION**
Introduction: Hydrologic cycle, Water-budget equation, Applications in engineering, Sources of data
Precipitation: Forms of precipitation, characteristics of precipitation in India,
Measurement of precipitation, rain gauge network
Mean precipitation over an area
Depth-Area-Duration relationships
Depth-Duration-Frequency relationships
Probable maximum precipitation and rainfall data in India

**UNIT II: ABSTRACTIONS FROM PRECIPITATION**
Evaporation process,
Evaporimeters, analytical methods of evaporation estimation,
Reservoir evaporation and methods for its reduction,
Evapotranspiration, measurement of evapotranspiration,
Evapotranspiration equations,
Potential evapotranspiration over India and actual evapotranspiration,
Interception, depression storage,
Infiltration, infiltration capacity, measurement of infiltration,

**UNIT III: RUNOFF**

Runoff volume, SCS-CN method of estimating runoff volume,

Flow duration curve, flow-mass curve, Hydrograph, factors affecting runoff hydrograph,

Components of hydrograph,

Base flow separation,

Effective rainfall,

Unit hydrograph – applications and limitations

Unit hydrograph from direct runoff hydrograph

S-Hydrograph

Surface water resources of India, environmental flows.

**UNIT IV: GROUND WATER AND WELL HYDRAULICS**

---Ground water hydrology---

Occurrence, movement and distribution of ground water

Aquifers – Types, specific yield, permeability, Darcy's law

---Well hydraulics---

Steady state flow in wells,

Equilibrium equations for confined and unconfined aquifers, aquifer tests,

Well constants

**UNIT V: WATER REQUIREMENTS**

Crop water requirements:

Water withdrawals and uses –water for energy production,

Water for agriculture,

Water for hydroelectric generation; flood control.

Analysis of surface water supply, Water requirement of Crops-Crops and crop seasons in India,

Cropping pattern, duty and delta;

Quality of irrigation water; Soil-water relationships, root zone soil water,

Infiltration, consumptive use, irrigation requirement, frequency of irrigation;

Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation

**UNIT VI: DESIGN OF CANALS**

Distribution systems -canal systems, alignment of canals, canal losses,

Estimation of design discharge.

Design of channels-rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels.

Lining of canals, types of lining

**TEXTBOOKS**

1. K. Subramanya, Hydrology (Tata Mc Graw Hill Education).
2. S. K. Garg, Irrigation engineering and hydraulic structures (Khanna publishers).
3. V.P. Singh, Elements of Engineering Hydrology (Tata Mc Graw Hill Education).
4. Jaya Rami Reddy,

5. K.N. Duggal and J.P. Soni, Elements of Water Resources Engineering (New age international)
6. K. Subramanya, Flow in open channels (Tata McGraw-Hill Education)

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 211 L | Surveying Lab - II | C | 3 | 0 | 0 | 3 |

**LIST OF PRACTICAL EXPERIMENTS**
**Theodolite**
1. Introduction to Advanced Surveying Laboratory- Electronic Theodolite & Total Station.
2. Study of Theodolite in detail-practice for measurement of horizontal and vertical angles .
3. Measurement of horizontal angles by repetition method.
4. Measurement of horizontal angles by Reiteration method.
5. Trigonometric leveling-heights and distance problem.
6. Heights and distance using principles of Tachometric surveying.
7. Measurement of Vertical heights.
8. Setting out works for buildings & pipe lines.

**Total Station**
11. Determine of area using Total Station
12. Traversing by Total Station
13. Contouring using Total Station
14. Determination of Remote height using total station
15. Stake out using total station
16. Measurement of Distance, gradient, difference in height between two inaccessible points using total station
17. Curve Setting and different methods
18. Setting out works for buildings & pipe lines
19. Position Fixing Using Global Positioning System (GPS) in the field

**Resistivity meter**

20. Measurement of Resistance of Sub-surface formations by Wenner's method.

21.Measurement of Resistance of Sub-surface formations by Schlumberger method.

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 221 | Probability & Statistics for Engineers | BS | 3 | 0 | 0 | 3 |

**UNIT I**

Basic principle of counting, permutations, combinations, Multinomial coefficients, sample space and events, Axioms of probability, sample spaces having equally likely outcomes, Conditional probability, Bayes` theorem, independent events.

**UNIT II**

Random variable, discrete random variable, expected value, expectation of a function of a random variable, variance, discrete probability distributions- Bernoulli, Binomial, Poisson, Geometric, negative, Binomial distributions, expected value of sums of random variables, cumulative distribution function and its    properties.

**UNIT III**

Continuous random variables, Expectation and variance – their properties, Continuous probability distributions – uniform, normal, exponential distributions, Distribution functions.

**UNIT IV**

Joint distribution functions, Independent random variables and their sums, conditional distributions, Joint probability distribution of functions of random variables, covariance, correlation

**UNIT V**
Definition of statistics, population and sample, Representative sample, Descriptive statistics – classification and tabulation of univariate data, Graphical representation, frequency curves

**TEXTBOOKS**
1. Sheldon Ross, A First course in probability (Ninth edition).

**REFERENCE BOOKS**
1. Michael Baron, Probability and Statistics for computer scientists.

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 209 L | Fluid Mechanics and Hydraulic Machinery Lab | C | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**

1. Determination of fluid properties

a) Density

b) Viscosity

2. Pressure measurements

 a.) U-tube manometer

3. Verification of Bernoulli's theorem

4. Find the coefficient of discharge of

 a) Rectangular notch

b) Triangular notch

 5. Find the coefficient of discharge of
  a) Venturimeter

b) Orificemeter
6. Determination of hydraulic co-efficient of orifices
7. Co-efficient of discharge for a given mouthpiece
8. Stability of floating body and determination of Metacentric height.
9. Determine the friction losses: straight pipes, bends, sudden expansion and contraction, smooth vs rough pipe.
10. Determination on Reynold's number.
11. Determination of velocity using a pitot tube.

**TEXTBOOKS**

1. S K Som, G Biswas, Suman Chakraborty, Introduction to Fluid Mechanics and Fluid machines, Tata McGraw Hill Education.

2. R. W. Fox, P. J.Pritchard, A. T Mcdonald, Introduction to Fluid Mechanics, John Wiley

3. F. M White, Fluid Mechanics, Tata McGraw Hill Education.

**REFERENCE BOOKS/OTHER READING MATERIAL**

4. K. Subramanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill Publishing Company.

5. R. K. Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 205 | Geotechnical Engineering I | C | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION AND CLASSIFICATION**
Introduction to soil formation; soil structure and clay mineralogy; Adsorbed water; Basic Definitions and Relationships-Soil as three-phase system, Mass-volume relationships; Relative density; Determination of Moisture content; Specific gravity; Unit weight; Physical characterization of soil, Grain size analysis-dry& wet conditions; Consistency limits, Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

**UNIT II: SEEPAGE AND PERMEABILITY**
Introduction, one dimensioned flow of water through soils Darcy's law and its validity, Laboratory permeability tests, Factors affecting permeability, Permeability of stratified soil masses, Seepage through soils, Quick condition, Flow nets.

**UNIT III: STRESSES IN SOILS**
Stresses in soils; Stresses induced by applied loads, Boussinesq's and Westergaard's theories for point loads and area loads, Newmark's influence chart; 2:1 stress distribution method, Contact pressure under rigid and flexible area, Computation of displacements from elastic theory.

**UNIT IV: COMPACTION AND CONSOLIDATION**

Mechanism of compaction; factors affecting, Laboratory and field compaction methods, Compressibility of soils; Stress history, Concept of consolidation by spring analogy, Terzaghi's theory of one-dimensional Consolidation; Time rate of consolidation and degree of consolidation, Determination of coefficient of consolidation, Over consolidated and normally consolidated clays.

**UNIT V: SHEAR STRENGTH OF SOILS**

Shear strength of soils; Principal planes; Mohr – Coulomb Failure theories, Stress strain behavior of sands and clays; Critical void ratio, Shear strength determination – UCS, Shear box test, Triaxial – UU, CU, CD, Vane shear test.

**TEXTBOOKS**

1. Principles of Geotechnical Engineering, Braja M. Das, Cengage Learning.
2. Basic and Applied Soil Mechanics, Gopal Ranjan and A. S. R. Rao, New Age International Publishers.

**REFERENCE BOOKS**

1. An Introduction to Geotechnical Engineering, Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ.
2. Soil Mechanics, Craig R.F., Chapman & Hall.
3. Fundamentals of Soil Engineering, Taylor, John Wiley & Sons.
4. Soil Mechanics in Engineering Practice, Karl Terzaghi, Ralph B. Peck, and Gholamreza.

### SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 202 | Industry Specific Employability Skills IV | C | 1 | 1 | 0 | 1 |

**UNIT I**

Permutation and Combination, Probability, Geometry, and Algebra.

**UNIT II**

Clocks, Calendars and Blood Relations, Arrangements, Cubes and Syllogism.

**UNIT III: CRITICAL REASONING**

Introduction to Different Parts of an Argument in Reasoning, Assumption of an Argument, strengthening of an Argument, Weakening of an argument, **Para** jumbles.

**UNIT IV VERBAL REASONING**

Word Analogy, Sentence Completion & Text Completion, Sentence Equivalence.

**UNIT V**

Reading Comprehension, Identification of errors, Sentence correction.

**TEXT BOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Arun Sharma – How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. RsAgarwal,A Modern Approach to Verbal and Non Verbal Reasoning,S.Chand Publications.
3. Verbal Ability and Reading comprehension-Sharma and Upadhyay.
4. Manhattan GMAT Sentence Correction Guide, 5th Edition.
5. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning. S.Chand Publications.
6. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.

## SEMESTER-IV

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 330 | Industry Standard Coding Practice -2 | ES | 0 | 0 | 4 | 1 |

**UNIT I**
Problems Solving with: Structure Pointers, formation of links, Operations on Linked lists, Operations on a circular linked list, Operations on a double linked list & Industry Standard Practice Questions.

**UNIT II**
Problem Solving with - Stack Operations, Queue data structure Implementation, Linear / Binary Search Algorithms, Sorting Algorithms, Industry Standard Practice Questions.

**UNIT III**
Problem Solving with - Nonlinear data structures, trees operations, application of search property on a binary tree, tree balancing.

**UNIT IV**
Problem Solving with - Multiway search structures, Operations on a 2-4 tree, nonlinear structures, red, black trees & operations, Tries, String Algorithms & Industry Standard Practice Questions.

**UNIT V**

Problem Solving with – features of Object-oriented programming, leveraging Standard Template Libraries. Industry Standards of leveraging DBMS concepts, SQL Queries, Entity Relationship Models, Query Optimization, Transactions & Concurrency, Normalization & Industry Standard Practice Questions.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**

1. Fundamentals of Data Structures in C++ - 2e- Sahni Horowitz - Universities Press.
2. Algorithms -4e- Robert Sedgewick & Kevin Wayne - Addison-Wesley Professional.
3. C++ Standard Library A Tutorial and Reference – 2e - Nicolai M. Josuttis - Addison Wesley Longman.
4. An Introduction to Database Systems – 8e - C.J. Date – Pearson.
5. Competitive Programming – 3e – Steven Halim, Felix Halim.

# SEMESTER-V

**SEMESTER-V**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 202 | Reinforced Concrete Design | C | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION OF RCC MATERIALS**

Review of Concrete making materials, Structural concrete Grades, Properties of Concrete, Modulus of elasticity-flexural strength, Characteristic and Design values, Partial safety factor.

