ANNA UNIVERSITY, CHENNAI
NON AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
B. E. CIVIL ENGINEERING
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B E Civil Engineering will

I. Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations.

II. Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.

III. Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.

IV. Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.

V. Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering.

PROGRAM OUTCOMES (POs)

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<th>PO#</th>
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<td>1</td>
<td>Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
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<td>2</td>
<td>Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of Mathematics, natural sciences, and engineering sciences.</td>
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<td>3</td>
<td>Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, the cultural, societal, and environmental considerations.</td>
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<td>4</td>
<td>Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</td>
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<td>5</td>
<td>Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</td>
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<td>6</td>
<td>The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
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Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the Civil Engineering Degree programme, the Graduates shall exhibit the following:

PSO1 Knowledge of Civil Engineering discipline
Demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge.

PSO2 Critical analysis of Civil Engineering problems and innovation
Critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering issues
Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio-cultural factors.

PEO / PO Mapping:

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1 – Low; 2 – Medium; 3 – High; ‘-“– No correlation
## PROFESSIONAL ELECTIVE COURSES: VERTICALS

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| 46. | | Watershed Conservation and Management | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 2 |
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| 56. | Coastal Zone Management and Remote Sensing | 2 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 3 | 1 | 2 | 3 | 3 | 3 | 3 |
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| 59. | Earth and Rockfill Dams | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 2 |
| 60. | Computational Fluid Dynamics | 3 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 |
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| 62. | Transport and Environment | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 3 |
| 63. | Environmental Quality Monitoring | 3 | 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
### ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
B. E. CIVIL ENGINEERING
CURRICULUM AND SYLLABI FOR SEMESTERS I TO VIII

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$ NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA

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# NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
### SEMESTER V

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* Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

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*Open Elective – I shall be chosen from the emerging technologies

* Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)

* NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
## SEMESTER VII/VIII*

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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII

**Open Elective – II shall be chosen from the emerging technologies

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes

## SEMESTER VIII/VII*

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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII

TOTAL CREDITS: 166

## MANDATORY COURSES I*

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*Mandatory Courses are offered as Non-Credit Courses
### MANDATORY COURSES II*

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*Mandatory Courses are offered as Non-Credit Courses*
# PROFESSIONAL ELECTIVE COURSES : VERTICALS

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<tr>
<th>VERTICAL I (Structures)</th>
<th>VERTICAL II (Construction techniques and Practices)</th>
<th>VERTICAL III (Geotechnical)</th>
<th>VERTICAL IV (Geo-Informatics)</th>
<th>VERTICAL V (Transportation infrastructure)</th>
<th>VERTICAL VI (Environment)</th>
<th>VERTICAL VII (Water Resources)</th>
<th>VERTICAL VIII (Ocean Engineering)</th>
<th>VERTICAL IX (Diversified Course)</th>
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<tr>
<td>Concrete Structures</td>
<td>Formwork Engineering</td>
<td>Geo-Environmental Engineering</td>
<td>Total Station and GPS Surveying</td>
<td>Airports and Harbours</td>
<td>Climate Change Adaptation and Mitigation</td>
<td>Irrigation Engineering and Drawing</td>
<td>Ocean Wave Dynamics</td>
<td>Steel Concrete Composite Structures</td>
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<td>Construction Equipment and Machinery</td>
<td>Ground Improvement Techniques</td>
<td>Remote Sensing Concepts</td>
<td>Traffic Engineering and Management</td>
<td>Air and Noise Pollution Control Engineering</td>
<td>Groundwater Engineering</td>
<td>Marine Geotechnical Engineering</td>
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<td>Prestressed Concrete Structures</td>
<td>Digitalized Construction Lab</td>
<td>Rock Mechanics</td>
<td>Cartography and GIS</td>
<td>Smart cities</td>
<td>Industrial Wastewater Management</td>
<td>Watershed Conservation and Management</td>
<td>Off shore Structures</td>
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<td>Dynamics and Earthquake Resistant Structures</td>
<td>Advanced Construction Techniques</td>
<td>Pile Foundation</td>
<td>Airborne and Terrestrial laser mapping</td>
<td>Pavement Engineering</td>
<td>Environmental Policy and Legislations</td>
<td>Urban Water Infrastructure</td>
<td>Coastal Hazards and Mitigation</td>
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Registration of Professional Elective Courses from Verticals:

Refer to the Regulations 2021, Clause 6.3. (Amended on 27.07.2023)
### PROFESSIONAL ELECTIVE COURSES: VERTICALS

#### VERTICAL I: STRUCTURES

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OPEN ELECTIVES
(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories)

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)
To be offered other than Faculty of Information and Communication Engineering

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ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes. Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 (Amendments) of Regulations 2021.

VERTICALS FOR MINOR DEGREE (In addition to all the verticals of other programmes)

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<th>VERTICAL I</th>
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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

### VERTICAL 1: FINTECH AND BLOCK CHAIN

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This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do’s and dont’s, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.
(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the underprivileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

HS3152 PROFESSIONAL ENGLISH I

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COURSE OBJECTIVES:
- To improve the communicative competence of learners
- To learn to use basic grammatical structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does
the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; and Product /Process description. Grammar – Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS

Reading – Newspaper articles; Journal reports –and Non Verbal Communication ( tables, pie charts etc., ). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

LEARNING OUTCOMES :

At the end of the course, learners will be able

CO1: To use appropriate words in a professional context
CO2: To gain understanding of basic grammatical structures and use them in right context.
CO3: To read and infer the denotative and connotative meanings of technical texts
CO4: To read and interpret information presented in tables, charts and other graphic forms
CO5: To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:


ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

CO’s-PO’s & PSO’s MAPPING

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- Note: The average value of this course to be used for program articulation matrix.

MA3151 MATRICES AND CALCULUS

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COURSE OBJECTIVES:
- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES


UNIT II DIFFERENTIAL CALCULUS


UNIT III FUNCTIONS OF SEVERAL VARIABLES

UNIT IV INTEGRAL CALCULUS 9+3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS 9+3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 Use the matrix algebra methods for solving practical problems.
CO2 Apply differential calculus tools in solving various application problems.
CO3 Able to use differential calculus ideas on several variable functions.
CO4 Apply different methods of integration in solving practical problems.
CO5 Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

CO's-PO's & PSO's MAPPING

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COURSE OBJECTIVES:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS 9

UNIT II ELECTROMAGNETIC WAVES 9
The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

UNIT IV BASIC QUANTUM MECHANICS 9
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students should be able to

CO1 Understand the importance of mechanics.
CO2 Express their knowledge in electromagnetic waves.
CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4 Understand the importance of quantum physics.
CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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1-Low, 2-Medium, 3-High, “-”-”no correlation
Note: the average value of this course to be used for program articulation matrix.

CY3151 ENGINEERING CHEMISTRY

COURSE OBJECTIVES:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT

UNIT II NANOChemISTRY
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.
UNIT III PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION

UNIT V ENERGY SOURCES AND STORAGE DEVICES
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; Electric vehicles-working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

COURSE OUTCOMES:
At the end of the course, the students will be able:
CO1 To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2 To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
CO3 To apply the knowledge of phase rule and composites for material selection requirements.
CO4 To recommend suitable fuels for engineering processes and applications.
CO5 To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

REFERENCES:
### Course Objectives:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

### Unit I: Computational Thinking and Problem Solving

### Unit II: Data Types, Expressions, Statements
- Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

### Unit III: Control Flow, Functions, Strings
- Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

### Unit IV: Lists, Tuples, Dictionaries
- Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

### Unit V: Files, Modules, Packages
- Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

**TOTAL : 45 PERIODS**
COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

COs- PO’s & PSO's MAPPING

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GE3152 கிரீடாற் மபார்

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TEXT-CUM-REFERENCE BOOKS
1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookkand Educational Services Corporation, Tamil Nadu)

TOTAL : 15 PERIODS
UNIT I  LANGUAGE AND LITERATURE  3

UNIT II  HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  3

UNIT III  FOLK AND MARTIAL ARTS  3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV  THINAI CONCEPT OF TAMILS  3
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE  3
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. கல்வியியல் மற்றும் மருத்துவம் - மாநிலம் பாதுகாப்பு - கே.கே. பிள்மள. (மாநிலம்: கல்வியியல் மற்றும் மருத்துவம் பாதுகாப்பு குழு).
2. சிறந்தநிலை கல்வி - விளங்காதல் தொழி. கலைக். (மாநிலம்: புல்லியாளும்).
3. சிறந்தநிலை கல்வியியல் - மாநிலத் தொழி. கலைக். (சமாதியியான தொழி. கலைக்).
4. பானைகாலா - மாநிலத் தொழி. கலைக். (சமாதியியான தொழி. கலைக்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. Keeladi - ’Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter’s age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc. TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems..
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

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1 - low, 2 - medium, 3 - high, '-' - no correlation

BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young’s modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
    b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS
COURSE OUTCOMES:
Upon completion of the course, the students should be able to
CO1 Understand the functioning of various physics laboratory equipment.
CO2 Use graphical models to analyze laboratory data.
CO3 Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4 Access, process and analyze scientific information.
CO5 Solve problems individually and collaboratively.

CO’s-PO’s & PSO’s MAPPING

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- 1-Low,2-Medium,3-High,”-“-no correlation
- Note: the average value of this course to be used for program articulation matrix.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
13. Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES :
CO1 To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2 To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3 To analyse and determine the composition of alloys.
CO4 To learn simple method of synthesis of nanoparticles
CO5 To quantitatively analyse the impurities in solution by electroanalytical techniques”
TEXT BOOKS:

COs- PO’s & PSO’s MAPPING

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GE3172 ENGLISH LABORATORY

COURSE OBJECTIVES:
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students’ English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II NARRATION AND SUMMATION
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings-engaging in small talk-describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS PRODUCT
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description-describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-
UNIT V  EXPRESSION
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
CO1 To listen to and comprehend general as well as complex academic information
CO2 To listen to and understand different points of view in a discussion
CO3 To speak fluently and accurately in formal and informal communicative contexts
CO4 To describe products and processes and explain their uses and purposes clearly and accurately
CO5 To express their opinions effectively in both formal and informal discussions

ASSESSMENT PATTERN
• One online / app based assessment to test listening /speaking
• End Semester ONLY listening and speaking will be conducted online.
• Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

COs- PO’s & PSO’s MAPPING

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• 1-low, 2-medium, 3-high, ‘-’- no correlation

Note: The average value of this course to be used for program articulation matrix

HS3252  PROFESSIONAL ENGLISH II

COURSE OBJECTIVES:
• To engage learners in meaningful language activities to improve their reading and writing skills
• To learn various reading strategies and apply in comprehending documents in professional context.
• To help learners understand the purpose, audience, contexts of different types of writing
• To develop analytical thinking skills for problem solving in communicative contexts
• To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I  MAKING COMPARISONS
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases
UNIT II  EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING  6
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints.Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III  PROBLEM SOLVING  6
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Errorcorrection; If conditional sentences

UNIT IV  REPORTING OF EVENTS AND RESEARCH  6

UNIT V  THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY  6
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar –Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

COURSE OUTCOMES:
At the end of the course, learners will be able
CO1 To compare and contrast products and ideas in technical texts.
CO2 To identify and report cause and effects in events, industrial processes through technical texts
CO3 To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4 To present their ideas and opinions in a planned and logical manner
CO5 To draft effective resumes in the context of job search.

TEXT BOOKS :
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCES:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

COs- PO’s & PSO’s MAPPING

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- 1-low, 2-medium, 3-high, "-"- no correlation

Note: The average value of this course to be used for program articulation matrix
COURSE OBJECTIVES:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I  TESTING OF HYPOTHESIS  9+3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II  DESIGN OF EXPERIMENTS  9+3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  9+3

UNIT IV  INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION  9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  9+3

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:

CO1 Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2 Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3 Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4 Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5 Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:
REFERENCES:

COs- PO's & PSO's MAPPING

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PH3201 PHYSICS FOR CIVIL ENGINEERING   L T P C
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COURSE OBJECTIVES:
- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

UNIT I THERMAL APPLICATIONS

UNIT II VENTILATION AND REFRIGERATION
Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

UNIT III ACOUSTICS AND LIGHTING DESIGNS
Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multistoried buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.
UNIT IV  NEW ENGINEERING MATERIALS
Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

UNIT V  NATURAL DISASTERS
Seismology and Seismic waves - Earthquake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of the course, the students should be able to
CO1 acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.
CO2 gain knowledge on the ventilation and air conditioning of buildings
CO3 understand the concepts of sound absorption, noise insulation and lighting designs
CO4 know about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics
CO5 get an awareness on natural disasters such as earthquake, cyclone, fire and safety measures

TEXT BOOKS:

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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1-Low,2-Medium,3-High,”-“-no correlation
Note: the average value of this course to be used for program articulation matrix.
COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I  ELECTRICAL CIRCUITS
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three-phase systems

UNIT II   MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS
Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.
Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III  ELECTRICAL MACHINES

UNIT IV  ANALOG ELECTRONICS

UNIT V   SENSORS AND TRANSDUCERS
Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

COURSE OUTCOMES:
After completing this course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestics wiring and protective devices
CO3: Explain the working principle and applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the types and operating principles of sensors and transducers

TOTAL: 45 PERIODS
**TEXT BOOKS:**
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf's Introduction to Electric Circuits, Wiley, 2018

**REFERENCES:**

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**GE3251 ENGINEERING GRAPHICS**

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<td>The main learning objective of this course is to prepare the students for:</td>
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<tr>
<td>- Drawing engineering curves.</td>
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<td>- Drawing freehand sketch of simple objects.</td>
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<td>- Drawing orthographic projection of solids and section of solids.</td>
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<td>- Drawing development of solids</td>
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<tr>
<td>- Drawing isometric and perspective projections of simple solids.</td>
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**CONCEPTS AND CONVENTIONS (Not for Examination)**
Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

**UNIT I PLANE CURVES**
6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

**UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE**
6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

**UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING**
6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects. Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)
UNIT IV  
PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES  
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones. Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V  
ISOMETRIC AND PERSPECTIVE PROJECTIONS  
Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method. Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)

COURSE OUTCOMES:  
On successful completion of this course, the student will be able to  
CO1 Use BIS conventions and specifications for engineering drawing.  
CO2 Construct the conic curves, involutes and cycloid.  
CO3 Solve practical problems involving projection of lines.  
CO4 Draw the orthographic, isometric and perspective projections of simple solids.  
CO5 Draw the development of simple solids.

TEXT BOOKS:  

REFERENCES:  

Publication of Bureau of Indian Standards:  

Special points applicable to University Examinations on Engineering Graphics:  
1. There will be five questions, each of either or type covering all units of the syllabus.  
2. All questions will carry equal marks of 20 each making a total of 100.  
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.  
4. The examination will be conducted in appropriate sessions on the same day.
COs- PO's & PSO's MAPPING

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Low (1); Medium (2); High (3)

NCC Credit Course Level 1*

**NX3251**

(ARMY WING) NCC Credit Course Level - I

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**NCC GENERAL**

- NCC 1 Aims, Objectives & Organization of NCC
- NCC 2 Incentives
- NCC 3 Duties of NCC Cadet
- NCC 4 NCC Camps: Types & Conduct

**NATIONAL INTEGRATION AND AWARENESS**

- NI 1 National Integration: Importance & Necessity
- NI 2 Factors Affecting National Integration
- NI 3 Unity in Diversity & Role of NCC in Nation Building
- NI 4 Threats to National Security

**PERSONALITY DEVELOPMENT**

- PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving
- PD 2 Communication Skills
- PD 3 Group Discussion: Stress & Emotions

**LEADERSHIP**

- L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ‘Code
- L 2 Case Studies: Shivaji, Jhasi Ki Rani

**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**

- SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth
- SS 4 Protection of Children and Women Safety
- SS 5 Road / Rail Travel Safety
- SS 6 New Initiatives
- SS 7 Cyber and Mobile Security Awareness

**TOTAL : 30 PERIODS**
## NCC Credit Course Level 1*

### NX3252  
**NAVAL WING** NCC Credit Course Level - I  
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### NCC GENERAL
- **NCC 1**  Aims, Objectives & Organization of NCC  
- **NCC 2**  Incentives  
- **NCC 3**  Duties of NCC Cadet  
- **NCC 4**  NCC Camps: Types & Conduct

### NATIONAL INTEGRATION AND AWARENESS
- **NI 1**  National Integration: Importance & Necessity  
- **NI 2**  Factors Affecting National Integration  
- **NI 3**  Unity in Diversity & Role of NCC in Nation Building  
- **NI 4**  Threats to National Security

### PERSONALITY DEVELOPMENT
- **PD 1**  Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  
- **PD 2**  Communication Skills  
- **PD 3**  Group Discussion: Stress & Emotions

### SOCIAL SERVICE AND COMMUNITY DEVELOPMENT
- **SS 1**  Basics, Rural Development Programmes, NGOs, Contribution of Youth  
- **SS 4**  Protection of Children and Women Safety  
- **SS 5**  Road / Rail Travel Safety  
- **SS 6**  New Initiatives  
- **SS 7**  Cyber and Mobile Security Awareness

TOTAL : 30 PERIODS

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## NCC Credit Course Level 1*

### NX3253  
**AIR FORCE WING** NCC Credit Course Level - I  
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### NCC GENERAL
- **NCC 1**  Aims, Objectives & Organization of NCC  
- **NCC 2**  Incentives  
- **NCC 3**  Duties of NCC Cadet  
- **NCC 4**  NCC Camps: Types & Conduct

### NATIONAL INTEGRATION AND AWARENESS
- **NI 1**  National Integration: Importance & Necessity  
- **NI 2**  Factors Affecting National Integration  
- **NI 3**  Unity in Diversity & Role of NCC in Nation Building  
- **NI 4**  Threats to National Security

### PERSONALITY DEVELOPMENT
- **PD 1**  Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  
- **PD 2**  Communication Skills  
- **PD 3**  Group Discussion: Stress & Emotions
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**TOTAL: 30 PERIODS**

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**TOTAL: 15 PERIODS**
TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலை – மக்களும் பணபொடும் – தம. பிள்மள (தவளியீடு: தமிழ்நொட்டு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி –மவமக நதிக்கமரயில் எங்ககொல நகர நொகரிகம் (ததொல்லியல் தவளியீடு).
4. தபொருமந – ஆற்றங்கமர நொகரிகம். (ததொல்லியல் தவளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE3252 TAMILS AND TECHNOLOGY L T P C
1 0 0 1
UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.
UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.
UNIT III MANUFACTURING TECHNOLOGY 3
UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.
TEXT-CUM-REFERENCE BOOKS
1. தமிழ் வரலை மகிழ்தல் பலகையை செய்தல் (எனினும்: தமிழ்நூறு பல்கலைக்கழகம் கல்விப்பில் பல்கலைக்கழகம்).
2. கணினித் தமிழ் - முமனவள் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. சிறுமி - கோழிக்கோட்டையில் சாக்கல் தொடர் நகரிகம் (தமிழ்நூறு கல்விப்பில்).
4. போருக்கல் - அறிவியல் நகரிகம். (தமிழ்நூறு கல்விப்பில்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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GE3271 ENGINEERING PRACTICES LABORATORY

COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

PLUMBING WORK:
- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15
a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/calibration
e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:
a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:
a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:
a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:
a) Making of a square tray

FOUNDRY WORK:
a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:
a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
a) Study an elements of smart phone..
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/laptop

TOTAL : 60 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:

**CO1** Draw pipe line plans; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

**CO2** Wire various electrical joints in common household electrical wire work.

**CO3** Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

**CO4** Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

**COs- PO’s & PSO’s MAPPING**

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Low (1); Medium (2); High (3)

BE3272 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To train the students in conducting load tests electrical machines
- To gain practical experience in experimentally obtaining the characteristics of electronic devices and rectifiers
- To train the students to measure three phase power and displacement

**List of Experiments**
1. Verification of ohms and Kirchhoff’s Laws.
2. Three Phase Power Measurement
3. Load test on DC Shunt Motor.
4. Load test on Self Excited DC Generator
5. Load test on Single phase Transformer
6. Load Test on Induction Motor
7. Characteristics of PN and Zener Diodes
8. Characteristics of BJT, SCR and MOSFET
9. Design and analysis of Half wave and Full Wave rectifiers
10. Measurement of displacement of LVDT

TOTAL: 60 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to

**CO1:** Use experimental methods to verify the Ohm’s law and Kirchhoff’s Law and to measure three phase power

**CO2:** Analyze experimentally the load characteristics of electrical machines

**CO3:** Analyze the characteristics of basic electronic devices

**CO4:** Use LVDT to measure displacement
COURSE OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays.
- To give instructions and recommendations that are clear and relevant to the context.

UNIT I

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-
discussing progress toward goals-talking about experiences- talking about events in life- discussing past events- Writing: writing emails (formal & semi-formal).

UNIT II

Speaking: discussing news stories- talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-
discussing plans and decisions- discussing purposes and reasons- understanding common technology terms- Writing: - writing different types of emails.

UNIT III

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV

Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules-( example- discussing rental arrangements)- understanding technical instructions- Writing: writing instructions-writing a short article.

UNIT V

Speaking: describing things relatively-describing clothing-discussing safety issues( making recommendations) talking about electrical devices-describing controlling actions- Writing: job application( Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS
LEARNING OUTCOMES
At the end of the course, learners will be able
CO1 Speak effectively in group discussions held in a formal/semi formal contexts.
CO2 Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
CO3 Write emails, letters and effective job applications.
CO4 Write critical reports to convey data and information with clarity and precision
CO5 Give appropriate instructions and recommendations for safe execution of tasks

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

COs- PO's & PSO's MAPPING

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- 1-low, 2-medium, 3-high, '-' no correlation
- Note: The average value of this course to be used for program articulation matrix.

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

COURSE OBJECTIVES
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES 9 + 3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.
UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3
Classification of PDE – Method of separation of variables - Fourier series solutions of one
dimensional wave equation – One dimensional equation of heat conduction – Steady state solution
of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS 9 + 3
Statement of Fourier integral theorem– Fourier transform pair – Fourier sine and
cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval’s
identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3
Z-transforms - Elementary properties – Convergence of Z-transforms - – Initial and final value
theorems - Inverse Z-transform using partial fraction and convolution theorem - Formation of
difference equations – Solution of difference equations using Z - transforms.

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:

CO1 Understand how to solve the given standard partial differential equations.
CO2 Solve differential equations using Fourier series analysis which plays a vital role in engineering
applications.
CO3 Appreciate the physical significance of Fourier series techniques in solving one and two
dimensional heat flow problems and one dimensional wave equations.
CO4 Understand the mathematical principles on transforms and partial differential equations would
provide them the ability to formulate and solve some of the physical problems of engineering.
CO5 Use the effective mathematical tools for the solutions of partial differential equations by using Z
transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:
Delhi, 2016.

COs- PO's & PSO's MAPPING

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COURSE OBJECTIVES

- To Learn the use scalar and vector analytical techniques for analyzing forces in Statically determinate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I

STATICS OF PARTICLES


UNIT II

EQUILIBRIUM OF RIGID BODIES


UNIT III

DISTRIBUTED FORCES

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV

FRICITION

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

UNIT V

DYNAMICS OF PARTICLES


TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1 Illustrate the vectorial and scalar representation of forces and moments
CO2 Analyse the rigid body in equilibrium
CO3 Evaluate the properties of distributed forces
CO4 Determine the friction and the effects by the laws of friction
CO5 Calculate dynamic forces exerted in rigid body

TEXTBOOKS:

REFERENCES:

COs- PO's & PSO's MAPPING

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Low (1); Medium (2); High (3)

CE3301 FLUID MECHANICS

COURSE OBJECTIVES:
- To introduce the students about properties and behaviour of the fluids under static conditions and impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS

UNIT II BASIC CONCEPTS OF FLUID FLOW
Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets; Dynamics : Application of control volume to continuity, energy and momentum – Euler's equation of motion along a stream line – Bernoulli’s equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES
Fundamental dimensions – Dimensional homogeneity – Rayleigh’s method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.
UNIT IV INCOMPRESSIBLE VISCOUS FLOW


UNIT V BOUNDARY LAYERS

Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer – Drag and Lift forces.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to

CO1 Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.

CO2 Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.

CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performance of prototypes by model studies.

CO4 Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.

CO5 Explain the concept of boundary layer and its application to find the drag force exerted by the fluid on the flat solid surface.

TEXTBOOKS:


REFERENCES:


COs- PO's & PSO's MAPPING

<table>
<thead>
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## CE3302 CONSTRUCTION MATERIALS AND TECHNOLOGY

**COURSE OBJECTIVES:**
- To introduce students to various construction materials and the techniques that are commonly used in civil engineering construction.

### UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME
9

### UNIT II OTHER MATERIALS
9

### UNIT III CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS
9

### UNIT IV CONSTRUCTION Equipments
9
- Selection of equipment for earthwork excavation, concreting, material handling and erection of structures – Dewatering and pumping equipment.

### UNIT V CONSTRUCTION PLANNING
9
- Introduction to construction planning – Scheduling for activities – Critical path method (CPM) and PERT network modelling and time analysis – Case illustrations.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**
Students will be able to:

- **CO1** Identify the good quality brick, stone and blocks for construction.
- **CO2** Recognize the market forms of timber, steel, aluminum and applications of various composite materials.
- **CO3** Identify the best construction and service practices such as thermal insulations and air conditioning of the building.
- **CO4** Select various equipments for construction works conditioning of building.
- **CO5** Understand the construction planning and scheduling techniques.

**TEXTBOOKS**
REFERENCES:

COs- PO’s & PSO’s MAPPING

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CE3303 WATER SUPPLY AND WASTEWATER ENGINEERING

COURSE OBJECTIVES:
- To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal and design of intake structures and sewerage system.

UNIT I WATER SUPPLY
Estimation of surface and subsurface water resources - Predicting demand for water- Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT
Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clariflocculator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspects.
UNIT III  WATER STORAGE AND DISTRIBUTION
Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV  PLANNING AND DESIGN OF SEWERAGE SYSTEM
Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage-Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT V  SEWAGE TREATMENT AND DISPOSAL
Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission
CO2 Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations
CO3 Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatment process
CO4 Ability to design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.
CO5 Able to understand and design the various advanced treatment system and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage

TEXTBOOKS:

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| PSO2     | Critical analysis of Civil Engineering problems and innovation | 2   | 2   | 2   |     |     | 2   |
| PSO3     | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2   | 2   | 3   |     |     | 2   |

CE3351

SURVEYING AND LEVELLING

COURSE OBJECTIVES:
- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers and to learn the various methods of plane and geodetic surveying to solve the real world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying.

UNIT I   FUNDAMENTALS OF CONVENTIONAL SURVEYING

UNIT II   LEVELLING

UNIT III   THEODOLITE SURVEYING
UNIT IV    CONTROL SURVEYING AND ADJUSTMENT


UNIT V MODERN SURVEYING


TOTAL 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Introduce the rudiments of various surveying and its principles.
CO2 Imparts knowledge in computation of levels of terrain and ground features
CO3 Imparts concepts of Theodolite Surveying for complex surveying operations
CO4 Understand the procedure for establishing horizontal and vertical control
CO5 Imparts the knowledge on modern surveying instruments

TEXTBOOKS:


REFERENCES:


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| PSO1   | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
CE3361                         SURVEYING AND LEVELLING LABORATORY                         L  T  P  C
COURSE OBJECTIVE:
- At the end of the course the student will possess knowledge about survey field techniques
LIST OF EXPERIMENTS:
Chain Survey
1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room
Compass Survey
3. Compass Traversing – Measuring Bearings & arriving included angles
Levelling - Study of levels and levelling staff
4. Fly levelling using Dumpy level & Tilting level
5. Check levelling
Theodolite - Study of Theodolite
6. Measurements of horizontal angles by reiteration and repetition and vertical angles
7. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.
Tacheometry – Tangential system – Stadia system
8. Determination of Tacheometric Constants
9. Heights and distances by stadia Tacheometry
10. Heights and distances by Tangential Tacheometry
Total Station - Study of Total Station, Measuring Horizontal and vertical angles
11. Traverse using Total station and Area of Traverse
12. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL: 45 PERIODS
COURSE OUTCOMES
On completion of the course, the student is expected to
CO1 Impart knowledge on the usage of basic surveying instruments like chain/tape, compass and levelling instruments
CO2 Able to use levelling instrument for surveying operations
CO3 Able to use theodolite for various surveying operations
CO4 Able to carry out necessary surveys for social infrastructures
CO5 Able to prepare planimetric maps
REFERENCES:

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**CE3311 WATER AND WASTEWATER ANALYSIS LABORATORY**

**COURSE OBJECTIVE:**
- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

**LIST OF EXPERIMENTS: ANALYSIS OF WATER SAMPLE**
1. Sampling and preservation methods for water and wastewater (Demonstration only)
2. Measurement of Electrical conductivity and turbidity
3. Determination of fluoride in water by spectrophotometric method /ISE
4. Determination of iron in water (Demo)
5. Determination of Sulphate in water
6. Determination of Optimum Coagulant Dosage by Jar test apparatus
7. Determination of available Chlorine in Bleaching powder and residual chlorine in water
ANALYSIS OF WASTEWATER SAMPLE
8. Estimation of suspended, volatile and fixed solids
9. Determination of Sludge Volume Index in waste water
10. Determination of Dissolved Oxygen
11. Estimation of B.O.D.
12. Estimation of C.O.D.
13. Determination of TKN and Ammonia Nitrogen in wastewater
14. Determination of total and faecal coliform (Demonstration only)

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Calibrate and standardize the equipment
CO2 Collect proper sample for analysis
CO3 To know the sample preservation methods
CO4 To perform field oriented testing of water, wastewater
CO5 To perform coliform analysis

REFERENCES:

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COURSE OBJECTIVES:

- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD: 10 Hours
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL: 10 Hours
Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook

MS POWERPOINT: 10 Hours
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS
COURSE OUTCOMES:
On successful completion the students will be able to
CO1 Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
CO2 Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
CO3 Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

CE3401 APPLIED HYDRAULICS ENGINEERING L T P C
3 1 0 4
COURSE OBJECTIVES:
- To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

UNIT I UNIFORM FLOW 9+3
Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow - Velocity distribution in open channel - Steady uniform flow: Chezy’s equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.

UNIT II VARIED FLOWS 9+3

UNIT III RAPIDLY VARIED FLOWS 8+3
Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Positive and Negative surges.

UNIT IV TURBINES 9+3
Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed – Minimum Speed to start the pump.

UNIT V PUMPS 9+3
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitation’s in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done.

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application
CO2 Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.
CO3 Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
CO4 Design turbines and explain the working principle
CO5 Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.
TEXT BOOKS:
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

REFERENCES:

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<td>Conceptualization and evaluation of engineering solutions to Civil Engineering Issues</td>
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CE3402  STRENGTH OF MATERIALS  L T P C
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COURSE OBJECTIVES:
- To learn the fundamental concepts of Stress in simple and complex states and to know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending and to determine the deformation in determinate beams and to know the basic concepts of analysis of indeterminate beams.

UNIT I  SIMPLE AND COMPOUND STRESSES  9
Stresses in simple and compound bars – Thermal stresses – Elastic constants - Thin cylindrical and spherical shells – Biaxial state of stress – Principal stresses and principal planes – Mohr’s circle of stresses - Torsion on circular shafts.

UNIT II  BENDING OF BEAMS  9
Types of beams and transverse loadings– Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution.
UNIT III   DEFLECTION OF BEAMS
Double Integration method – Macaulay's method – Area moment method – Conjugate beam method
- Strain energy method for determinate beams.

UNIT IV   INDETERMINATE BEAMS
Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for
standard cases of loading — Continuous beams – support reactions and moments – Theorem of
three moments – Shear Force and Bending Moment Diagrams.

UNIT V   ADVANCED TOPICS
Unsymmetrical bending of beams - shear center applied - Thick cylinders - Theories of failure –
Principal stress, principal strain, shear stress, strain energy and distortion energy theories –
application problems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to
CO1 Understand the concepts of stress and strain, principal stresses and principal planes.
CO2 Determine Shear force and bending moment in beams and understand concept of theory of
simple bending.
CO3 Calculate the deflection of beams by different methods and selection of method for determining
slope or deflection.
CO4 Analyze propped cantilever, fixed beams and continuous beams for external loadings and
support settlements.
CO5 Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and
study the various theories of failure

TEXTBOOKS
   Delhi, 2018.
   2017.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol -II,

REFERENCES:
   2015
5. Irving H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India,
   New Delhi, 2002
   2010.
   Delhi 2015.
COs- PO’s & PSO’s MAPPING

<table>
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PROGRAM OUTCOMES(PO)

PROGRAM SPECIFIC OUTCOMES(PSO)

CE3403 CONCRETE TECHNOLOGY

COURSE OBJECTIVES:
- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete.
- To familiarize with the IS method of mix design as per the latest code.
- To understand the fresh and hardened properties of concrete. To know the importance and applications of special concretes

UNIT I CONSTITUENT ATERIALS
Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water- Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES
Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX
Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples

74
UNIT IV  FRESH AND HARDENED PROPERTIES OF CONCRETE

Workability - Tests for workability of concrete - Slump Test and Compacting factor Test - Segregation and Bleeding - Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete - Stress-strain curve for concrete - Determination of Modulus of elasticity.

UNIT V  SPECIAL CONCRETES


TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to

CO1 Understand the requirements of cement, aggregates and water for concrete
CO2 Select suitable admixtures for enhancing the properties of concrete
CO3 Design concrete mixes as per IS method of mix design
CO4 Determine the properties of concrete at fresh and hardened state.
CO5 Know the importance of special concretes for specific requirements.

TEXTBOOKS:

REFERENCES:
3. Job Thomas, Concrete Technology, Cencage learning India Private Ltd, New Delhi, 2015.

COs- PO’s & PSO’s MAPPING

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</table>
COURSE OBJECTIVES

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I  SOIL CLASSIFICATION AND COMPACTION


UNIT II  EFFECTIVE STRESS AND PERMEABILITY


UNIT III  STRESS DISTRIBUTION AND SETTLEMENT


UNIT IV  SHEAR STRENGTH

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V  SLOPE STABILITY


COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

CO1 Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2 Show the basic understanding of flow through soil medium and its impact of engineering solution

CO3 Understand the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation

CO4 Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.

CO5 Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.
# TEXTBOOKS:

# REFERENCES:

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## PROGRAM OUTCOMES(PO)

### PROGRAM SPECIFIC OUTCOMES(PSO)

| PSO1 | Knowledge of Civil Engineering discipline | 3    | 2    | 2    | 2    | 2    | 2                       |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3    | 2    | 2    | 2    | 3    | 2                       |
| PSO3 | Conceptualization and evaluation of Engineering solutions to Civil engineering issues | 2    | 3    | 3    | 3    | 2    | 3                       |

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### COURSE OBJECTIVE:
- To give an overview about the highway and railway engineering with respect to, planning, design, construction and maintenance as per IRC standards, specifications and methods.

### UNIT I HIGHWAY ENGINEERING

Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Typical cross sections of Urban and Rural roads – Engineering surveys for alignment- Conventional and Modern method
UNIT II DESIGN OF HIGHWAY ELEMENTS
Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients– pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

UNIT III HIGHWAY CONSTRUCTION AND MAINTENANCE

UNIT IV RAILWAY PLANNING AND CONSTRUCTION
Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods-Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems)-Railway drainage- Level Crossings-Signalling.

UNIT V RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION

TOTAL: 45 PERIODS

COURSE OUTCOMES
On completion of the course, the student is expected to

CO1 Plan a highway according to the principles and standards adopted in various institutions in India.
CO2 Design the geometric features of road network and components of pavement.
CO3 Test the highway materials and construction practice methods and know its properties and able to perform pavement evaluation and management.
CO4 Understand the methods of route alignment and design elements in railway planning and constructions.
CO5 Understand the construction techniques and maintenance of track laying and railway stations.

TEXTBOOKS:

REFERENCES:
1. Indian Road Congress (IRC), Guidelines for the Design of Flexible Pavements, (Third Revision), IRC:37-2012
6. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning, New Delhi, 2010
C0s- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

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GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY  L  T  P  C  2 0 0 2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY  6

UNIT II  ENVIRONMENTAL POLLUTION  6

UNIT III  RENEWABLE SOURCES OF ENERGY  6
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV  SUSTAINABILITY AND MANAGEMENT  6
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V  SUSTAINABILITY PRACTICES  6

TOTAL : 30 PERIODS

COURSE OUTCOMES:

CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.

CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.

CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.

CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:

5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

REFERENCES:


### COs- PO's & PSO's MAPPING

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*1-low, 2-medium, 3-high, "-"- no correlation

### NCC Credit Course Level 2*

**NX3451**

**ARMY WING**

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### BORDER & COASTAL AREAS

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**TOTAL: 45 PERIODS**

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### NCC Credit Course Level 2*

**NX3452 (NAVAL WING) NCC Credit Course Level - II**

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#### PERSONALITY DEVELOPMENT

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#### LEADERSHIP

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#### DISASTER MANAGEMENT

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#### ENVIRONMENTAL AWARENESS & CONSERVATION

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#### NAVAL ORIENTATION

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#### ADVENTURE

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#### BORDER & COASTAL AREAS

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**TOTAL: 45 PERIODS**

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82
NCC Credit Course Level 2

NX3453 (AIR FORCE WING) NCC Credit Course Level - II

PERSONALITY DEVELOPMENT
PD 3 Group Discussion: Change your mindset, Time Management, Social Skills 6
PD 5 Public Speaking 3

LEADERSHIP
L 2 Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965 7

DISASTER MANAGEMENT
DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3
DM 2 Initiative Training, Organising Skills, Do's & Don’t's, Natural Disasters, Man Made Disasters 9
DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION
EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS
GA 1 General Knowledge 4

GENERAL SERVICE KNOWLEDGE
GSK 1 Armed Forces & IAF Capsule 2
GSK 2 Modes of Entry in IAF, Civil Aviation 2
GSK 3 Aircrafts - Types, Capabilities & Role 2

ADVENTURE
AD 1 Introduction to Adventure Activities 1

BORDER & COASTAL AREAS
BCA 1 History, Geography & Topography of Border/Coastal areas 2

TOTAL: 45 PERIODS

CE3411 HYDRAULIC ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

LIST OF EXPERIMENTS (Any 10 of the following)

A. FLOW MEASUREMENT
1. Calibration of Rotameter
2. Flow through Orifice meter/mouthpiece, Venturimeter and Notches
3. Bernoulli’s Experiment
B. LOSSES IN PIPES
4. Determination of friction factor in pipes.
5. Determination of minor losses

C. PUMPS
6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Reciprocating pump

D. TURBINES
10. Characteristics of Pelton wheel turbine
11. Characteristics of Francis turbine

E. DETERMINATION OF METACENTRIC HEIGHT
12. Determination of metacentric height of floating bodies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to

CO1 Apply Bernoulli equation for calibration of flow measuring devices.
CO2 Measure friction factor in pipes and compare with Moody diagram
CO3 Determine the performance characteristics of rotodynamic pumps.
CO4 Determine the performance characteristics of positive displacement pumps.
CO5 Determine the performance characteristics of turbines.

REFERENCES:

COs- PO's & PSO's MAPPING

<table>
<thead>
<tr>
<th>Program Outcomes</th>
<th>PO1 Knowledge of Engineering Sciences</th>
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COURSE OBJECTIVES:

- To develop skills to test various construction materials.

I. TESTS ON METALS
   a. Tension test on steel rod
   b. Torsion test on mild steel rod
   c. Deflection test on metal beam
   d. Double shear test on metal
   e. Impact test on metal specimen (Izod and Charpy)
   f. Hardness test on metals (Rockwell and Brinell Hardness Tests)
   g. Compression test on helical spring
   h. Deflection test on carriage spring

II. TESTS ON CEMENT
   a. Determination of fineness of cement
   b. Determination of consistency of cement
   c. Determination of specific gravity of cement
   d. Determination of initial and final setting time of cement

III. TESTS ON FINE AGGREGATE
   a. Determination of specific gravity and water absorption of fine aggregate
   b. Determination of grading of fine aggregate
   c. Determination of water absorption for fine aggregate

IV. TESTS ON COARSE AGGREGATE
   a. Determination of compacted and loose bulk density of coarse aggregate
   b. Determination of impact value of coarse aggregate
   c. Determination of elongation index of coarse aggregate
   d. Determination of flakiness index of coarse aggregate
   e. Determination of aggregate crushing value of coarse aggregate
   f. Determination of specific gravity and water absorption of coarse aggregate

V. TESTS ON BRICKS
   a. Determination of compressive strength of bricks
   b. Determination of water absorption of bricks
   c. Determination of efflorescence of bricks

VI. TESTS ON CONCRETE
   a. Determination of slump of concrete
   b. Determination of compressive strength of concrete
   c. Determination of flowability of self-compacting concrete (Demo only)

VII. TEST ON WOOD
   a. Determination of Compression test on wood

TOTAL: 60 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

CO1 Determine the mechanical properties of steel.
CO2 Determine the physical properties of cement
CO3 Determine the physical properties of fine and coarse aggregate.
CO4 Determine the workability and compressive strength of concrete.
CO5 Determine the strength of brick and wood.
COs- PO’s & PSO’s MAPPING

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CE3413 SOIL MECHANICS LABORATORY

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COURSE OBJECTIVES:
- To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

EXERCISES:
1. DETERMINATION OF INDEX PROPERTIES
   a. Specific gravity of soil solids
   b. Grain size distribution – Sieve analysis
   c. Grain size distribution - Hydrometer analysis
   d. Liquid limit and Plastic limit tests
   e. Shrinkage limit and Differential free swell tests
2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS
   a. Field density Test (Sand replacement method)
3. DETERMINATION OF ENGINEERING PROPERTIES
   a. Permeability determination (constant head and falling head methods)
   b. One dimensional consolidation test (determination of co-efficient of consolidation only)
   c. Direct shear test in cohesion less soil
   d. Unconfined compression test in cohesive soil
   e. Laboratory vane shear test in cohesive soil
   f. Tri-axial compression test in cohesion less soil (Demonstration only)
   g. California Bearing Ratio Test
4. TEST ON GEOSYNTHETICS (Demonstration only)
   Determination of tensile strength and interfacial friction angle.
   a. Determination of apparent opening sizes and permeability.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to

CO1 Conduct tests to determine the index properties of soils
CO2 Determine the insitu density and compaction characteristics.
CO3 Conduct tests to determine the compressibility, permeability and shear strength of soils.
CO4 Understand the various tests on Geosynthetics.

REFERENCES:
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVE:

- To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RC flanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.

UNIT I  METHODS OF DESIGN OF CONCRETE STRUCTURES  9

UNIT II  LIMIT STATE METHOD - FLANGED BEAM, SHEAR & TORSION  9
Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.

UNIT III  LIMIT STATE DESIGN OF SLABS AND STAIRCASE  9
Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions - Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab.

UNIT IV  LIMIT STATE DESIGN OF COLUMNS  9
Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

UNIT V  LIMIT STATE DESIGN OF FOOTING  9
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

COURSE OUTCOMES:
At the end of the course the student will be able to

CO1 Know the various design concepts and design RC rectangular beams by working stress and limit state methods

CO2 Understand the design of flanged beams, design for shear and torsion, and anchorage and development length.

CO3 Design a RC slabs and staircase and draw the reinforcement detailing.

CO4 Design short columns for axial, uni-axial and bi-axial eccentric loadings

CO5 Design wall footings, isolated footings and combined rectangular footing.

TEXT BOOKS:

REFERENCES:
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### CE3502 STRUCTURAL ANALYSIS I

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**COURSE OBJECTIVE:**
- To introduce the students to the basic theory and concepts of classical methods of structural analysis

**UNIT I**

**ANALYSIS OF TRUSSES**

**UNIT II**

**SLOPE DEFLECTION METHOD**
- Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

**UNIT III**

**MOMENT DISTRIBUTION METHOD**
- Stiffness - distribution and carry over factors — Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

**UNIT IV**

**FLEXIBILITY METHOD**
- Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.
UNIT V
STIFFNESS METHOD
Restrained structure – Formation of stiffness matrices - equilibrium condition - Analysis of Continuous beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to
CO1 Analyze the pin-jointed plane and space frames.
CO2 Analyse the continuous beams and rigid frames by slope deflection method.
CO3 Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
CO4 Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
CO5 Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

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COURSE OBJECTIVE:
- To impart knowledge to plan and execute a detailed site investigation programme, to select
geotechnical design parameters and type of foundations. Also to familiarize the students for the
gеotechnical design of different type of foundations and retaining walls.

UNIT I  SITE INVESTIGATION AND SELECTION OF FOUNDATION  9
Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary
drilling – Depth and spacing of bore holes – Soil samples – Representative and undisturbed –
Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration
tests (SPT and SCPT) – Data interpretation - Strength parameters and Evaluation of Liquefaction
potential - Selection of foundation based on soil condition- Bore log report.

UNIT II  BEARING CAPACITY OF SHALLOW FOUNDATION  9
Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow
foundation on homogeneous deposits – Terzaghi’s formula and BIS formula – Factors affecting
bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable
bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of
Settlement of foundations on granular and clay deposits – Total and differential settlement –
Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III  FOOTINGS AND RAFTS  9
Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement
distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid
behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration
– Codal provision

UNIT IV  PILE FOUNDATION  9
Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of
single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and
Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity- Group
capacity by different methods (Field’s rule, Converse – Labarra formula and block failure criterion) –
Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles –
Capacity under compression and uplift – Codal provision.

UNIT V  RETAINING WALLS  9
Plastic equilibrium in soils – Active and passive states – Rankine’s theory – Cohesionless and
cohesive soil – Coulomb’s wedge theory – Condition for critical failure plane – Earth pressure on
retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to
line load – Stability analysis of retaining walls – Codal provision.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Graduate will demonstrate an ability to plan and execute a detailed site investigation to select
gеotechnical design parameters and type of foundation
  CO2 Graduate will demonstrate an ability to design shallow foundations, its component or process
as per the needs and specifications.
  CO3 Graduate will demonstrate an ability to design combined footings and raft foundations, its
component or process as per the needs and specifications.
  CO4 Graduate will demonstrate an ability to design deep foundations, its component or process as
per the needs and specifications.
  CO5 Graduate will demonstrate an ability to design retaining walls, its component or process as per
the needs and specifications.
TEXTBOOKS:

REFERENCES:

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CE3511 HIGHWAY ENGINEERING LABORATORY L T P C
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COURSE OBJECTIVE:
- To learn the principles and procedures of testing of materials used in the construction of highways.

EXCERCISES:
I TEST ON AGGREGATES
1. Specific gravity determination of the coarse aggregate sample
2. Determination of abrasion value of the coarse aggregate sample.
3. Determination of water absorption capacity of the coarse aggregate sample.
II TEST ON BITUMEN
4. Specific gravity determination of the bitumen/asphalt sample.
5. Determination of consistency of the bituminous material.
6. Viscosity determination of bituminous binder.
7. Determination of softening point of the asphalt/bitumen sample
8. Determination of ductility value of the bitumen sample
9. Estimation of loss of bitumen on heating
10. Determination of optimum binder content by Marshall method

III BITUMINOUS MIXES
11. Determination of stripping value of the bituminous mix Demonstration
12. Determination of bitumen content in the bituminous mix by cold solvent extraction method

TOTAL: 60 PERIODS

COURSE OUTCOMES
CO1 Characterize Pavement Aggregate through relevant test.
CO2 Ascertain the Quality of Bitumen.
CO4 Evaluate the Consistency and Properties of Bitumen.
CO5 Determine the Bitumen Content in the Bituminous Mixes

REFERENCES
4. Laboratory Manual in Highway engineering published, Duggal,Ajay K 2017

COs- PO's & PSO's MAPPING

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CE3512 SURVEY CAMP (2 weeks) L T P C 0 0 0 1

COURSE OBJECTIVES:
- The objective of the survey camp is to enable the students to get practical training in the field work. Groups of not more than six members in a group will carry out each exercise in survey camp. At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:
1. Traverse – using Theodolite / Total station
2. Contouring
   (i) Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
   (ii) Block Level/ By squares of size at least 100 Meter x 100 Meter at least 20 Meter interval
   (iii) L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M
3. Offset of Buildings and Plotting
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Traversing using GPS
6. Curve setting by deflection angle

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

COURSE OUTCOMES
- On completion of the course, the student is expected to be able to
  CO1 Handle the modern surveying instruments like Total station and GPS
  CO2 Apply modern surveying techniques in field to establish horizontal control.
  CO3 Understand the surveying techniques in field to establish vertical control
  CO4 Apply different survey adjustment techniques.
  CO5 Carry out different setting out works in the field

COs- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES(PSO)

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| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |
COURSE OBJECTIVE

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and to provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice.

UNIT I  INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS  9
General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts

UNIT II  DESIGN OF TENSION AND COMPRESSION MEMBERS  9
Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect - Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory - Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base

UNIT III  DESIGN OF BEAMS  9
Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders

UNIT IV  INDUSTRIAL STRUCTURES  9
Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design, Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineered buildings

UNIT V  PLASTIC ANALYSIS AND DESIGN  9
Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portal frames using plastic design approach

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

CO1  Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths

CO2  Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria

CO3  Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams

CO4  Identify and compute the design loads on Industrial structures, and gantry girder

CO5  Find out ultimate load of steel beams and portal frames using plastic analysis

TEXT BOOKS

REFERENCES
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
COURSE OBJECTIVE:
- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses and to analyse arches and suspension bridges.