**UNIT II: DESIGN OF BEAMS**

RCC- Limit State method- Assumptions, Stress-Strain behavior of Steel and Concrete, Working stress method- comparison of design process, Analysis and Design of Singly Reinforced Beams, Analysis of Singly Reinforced RC Section- Neutral axis-Balanced-Under Reinforced-Over Reinforced Sections- Moment of Resistance- Design parameters, Design examples, Analysis and Design of Doubly Reinforced Beams, Necessity of Doubly Reinforced sections, Analysis of Doubly Reinforced RC Section-Moment of Resistance, Design parameters and design Examples.

## UNIT III: DESIGN OF SLABS
Design of One-way slab, Design of Two-way slabs, Effect of edge conditions- Moment of Resistance-Torsion reinforcement at corners, Design examples, Design of Continuous Slab/Beam, Effect of continuity- analysis of continuous beam/slab, Moment and shear coefficients for continuous beam/slab-Critical sections.

## UNIT IV: DESIGN OF COLUMNS
Design principles of RC columns, Assumptions- Rectangular and Circular columns- Helical reinforcement, Minimum Eccentricity-Use of Interaction diagrams for Axial load and Moment.

## UNIT V: DESIGN OF FOOTINGS
RC footings, Minimum depth of footing, Safe bearing capacity, Design for Bending-Shear in One way, Shear in Two way- Transfer of load at base of column.

## TEXTBOOKS
1. IS-456-2000, IS 3370(Part-IV), BIS 2000.
2. Reinforced Concrete Design- S Unnikrishna Pillai and Devdas Menon
3. Design of Reinforced Concrete Structures (Limit State) – A.K.Jain, 1st Edition, Nemchand Brothers, Roorkee.
4. RCC Designs-B.C.Pummia, A.K.Jain and A.K.Jain, 10th edition Lakshmi Publications Ltd, New Delhi.

## SEMESTER-V

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 302 | Geotechnical Engineering - II | C | 3 | 0 | 0 | 3 |

## UNIT I: SLOPE STABILITY
Infinite and finite earth slopes in sand and clay, Types of failures – factor of safety of infinite slopes, stability analysis by Swedish arc method, standard method of slices, Taylor's Stability Number-Stability of slopes of dams and embankments – different conditions.

## UNIT II: LATERAL EARTH PRESSURES & RETAINING WALLS
Rankine's & Coulomb's theory of earth pressure, Culmann's graphical method – earth pressures in layered soils, Types of retaining walls, Design approach for gravity retaining wall, cantilever retaining wall, bulk heads, anchored bulk heads.

## UNIT III: SHALLOW FOUNDATIONS

Types of foundations and factors to be considered in their location, Bearing capacity – criteria for determination of bearing capacity, Factors influencing bearing capacity – analytical methods to determine bearing capacity, Terzaghi's theory - IS Methods, Safe bearing pressure based on N- value – allowable bearing pressure; Safe bearing capacity and settlement from plate load test.

## UNIT IV: DEEP FOUNDATIONS

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, Types – Different shapes of well, Types of caissons – Components of well - functions – forces acting on well foundations, Design Criteria – Determination of steining thickness and plug - construction and Sinking of wells – Tilt and shift.

## UNIT V: SOIL EXPLORATION

Need – Methods of soil exploration, Boring and Sampling methods, Field tests – Penetration Tests – Pressure meter, Planning of programme and preparation of soil investigation report.

## SEMESTER-V

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 302 L | Geotechnical Engineering Lab | C | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIEMENTS**

**1. Consistency Limits**
Liquid limit, Plastic limit, Shrinkage limit.

**2. Soil Gradation**
Sieve analysis, Hydrometer analysis

**3. Specific Gravity**
Density bottle method, Pycnometer method

**4. Unit Weight**
Determination of Unit Weight by Core cutter Method, Determination of Unit Weight by Sand Replacement Method, Relative Density by Vibration Table Test.

**5. Compaction**
Standard Proctor Compaction, Modified Proctor Compaction

**6. Hydraulic Conductivity**
Constant Head Permeability Test, Falling Head Permeability Test

**7. Consolidation**

**8. Strength Tests**
Unconfined Compressive Strength (UCS), Unconsolidated Undrained Triaxial Test, (UU), Laboratory Vane Shear Test,Direct Shear Test,California Bearing Ratio Test (CBR)

**REFERENCE BOOKS**
1. Experimental Soil Mechanics, Jean P. Bardet, Prentice Hall Publishers.
2. Soil Mechanics Laboratory Manual, Braja M. Das, 6th Ed., Oxford University Press.
3. Soil Mechanics Lab Manual, Michael E. Kalinski, 2nd Ed., Wiley Publishers.

**SEMESTER-V**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 306 | Water Resources Engineering | C | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION**
Introduction: Hydrologic cycle, Water-budget equation, Applications in engineering, Sources of data, Precipitation: Forms of precipitation, characteristics of precipitation in India, Measurement of precipitation, rain gauge network, Mean precipitation over an area Depth-Area-Duration relationships, Depth-Duration-Frequency relationships, Probable maximum precipitation and rainfall data in India.

**UNIT II: ABSTRACTIONS FROM PRECIPITATION**

Evaporation process, Evaporimeters, analytical methods of evaporation estimation, Reservoir evaporation and methods for its reduction, Evapotranspiration, measurement of evapotranspiration, Evapotranspiration equations, Potential evapotranspiration over India and actual evapotranspiration, Interception, depression storage, Infiltration, infiltration capacity, measurement of infiltration.

## UNIT III: RUNOFF
Runoff volume, SCS-CN method of estimating runoff volume, Flow duration curve, flow-mass curve, Hydrograph, factors affecting runoff hydrograph, Components of hydrograph,
Base flow separation, Effective rainfall, Unit hydrograph – applications and limitations Unit hydrograph from direct runoff hydrograph, S-Hydrograph, Surface water resources of India, environmental flows.

## UNIT IV: GROUND WATER AND WELL HYDRAULICS
---Ground water hydrology---
Occurrence, movement and distribution of ground water, Aquifers – Types, specific yield, permeability, Darcy's law, ---Well hydraulics---, Steady state flow in wells, Equilibrium equations for confined and unconfined aquifers, aquifer tests, Well constants

## UNIT V: WATER REQUIREMENTS
Crop water requirements: Water withdrawals and uses –water for energy production,
Water for agriculture, Water for hydroelectric generation; flood control.Analysis of surface water supply, Water requirement of Crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, Infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

## UNIT VI: DESIGN OF CANALS
Distribution systems -canal systems, alignment of canals, canal losses,
Estimation of design discharge.
Design of channels-rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels.
Lining of canals, types of lining

### TEXTBOOKS
1. K. Subramanya, Hydrology (Tata Mc Graw Hill Education).
2. S. K. Garg, Irrigation engineering and hydraulic structures (Khanna publishers).
3. V.P. Singh, Elements of Engineering Hydrology (Tata Mc Graw Hill Education).
4. Jaya Rami Reddy, Engineering Hydrology.

### REFERENCE BOOKS/OTHER READING MATERIAL
5. K.N. Duggal and J.P. Soni, Elements of Water Resources Engineering (New age international)
6. K. Subramanya, Flow in open channels (Tata McGraw-Hill Education)

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 207 | Transportation Engineering - I | C | 3 | 0 | 0 | 3 |

**UNIT I: HIGHWAY NETWORK PLANNING AND ALIGNMENT**
Transportation and Society, Transportation Modes, Road Classification and Patterns, Road Development plans**,** Highway Alignment Requirements, factors controlling alignment**,** Engineering Surveys**,** Detailed Project Report.

**UNIT II: HIGHWAY GEOMETRIC DESIGN**
Highway Cross Section Elements, Sight Distance characteristics of highways, Numerical Problems**,**

Design of Horizontal Alignment- Super elevation and transition curves, Numerical Problems, Extra widening, Numerical Problems, Extra widening, Numerical Problems, Design of Vertical Alignment- Grades and Grade Compensation, Numerical Problems, Types of vertical curves and design. Numerical Problems.

**UNIT III: TRAFFIC FLOW CHARACTERISTICS AND DESIGN OF INTERSECTIONS**
Road User and Vehicle Characteristics, Traffic Studies: Volume, speed, Traffic Studies: Travel time and delay, parking study, Traffic Stream Characteristics, PCU and Peak Hour Factor, Traffic Stream Characteristics, PCU and Peak Hour Factor, Capacity and Level of Service of Highways, Design of Traffic Control Devices, Signal Design by Webster's Method, Design of Roundabouts- IRC and HCM methods.

**UNIT IV: PAVEMENT MATERIALS, TESTING AND DESIGN OF PAVEMENTS**
Highway materials - desirable properties and quality control tests, Marshal Method of Bituminous Mix Design, Types of Pavement Structures, Factors Controlling Design of Pavements, Stresses in Pavements, Design of Flexible Pavements- IRC and AASHTO Method of Design, Design of Rigid Pavements- IRC and AASHTO Method of Design.

**UNIT V: HIGHWAY CONSTRUCTION AND MAINTENANCE**
Construction Procedure for various layers of flexible pavements, Construction Procedure for various layers of rigid pavements, Distresses in flexible and Rigid Pavements, Maintenance of bituminous and concrete pavements.

**TEXTBOOKS**
1. Fred L. Mannering, Scott S.Washburn and Walter P.Kilareski, Principles of Highway Engineering and Traffic Analysis, Wiley India.
2. Partha Chakraborty and Animesh Das, Principles of Transportation Engineering, Prentic Hall India.
3. S. K. Khanna., C. E. G. Justo and A. Veeraragavan, Highway Engineering- Nem Chand Bros, India.

**REFERENCE BOOKS/OTHER READING MATERIAL**
1. Ministry of Road Transport and Highways- Specifications for Roads and Bridge Works, Fifth Revision, IRC, New Delhi, India-2013.
2. IRC 37:2012- Guidelines for the Design of Flexible Pavements.
3. IRC 58:2015- Guidelines for the Design of Plain Jointed Rigid Pavements for Highways.
4. Highway Capacity Manual (2010), Transportation Research Board, USA
5. Indian Highway Capacity Manual (2017), Central Road research institute, New Delhi.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 308 | Environmental Engineering | C | 3 | 0 | 0 | 3 |

**UNIT I: WATER**

Introduction: Water supply and demand, Population forecasts, Design period, Types of water demand, Factors affecting, fluctuations, fire demand, Water quality and testing, Drinking water standards, sources of water.

## UNIT II: WATER TREATMENT

General outline of water treatment units, Screens – design, Sedimentation – principles, design factors, Coagulation-flocculation clarifier design, Coagulants, feeding arrangements.

Filtration – theory – working of slow and rapid gravity filters, Design of filters, Operational troubles, Disinfection – theory of chlorination, Chlorine demand and other disinfection, practices, Water softening methods, Design of distribution systems, pipe appurtenances.

Analysis of pipe networks.

## UNIT III: SANITARY ENGINEERING

Characteristics of sewage, wastewater collection, Estimation of wastewater and storm water, Design of sewers – shapes and materials, Sewer appurtenances, manholes – inverted siphon – catch basins – flushing tanks.

## UNIT IV: OTHER POLLUTIONS AND THEIR IMPORTANCE

Module 1--

Air pollution – Composition and properties of air, quantification of air pollutants, Classification of air pollution– Effects of air pollution,

Global effects–Meteorological parameters affecting air pollution, Air quality standards

Atmospheric stability–Plume behavior

--Module 2—

Noise pollution – Basic concept, Measurement and various control methods.

## TEXTBOOKS

1. S.K. Garg, Water Supply Engineering: Environmental Engineering (Volume 1).
2. S.K. Garg, Environmental Engineering : Sewage Disposal and Air Pollution Engineering (Volume - 2).
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous , Environmental Engineering.
4. B.C. Punmia and Ashok Kumar Jain, Wastewater Engineering (Including Air Pollution).