UNIT I  INFLUENCE LINES FOR DETERMINATE STRUCTURES  9
Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures – Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames.

UNIT II  INFLUENCE LINES FOR INDETERMINATE BEAMS  9
Muller Breslau’s principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.

UNIT III  ARCHES  9
Arches - Eddy’s theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening – Settlement and temperature effects.

UNIT IV  SUSPENSION BRIDGES AND SPACE TRUSSES  9
Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.
UNIT V APPROXIMATE ANALYSIS OF FRAMES


TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to;
CO1 Draw influence lines for statically determinate structures and calculate critical stress resultants.
CO2 Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
CO3 Analyse three hinged, two hinged and fixed arches.
CO4 Analyse the suspension bridges with stiffening girders
CO5 Analyse HYDe rigid frames by approximate methods for gravity and horizontal loads.

TEXTBOOKS:

REFERENCES:

COs- PO's & PSO’s MAPPING

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COURSE OBJECTIVES:
- This course will familiarize the students on the role and importance of geology in civil engineering, apart from learning the techniques of surface and subsurface investigations using geological, geophysical and geomechanical methods.

UNIT I  PHYSICAL GEOLOGY AND GEOMORPHOLOGY
Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks and relevance to Civil Engineering; Fluvial, Marine, Glacial and Aeolian landforms and their importance in Civil Engineering; Plate tectonics and its relevance to earthquakes; Groundwater: types of aquifers, origin, movement and role of groundwater in Civil Engineering constructions.

UNIT II  MINERALOGY AND PETROLOGY
Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica (Muscovite, Biotite & Vermiculite), Pyroxene (Augite & Hypersthene), Amphibole (Hornblende), Calcite, Gypsum and Clay minerals and their significance. Formation of Igneous, Metamorphic and Sedimentary rocks; Description of important rocks: Granite, Syenite, Dolerite, Basalt, Quartzite, Slate, Schist, Gneiss, Marble, Sandstone, Limestone, Shale and Conglomerate. Engineering properties of rocks: field and laboratory tests.

UNIT III  STRUCTURAL GEOLOGY AND ROCK MECHANICS
Attitudes of beds: Strike and Dip measurements and their relevance to civil engineering; Different types of folds, faults, joints and fractures in rocks and their significance in civil engineering constructions; Geomechanical properties of rocks: Rock Quality Designation (RQD), Rock Mass Rating (RMR) and Geological Strength Index (GSI) and their importance in various civil engineering projects.

UNIT IV  GEOPROSPECTING
Geological mapping techniques; Remote Sensing: Fundamentals and its role in geological mapping; Geophysical methods for subsurface investigations: Electrical, Seismic & Ground Penetrating Radar (GPR); Subsurface logging and their importance in civil engineering projects.

UNIT V  GEOLOGICAL CONSIDERATIONS AND GEOHAZARDS
Geological conditions necessary for designing and construction of important structures: Dams, Reservoirs, Tunnels, Road cuttings and Coastal protection; Landslides: Causes and mitigation; Earthquakes & Tsunamis: Causes and mitigation; Case studies for the above topics. TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of this course, the students expected to be able to:
CO1 Knowing the internal structure of earth and its relation to earthquakes. Landforms created by various geological agents and their importance in civil engineering.
CO2 Getting knowledge on various minerals and rocks that can be used as construction materials and road aggregates. In addition, testing the suitability of rocks for foundation purposes.
CO3 Studying various geological structures and their impact in engineering constructions. Further, learning the geomechanical properties of rocks and their significance in engineering projects.
CO4 Gaining knowledge on the role of geological mapping, remote sensing and geophysics for surface and subsurface investigations. In addition, students will also gain knowledge on borehole logging techniques and their applications in civil engineering.
CO5 Applying geological knowledge for designing and constructing major civil engineering structures, and also mitigating various geological hazards such as earthquakes, landslides and tsunamis.

TEXT BOOKS:

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NCC Credit Course Level 3*

NX3651 (ARMY WING) NCC Credit Course - III

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PERSONALITY DEVELOPMENT

PD 3 Group Discussion: Team Work 2
PD 4 Career Counselling, SSB Procedure & Interview Skills 3
PD 5 Public Speaking 4

BORDER & COASTAL AREAS

BCA 2 Security Setup and Border/Coastal management in the area 2
BCA 3 Security Challenges & Role of cadets in Border management 2
<table>
<thead>
<tr>
<th>Domain</th>
<th>Components</th>
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<tbody>
<tr>
<td>ARMED FORCES</td>
<td>AF 2 Modes of Entry to Army, CAPF, Police</td>
</tr>
<tr>
<td>COMMUNICATION</td>
<td>C 1 Introduction to Communication &amp; Latest Trends</td>
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<tr>
<td>INFANTRY</td>
<td>INF 1 Organisation of Infantry Battalion &amp; its weapons</td>
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<td>MILITARY HISTORY</td>
<td>MH 1 Biographies of Renowned Generals</td>
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<td>MH 2 War Heroes - PVC Awardees</td>
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<td>MH 3 Study of Battles - Indo Pak War 1965, 1971 &amp; Kargil</td>
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<td>MH 4 War Movies</td>
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<td>PERSONALITY DEVELOPMENT</td>
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<td>BCA 3 Security Challenges &amp; Role of cadets in Border management</td>
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<td>NAVAL ORIENTATION</td>
<td>NO 3 Modes of Entry - IN, ICG, Merchant Navy</td>
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<td>AF 2 Naval Expeditions &amp; Campaigns</td>
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<td>NAVAL COMMUNICATION</td>
<td>NC 1 Introduction to Naval Communications</td>
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<td>NC 2 Semaphore</td>
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<td>NAVIGATION</td>
<td>N 1 Navigation of Ship - Basic Requirements</td>
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<td>N 2 Chart Work</td>
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<td>SEAMANSHIP</td>
<td>MH 1 Introduction to Anchor Work</td>
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<td>MH 2 Rigging Capsule</td>
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<td>MH 3 Boatwork - Parts of Boat</td>
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<td>MH 4 Boat Pulling Instructions</td>
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<td>MH 5 Whaler Sailing Instructions</td>
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<td>FIRE FIGHTING FLOODING &amp; DAMAGE CONTROL</td>
<td>FFDC 1 Fire Fighting</td>
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<td>FFDC 2 Damage Control</td>
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<tr>
<td>SHIP MODELLING</td>
<td>SM Ship Modelling Capsule</td>
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TOTAL: 45 PERIODS
### PERSONALITY DEVELOPMENT

| PD 3 | Group Discussion: Team Work | 2 |
| PD 4 | Career Counselling, SSB Procedure & Interview Skills | 3 |
| PD 5 | Public Speaking | 4 |

### BORDER & COASTAL AREAS

| BCA 2 | Security Setup and Border/Coastal management in the area | 2 |
| BCA 3 | Security Challenges & Role of cadets in Border management | 2 |

### AIRMANSHIP

| A 1 | Airmanship | 1 |

### BASIC FLIGHT INSTRUMENTS

| FI 1 | Basic Flight Instruments | 3 |

### AERO MODELLING

| AM 1 | Aero Modelling Capsule | 3 |

### GENERAL SERVICE KNOWLEDGE

| GSK 4 | Latest Trends & Acquisitions | 2 |

### AIR CAMPAIGNS

| AC 1 | Air Campaigns | 6 |

### PRINCIPLES OF FLIGHT

| PF 1 | Principles of Flight | 3 |
| PF 2 | Forces acting on Aircraft | 3 |

### NAVIGATION

| NM 1 | Navigation | 2 |
| NM 2 | Introduction to Met and Atmosphere | 3 |

### AERO ENGINES

| E 1 | Introduction and types of Aero Engine | 3 |
| E 2 | Aircraft Controls | 3 |

#### TOTAL: 45 PERIODS

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**CE3611 Building Drawing and Detailing Laboratory**

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**COURSE OBJECTIVE:**

- To impart knowledge and skill relevant to Building drawing and Detailing lab using computer software

**LIST OF EXPERIMENTS**

1. Principles of planning and orientation
2. Buildings with load bearing walls and RCC roof (Plan, section, elevation)
3. Buildings with sloping roof
5. Building information modeling.
6. Reinforcement details of RCC structural elements (slab, beam and column)
7. Reinforcement details of footings (Isolated, stepped, combined footing)
8. Steel structures (Steel Connections detailing, beam to column connection, beam to beam connection – bolt & Weld, Roof truss & purlin)

**TOTAL : 60 PERIODS**

**REFERENCES:**
5. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

**COURSE OUTCOME**
- On completion of the course, the student is expected to be able to
  CO1 Draft the plan, elevation and sectional view of the load bearing and framed buildings
  CO2 Draw the structural detailing of RCC elements
  CO3 Draw the structural detailing of RCC water tanks, footings and retaining walls
  CO4 Draw the structural detailing of steel structures
  CO5 Draft the structural detailing of Industrial structures

**COs- PO’s & PSO’s MAPPING**

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<thead>
<tr>
<th>PO/PSO</th>
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<td><strong>PROGRAM OUTCOMES (PO)</strong></td>
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<td>PO1 Knowledge of Engineering Sciences</td>
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<td>PO2 Problem analysis</td>
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<td>PO4 Investigation</td>
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<td>PO12 Life Long Learning</td>
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Course Objective:
- The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

Unit I: Quantity Estimation
Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

Unit II: Rate Analysis and Costing
Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in class room using Computer softwares) – (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

Unit III: Specifications, Reports and Tenders

Unit IV: Contracts

Unit V: Valuation

Course Outcomes:
The student will be able to
CO1 Gain knowledge on types of contracts.
CO2 Understand types of specifications, principles for report preparation, tender notices types.
CO3 Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
CO4 Estimate the quantities for buildings.
CO5 Evaluate valuation for building and land.

Textbooks:

References:
3. Arbitration and Conciliation Act, 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019
### COs- PO’s & PSO’s MAPPING

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#### PROGRAM SPECIFIC OUTCOMES (PSO)

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<th>PSO</th>
<th>Program Specific Outcomes</th>
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**AI3404 HYDROLOGY AND WATER RESOURCES ENGINEERING**

**OBJECTIVES:**

- To introduce to the students, the concepts of hydrological processes, hydrological extremes and groundwater.
- To prepare the students to quantify, regulate and manage water resources.

**UNIT I PRECIPITATION AND ABSTRACTIONS**


**UNIT II RUNOFF**

Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange’s table and empirical methods - SCS-CN method – Stage discharge relationship - Flow measurements - Hydrograph – Unit Hydrograph – IUH.

**UNIT III HYDROLOGICAL EXTREMES**


**UNIT IV RESERVOIRS**

Classification of reservoirs - Site selection - General principles of design - Spillways - Elevation-Area-Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve.
UNIT V  GROUNDWATER AND MANAGEMENT

Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES

COURSE OUTCOMES:
On completion of the course, the student is expected to
1. Define the hydrological processes and their integrated behaviour in catchments
2. Apply the knowledge of hydrological processes to address basin characteristics, runoff and hydrograph
3. Explain the concept of hydrological extremes and its management strategies
4. Describe the principles of storage reservoirs
5. Understand and apply the concepts of groundwater management

CO – PO MAPPING: HYDROLOGY AND WATER RESOURCES ENGINEERING

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<tr>
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<tr>
<td>PSO1 To bring expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<tr>
<td>PSO2 To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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</table>
COURSE DESCRIPTION
This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

COURSE OBJECTIVES:
- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students’ minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES
Reading Text: Excerpts from John Stuart Mills’ On Liberty

UNIT II SECULAR VALUES
Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani

UNIT III SCIENTIFIC VALUES
Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

UNIT IV SOCIAL ETHICS
Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.
Reading Text: Excerpt from 21 Lessons for the 21st Century by Yuval Noah Harari

UNIT V SCIENTIFIC ETHICS
Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.

TOTAL: 30 PERIODS
REFERENCES:
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

COURSE OUTCOMES
Students will be able to
CO1: Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2: Practice democratic and scientific values in both their personal and professional life.
CO3: Find rational solutions to social problems.
CO4: Behave in an ethical manner in society
CO5: Practice critical thinking and the pursuit of truth.

GE3752 TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVES:
- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.
UNIT V QUALITY MANAGEMENT SYSTEM


TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi’s Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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CE3811 PROJECT WORK/INTERNSHIP

COURSE OBJECTIVE:
• To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

STRATEGY:
The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 300 PERIODS
COURSE OUTCOMES:
• On Completion of the project works students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

CO1 Identify civil engineering problems reviewing available literature.
CO2 Identify appropriate techniques to analyze complex civil engineering problems.
CO3 Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

COs- PO’s & PSO’s MAPPING

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: STRUCTURES

CE3001 CONCRETE STRUCTURES

<table>
<thead>
<tr>
<th>Course Objective:</th>
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<tr>
<td>To acquire hands on experience in design and preparation of structural drawings for concrete / steel structures normally encountered in Civil Engineering practice using Computer Software Staad Pro, E-Tabs and any Structural design and analysis Software.</td>
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UNIT I INTRODUCTION AND CODES
UNIT II  LOADS ACTING ON STRUCTURES  9
Scheme Design, Concrete floor systems, Sizing and design of various slab systems, Beams, Reinforced Concrete Columns - Location and Shape, Design Axial Load, sizing, Lateral Load Systems, IS 1893- Requirements.

UNIT III  MODELLING OF BASIC STRUCTURAL ELEMENTS  9
Introduction to Analysis & Modelling, Modelling of Cantilever, Portal Frame, three bay Portal Frame, 3D structural models - Geometry, gravity loads, defining earthquake loads, defining wind loads, Modelling Shear walls, Practical Structural Model of building, Structural models of Floor System, Estimation of deflections

UNIT IV  DESIGN OF STRUCTURAL ELEMENTS  9
Design of Beams- flexural reinforcement, shear reinforcement, Design of flat slabs- Flexural Reinforcement, shear reinforcement, Design of 2-way continuous slabs.
Design of Reinforcements in Columns, Post processing, Design and arrangement of vertical reinforcement, horizontal reinforcement in the design of buildings. Design of shear walls - Sizing of elements based on Constructability aspects like formwork, concrete placement and compaction, rebar arrangement to satisfy economy and optimum utilisation.

UNIT V  DETAILING OF STRUCTURAL ELEMENTS  9
Development of Reinforcement, Typical details of- flat slabs, two-way continuous slabs, beams, columns and shear wall, detailing and documentation.
Case Studies : Structural analysis and design of a multi-storey building with load calculation (dead, live, wind and seismic) as per Indian standard codes using any Structural design and analysis Software.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will able to
CO1  Plan a layout of a structure
CO2  Calculate loads using IS codes and various computational tools
CO3  Analyse the structure for various loads and load combination according to the relevant IS codes
CO4  Design and Analysis of structures using computer software/tools
CO5  Prepare the complete structural drawings using computer software

REFERENCES:
COs- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 2 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 1 | 1 | 2 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2 | 2 | 3 | 3 | 3 | 3 |

CE3002 STEEL STRUCTURES L T P C 3 0 0 3

COURSE OBJECTIVES
- To acquire hands on experience in design and preparation of structural drawings for steel structures like industrial buildings, steel framed buildings using structural design software and detailed drawing softwares
- To introduce the students to design of light gauge steel structures

UNIT I DESIGN ASPECTS AND LOADS ON A STEEL BUILDING 9
Inputs for the design of a steel building - Design basis report, covering Site Data, geometrical, functional and structural requirements for its end usage - material specifications - Methods of designing a steel building. Calculating the various loads acting on a steel building - Vertical & Lateral loads - Effects of each loads separately and in combination – Dead, superimposed dead, live, temperature, MEP service loads - Lateral loads due to Wind and Seismic effects.

UNIT II SELECTION OF LOAD RESISTING SYSTEM AND MODELLING OF STRUCTURE 9

UNIT III DESIGN OF VARIOUS ELEMENTS OF A STEEL BUILDING 9
Manual and Software aided design – Beams, columns, floors, bracings, purlins/girts and facades, base plates and anchor bolts – Various loads, different conditions of supports, exposure, and purpose of use - Design of Connections between the members – bolted and welded, moment and shear connections
UNIT IV DESIGN OF AN INDUSTRIAL BUILDING
Functional requirements - Serviceability Requirements - Structural Configurations - Selection of sections as per requirements - Configuration of the elements, connectivity - Analysis and design of different types of trusses — Design of Gantry Girders – Design of gable frames – Design of steel columns for combined loading - Analysis and design of industrial buildings - Study of General assembly drawings - Fabrication processes - Fabrication, logistics & erection – Sequence of erection - Inspection of a completed structure.

UNIT V DESIGN OF LIGHT GAUGE STEEL STRUCTURES
Philosophy of design of light gauge steel members, Direct Strength Method (DSM) ,Effective width method (EWM) – Concept of buckling, local buckling and post-buckling strength - Analysis and design of Compression members– Analysis and design of flexural members, Lateral buckling of beams, Shear Lag, Flange Curling – Design of wall panels

COURSE OUTCOMES:
Students will be able to
CO1 Plan the layout of the structure and calculate the loads of the steel structure.
CO2 Select a load resisting system, model the structure and interpret the results.
CO3 Design the various elements of a steel buildings
CO4 Design a typical industrial building
CO5 Design the various elements of a cold –formed steel buildings

TEXT BOOKS
1. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

REFERENCES
7. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996
8. www.nptel.ac.in

INDIAN STANDARD CODES
1. IS: 800 – 2007, Code of Practice for general construction in steel, BIS, New Delhi
2. SP 6 (1) – Structural steel sections
3. IS 875 (1-5) - 1987 Code of practice for Design Loads (Other than Earthquake) for Buildings and Structures, BIS
5. IS: 808 – 1989 Dimensions For Hot Rolled Steel Beam, Column, Channel and Angle Sections.

COs- PO's & PSO's MAPPING

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TOTAL : 45 PERIODS
| PO4 | Investigation | - | - | 2 | 1 | 1 | 1 |
| PO5 | Modern Tool Usage | 2 | 2 | 2 | 2 | 2 | 2 |
| PO6 | Engineer and Society | - | - | - | 1 | 1 | 1 |
| PO7 | Environment and Sustainability | - | 1 | 1 | 2 | 2 | 1 |
| PO8 | Ethics | 1 | 1 | 2 | 2 | 2 | 2 |
| PO9 | Individual and Team work | - | 1 | 1 | 2 | 1 | 1 |
| PO10 | Communication | 2 | 1 | 1 | 1 | 1 | 1 |
| PO11 | Project Management and Finance | 1 | - | - | 1 | 1 | 1 |
| PO12 | Life Long Learning | 2 | 1 | 1 | 2 | 2 | 2 |

**PROGRAM SPECIFIC OUTCOMES (PSO)**

| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 2 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 3 | 3 | 3 | 3 | 3 |

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**CE3003 PREFABRICATED STRUCTURES**

**COURSE OBJECTIVE:**
- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about the structural stability.

**UNIT I INTRODUCTION**
9

**UNIT II PREFABRICATED COMPONENTS AND SYSTEMS**
9
Behaviour and types of structural components – roof and floor slabs – Walls panels – Shear walls – Beams - Columns – skeletal system – portal frame system - Large panel systems – block system

**UNIT III DESIGN PRINCIPLES**
9
Design philosophy - Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems - Design for stripping, stacking, transportation and erection of elements

**UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS**
9
Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints, contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

**UNIT V DESIGN FOR ABNORMAL LOADS**
9
Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse - case study.

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
Students will be able to
CO1 Understand concepts about principles of prefabrication, production, transportation, erection.
CO2 Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.
CO3 Acquire knowledge about design of cross section, joint flexibility.
CO4 Acquire knowledge about joints and connection in precast construction.
CO5 Acquire knowledge about structural stability.

TEXTBOOKS:
2. Lewitt, M. "Precast Concrete - Materials, Manufacture, Properties And Usage", CRC Press, 2019

REFERENCES:
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

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PROGRAM SPECIFIC OUTCOMES (PSO)

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CE3004 PRESTRESSED CONCRETE STRUCTURES

COURSE OBJECTIVE
- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems
UNIT I  INTRODUCTION – THEORY AND BEHAVIOUR  
Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post-tensioned and pre-tensioned members.

UNIT II  DESIGN FOR FLEXURE AND SHEAR  
Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.

UNIT III  DEFLECTION AND DESIGN OF ANCHORAGE ZONE  
Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel’s method, Guyon’s method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV  COMPOSITE BEAMS AND CONTINUOUS BEAMS  

UNIT V  MISCELLANEOUS STRUCTURES  
Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

COURSE OUTCOMES:
Students will be able to
CO1 Design a prestressed concrete beam accounting for losses.
CO2 Design for flexure and shear.
CO3 Design the anchorage zone for post-tensioned members and estimate the deflection in beams.
CO4 Design composite members and continuous beams.
CO5 Design water tanks, pipes, poles and sleepers.

TEXTBOOKS:

REFERENCES:

TOTAL: 45 PERIODS
CE3005 REHABILITATION/HERITAGE RESTORATION

L T P C 3 0 0 3

COURSE OBJECTIVE:
- To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures, Restoration of Heritage structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATEGIES
9
Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE
9
Quality assurance for concrete – Strength and Durability of concrete - Cracks, different types, causes - Effects due to climate, temperature, Sustained elevated Temperature, Corrosion –

UNIT III SPECIAL CONCRETES
9

UNIT IV TESTING TECHNIQUES AND PROTECTION METHODS
9
Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.

UNIT V STRENGTHENING, REPAIR, REHABILITATION AND RESTORATION OF STRUCTURES
9
Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, leakage and earthquake - Restoration of Heritage structures - Case studies.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Students will be able to
CO1  Know the importance of inspection and maintenance.
CO2  Study the Impacts of cracks, corrosion and climate on structures.
CO3  Know various special concretes
CO4  Understand the testing techniques and various protection measures
CO5  Know the Repair of structures and Restoration of Heritage structures

TEXT BOOKS:

REFERENCES:
2. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVE

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

UNIT I INTRODUCTION TO DYNAMICS

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D’Alemberts Principles - Formulation of equation of motion for SDOF system and MDOF system — Evaluation of natural frequencies and modes - Effect of damping.

UNIT II SEISMOLOGY


UNIT III EARTHQUAKE EFFECTS ON STRUCTURES


UNIT IV EARTHQUAKE LOAD ANALYSIS

Design spectra – Codal provision – Different methods of earthquake analysis — Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL: 45 PERIODS

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

CO1 Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

CO2 Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

CO3 Explain the behavior of various types of structures under earthquake

CO4 Determine the forces in a structure due to earthquake

CO5 Design earthquake resistant building structures

TEXTBOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:
a. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code of Practice
c. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

COs- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1 | Knowledge of Civil Engineering discipline | 3 3 3 3 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 3 3 3 3 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 2 3 3 3 |

CE3007 INTRODUCTION TO FINITE ELEMENT METHOD

COURSE OBJECTIVE
- To develop a thorough understanding of the finite element analysis techniques with an ability to effectively use the tools of the analysis for solving practical problems arising in Civil Engineering.

UNIT I INTRODUCTION


UNIT II STIFFNESS MATRIX FORMULATION

Introduction to Discrete and Continua elements – Discrete Elements - Direct stiffness method - Special characteristics of stiffness matrix - Assemblage of elements – Boundary condition & reaction - 2D – truss element - 2D - beam element - Analysis of framed Structures - Basic steps in finite

UNIT III ONE DIMENSIONAL PROBLEMS

UNIT IV TWO DIMENSIONAL PROBLEMS
Two dimensional isoparametric elements - Four noded quadrilateral elements - triangular elements. Computation of stiffness matrix for isoparametric elements - numerical integration (Gauss quadrature) Convergence criteria for isoparametric elements.

UNIT V ANALYSIS OF PLATES
Introduction to Plate Bending Problems - displacement functions – Analysis of Thin Plate - Analysis of Thick Plate - Analysis of Skew Plate, Finite Element Analysis of Shell, plane stress and plane strain analysis, Example problem using any general-purpose finite element software

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 to understand the basics of finite element formulation.
CO2 to formulate the stiffness matrix for beam, truss and framed structures.
CO3 to apply finite element formulations to solve one-dimensional problems.
CO4 to apply finite element method to solve two dimensional problems.
CO5 to apply finite element method to analyze plate bending problems.

TEXT BOOKS:

REFERENCES

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VERTICAL II: CONSTRUCTION TECHNIQUES AND PRACTICES

CE3008 FORM WORK ENGINEERING

L T P C 3 0 0 3

COURSE OBJECTIVE:
• On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work.