## SEMESTER-V

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 207 L | Transportation Engineering Lab | C | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**

**TESTS ON AGGREGATES**

Aggregate crushing value test, Aggregate impact value test, Los Angele's abrasion test, Shape tests, Gradation of aggregate, Specific gravity test.

**TESTS ON BITUMEN**
Penetration test, Softening point test, Flash and fire point test, Ductility test, Viscosity test.

**TRAFFIC STUDIES**
Traffic Volume Counts, Traffic Turning Movement Counts, Traffic Spot Speed Study.

**TESTS ON BITUMINOUS MIXES**
Bituminous Mix Design, Proportioning of Aggregates, Proportioning of Aggregates, Bulk Density and Stability Flow tests, Binder Content Determination.

**PAVEMENT DESIGN**
Pavement Design, Soil CBR Test, Pavement Design (IRC 37 -2012)

**TEXTBOOKS**
1. Highway Materials And Pavement Testing by S. K. Khanna, C. E. G. Justo, A. Veeraragavan; Nem Chand & Bros

**REFERENCE BOOKS/OTHER READING MATERIAL**
2. Bituminous Road Construction in India by Prithvi Singh Kandhal; PHI Learning; Revised edition (30 July 2016)
3. S. K. Khanna., C. E. G. Justo and A. Veeraragavan, Highway Engineering- Nem Chand Bros, India.
4. IRC 37:2012- Guidelines for the Design of Flexible Pavements.

**SEMESTER-V**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 301 | Industry Specific Employability Skills V | HS | 1 | 1 | 0 | 0 |

**UNIT I: NUMBERS**
Types and Properties of Numbers and Remainders, LCM, GCD, Fractions and decimals, Surds and Progressions.

**UNIT II**
Permutations, Combinations and Probability**,** Data Interpretation**.**

**UNIT III**
Geometry and Coordinate Geometry**,** Trigonometry and Mensuration**.**

**UNIT IV: REASONING**
Syllogism and Non-Verbal Reasoning**,** Analytical Reasoning.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Arun Sharma – How to prepare for Quantitative Aptitude, Tata Mcgraw Hill.
2. R.S Agarwal, A Modern Approach to Verbal and Non Verbal Reasoning, S.Chand Publications.
3. Arun Sharma– How to Prepare for Data Interpretation & Logical Reasoning for the CAT.

**SEMESTER-V**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CSE 331 | Industry Standard Coding Practice -3 | ES | 0 | 0 | 4 | 1 |

**UNIT I**
Problem solving with - Descriptive statistics, Mean/median/mode, Measures of dispersion/range variance, deviations, mean/median/mode problems, Random variables, Univariate & Bivariate random variables.

**UNIT II**
Problem solving with - Graphs, Handshaking Lemma, Simple Graphs, DFS/BFS, Connected components, coloring, Introduction to DAGs, Spanning Trees, Articulation Points/ Connected points.

**UNIT III**
Problem solving with - Greedy Methods: Coin change, Fractional Knapsack, Activity Selections/ Job sequencing with Deadlines, Spanning Trees, Dynamic Programming: 0/1 Knapsack, Substructures, Longest common substring/subsequence, Longest Increasing sub sequence, Grid based Problems.

**UNIT IV**
Problem solving with - Divide & Conquer Strategies: Quick/Merge Sort, Min/Power functions, Backtracking, N Queens problem, Finding the path & Grid based problems, iterative/loop free approaches.

**UNIT V**
R Language Constructs, calculations, Operators, vectors, lists, Practice problems implementing R language, Matrices and data frame, Conditional statements and loops, Problem Solving on R language examples

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. An Introduction to Statistical Learning: with Applications in R - Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.
2. Introduction to Algorithms by Thomas H. Corman, The MIT Press, 3rd Edition.
3. Introduction to Algorithms: A Creative Approach by Udi Mander, Pearson
4. R Cookbook - Paul Teetor, O'reilly.
5. Competitive Programming – 3e – Steven Halim, Felix Halim.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 310 | Estimation and Costing | C | 3 | 0 | 0 | 3 |

**UNIT I: ESTIMATION PROCEDURES**
Procedure of estimating, Main items of work, Deduction for openings, Degree of accuracy, Arch Masonry Calculation.

**UNIT II: BUILDING ESTIMATION**
Individual wall method, Centre line method, Estimate of RCC slab, Estimate of RCC beam, RCC column with foundation, Estimate of earthwork – Buildings, Estimate of earthwork – Roads and Canals.

**UNIT III: SPECIFICATIONS AND ANALYSIS OF RATES**
Purpose and method of writing specifications, Detailed specifications (DS) for Brick work, DS for R.C.C. Plastering and Mosaic Flooring, DS for R.R Stone and Masonry, Preparing Analysis of rates for Concrete, Preparing Analysis of rates for RCC Works, Preparing Analysis of rates for Brick work in foundation and super structure, Preparing Analysis of rates for Plastering preparing lead statements.

**UNIT IV: PWD ACCOUNTS AND PROCEDURE OF WORKS**
Organization of Engineering department; Work charged establishment, Contract; Tender; Tender notice; Tender Schedule, Earnest money; Security money, Measurement book; Administrative approval; Technical sanction; Plinth area; Floor Area;Carpet area, Approximate Estimate; Plinth area estimate, Revised Estimate; Supplementary estimate,
Annual budgets of work, cash flow allocations yearly.

**UNIT V: VALUATION AND CONTRACTS**
TF Accounts of Materials USR Cost; Price & value, Methods of valuation; Out goings; Depreciation, Methods of valuation; Out goings; Depreciation, Methods of valuation; Out goings; Depreciation, Contract: types of contracts, Contract Law, EMD, Tenders, Acceptance of Contract, Branch of Contract.

**TEXTBOOKS**
1. Estimating and Costing in Civil Engineering (Theory & Practice) by B.N. Dutta; 28th Revised Edition or Latest; UBS Publishers' Distributors Ltd.
2. Estimating, Costing, Specification & Valuation in Civil Engineering by M. Chakraborti, 29th Revised Edition or Latest; S Chand Publishing House.

**REFERENCE BOOKS/OTHER READING MATERIAL**
1. Estimating, Costing, and Valuation [Professional Practice and Quantity Surveying] by Rangawala; 17th Edition or Latest; Charotar Publishing House Pvt. Ltd.
2. A Text Book of Estimating and Costing for Civil Engineering by G.S. Birdie; 6th Edition or Latest; Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi

3. A Textbook of Estimating, Costing & Accounts (Civil) by R.C. Kohli; 13th Revised Edition or Latest; S. Chand & Company Pvt. Ltd. New Delhi.

## SEMESTER-V

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 401 | Design of Steel Structures | C | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION AND METHODS OF STRUCTURAL DESIGN**
Mechanical behaviour of steel – Measures of Yielding – Measures of Ductility, Types of Structures – Structural Steel Sections, Design Philosophies-Working Stress method- Ultimate Strength Method-Load and Resistant factor- Limit State Method-Partial safety factor-Load-Load Combinations-Classification of Cross sections- General aspects in the design.

**UNIT II: DESIGN OF STEEL FASTENERS AND TENSION MEMBERS**
Types of fasteners – Riveted connections- Bolted Connections-Assumptions- Failure of bolted joints - Strength of bolted joints – Design examples, Design of Welded connections – Butt weld- fillet weld – Design examples, Design of Tension Members: General-Modes of Failure of Tension member-Analysis of Tension members- Example - Design steps – Design examples – Lug angles – Design.

**UNIT III: DESIGN OF COMPRESSION MEMBERS**
General – Strength of Compression members- Design Compressive strength- Example on analysis of Compression members, Design of Angle struts – Design Examples- Built up Columns- Design of Lacing – Design of Battens- Design Examples- Design of Roof members.

**UNIT IV: DESIGN OF BEAM AND COLUMN SPLICES**
Design of Beams: General- Lateral Stability of Beams- Bending Strength of Beams –Plastic Section Modulus - Design Examples, Design of Beam Columns: Behaviour of members under combined loading – Modes of Failures – Design Examples, Design of Column Splices and Column Base: Design of Column Splice-Design Examples- Design of Column Base- Slab Base- Gusseted Base- Design Examples.

**UNIT V: DESIGN OF ECCENTRIC CONNECTIONS AND PLATE GIRDER**
Design of Eccentric Connections: Design of Brackets- Type-1 and Type 2 – Moment
Resistant connections - Design Examples, Design of Plate Girder: General- Components of Plate Girder- Optimum depth – Bending Strength – Shear Strength – Shear Buckling- Simple Post critical method- Tension Field method- Stiffeners-Bearing- Transverse stiffeners - Design Examples.

**TEXTBOOKS**
1. Limit State Design of Steel Structures – S.K.Duggal, TMH Education Pvt Ltd, 2nd Edition,2014.

2. IS-800-2007, BIS Publication.
3. Design of Steel structures – S.S. Bhavikatti, IK International Pub Pvt Ltd, 4th Edition.

**REFERENCE BOOKS/OTHER READING MATERIAL**

4. Mindess, Sidney., Young, J.F., Darwin, D., "Concrete", Pearson Education, 2003.
5. RCC Designs-B.C.Pummia, A.K.Jain and A.K.Jain, 10th edition Lakshmi Publications Ltd, New Delhi.

# SEMESTER-VI

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 308 L | Environmental Engineering Lab | C | 3 | 0 | 0 | 3 |

**LIST OF PRACTICAL EXPERIMENTS**
1. Determination of pH
2. Determination of acidity and alkalinity
3. Total solids in a water sample
4. Conductivity of a water sample
5. Determination of hardness of water
6. Determination of turbidity
7. Chlorine demand of water
8. Dissolved oxygen
9. Biological oxygen demand
10. Optimum dosage of alum using jar test
11. Chemical oxygen demand
12. Total coliforms (using multiple tube fermentation technique)
13. Air quality monitoring

**TEXTBOOKS**
1. S.K. Garg, Water Supply Engineering: Environmental Engineering (Volume 1).
2. S.K. Garg, Environmental Engineering : Sewage Disposal and Air Pollution Engineering (Volume - 2).
3. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous , Environmental Engineering.
4. B.C. Punmia and Ashok Kumar Jain, Wastewater Engineering (Including Air Pollution).

**REFERENCE BOOKS/OTHER READING MATERIAL:**
1. MetCalf & Eddy, Wastewater Engineering Treatment and Reuse.

**SEMESTER-VI**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 303 | Construction Engineering and Management | C | 3 | 0 | 0 | 3 |

**UNIT I: BASICS OF CONSTRUCTION**
Definition, introduction and Basics of Construction, Unique features of construction, Construction projects types and features, Phases of a project, Agencies involved and their methods of execution.

**UNIT II: CONSTRUCTION PROJECT PLANNING**
Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, Co Role of client and contractor, Process of development of plans and schedules, hoI work break-down structure, activity lists, assessment of work content, concept of productivities, Ho estimating durations, sequence of activities and utility data; Techniques of planning- Bar charts, Gantt Charts, Co Networks: the terminology, types, relationships, preparation of CPM networks: PERT analysis.

**UNIT III: CONSTRUCTION METHODS BASICS**
The Types of foundations and construction methods; Basics of Formwork and Staging;
Common building construction methods, Modular construction methods for repetitive works, Uti Precast concrete construction methods, Ut Basic construction methods for steel structures; Basics of construction methods for Bridges.

**UNIT IV: CONSTRUCTION EQUIPMENT BASICS**
Conventional construction methods Vs Mechanized methods and advantages, Equipment for Earthmoving, Dewatering, Equipment for Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

**UNIT V: PLANNING AND ORGANIZING CONSTRUCTION SITE AND RESOURCES**
site layout including enabling structures, developing site organization, Documentation at site, Manpower: planning, organizing, staffing, motivation, Materials: concepts of planning, procurement and inventory control, Pe Equipment: basic concepts of planning and organizing, Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value, Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and levelling. Common Good Practices in Construction.

**UNIT VI: PROJECT MONITORING & CONTROL**
Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans, B Basics of Modern Project management systems such as Lean Construction; Use of Building

Information Modelling (BIM), Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control, Dd Safety, Health and Environment on project sites: accidents; their causes, effects and its preventive measures.

**UNIT VII:  CONTRACTS MANAGEMENT BASICS**
 Importance of contracts; Types of Contracts, parties to a contract, Gg Common contract clauses (Notice to proceed, rights and duties, Dd Contract Duration and Price, Dd Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Dd Dispute Resolution methods.  Acts and Rules.

**UNIT VIII: CONSTRUCTION COSTS**.
Dd Make-up of construction costs; Dd Classification of costs, Dd Time cost trade-off in construction projects, compression and decompression.

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
3. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
4. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
6. Chudley, R., Construction Technology, ELBS Publishers, 2007.
**7.** National Building Code, Bureau of Indian Standards, New Delhi, 2017**.**

**SEMESTER-VI**

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ISES 302 | Industry Specific Employability Skills VI | HS | 1 | 1 | 0 | 0 |

**UNIT I**
Antonyms, synonyms, odd words, Idioms and phrasal verbs, same word with different part of speech, Word analogy. Sentence completion.

**UNIT II**
Text completion, Sentence equivalence, Introduction to Different Parts of an Argument in Reasoning, Assumption of an Argument, strengthening of an Argument, Weakening of an argument.

**UNIT III**
Para jumbles, Sentence Completion & Text Completion, Reading Comprehension, Identification of errors, Sentence correction, Resume writing, Cover letter.

**UNIT IV**
GD, PI

**TEXTBOOKS/REFERENCE BOOKS/OTHER READING MATERIAL**
1. Verbal Ability and Reading comprehension-Sharma and Upadhyay.
2. Charles Harrington Elstor, Verbal Advantage: Ten Easy Steps to a Powerful Vocabulary, Large Print, September 2000.
3. GRE Word List 3861 – GRE Words for High Verbal Score, 2016 Edition.
4. The Official Guide to the GRE-General Revised Test, 2nd Edition, Mc Graw Hill Publication.
5. Soft Skills Training: A Workbook to Develop Skills for Employment Book by Frederick H. Wentz.
6. The Resume Writing Guide: A Step by Step Workbook for Writing ...Book by Lisa McGrimmon.

| Course Code | Course Name | Course Category | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 502 | Capstone Project | PR | 0 | 0 | 24 | 12 |

### Capstone Project Guidelines

**Introduction**

These guidelines are conceived as a set of procedures stating broad expectations from both students and mentors of the Capstone project which is part of the B.Tech Civil curriculum. These guidelines are intended to make the project work evaluation process easier, formal and more authentic. The Capstone Project is in 8th semester. The total number of credits offered for the capstone project is 12. The Capstone project has to be sufficiently complex and feasible so as to be considered for 12 credits. The evaluation of the project is done by a review panel comprising department faculty members and the review process is continuous. In the first review by the constituted panel, the project may be accepted or rejected or major/minor changes can be suggested.

**Project Selection**

Capstone project may be an in-campus project or can be mapped with internship carried out in the industry or the research internship carried out in the other premier Universities in India/Abroad.

**In campus project:** The idea for student's Project may be a proposal from a faculty member or student's own, or perhaps a combination of the two. The project has to be sufficiently complex and feasible. Students are advised to choose a project that involves a combination of sound background research, a solid implementation, or piece of theoretical work, and a thorough evaluation of the Project's output. Interdisciplinary Project proposals and innovative Projects are encouraged and more appreciable.

**Mapping with any Internship:**
1. Any type of internships can be carried out by the students in the 8th semester after getting the due approval from the Project coordinator and the Head of the department.
2. The internship period has to be a minimum of 10 weeks of duration in the semester and the students could have carried out the practical work for at least 180 hrs during this period.
3. The internship has to involve some Software/Hardware design and implementation component and/or research component and the complexity of this work is expected to match the requirements of Capstone Project work.

Mentor allocation process: Students can form a batch of 4 (5 may be allowed in exceptional cases on the discretion of the project coordinators) and select their mentor provided the Faculty member accepts them and the faculty member has less than the specified number projects under his/her mentorship.

Project Equipment**:** In case of deserving projects for limited financing of equipment, the students can

approach the concerned university authorities following due procedure.

<u>Meetings with Your Supervisor</u>**:**
Instructions to students: You must make sure that you arrange regular meetings with your Mentor. The meetings may be brief once your project is under way, but your Mentor needs to know that your work is progressing. You are also expected to be contactable throughout the project. You should inform the Mentor your contact details and keep these updated if these change.
Instructions to Mentors: Mentors are advised to maintain a project dairy depicting attendance of student and progress of project.

<u>Legal and Ethical Considerations</u>**:** If a student want to do some project with some company where their relatives or friends work, the details need to be disclosed to their mentor. The mentor has to report the same to the project coordinators for permission. Again, if a student doing internship with a company, the data, procedures/algorithms and software developed may be classified and may not be allowed to submit in the report. The students need to consider that before requesting mapping.

<u>Project Report format:</u> Format of the report is similar to the format of standard Journal papers published. (Abstract-Literature survey-Methodology-Algorithms-Simulation-Results-explanation of results-Future work etc)

<u>Project milestones and Assessment</u>
Starting date of the project to be taken as the commencement date of 8th semester. A student is expected to finish the project in the same semester. The students are expected to plan from the beginning for at least one research publication in a reputed journal.

**8<sup>th</sup> Semester:**

Stage 1: Title, Scope of the project and Literature survey to be submitted within 2 weeks from the commencement of the project. In the first review by the constituted panel, the project may be accepted or rejected or major/minor changes can be suggested.

Stage 2: Methodology, Requirement analysis and Deliverables to be submitted within 6 weeks from the commencement of the project.

Stage 3: Project design and implementation plan have to be submitted within 8 weeks of the commencement of the 8<sup>th</sup> semester. Internal review will be conducted by the Mentor and this review has a weightage of 50%.

Stage 4: Project (Software/Hardware) implementation to be done and demonstrate that the project meets the requirements and expectations.

Stage 5: The results need to be analysed and if any fine tuning required is to be done.

**Final evaluation:** by expert committee at the end of the 10<sup>th</sup> week and this evaluation has a weightage of 50%.

# OPEN ELECTIVES SEMESTER III

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 408 | Construction Materials | OE | 3 | 0 | 2 | 4 |

**UNIT I: OVERVIEW OF CONCRETE AND CONSTRUCTION MATERIALS**
Nature and advantages of concrete, Overview of various construction materials, Overview of Cement, Overview of fine and coarse aggregates, Properties of water, Role of chemical and mineral admixtures.

**UNIT II: CEMENT**
Manufacture and composition of cement, Modified portland cements, Specifications and tests for portland cements, Chemistry of hydration, Properties of hydration products, Microstructure and properties of hydrated cement paste, Blended cements, fly ash and slag, Effect of fly ash and slag on properties of fresh and hardened concrete.

**UNIT III: WATER, AGGREGATES AND ADMIXTURE**
Water quality, classifications and properties of aggregates, nonstandard aggregates **,** use of chemical admixture, water reducing admixture, admixture for set control.

**UNIT IV: PROPERTIES OF CONCRETE, CURING CONDITIONS AND MIX DESIGN**
Workability and properties of fresh concrete, Factors influencing workability, setting of concrete and tests for fresh concrete, Finishing of concrete and role of curing temperature, Tests for compressive strength, Quality assessment of concrete and other methodologies, Fundamentals of mix design, Mix design as per BIS Method.

**UNIT V: DURABILITY AND SPECIAL CONCRETES**
Permeability of concrete, Physical attack, Chemical attack-carbonation, Sulphate attack and chloride attack, High strength concrete, Self-compacting concretes, Lightweight concretes and other concretes.

**TEXT BOOKS**
  a. Shetty, M. S., and Jain, A K., "Concrete Technology: Theory and Practice", 8th Edition, S,chand publications., New Delhi, 2019.
  b. Nevelli, A.M., "Properties of Concrete", – 5th Ed, Prentice Hall Publishers, 2012.
  c. Gambhir, M.L., "Concrete Technology", Tata Mc Graw Hill Publishers – 2012.

**REFERENCE BOOKS/OTHER READING MATERIAL**
   a.   Mindess, Sidney., Young, J.F., Darwin, D., "Concrete", Pearson Education, 2003.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ECE 418 | Machine Learning | OE | 3 | 0 | 2 | 4 |

**UNIT I**
Introduction to machine learning, Supervised and Unsupervised Learning, Linear Regression, Logistic Regression, Generalized Linear Models.

**UNIT II**
Gaussian Discriminant Analysis (GDA), Naive Bayes, Support Vector Machines, K-Nearest Neighbor, Decision Trees, Random forest.

**UNIT III**
Clustering in Machine Learning, Different Types of Clustering Algorithm, K-Means Clustering, Gaussian Mixture Models, Bias-variance trade off.

**UNIT IV**
Introduction to Neural Networks, Feed-forward Network, Gradient descent optimization, Error Backpropagation, Evaluation of error-function derivatives, Efficiency of backpropagation, under and over fitting.

**UNIT V**
Introduction to Convolutional neural network (CNN), Backpropagation in CNN, Sparse Kernel Machines, Markov Chain Monte Carlo, Introduction to Reinforment learning.

**TEXTBOOKS/REFERENCES**
1. Christopher M. Bishop, "Pattern Recognition and Machine Learning" by Springer, 2007.
2. Tom M. Mitchell, "Machine Learning", First Edition by Tata McGraw-Hill Education, 2013.
3. EthemAlpaydin, "Introduction to Machine Learning" 2nd Edition, The MIT Press, 2009.

**LIST OF PRACTICAL EXPERIMENTS**
1. Implement Linear Regression on the given dataset using python/MATLAB.
2. Implement Naïve Bayes classifier using Python/MATLAB.
3. Implement Logistic Regression on the given dataset using python/MATLAB.
4. Implement SVM algorithm using Python/MATLAB.
5. Implement Decision tree classifier and Random Forest classifier  using python/MATLAB.
6. Implement Random Forest classifier using python/MATLAB.

7. Implement K-means algorithm for clustering the data using python/MATLAB.
8. Implement K-Nearest Neighbour classifier using python/MATLAB.
9. Emulate logic gates using neural Network using python.
10. Implement single-Layer Neural Network for image/data analysis using Python/MATLAB.
11. Implement Convolution Neural Network for image/data analysis using Python/MATLAB.
12. Implement Markov model for analysis of stock market data using python/MATLAB

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| EEE 422 | Optimization Techniques | OE | 3 | 0 | 0 | 3 |

**UNIT: I UNCONSTRAINED OPTIMIZATION**
Basics: Set-constrained and unconstrained optimization; conditions for local minimizers, One-dimensional search methods: golden section, Fibonacci, bisection, Newton's and Secant methods; bracketing; line search, Gradient methods: steepest descent method; analysis of gradient methods.

**UNIT: II METHODS**
Newton's method: analysis; Levenberg-Marquardt modification; nonlinear least squares, Conjugate Gradient method: conjugate direction algorithm; conjugate gradient algorithm; non-quadratic problems, Quasi-Newton method: approximating the inverse Hessian; rank-one correction; DFP and BFGS algorithms, Least-squares analysis; RLS; linear equation with minimum norm; Kaczmarz's algorithm; general solution.

**UNIT: III LINEAR PROGRAMMING**
Linear Programming: standard form; convex polyhedral; basic solutions and properties, Simplex method: canonical augmented matrix; algorithm; matrix form; two-phase; revised method, Duality: Dual linear programs and properties.