UNIT I INTRODUCTION TO FORM WORK 9
Introduction to Formwork and false work, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples - Overall Planning - Detailed planning - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork.

UNIT II FORMWORK MATERIALS ASSESORIES & PRESSURES 9

UNIT III FORMWORK DESIGN 9

UNIT IV FORMWORK FOR SPECIAL STRUCTURES 9
Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT V CASE STUDIES 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1 To understand the overall and detailed planning of formwork.
CO2 To impart knowledge on formwork materials, accessories, pressures and labour requirement.
CO3 To develop the conceptual understanding of design, construction and erection of formwork.
CO4 To impart the knowledge about different types of formwork used for special structures.
CO5 To understand the errors in design and judge the formwork failures through case studies.

TEXT BOOKS

REFERENCES:
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
5. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

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COURSE OBJECTIVE
- To expose the students in the field of construction equipment and machineries so as to gain knowledge in carrying out engineering tasks.

UNIT I CONSTRUCTION EQUIPMENTS
Identification - Planning of equipment - Selection of equipment - Equipment management in projects - Maintenance management - Equipment cost - Operating cost - Cost control of equipment - Depreciation analysis - Replacement analysis - Safety management.

UNIT II EQUIPMENT FOR EARTHWORK
Fundamentals of earthwork operations - Earth moving operations - Types of earthwork equipment - Tractors, motor graders, scrapers, front end waders - Dozer, excavators, rippers, loaders, trucks and hauling equipment, compacting equipment, finishing equipment - Case studies on earthwork equipment.

UNIT III OTHER CONSTRUCTION EQUIPMENT
Equipment for dredging, trenching, drag line and clamshells, tunneling - Jacking equipment - Equipment for drilling and blasting - Pile driving equipment - Erection equipment - Crane, mobile crane - Types of pumps used in construction - Equipment for dewatering, grouting and demolition.

UNIT IV ASPHALT AND CONCRETE PLANTS
Aggregate production - Different crushers - Feeders - Screening equipment - Handling equipment - Batching and mixing equipment - Ready mix concrete equipment, concrete pumping equipment - Asphalt plant - Asphalt pavers - Asphalt compacting equipment.

UNIT V MATERIALS HANDLING EQUIPMENT
Forklifts and related equipment - Portable material bins - Material handling conveyors - Material handling cranes - Industrial trucks - Aerial transporting equipment.

COURSE OUTCOMES:
On completion of this course, the student is expected to be able to:
CO1 Develop knowledge on planning of equipment and selection of equipment
CO2 Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment
CO3 Develop the knowledge on special construction equipment
CO4 Apply the knowledge on asphalt and concrete plants
CO5 Apply the knowledge and select the proper materials handling equipment

TEXTBOOKS:

REFERENCES:
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*1’ = Low; ‘2’ = Medium; ‘3’ = High*

### CE3010 SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION

#### COURSE OBJECTIVE:
- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

#### UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION
- Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

#### UNIT II ENERGY CALCULATIONS
- Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via a-vis operational energy in conditioned building - Life Cycle energy use.

#### UNIT III GREEN BUILDINGS
- Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building’

#### UNIT IV CORE CONCEPTS IN LEAN
- Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).

#### UNIT V LEAN CONSTRUCTION TOOLS AND TECHNIQUES

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  - CO1 Describe the various sustainable materials used in construction.
  - CO2 Explain the method of estimating the amount of energy required for building.
  - CO3 Describe the features of LEED, TERI and GRIHA ratings of buildings.
  - CO4 Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.
  - CO5 Apply lean tools & techniques to achieve sustainability in construction projects.
REFERENCES:

COs- PO’s & PSO’s MAPPING

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CE3011 DIGITALIZED CONSTRUCTION LAB L T P C 0 0 6 3

COURSE OBJECTIVE:
- To train the students in field of digitalization of construction. Students can be trained in the latest softwares relevant to construction industry

List of experiments:
- To implement the digital knowledge in construction (use relevant softwares)
  1. Introduction and understanding of Primavera project planner for construction
  2. Using Primavera project planner, update the schedule of the project of a construction project
  3. Introduction and understanding of MS Project for a construction project
  4. Using MS project, schedule the construction project planning
  5. Introduction to BIM in construction projects
    a. Development of BIM for small construction project
  6. Progress the work flows in construction project using BIM
  7. Development of bid management for a small firm construction industry using software.

TOTAL: 90 PERIODS
COURSE OUTCOMES:
At the end of the course the student will be able to understand the output of digitalization of construction
CO1 To understand the importance of latest softwares in a construction industry.
CO2 To plan a construction project using Primervera
CO3 To plan a construction project using MS project
CO4 To develop a BIM information model
CO5 To analyse the bid management and its effectiveness using bid management software

COs- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1 Knowledge of softwares in construction | 3   | 2   | 2   | 3   | 2   | 2       |
| PSO2 Critical analysis of softwares in construction | 2   | 2   | 3   | 2   | 2   | 2       |
| PSO3 Evaluation of usage of softwares and cost saving in construction sector | 3   | 3   | 2   | 3   | 3   | 3       |

CE3012 CONSTRUCTION MANAGEMENT AND SAFETY  L T P C  2 0 2 3

COURSE OBJECTIVE
- To study and understand the formulation, costing of construction projects, scheduling and various safety concepts and its requirements applied to construction projects.

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION  6

UNIT II ESTIMATION OF PROJECT COST & ECONOMICS  6

UNIT III PLANNING AND SCHEDULING  6

UNIT IV SAFETY DURING CONSTRUCTION  6
Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty.
UNIT V SAFE OPERATING PROCEDURES


TOTAL: 30 PERIODS

LAB
Ex 1 Introduction to various construction management software
Ex 2 Planning and creating new project
Ex 3 Scheduling and constraints using PRIMAVERA
Ex 4 Project cost management using PRIMAVERA
Ex 5 Construction project safety management using BIM

TOTAL: 30 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1 Perform formulations of projects.
CO2 Analyze project costing.
CO3 Identify and estimate the activity in the construction.
CO4 Develop the knowledge on accidents and their causes.
CO5 Plan, assess, analyze and manage the construction project sites.

REFERENCES:
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992

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COURSE OBJECTIVE:

- To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

UNIT I  SUB STRUCTURE CONSTRUCTION  9
Construction Methodology - Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

UNIT II  SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS  9
Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT III  CONSTRUCTION OF SPECIAL STRUCTURES  9
Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges. Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT IV  REHABILITATION AND STRENGTHENING TECHNIQUES  9

UNIT V  DEMOLITION  9
Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Understand the modern construction techniques used in the sub structure construction.

CO2 Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings

CO3 Understand the concepts used in the construction of special structures

CO4 Knowledge on Various strengthening and repair methods for different cases.

CO5 Identify the suitable demolition technique for demolishing a building.

REFERENCES:

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### PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1 | Knowledge of Civil Engineering discipline | 3 | 2 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 2 | 3 | 3 | 2 | 3 |

### CE3014  ENERGY EFFICIENT BUILDINGS  

**COURSE OBJECTIVE**

- To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building

**UNIT I  INTRODUCTION**


**UNIT II  PASSIVE SOLAR HEATING AND COOLING**


**UNIT III  DAYLIGHTING AND ELECTRICAL LIGHTING**


UNIT IV HEAT CONTROL AND VENTILATION

UNIT V DESIGN FOR CLIMATIC ZONES

TOTAL: 45 PERIODS

COURSE OUTCOMES
On completion of this course, the student is expected to be able to
CO1 Explain environmental energy supplies on buildings
CO2 Explain the passives of arheating, cooling system
CO3 Discuss the various aspects of day-lighting and electrical lighting in a building
CO4 Predict and design building ventilation and heat control for indoor comfort
CO5 Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations

REFERENCES

COs- PO’s & PSO’s MAPPING

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VERTICAL III: GEOTECHNICAL

CE3015 GEOENVIRONMENTAL ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVE:
- The student acquires the knowledge on the Geotechnical engineering problems associated with soil contamination, safe disposal of waste and remediate the contaminated soils by different techniques hereby protecting environment.

UNIT I SOIL – WASTE INTERACTION

UNIT II CONTAMINANT TRANSPORT AND SITE CHARACTERISATION

UNIT III WASTE CONTAINMENT AND REMEDIATION OF CONTAMINATED SITES
In-situ containment – vertical and horizontal barrier – surface cover – ground water pumping system on subsurface drain – soil remediation – Soil Vapour extraction, soil waste stabilization, solidification of soils, electrokinetic remediation, soil heating, vitrification, bio remediation, Phyto-remediation – ground water remediation – pump and treat , In-situ flushing, permeable reacting barrier, In-situ air sparging.

UNIT IV LANDFILLS AND SURFACE IMPOUNDMENTS

UNIT V STABILISATION OF WASTE

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to;
CO1 Understand the various causes and consequences of waste interaction with soil and their modification.
CO2 Understand the various mechanism of transport of contaminants into the subsurface and characterization of contaminated sites and their risk analysis.
CO3 Understand on how to decontaminate the site so as to reuse the site for human settlement
CO4 Understand how to safely dispose the waste through different containment process.
CO5 Expose on how to convert the waste into a resource material through soil waste stabilization techniques with or without chemical stabilization.
REFERENCES:

COs- PO's & PSO's MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

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| PSO2 Critical analysis of Geotechnical Engineering problems and innovation | 2   | 2   | 2   | 2   | 2   | 2 |
| PSO3 Conceptualization and evaluation Of engineering solutions to geotechnical engineering issues | 3   | 3   | 2   | 3   | 2   | 3 |

CE3016 GROUND IMPROVEMENT TECHNIQUES L T P C 3 0 0 3

COURSE OBJECTIVE:
- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

UNIT I HYDRAULIC MODIFICATIONS
Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.
UNIT II  MECHANICAL MODIFICATIONS

UNIT III  PHYSICAL MODIFICATION

UNIT IV  MODIFICATION BY INCLUSIONS
Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

UNIT V  CHEMICAL MODIFICATION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:

CO1 identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications

CO2 improve the ground characteristics by mechanical modifications using various method and design the system

CO3 improve the ground characteristics by physical modifications using various method and design the system

CO4 improve the characteristics of soils by various reinforcement techniques and design

CO5 Analyse the ground and decide the suitable chemical method for improving its characteristics

REFERENCES:
1. Pappala, A.J., Huang, J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
11. Han, J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.
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**CE3017 SOIL DYNAMICS AND MACHINE FOUNDATIONS**  

**COURSE OBJECTIVE:**
- To design different types of machine foundations based on the dynamic properties of soils and to get an exposure on vibration isolation techniques.

**UNIT I  THEORY OF VIBRATION**  
9

**UNIT II  DYNAMIC SOIL PROPERTIES**  
9

**UNIT III  MACHINE FOUNDATIONS**  
9

**UNIT IV  DESIGN OF MACHINE FOUNDATION**  
9
Evaluation of design parameters – Types of Machines and foundations – General requirements – their importance – Analysis and design of block type and framed type machine foundations – Modes
UNIT V VIBRATION ISOLATION


TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to;

CO1 Acquire knowledge to apply theories of vibration to solve dynamic soil problems.
CO2 Evaluate the dynamic properties of soil using laboratory and field tests.
CO3 Acquire basic knowledge about machine foundations and design various types of machine foundation.
CO4 To know and capable of selecting the types of vibration isolation materials.
CO5 To apply vibration isolation techniques for various field problems.

REFERENCES:

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### CE3018  ROCK MECHANICS  L T P C

**3 0 0 3**

#### COURSE OBJECTIVES:
- Students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks.

#### UNIT I  CLASSIFICATION OF ROCKS  9
Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations.

#### UNIT II  STRENGTH CRITERIA OF ROCKS  9
Behaviour of rock under hydrostatic compression and deviatomic loading - Modes of rock failure planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cutoff. Hoek and Brown Strength criteria for rocks with discontinuity sets.

#### UNIT III  IN-SITU STRESSES IN ROCKS  9
In-situ stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks.

#### UNIT IV  SLOPE STABILITY AND BEARING CAPACITY OF ROCKS  9
Rock slopes - role of discontinuities in slope failure, slope analysis and factor of safety - remedial measures for critical slopes – Bearing capacity of foundations on rocks.

#### UNIT V  ROCK STABILIZATION  9
Stabilization of rocks-rock support and rock reinforcement-active and passive supports-ground response curve-support reaction curve-reinforcement of fractured and joined rocks-Shotcreting-bolting-anchoring-installation methods.