**UNIT: IV EQUALITY AND INEQUALITY CONSTRAINTS**
Equality constraints: Problem formulation; tangent and normal spaces; Lagrange conditions; second-order conditions; minimizing quadratics with linear constraints, Inequality constraints: Karush-Kuhn Tucker conditions; second-order conditions.

**UNIT: V CONSTRAINED OPTIMIZATION**
Convex optimization: convex functions, convex optimization problems; semi-definite programming, Algorithms: Projections; projected gradient with linear constraints; Lagrangian algorithms; penalty methods, Multi-objective Optimization: Pareto solutions, Pareto front computation, from multi-objective to single-objective optimization; uncertain LP problems.

**TEXTBOOKS/REFERENCES**
1. E. K. P. Chong and S. H. Zak, "An Introduction to Optimization," 4th edition, Wiley, 2013.
2. D. G. Luenberger and Y. Ye, "Linear and Nonlinear Programming," 4th edition, Springer, 2016.

3. D. P. Bertsekas, "Nonlinear programming," Athena Scientific, 1999.
4. S. Boyd and L. Vandenberghe, "Convex optimization," Cambridge University Press, 2004.
5. M. Fathi and H. Bevarani, "Optimization in Electrical Engineering," Springer, 2019

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ME 418 | Introduction to Electric Vehicles | OE | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION**
History, EV Benefits, EV/HEV subsystems and configurations.

**UNIT II: VEHICLE DYNAMICS**
Vehicle dynamics, forces acting, power and torque calculations, Simulations, Drive cycles.

**UNIT III: BATTERIES**
Battery parameters, why Li, SoH & SoC estimation/self-discharge, Battery pack
design/development, battery computations, Charging, BMS and its design, future batteries.

**UNIT IV: ELECTRICAL COMPONENTS FOR EV AND HEV**
EV Motors (IM, PM etc,) D-q circuit, DC-DC converters, DC-AC converters, control system
overview.

**UNIT V: EV DESIGN**
Mechanical, Electrical and Thermal design consideration, Sample design calculations for
EV and HEV's.

**TEXTBOOKS**
1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and
fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication.

**REFERENCES**
1. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric
and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2018.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| IDEA 102 | Design Thinking | OE | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION TO DESIGN THINKING**
Design Thinker's mindset, what is Design Thinking and why is it popular? Innovative thinking, what is a wicked problem and how can we solve it? The design thinking stages overview.

**UNIT II: DESIGN THINKING - EMPATHISE**
Power of Empathy, Probes for context mapping, Power of stories in building empathy for the target group, User Research methods -Qualitative user research, best practices of qualitative user research, best practices of qualitative user research. Conducting ethical user research. Basics of recruiting participants for user research.

**UNIT III: DESIGN THINKING – DEFINE/REDEFINE THE CHALLENGE**
Define problem, Frame insights, Understand context.

**UNIT IV: DESIGN THINKING – IDEATE**
Brainstorm and ideate, Divergence to Convergence, Creative confidence.

**UNIT V: DESIGN THINKING – PROTOTYPE & TEST**
Prototype to product, Prototyping methods, Heuristic Evaluation, Project 1 (in teams)-Applying Design thinking, Empathy & Ideation, principles & tools. Project 2 (in teams)-Applying Design thinking/Innovation principles and approach using specific tools. Storytelling -Role of Storytelling in Design thinking.

**INSTRUCTIONAL METHOD**
1. The course delivery method will be through online platforms (Zoom is preferred due to the breakout rooms options) depend upon the requirement of content and need of students. This will be an experiential learning throughout the course.
2. The internal evaluation will be done based on continuous evaluation of students in the hands-on workshop assignments and classroom.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in their given projects and also through questionnaire-based exam.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 305 | Introduction to Science and Technology Studies | OE | 4 | 0 | 0 | 4 |

**UNIT I: PHILOSOPHY OF SCIENCE: ISSUES AND PERSPECTIVES**
What is science? Some Historical Background, Scientific reasoning- Induction, deduction and the problem of Hume, Scientific Explanation and Causality, Popper's Philosophy of Science, Scientific Revolutions.

**UNIT II: PERSPECTIVES FROM SOCIOLOGY OF SCIENCE AND TECHNOLOGY**
Questioning Functionalism in the Sociology of Science, The strong program, The social construction of Scientific and technological realities, Studying laboratories.

**UNIT III: SCIENCE, TECHNOLOGY AND DEVELOPMENT: A CRITICAL ENQUIRY**
Medicine, Agriculture, Environment, War.

**UNIT IV: EXCLUSIONS IN SCIENCE AND TECHNOLOGY INSTITUTIONS**
Under presentation of women in Science and Technology Institutions in India and abroad, Autobiographical Accounts, The Caste of Merit- excerpts.

**UNIT V: FEMINIST AND OTHER CRITIQUES OF SCIENCE**
The Mis-measure of Man IQ tests, Craniometry, Examples of how gender figures in doing science, The Medical Construction of gender: The case of Intersex babies, Feminist epistemologies of Science, Hidden Figures Movie

**TEXTBOOKS/REFERENCES**
1. Samir Okasha (2003). Philosophy of science: A very short introduction.
2. Sismondo, S. (2010). An introduction to science and technology studies.
3. S G Kulkarni. Philosophy of Science: issues and Perspectives.
4. Mary Wyer et al (2000) Women Science and Technology.
5. Ajantha Subramanian (2018) The Caste of Merit.
6. Stefan Jay Gould The Mismeasure of Man.
7. Ashish Nandy   Science Hegemony and Violence.
8. Gita Chadha and Asha Achuthan (Eds) Review of Women Studies, Economic and Political Weekly.

9. Jayasree Subramanian (2007) Perceiving and Producing Merit: Gender and Doing Science in India.
10. Sumi Krishna & Gita Chadha (Eds) Feminists and Science

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PSY 111 | Psychology for Everyday Living | OE | 4 | 0 | 0 | 4 |

**UNIT I: MYTHS AND MISCONCEPTIONS IN PSYCHOLOGY**
Definition, nature and goals of psychology, Common myths and misconceptions about psychology, Schools of psychology; Basic and applied areas of psychology

**UNIT II: THE ROLE OF PERCEPTION AND ATTITUDE TOWARDS UNDERSTANDING THE WORLD**
Perception: Understanding perception, Gestalt laws of organization, common illusions, Perceptual constancy - depth perception, size perception, perception of movement, Attitude formation, Attitude change.

**UNIT III: INTELLIGENCE AND LEARNING**
Definitions and nature of intelligence, Emotional and social intelligence; Measuring IQ, EQ and SQ, Fundamentals of learning and its applications, Memory techniques.

**UNIT IV: UNDERSTANDING THE SELF**
Definition; Approaches to personality – trait and type, Psychoanalytical and humanistic theory, Tests of personality – MBTI and NEO-PI, Identity; Self-concept, self-esteem and self-efficacy.

**UNIT V: STRESS, COPING AND QUALITY OF LIFE**
Nature, sources of stress and its reactions, Factors influencing stress, coping with and managing stress - cognitive and behavioral techniques, Improving quality of life.

**TEXTBOOKS/REFERENCES**
1. Baron, R. A. (2001). CE, CBology. New Delhi: Pearson Education India.
2. Nolen-Hoeksema, S., Fredrickson, B.L. & Loftus, G.R. (2014).Atkinson &Hilgard's Introduction to Psychology.16th Ed. United Kingdom: Cengage Learning.
3. Morgan, C. T., King, R. A., & Schopler, J. (2004). Introduction to Psychology. New Delhi: Tata McGraw Hill

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PSY 116 | Fundamentals of Neuro Linguistic Programming-Level 1 | OE | 3 | 0 | 0 | 3 |

**UNIT I: WHAT IS NLP?**
Introduction to NLP, NLP Frames, NLP Presuppositions – Beliefs of Excellence. The Communication Model (Deletion, Distortion and Generalization) Components of the NLP Communication Model.

**UNIT II: META PROGRAMS**
Sensory Acuity and Calibration, Representation System (Modalities), Sub modalities Practicing Sub modalities, Identifying your primary representational system.

**UNIT III: ANCHORING**
Eye Accessing Cues Rapport – Unconscious responsiveness. State: Introduction to states, Anchoring Process, State Elicitation Summary, Stacking Anchors, Stacking Anchors Summary (X, Y, Z state).

**UNIT IV: WELL-FORMED / WELL-DEFINED OUTCOMES**
Pain and Pleasure exercise, Wellness Vision Planning (Wheel of Life) Ardell's model for Wellness Coaching. T-F-A-R Coaching Model Timeline Coaching.

**UNIT V: COACHING PATTERNS**
New Behaviour Generator, Circle of Excellence – Resourceful States. Walt Disney Strategy, Reframing Coaching using values Perceptual Positions (Relationship Coaching / Leadership Coaching).

**TEXTBOOKS/REFERENCES**
1. NLP The New Technology of Achievement – Edited by Steve Andreas and Charles Faulkner.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| BIO 112 | Basic Microbiology | OE | 4 | 0 | 0 | 4 |

**UNIT I: INTRODUCTION TO MICROBIOLOGY**

History of microbiology, Essential methods to study microbes: sterilization and disinfection: Methods of sterilization- physical methods (heat, filtration), radiation and chemical methods, Principles of microscopy, Spontaneous generation vs. biogenesis. Contributions of Anton von Leeuwenhoek, Louis Pasteur-germ theory of disease, Robert Koch- Koch's postulates, Joseph Lister, Alexander Fleming, Microbial growth, Growth media types - selective and differential media; Influence of environmental factors for microbial growth. Growth phases and kinetics; Maintenance and preservation of bacterial cultures.

**UNIT II: BACTERIAL CELLS - STRUCTURE AND FUNCTION**

Different groups of microorganisms and their general characteristics, Ultrastructure of Gram positive and Gram-negative bacterial cell wall, Size, shape and arrangement of bacterial cells. cell membrane, cytoplasmic matrix, pili, capsule, flagella Classification & molecular taxonomy-Phylogenetic tree; measuring diversity by 16S/18S rRNA, RAPD, T-RFLP.

**UNIT III: MOLECULAR PATHOGENS**

Viral structure and classification; Bacteriophage and its life cycle; Viral pathogenesis; Immune response to viral infections; Acute, chronic and latent viral infections; Viral vaccines, Viroid, Prions, Plasmid and transposable elements.

**UNIT IV: MICROBIAL DISEASE AND ANTIMICROBIAL AGENTS**

Microbial disease: - Tuberculosis, Typhoid, Infection caused by E. coli, Staphylococcus, Sterptococcus, Role of quorum sensing and biofilm in microbial disease, Action of antimicrobial drugs: inhibitors of cell wall synthesis, inhibitors of protein synthesis, inhibitors of nucleic acid synthesis, competitive inhibitors, antifungal, antiviral, anti- protozoan drugs, Mechanism of antibiotic

resistance.

## UNIT V: APPLIED MICROBIOLOGY

Microorganism of Industrial use, Basics of fermenter design, Primary and secondary metabolites, Strains-screening, adaptation and strain improvement Industrial production of antibiotics – penicillin; alcohol- ethanol. Food microbiology – Microorganisms in food, Introduction to probiotics and prebiotics, Food preservation Environmental microbiology – Bioremediation, Bioleaching, Microbial degradation of textile waste.

## TEXTBOOKS/REFERENCES

1. Microbiology, 6th edition (1993), Pelczar, Chan and Krieg; McGraw Hill International
2. Prescott, Harley, and Klein's Microbiology, 8th edition, (2011), Joanne M. Willey, Linda M. Sherwood, Christopher J. Woolverton, McGraw Hill International.
3. Stainer R. Y., Ingraham. J. L., Wheelis M. J., Painter P. R. (1999). General microbiology. MacMillan Educational Ltd. London.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 223 | Introduction to Quantum Computation | OE | 3 | 1 | 0 | 4 |

## UNIT I: MATRIX, TENSOR AND DIRAC NOTATION

Basis vectors and orthogonality, Matrices Hilbert spaces, Inner and outer products, Tensors in index notation, Metric tensors, covariant and contravariant tensors, Unitary operators and projectors, Hermetian operator, Adjoint of operator, Wavefunction as vector and operator as metrics, Dirac notation, Tutorial 1, Tutorial 2, Tutorial 3.

## UNIT II: INTRODUCTION AND OVERVIEW OF QUANTUM MECHANICS

Photon, Concept of Planck Constant, Photoelectric effect, Wave particle duality, Wave packet, Davisson and Germer Experiment, Superposition Principle, Young Double slit experiment, Qubits and pieces, Concept of Bloch sphere, Derivation on Bloch sphere representation, Tutorial 4, Tutorial 5, Tutorial 6.

## UNIT III: FUNDAMENTALS OF QUANTUM COMMUNICATION

No-cloning theorem, Hidden Information of state, Einstein-Podolsky-Rosen Paradox, Bell states, Bell inequalities, Bell inequalities – Examples, Quantum entanglement, Quantum entanglement considering Heisenberg principal, Quantum teleportation, Tutorial 7, Tutorial 8, Tutorial 9.

## UNIT IV: QUANTUM GATE

Pauli Gates, Phase Gate, Controlled phase shift, Hadamard gates, SWAP Gates, CNOT Gates, Toffoli gates, Combination of Gates, Circuit of Gates, Tutorial 10, Tutorial 11, Tutorial 12.

## UNIT V: QUANTUM ALGORITHM, KEY DISTRIBUTION AND ERROR

Deutsch algorithm, Deutsch-Josza algorithm, Shor's Algorithm – Periodicity, Shor's period-finding algorithm, Introduction to Quantum key distribution, BB84 protocol, Quantum Error Correction, Quantum Error Correction Example, Physical Qubits, Tutorial 13, Tutorial 14, Tutorial 15.

**TEXTBOOKS/REFERENCES**
1. Phillip Kaye, Raymond Laflamme, and Michele Mosca (2007). An Introduction to Quantum Computing. Oxford University Press.
2. Michael A. Nielsen and Isaac L. Chuang (2000). Quantum Computation and Quantum information. Cambridge University Press.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| HIS 005 | Introduction to Gender | OE | 4 | 0 | 0 | 4 |

**UNIT I: THE NATION AND ITS MANY ROOTS**
What is a Nation? –Theories of Nationalism, The many names of India: India, Hindia, Aryavarta or Bharat, Mother India: Iconising a Nation

**UNIT II: UNEARTHING THE PAST**
The Evolutionary Past: Interbreeding Vs Replacement Theory, Out of Africa Theory, what is a civilization? Theories of Civilization, Indus Valley Civilization

**UNIT III: STORIES OF GODS AND PEOPLE**
The Emergence of Myths, Myth Vs Reality, Vedic Age in India, Tribes, Caste and Battles.

**UNIT IV: POLITY AND GOVERNANCE**
Religion, Economy and the State –Asoka, Chankya and the Buddha, Land the Economy: Exploring the Arthasastra, Social Order and the State: Through the Epics, Two millennia of pluralism: Jews, Christians and other religions in India.

**UNIT V: TOWARDS UNDERSTANDING THE NATION**
The Mughals in India, Multiple Identities – the same heritage, The Past as a Signifier

**TEXTBOOKS**
1. Y. N.Harari, A Brief History of Humankind, Harper, 2015.
2. Upinder Singh, A History of Ancient and Early Medieval India, Pearson, 2009.
3. Romila Thapar, Early India: From the Origins to AD 1300, University of California Press, 2004

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| ECO 251 | Indian Economy | OE | 4 | 0 | 0 | 4 |

**UNIT I: PERFORMANCE OF INDIAN ECONOMY SINCE 1947**
Growth and Structural Changes, Features/characteristics of Indian economy, Human Development Index Traditional Methodology, Human Development Index: New Methodology, Sustainable Development, Capital Formation, Demographic Transition, Economic Planning in India, Reforms in Indian Economy.

**UNIT II: KEY ISSUES OF INDIAN ECONOMY**
Issues and Trends of Unemployment, Poverty in India, Problem of Inequality, Issues of Education, Gender Issues in India.

**UNIT III: STRUCTURAL PERFORMANCE OF INDIAN ECONOMY**
Importance and Features of Indian Agricultural, Trends in Performance and Productivity, Agricultural Markets and Institutions, Land Reforms, Green Revolution in Indian Agriculture, Agricultural Labour, Food Security, Public Distribution System, Trends, Productivity, and Growth of Industries, Industrial Policy in India, Industrial Sickness Small Scale Industries, Foreign Direct Investment in India.

**UNIT IV**
Trends and Performance in Services, WTO, India Foreign Trade, Monetary Policy, Fiscal Policy, Total contact hours.

**TEXTBOOKS/REFERENCES**
1. Jean Dreze and Amartya Sen, 2013. An Uncertain Glory: India and its Contradictions, Princeton University Press.

2. Himanshu, 2010, Towards New Poverty Lines for India, Economic and Political Weekly, January.
3. Kaushik Basu, 2009, ―China and India: Idiosyncratic Paths to High Growth, Economic and Political Weekly, September.
4. Gaurav Datt and Ashwani Mahajan, 2019- Indian Economy. S Chand and Company Limited, New Delhi 2019.
5. Puri, V.K. & Mishra S.K, 2019- Indian Economy. Himalaya Publishing House, New Delhi 2019.
6. Jalan, Bimal. Indian Economy: Problems and Prospects. Penguin India; New edition, 2004.
7. Jean Dreze and Angus Deaton, 2009, Food and Nutrition in India: Facts and Interpretations, Economic and Political Weekly, February.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| EGL 167 | Code Name Language | OE | 4 | 0 | 0 | 4 |

**UNIT I: THE REPRESENTATIONAL HIERARCHY**
Introduction to the Triune Brain Model, Information Processing by the triune brain, The Visual, Auditory and Kinesthetic Learning Styles. The impact of belief & perception on language.

**UNIT II: THE MAP IS NOT THE TERRITORY**
The Beliefs of Excellence, Identifying the inner map, Asking Clean question, Arriving at well-formed outcome.

**UNIT III: DECODING THE MAP**
Introduction to the meta programs, Comprehending the thirteen filters, Sub modalities – an insight, Using sub modalities as a tool for change.

**UNIT IV: REPROGRAMMING LANGUAGE**
Meta Modelling – an overview, the three critical filters: Deletion, Distortion, Generalization, The Filter and Need connect, The Milton Model: Language to influence.

**UNIT V: FROM PROGRAMMING TO REPROGRAMMING**
The Role of Tools & Techniques in Language Re programming, The archetypes and corresponding metaphors, Demonstration of a few tools & techniques like Swish, Perceptual Positions, Coach & Crash, and Tetralema, Hands on sessions.

**TEXTBOOKS/REFERENCES**
1. Brandler Richard, John Grinder. Frogs into Princes. US: Eden Grove Editions, 1990.
2. Mukherjee Sudip. Two Steps Ahead. India: Notion Press, 2020.

3. Sullivan Wendy and Judy Rees. Clean Language: Revealing Metaphors and Opening Minds.UK: Crown House Publishing, 2008.
4. Dilts Robert.Neuro Linguistic Programming: The Study of the structure of subjective experience. USA: Meta Publications, 2009.
5. Brothers Jo Barbara (ed.) Virginia Satir: Foundational Ideas. USA: Haworth Press, 1991.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| TLC 101 | Cognitive Learning Theories | OE | 2 | 1 | 0 | 3 |

## UNIT I: METACOGNITION, BRAIN, MEMORY AND LEARNING
The 3 Cos, where does learning happen? Actions pertaining to learning. What does the brain do? How does the brain learn? Memory, Intelligence, Thinking Levels.

## UNIT II: LEARNING THEORIES
Classification of Knowledge, The "Science" of Education, Behaviourism, Cognitivism, Constructivism, Humanism, Dale's cone of Learning, Glenn's holistic thinking pyramid.

## UNIT III: LEARNING INFLUENCERS
Discipline, Cognitive Factors, Self-Efficacy, Self-Regulation, Genetic Factors, External Factors, Generational Characteristics.

## UNIT IV: Learning Success – 8 Pillars
Beliefs, Habits, Resources, Skills & Strengths, Emotions, Motivation, Goals and Objectives, Mindset.

## TEXTBOOKS
1. Schunk, D. H. (2019). Learning Theories: An Educational Perspective. United Kingdom: Pearson.

## REFERENCES
1. Carey, B. (2014). How We Learn: The Surprising Truth About When, Where and Why It Happens. United Kingdom: Pan Macmillan.
2. Johnson, A. P. (2019). Essential Learning Theories: Applications to Authentic Teaching Situations. United States: Rowman & Littlefield Publishers.

3. http://www.aussieeducator.org.au/education/theories.html
4. https://sites.google.com/a/nau.edu/educationallearningtheories/home
5. https://crlt.umich.edu/tstrategies/tslt
6. https://www.researchgate.net/publication/347453692_A_Metacognition_Based_8_Pillars_Mindfulness_Model_and_Training_Strategies

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| EEE 305 | Advanced Control Systems | OE | 3 | 0 | 0 | 3 |

**UNIT: I STATE VARIABLE ANALYSIS AND DESIGN**
Review of classical control system, Review of classical control system, State variables, State models for physical systems, State variables, State models for physical systems, Solution of state equations. Transfer function, Eigenvalues and eigenvectors, Jacobian linearization technique, State transformations and diagonalization, Transformation to phase-variable canonical form, Controllability and observability, Duality property, Illustrative Problems.

**UNIT: II POLE PLACEMENT DESIGN AND STATE OBSERVERS**
Introduction, Stability Improvements by State Feedback, Necessary and Sufficient Conditions for Arbitrary Pole Placement, State Regulator Design, Design of State Observer, Compensator Design by the Separation Principle.

**UNIT: III NON-LINEAR SYSTEMS ANALYSIS**
Common Nonlinear System Behaviors, Common Nonlinearities in Control Systems, Describing Functions of Common Nonlinearities, Stability Analysis by Describing Function Method, Concept of Phase Plane Analysis, Construction of Phase Portraits, System Analysis on the Phase Plane, Variable Structure Systems.

**UNIT: IV LYAPUNOV'S STABILITY ANALYSIS**
Introduction, Lyapunov's Stability Criteria, the direct method of Lyapunov stability, Methods of constructing Lyapunov Function for Non-linear Systems, Illustrative examples.

**TEXTBOOKS/REFERENCES**
1. "Modern Control Engineering," K.Ogata, Pearson Education Asia/ PHI,4 th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
2. Control Systems Engineering (For the Modules 1 and 2) I.J. Nagarath and M.Gopal New Age 5 th Edition, 2007.
3. Nonlinear Control, Hassan K. Khalil Pearson Education Limited, 2015.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| EEE 305 L | Advanced Control Systems Lab | OE | 0 | 0 | 2 | 1 |

**LIST OF PRACTICAL EXPERIMENTS**
1. DC Motor modeling using LabVIEW
2. Speed control of DC Motor.
3. Position control of DC Motor.
4. Inverted pendulum control.
5. Characteristics of Brushed and Brushless DC motor.
6. Characteristics of Brushed and Brushless DC motor.
7. Position control of servo motor.
8. Tuning of PID controller gains for closed loop converter control.
9. Control system design for power systems.

**TEXTBOOKS/REFERENCES**
1. "Control Systems Engineering" (For the Modules 1 and 2) I.J. Nagarath and M.Gopal New Age, 5th Edition, 2007.
2. "Modern Control Engineering," K.Ogata, Pearson Education Asia/ PHI,4 th Edition, 2002. ISBN 978 - 81 - 203 - 4010 - 7.
3. "Nonlinear Control", Hassan K. Khalil Pearson Education Limited, 2015.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAT 307 | Combinatorics and Graph Theory | OE | 4 | 0 | 0 | 4 |

## UNIT I: COUNTING PRINCIPLES AND TECHNIQUES

Combinatorics and Permutations, Binomial Coefficients and Multinomial Coefficients, The Pigeonhole Principle, the inclusion-Exclusion formula, Generating Functions: Newton's Binomial Theorem, Exponential Generating Functions, Partitions of Integers, Recurrence relations.

## UNIT II: SPECIAL COUNTING NUMBERS

Partition number, Bell Numbers, Catalan numbers, Stirling numbers, Ramsey Numbers. System of distinct representatives.

## UNIT III: AN INTRODUCTION TO GRAPH THEORY

Euler Circuits and Walks, Hamiltonian Cycles and Paths, Bipartile Graphs, Trees, Plane and planar graphs, Directed graphs.

## UNIT IV: MORE ON GRAPH THEORY

Optimal Spanning trees, Connectivity, Colouring Planar Graphs, The Chromatic Polynomials, Graph of Symmetries, Burnside's Theorem.

## UNIT V: APPLICATIONS

Problems involving scheduling and assignment, Isomer problem in Chemistry, If time permits, we also discuss a few applications in Computer Science: To prove lower bounds in computational models, Randomized algorithms, and various net- work problems.

**TEXTBOOKS**
1. Combinatorics and graph theory by J.M. Harris, J.L. Hirst and M.J. Mossinghoff, springer.
2. Introduction to Graph Theory by Douglas West.
3. Graph theory with applications by J. A. Bondy and U. S. R. Murty.
4. Graph Theory with Applications to Engineering and Computer Sciences by Narsingh Deo, Prentice-Hall, 1974.
5. An Introduction to Combinatorics and Graph Theory by David Guichard https://www.whitman.edu/mathematics/cgt_online/cgt.pdf.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| PHY 301 | Atomic and Molecular Physics | OE | 3 | 0 | 0 | 3 |

**UNIT I: ATOMIC STRUCTURE**
Rutherford model of atom, Rutherford Model numerical, Electron orbits, Bohr atom, Energy levels and spectra, Numerical on energy level and spectra, Sommerfield's elliptic orbits, Numerical on Somerfield's theory, Relativistic Corrections of Sommerfield's Theory, Tutorial 1, Tutorial 2, Tutorial 3.

**UNIT II: VECTOR ATOM MODEL**
Vector atom model, Concept of space, Concept of quantization, Electron spin, Magnetic moments of atoms, Numerical on quantization, Stern-Gerlach experiment, atomic excitation and atomic spectra, Numerical on atomic excitation and atomic spectra, Tutorial 4, Tutorial 5, Tutorial 6.

**UNIT III: ONE AND TWO VALENCE ELECTRON SYSTEMS**
Pauli Exclusion Principle, Electron configuration, Quantum states, Electron spin, Spin-Orbit Interaction, Energy levels of Na atom, Sodium Doublet, Spectral terms of two electron atoms, Terms for equivalent electrons, L-S and J-J coupling schemes, Singlet-Triplet separation for interaction energy of L-S coupling, Landé g-factor Landé Interval rule, Spectra of Helium atom, Zeeman Effect, Tutorial 7, Tutorial 8, Tutorial 9.

**UNIT IV: ATOMIC AND MOLECULAR SPECTROSCOPY**

EM spectrum, X-ray, Daune and Hunt's Rule, X-ray emission spectra, Bremsstrahlung effect, Mosley's law and its applications, Auger effect, electronic spectra of molecules. Rotational spectra of diatomic molecules, Raman Effect, Molecular Polarizability, Tutorial 10, Tutorial 11, Tutorial 12.

**UNIT V: LASERS**
Optical absorption and emission, Einstein coefficients, Optical pumping, Masers principles, Lasers principles, Numerical of Lasers, Ruby Laser principles, He-Ne Laser Principles, Solid state and semiconductor lasers, Tutorial 13, Tutorial 14, Tutorial 15.

**TEXTBOOKS**
1. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, R. Eisberg and R. Resnik 2nd Edison, 2006, Wiley.
2. Concepts of Modern physics, Arthur Besier, S. Rai Choudhury, Shobhit Mahajan, 7th Edition, 2015, Mcgraw Higher Ed.

**REFERENCES**
1. The Fundamentals of Atomic and Molecular Physics, Brooks, Robert L. 1 Edition, 2013, Springer-Verlag New York.
2. Physics of Atoms and Molecules, B. H. Bransden, C. J. Joachain, 2 Edition, Pearson Education India.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| COM 101 | Business Organization and Management | OE | 3 | 0 | 0 | 3 |

**UNIT I**
Historical Grassroots and Genesis of Business – How to do Business? –Introduction to Business Organization – Various Forms of Business Organization – Sole Trading – Partnership – Company Form of Business – Features of Company- Incorporation of a Company – MOA & AOA - Types of Companies - Case Study Analysis.

**UNIT II**
Relevance of SWOT/PESTEL analysis in establishing a Business Organization – Objectives of Business – Corporate Social Responsibilities- Sustainability of Business - Corporate Governance - Case Study Analysis.

**UNIT III**
Introduction to Management – Development of Management Thought – Principles of Management - Professionalization of Management – Relevance of Management to Business – Role of a Manager in Business – Skills and Qualities of a Manager – Successful and Effective Managers – Challenges before today's managers - Case Study Analysis.

**UNIT IV**

Functions of Management - Overview of Planning – Types of Planning - Organizing (Levels of Management & Organizational Structures) – Directing – Coordinating and Control – Staffing – Reporting and Budgeting – Importance and Techniques of Control – Motivating Function of Manager - Case Study Analysis.

**UNIT V**
Best Practices in Management – Evidences from Indian and Western Counterpart – Contemporary Issues in Management – Knowledge Management – Innovation – Team Management - Learning Organizations – Case Study Analysis.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| COM 107 | Finance for Engineering | OE | 3 | 0 | 0 | 3 |

**UNIT I: FINANCIAL REPORTING**
Accounting Concept - Financial Records - Accounting Principles and Conventions – Preparation of Financial Statements – Profit and Loss Statement - Balance Sheet - Cash Flow Statement.

**UNIT II: FINANCE FUNCTIONS**
Introduction, Goals of financial management, Finance functions, Interface between Finance and Other Business Functions - Time Value of Money - Future Value - Effective Rate - Single and Multiple Payments – Discounting.

**UNIT III: ENGINEERING ECONOMIC ANALYSIS**
Classification of Capital Projects - Cost of Capital – Measurement of Cost of Capital - Evaluation Criteria for Capital Projects - Economic Analysis Techniques: Traditional and Discounted Cashflow methods - NPV vs. IRR.

**UNIT IV: RISKS ANALYSIS AND MEASUREMENT**
Concepts of Risk and Return - Types of Risks - Measurement of Return and Risk –

Risk analysis in Engineering Projects: Risk-adjusted Discount Rate - Certainty Equivalent Approach - Capital Rationing: Approaches to Capital Rationing - Practical Issues in the Evaluation of Projects.

**UNIT V: FINANCING OF CAPITAL PROJECTS**

Sources of Finance: Lenders, Borrowers and Financial Institutions – Forms of Finance: Equity Instruments - Debt Instruments - Types of Loans - Long-term Debt - Short-term Debt - Public Issue and Private Placement of Financial Securities - Financial Markets - Equity Markets - Bond Markets - Futures and Derivatives Markets

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| JOU 001 | Media Through the Ages: From Print to Social-Media | OE | 3 | 0 | 0 | 3 |

**UNIT I**

Introduction to Communication, Definition of Communication, Types: Intra-personal, Inter-personal, Group, Public and Mass Communication. Means of Communication, Process of Communication, Functions of Communications, Seven C's of Communication.

**UNIT II**

Definition of Mass Communication – Nature and process, Functions and types, Print, Electronic and Digital, Communication and Public Opinion: Nature, Meaning and Process.

**UNIT III**

Newspapers and Freedom Struggle, Colonial Rule and the Struggle for Press Freedom, Press and the Civil Liberties.

**UNIT IV**

Evolution of television, Prasar Bharati and Public Service Broadcasting, Growth of Satellite channels,

24x7 News channels.

**UNIT V**
Characteristics of New Media, New media as a form of communication, Evolution of Internet in India, Web Blogs, Online News Streaming.

**TEXTBOOKS/REFERENCES**
1. Hasan Seema., (2010), Mass Communication: Principles and Concepts. Chennai, India: CBS Publisher.
2. Mcquail Denis, (2010) Mass Communication Theory (Sixth Edition). London, England: Sage Publications.
3. Narula Uma, (2009),Mass Communication Theory and practice. New Delhi, India: Her-Anand Publication.
4. Chandra Bipan (2016) India's Struggle for Independence: 1857-1947 (reprint). New Delhi, India: Penguin Random House.
5. Desai A.R, (2016) Social Background of Indian Nationalism (reprint). India: Sage Publication.
6. Mehta Nalin (2015) Behind a Billion Screens: What Television Tells Us About Modern India (2015 edition): HarperCollins.
7. Mehta Nalin (2008) India on Television. New Delhi, India: HarperCollins.

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| IDEA 104 | Dream-Discover-Disrupt | OE | 3 | 0 | 0 | 3 |

**UNIT I: VENTURE IDEATION.**

**UNIT II: MARKETING.**

**UNIT III: CUSTOMER SEGMENTATION.**

**UNIT IV: CUSTOMER DISCOVERY.**

**UNIT V: SOLUTION DESIGN.**

| Course Code | Course Name | Course Category | Credits | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| MAN 001 | Mandarin | OE | 3 | 0 | 0 | 3 |

**COURSE DESCRIPTION**

This course is the first semester of four that forms an introduction to standard Mandarin Chinese and is designed for students with no previous background in spoken or written Mandarin. Students in this course focus on learning essential vocabulary, practicing pronunciation, and understanding simple grammatical structures. This knowledge prepares students to effectively communicate in Mandarin on a limited range of topics related to everyday situations and examine how culture and language interact. In-class activities and course assignments aim to assist students as they develop the oral proficiency and confidence necessary to initiate simple conversations. Out-of-classroom experiences such as cultural activities or guided interactions with native speakers supplement formal classroom instruction and provide ample opportunities for practical engagement.

**TEXTBOOK & COURSE MATERIALS**

1. A Course in Contemporary Chinese Volume 1 《當代中文課程 1》by the Mandarin Training Center at National Taiwan Normal University. Publisher: Sanctum Books; First Indian edition (31 March 2021)
2. Supplementary vocabulary & cultural materials

**METHOD OF INSTRUCTION**
This course is delivered through a series of classroom instruction sessions, activities, homework, in-class practice, and non-classroom structured activities. All four skills of language learning (listening, speaking, reading, and writing) will be covered, with a particular focus on communication skills necessary in Chinese culture.

**PART 2: OUTCOMES**
1. This course will help student master Mandarin pronunciation, basic reading and writing skills, and to develop the ability to participate in simple, practical conversations on everyday topics.
2. In this course, students will learn to greet, to introduce themselves, to communicate with other people in Mandarin Chinese, and have basic knowledge and ability in Mandarin Chinese.

**STUDENT LEARNING OUTCOMES**
1. By the completion of this course, students will be able to:
2. Use Mandarin Chinese to confidently communicate on a range of topics related to everyday situations such (e.g. to introduce themselves, discuss family, hobbies, likes and dislikes).
3. Recognize and write approximately 150 Chinese characters.
4. Read and write simple sentences in Chinese.
5. Demonstrate listening comprehension in a number of simple circumstances

**KNOWLEDGE OUTCOMES**
1. This course is designed to assist students to acquire and demonstrate knowledge about:
2. Essential vocabulary, pronunciation, and grammatical structures.
3. Understand how Chinese culture and Mandarin Chinese interact.
4. The differences and similarities between Chinese and the student's native language.

**SKILLS OUTCOMES**
1. This course is designed to assist students in acquiring or enhancing the following skills:
2. Basic communication skills in Mandarin Chinese.
3. Competency with the Pinyin-Chinese phonetics system.
4. Ability to read and write Chinese characters.
5. Confidence to initiate simple conversations with other people.

**PART 3: TOPIC OUTLINE/SCHEDULE**

**WEEK 01: INTRODUCTION, GREETING.**
1. Introduction of Mandarin Chinese & Pinyin (the Chinese phonetic system)
2. Greetings in normal and polite ways.

**WEEK 02: LEARNING TO INTRODUCE PEOPLE.**
1. Basic sentences with "是shi"
2. Answering question with "什麼shéme"
3. Way to ask questions with A-not-A and "嗎ma" in Chinese

**WEEK 03: LEARNING TO DISCUSS LIKES/DISLIKES.**
1. Answering question in Chinese (Affirmative and Negative answers with "不bù")
2. Modification Marker "很hěn"
3. Contrastive question with "呢ne"

**WEEK 04: LEARNING TO TALK ABOUT PEOPLE IN MY FAMILY MEMBERS AND THEIR NAMES.**
1. Asking question with "幾jǐ"
2. Basic sentences with "有yǒu"

**WEEK 05: LEARNING TO DESCRIBE PEOPLE, PLACES, AND POSSESSIONS.**
1. Possessive word "的de"
2. Modifier Marker "的de"

**WEEK 06: LEARNING TO TALK ABOUT THE NUMBER OF PEOPLE IN A FAMILY, PARTIAL EXAM.**
1. Totality "都dōu"
2. Measure word "個ge" and "張zhāng"
3. Partial exam for Oral & writing

**WEEK 07: LEARNING TO DESCRIBE LIKES/DISLIKES (E.G., SPORTS AND MOVIES).**
1. Time words & Hobbies
2. To go do something with "去qù"
3. Placement of time words

**WEEK 08: LEARNING TO EXPRESS WHAT TWO GROUPS HAVE IN COMMON.**
1. Topic sentences
2. Word order in sentences (Chinese sentence orders, difference between English and Chinese)
3. The word order of Adverbs "也yě", "都dōu" and "常cháng"

**WEEK 09: LEARNING TO POLITELY ASK OTHERS OPINIONS AND MAKE SIMPLE SUGGESTIONS.**
1. Asking question with "怎麼樣zěnmeyàng"
2. Particles with "吧ba" and "啊a"

**WEEK 10: LEARNING TO FORM CHOICE QUESTIONS, FINAL EXAM**
1. Asking choice question with "還是háishì"
2. Making sentences with "覺得juéde"
3. Final exam for Oral & writing

**PART 4: GRADING POLICY**

**EVALUATION CRITERIA**
The grade for this course will be based on the following table.

| Percentage (%) | Evaluation Area |
|---|---|
| 60 | Classroom performance (including performance of the basic conversation, participation in class activities, quizzes, and / or homework) |
| 10 | Partial Exam – Oral |
| 10 | Partial Exam – Writing |
| 10 | Final Exam – Oral |
| 10 | Final Exam – Writing |
| 100 | Total Points Possible |

## LATE WORK POLICY
Be sure to pay close attention to deadlines—there will be no make up assignments or quizzes, or late work accepted without a serious and compelling reason and instructor approval.

## GRADING SCALE
Final grades assigned for this course will be based on the percentage of total points earned and are assigned as follows:

| Letter Grade | Corresponding Percentage Points | Performance |
|---|---|---|
| A | 93-100% | Excellent Work |
| A- | 90-92% | Nearly Excellent Work |
| B+ | 87-89% | Very Good Work |
| B | 83-86% | Good Work |
| B- | 80-82% | Mostly Good Work |
| C+ | 77-79% | Above Average Work |
| C | 73-76% | Average Work |
| C- | 70-72% | Mostly Average Work |
| D+ | 67-69% | Below Average Work |
| D | 60-66% | Poor Work |
| F | 0-59% | Failing Work |

## PART 5: COURSE POLICIES

## ATTEND CLASS
Students are expected to attend all regularly scheduled classes and come prepared to participate fully in class activities. Students are further expected to be on time for all classes. Arriving late for class or an activity is disrespectful of both the instructor and fellow students.

**PARTICIPATE**
The participation grade will depend on both the quality and the quantity of student's comments and questions and shall account for a portion of the total course grade.

**BUILD RAPPORT**
If you find that you have any trouble keeping up with assignments or other aspects of the course, make sure you let your instructor know as early as possible. As you will find, building rapport and effective relationships are key to becoming an effective professional. Make sure that you are proactive in informing your instructor when difficulties arise during the semester so that they can help you find a solution.

**COMPLETE ASSIGNMENTS**
Assignments must be submitted by the given deadline or special permission must be requested from instructor before the due date. Extensions will not be given beyond the next assignment except under extreme circumstances.
All discussion assignments must be completed by the assignment due date and time. Late or missing discussion assignments will affect the student's grade.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 402 | Advanced Environmental Engineering | TE | 3 | 0 | 0 | 3 |

**UNIT I: INTRODUCTION**
Introduction: Wastewater Characteristics, Standards of disposal, Treatment objectives and Strategies, Layouts of Primary, Secondary and Advanced Treatment Units. Wastewater quality parameters.

**UNIT II: DESIGN OF PRIMARY TREATMENT OPERATIONS**
Design of preliminary and primary treatment operations: Screens, Grit Chambers, Skimming Tank, Primary and Secondary Sedimentation Tanks.

**UNIT III: BIOLOGICAL TREATMENT PROCESSES**
Objectives — Selection of Treatment Methods — Principles, Functions, Types, Attached Growth Processes: Trickling Filters (Standard Rate, High Rate), Biofilters, Practices, Features and Design, Operational Difficulties and Remedial Measures, Rotating Biological Contactors.

Activated Sludge Process, Design Criteria, Oxygen and Nutrient Requirements -Classification and Design of Oxidation Ponds, Lagoons.

## UNIT IV: SLUDGE TREATMENT AND DISPOSAL

Sludge Treatment and Disposal: Sludge Thickening, Aerobic and Anaerobic Sludge Digestion Processes Sludge Dewatering, Ultimate Disposal, Sludge Drying Beds, Other Methods of Sludge Treatment.

### TEXTBOOKS

1. S.K. Garg, Environmental Engineering: Sewage Disposal and Air Pollution Engineering (Volume - 2)
2. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous , Environmental Engineering.
3. B.C. Punmia and Ashok Kumar Jain, Wastewater Engineering (Including Air Pollution).
4. Wastewater Treatment –Concepts and Design Approach, by G L Karia and R A Christian, Prentice Hall of India, 2006.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 403 | Advanced Pavement Engineering | TE | 3 | 0 | 0 | 3 |

### UNIT I: PAVEMENT EVALUATION

Functional and Structural Evaluation – Intro, Functional evaluations - Merlin, Bump Integrator, Functional evaluations - Merlin, Bump Integrator, Pavement Distress Surveys – Flexible, Pavement Distress Surveys – Rigid, Automatic Distress Surveys - Network Survey Vehicles (NSV), Structural Evaluation – Benkleman Beam Deflectometer (BBD) and overlay design, Falling Weight Deflectometer (FWD).

### UNIT II: PAVEMENT MANAGEMENT SYSTEMS (PMS)

Pavement Condition Index (PCI), Pavement asset management principles, Maintenance and rehabilitation treatments, Introduction to PMS Decision Trees, Life Cycle Cost Analysis, Cost/Benefit Ratio.

### UNIT III: ADVANCES IN PAVEMENT MATERIAL CHARACTERIZATION

HMA Volumetric Relationships, Superpave Mix Design, Performance Testing – HMA Dynamic Modulus, Aggregate and Soil Resilient Modulus, Bitumen Dynamic Shear Rheometer (DSR).

**UNIT IV: ADVANCES IN PAVEMENT DESIGN PRACTICES**
AASHTO 1993 Design Method, PaveXpress Software – Tutorial, AAHSTOWare Pavement ME Design (PMED).

**UNIT V: SUSTAINABLE PAVEMENT MATERIALS AND METHODS**
Recycled Asphalt Pavement Technology, Cold Mix and Warm Asphalt Technology, Porous Asphalt Pavement Technology, Rubber and Waste Plastic Road Technology.

**TEXTBOOKS**
1. Yang H. Huang, Pavement Analysis and Design, 2nd edition, Pearson Education, India
2. Partha Chakraborty and Animesh Das, Principles of Transportation Engineering, Prentice Hall India.
3. Rajib B. Mallick, and Tahar El-Korchi, Pavement Engineering Principles and Practice, Third Edition, CRC Press.
4. M. Rashad Islam and Rafiqul A. Tarefder, Pavement Design: Materials, Analysis, And Highways, McGrawHill Publishers.
5. M.Y. Shahin, Pavement Management for Airports, Roads, and Parking Lots, 2nd Edition, Springer.

**REFERENCE BOOKS/OTHER READING MATERIAL**
1. Athanassios Nikolaides, Highway Engineering: Pavements, Materials and Control of Quality, 1st Edition, CRC Press
2. E. Ray Brown, Hot Mix Asphalt Materials, Mixture Design and Construction, 3rd Edition, NAPA Publications, USA
3. Asphalt Institute, MS-4 The Asphalt Handbook, 7th Edition, ISBN: 9781934154274, USA.

| COURSE CODE | COURSE NAME | COURSE CATEGORY | CREDITS | | | |
|---|---|---|---|---|---|---|
| | | | L | T | P | C |
| CE 404 | Introduction to Structural Dynamics | TE | 3 | 0 | 0 | 3 |

**UNIT I**
Dynamics of Structures: Objectives and importance. Types of dynamic loads, Dynamic degree of freedom, Mathematical modeling, Damping and stiffness, Torsional stiffness, Equivalent stiffness, Free and forced vibrations.

**UNIT II**
Single Degree of Freedom (SDOF) Systems: Undamped free vibrations, formulation of differential equation of motion: Newton's law of motion, D'Alembert's principle and energy approach. Natural frequency. Vibration response.

**UNIT III**
Single Degree of Freedom (SDOF) Systems: damped free vibrations, critically damped, under damped & over damped systems, formulation of differential equation of motion: Natural frequency. Vibration response.

**UNIT IV**
Forced vibration response of SDOF damped and undamped systems to harmonic loading, rotating and reciprocating unbalance, support motion and impulsive type forcing function. Vibration isolation and transmissibility. Seismic Instruments.

**UNIT V**
Vibrations of two degree of freedom systems, matrix formulation of equations of motion, principal modes of vibrations. Extension of the concept to MDOF systems. Introduction to Rayleigh's principle, modal analysis.

**TEXTBOOKS/REFERENCE BOOKS**
   a. K. Chopra – Dynamics of Structures: Theory and applications to earthquake engineering, Prentice Hall of India.
   b. W.T. Thomson – Theory of Vibrations - Kluwer Academic Pub.
   c. Mario Paz, William Leigh - Structural Dynamics -Theory and Computation.