**TOTAL: 45 PERIODS**

#### COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:

- **CO1** Classify the Rock mass and rate the quality of rock for tunnelling and foundations works and suggest the safer length of tunnelling and stand-up time.

- **CO2** Apply the knowledge of engineering and understand the stress – strain characteristics and failure criteria of rock and apply them to arrive at the shear strength parameters of rocks to be used for the design of structures resting on rock and also for the design of underground excavation in rocks.

- **CO3** Apply the knowledge of engineering and assess the influence of in-situ stress in the stability of various underground excavations and also acquire the knowledge of design of opening in rocks.

- **CO4** Apply the knowledge on rock mechanics and analyze the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks considering the presence of joints. design the foundations resting on rocks. Able to carry-out suitable foundation for the structure resting on rock.
CO5 Improve the in-situ strength of rocks by various methods such as rock reinforcement and rock support. Able to select suitable support system considering the interaction between rock and support. Also capable of executing the same in the field.

REFERENCES:

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| PSO1 Knowledge of Geotechnical Engineering discipline | 3   | 3   | 3   | 3   | 3   | 3   |
| PSO2 Critical analysis of Geotechnical Engineering problems and innovation | 2   | 2   | 2   | 3   | 3   | 2   |
| PSO3 Conceptualization and evaluation of engineering solutions to geotechnical engineering issues | 2   | 2   | 3   | 3   | 3   | 3   |

CE3019 EARTH AND EARTH RETAINING STRUCTURES

COURSE OBJECTIVES:
- At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.
UNIT I EARTH PRESSURE THEORIES
Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann’s method) – Active and passive cases – Earth pressure due to external loads.

UNIT II COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES
Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III SHEET PILE WALLS
Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV SUPPORTED EXCAVATIONS
Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning – Basic design concepts.

UNIT V SLURRY SUPPORTED EXCAVATION
Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls-bored pile walls-contiguous pile wall-secant piles-stability analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.

CO2 Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces.

CO3 Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors

CO4 Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities.

CO5 To understand the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1   | Knowledge of Geotechnical Engineering discipline | 3 | 2 | 2 | 3 | 2 | 3 |
| PSO2   | Critical analysis of Geotechnical Engineering problems and innovation | 3 | 2 | 2 | 3 | 3 | 3 |
| PSO3   | Conceptualization and evaluation of engineering solutions to geotechnical engineering issues | 3 | 2 | 2 | 3 | 3 | 3 |

CE3020 PILE FOUNDATION  L T P C  3 0 0 3

COURSE OBJECTIVES:
- The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions.

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE  9

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS  9
Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.
UNIT III  LATERAL AND UPLIFT LOAD CAPACITIES OF PILES  9
Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.

UNIT IV  STRUCTURAL DESIGN OF PILE AND PILE GROUPS  9
Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.

UNIT V  CAISSONS  9

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.
CO2 Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria based on field practices and codal provisions.
CO3 Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies.
CO4 Understand the design of pile and pile caps, considering the wind and seismic loads.
CO5 Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

REFERENCES:

COs- PO's & PSO's MAPPING

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COURSE OBJECTIVES:

- Students mainly focused in visualizing and critically analyzing the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground structures.
- To give idea about the equipment used in underground excavations

UNIT I   TUNNELS AND UNDERGROUND SPACE APPLICATION  
History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal defence facilities-submerged tunnels-underground library,museums.

UNIT II  EXCAVATION TECHNIQUES  
Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.

UNIT III  PLANNING AND GEOMETRIC DESIGN OF TUNNELS  
Topographical –geological survey-rock sampling-testing-determination of location size shape and alignment-subsidence problem on soft ground –tunneling design in hard rock.

UNIT IV  CONSTRUCTION OF TUNNEL  
Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of shield tunneling-factors affecting selection of shield-twin tunnel-NATM.

UNIT V  DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION  

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to
- CO1 To Understand need of utilization of underground space for various applications.
- CO2 To study various methods of excavations and tunneling methods.
- CO3 Planning and design process of tunnels.
- CO4 To identify the suitable method of tunneling.
- CO5 To study various types of support system and its merit and demerits.
REFERENCES:
3. Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark, Spor press.

COs- PO’s & PSO’s MAPPING

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VERTICAL IV: GEO-INFORMATICS

GI3492 TOTAL STATION AND GPS SURVEYING
L T P C 3 0 0 3

COURSE OBJECTIVE:
- To understand the working of Total Station and GPS and solve the surveying problems.

UNIT I FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9
Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying - Applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies – Refractive index (RI) – factors affecting RI - Computation of group for light and near infrared waves at standard and ambient conditions – Computation of RI for microwaves at ambient condition – Reference refractive index - Real-time application of first velocity correction. Measurement of atmospheric parameters - Mean refractive index – Second velocity correction - Total atmospheric correction - Use of temperature - pressure, transducers.

UNIT II ELECTRO-OPTICAL AND MICROWAVE 9
Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station
instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments.

COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.

UNIT III  SATELLITE SYSTEM


UNIT IV  GPS DATA PROCESSING


UNIT V  SURVEYING METHODS AND APPLICATIONS

Total Station: Traversing and Trilateration measurement and adjustment – Planimetric map and Contour map and Topography Mapping.

GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing - Topography mapping using PPK and RTK methods

Total Station and GNSS applications

TOTAL:45 PERIODS

COURSE OUTCOMES:

• On completion of the course, the student is expected to

CO1 Learn about the fundamental concept of Total station.
CO2 Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.
CO3 Gain Knowledge on basic concepts of GNSS
CO4 Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO5 Gain knowledge about Total station and GNSS data processing and Mapping.

TEXTBOOKS:


REFERENCES:


COs- PO's & PSO's MAPPING

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CE3022 REMOTE SENSING CONCEPTS  

COURSE OBJECTIVES:
- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation.

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION  

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL  

UNIT III ORBITS AND PLATFORMS  
Movements of planets and satellites – Newton’s law of gravitation - Gravitational field and potential - Escape velocity - Kepler's law of planetary motion - Orbit elements and types — Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Lagrange Orbit.

UNIT IV SENSING TECHNIQUES  
UNIT V DATA PRODUCTS AND INTERPRETATION

Photographic and digital products — Types, levels and open source satellite data products — selection and procurement of data— Visual interpretation: basic elements and interpretation keys - Digital interpretation — Concepts of Image rectification, Image enhancement and Image classification

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 understand the concepts and laws related to remote sensing
  CO2 understand the interaction of electromagnetic radiation with atmosphere and earth material
  CO3 acquire knowledge about satellite orbits and different types of satellites
  CO4 understand the different types of remote sensors
  CO5 gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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PROGRAM SPECIFIC OUTCOMES (PSO)

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| PSO2 | Critical analysis of Geoinformatics Engineering problems and innovations | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Geoinformatics engineering issues. | 2 | 2 | 3 | 3 | 3 |
COURSE OBJECTIVE

- To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

UNIT I  FUNDAMENTALS OF IMAGE PROCESSING  9
Information Systems - Encoding and decoding - acquisition, storage and retrieval –data products - satellite data formats - Digital Image Processing Systems - Hardware and software design consideration Scanner, digitizer - photo write systems.

UNIT II  SENSORS MODEL AND PRE PROCESSING  9

UNIT III  IMAGE ENHANCEMENT  9

UNIT IV  IMAGE CLASSIFICATION  9

UNIT V  ADVANCED CLASSIFIERS  9
Fuzzy set classification — sub- pixel classifier — hybrid classifiers, Texture based classification —Object based classifiers – Artificial Neural nets – Hebbian leaning – Expert system, types and examples – Knowledge systems.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to
- CO1 Understand about Remote sensing and Image processing systems
- CO2 Acquire knowledge about the source of error in satellite image and also to remove the error from satellite image.
- CO3 Select appropriate image Enhancement techniques based on image characteristics
- CO4 Classify the satellite image using various method and also evaluate the accuracy of classification.
- CO5 Apply the advanced image classification methods and conduct lifelong research in the field of image processing.

TEXTBOOKS :
REFERENCES:

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1 | Knowledge of Geoinformatics discipline | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO2 | Critical analysis of Geoinformatics Engineering problems and innovations | 3 | 3 | 3 | 3 | 3 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Geoinformatics engineering issues. | 3 | 3 | 3 | 3 | 3 | 3 |

GI3491 CARTOGRAPHY AND GIS

COURSE OBJECTIVES:
- To introduce concepts of Cartography and GIS
- To expose the process of map making and production
- To introduce GIS data structures, data input and data presentation

UNIT I ELEMENTS OF CARTOGRAPHY
UNIT II  MAP DESIGN AND PRODUCTION  9
Elements of a Map – Map Layout Principles – Map Design Fundamentals – Symbols and
Conventional Signs – Graded and Ungraded Symbols – Color Theory – Colours and Patterns in
Symbolization – Map Lettering – Map Production – Map Printing – Colours and Visualization – Map
Reproduction – Map Generalization – Geometric Transformations – Bilinear and Affine
Transformations.

UNIT III  FUNDAMENTALS OF GIS  9
Introduction to GIS – Definitions – History of GIS – Components of a GIS – Hardware, Software, Data,
People, Methods – Introduction to data quality – Types of data – Spatial, Attribute data – types of
attributes – scales/levels of measurements – spatial data models – Raster Data Structures – Raster

UNIT IV  DATA INPUT AND TOPOLOGY  9
Scanner – Raster Data Input – Raster Data File Formats – Georeferencing – Vector Data Input –
Digitizer – Datum Projection and Reprojection – Coordinate Transformation – Topology - Adjacency,
Connectivity and containment – Topological Consistency – Non topological file formats – Attribute
Data Linking – Linking External Databases – GPS Data Integration – Raster to Vector and Vector to
Raster Conversion.

UNIT V  DATA QUALITY AND OUTPUT  9
Assessment of Data Quality - Basic Aspects - Completeness, Logical Consistency, Positional
Accuracy, Temporal Accuracy, Thematic Accuracy and Lineage – Metadata – GIS Standards –
Interoperability – OGC - Spatial Data Infrastructure – Data Output – Map Compilation – Chart /
Graphs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
*On completion of the course, the student is expected to

CO1 Be familiar with appropriate map projection and co-ordinate system for production of Maps
and shall able to compile and design maps for their required purpose.

CO2 Be familiar with co-ordinate and Datum transformations

CO3 Understand the basic concepts and components of GIS, the techniques used for storage of
spatial data and data compression

CO4 Understand the concepts of spatial data quality and data standard

CO5 Understand the concept of spatial data inputs

TEXTBOOKS:
3. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical

REFERENCES:

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GI3391     PHOTOGRAMMETRY  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To introduce basics and concepts of optics, aerial photography acquisition and mapping from aerial photographs.

UNIT I   PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY  9
History - Definition, Applications – Types of Photographs, Classification – Photographic overlaps – Camera: metric vs. non-metric, Digital Aerial cameras – Multiple frame and Line cameras – Linear array scanner – Flight Planning – Crab & Drift– Computation of flight plan - Photogrammetry project Planning.

UNIT II   GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS  9
Photo coordinate measurement – Vertical photographs -geometry, scale, Coordinate system, Relief displacement – Stereoscopes – Stereoscopic parallax – parallax equations -Geometry, Scale, Coordinate system – Relief displacement -- Photo Interpretation.

UNIT III  STEREOPLOTTERS & ORIENTATION  9
Projection system, Viewing, Measuring and Tracing system Stereo plotters–Classification: Analog, semi analytical, Analytical and Digital systems – Interior orientation - Relative orientation – Absolute orientation - Collinearity condition and Coplanarity condition - Orientation: Two-dimensional coordinate transformations –Three-dimensional conformal coordinate transformation

UNIT IV   AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO  9
model – Strip and blocks of photographs – Aerotriangulation: strip adjustment, independent model triangulation, Bundle block Adjustment and GPS Aerotriangulation (INS and GNSS integration) - feature collection – DTM generation and Contour mapping – ortho rectification - mono plotting – stereo plotting

UNIT V    DIGITAL PHOTOGRAMMETRY  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1  Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.
CO2 Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.

CO3 Evaluate the standards of map based on the state-of-the-art tool and techniques and assess the production standards for photogrammetric map making.

CO4 Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.

CO5 Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of mapping technology.

TEXTBOOKS:

REFERENCES:

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GI3691  AIRBORNE AND TERRESTRIAL LASER MAPPING  L T P C
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COURSE OBJECTIVE:
- To introduce the concepts of Space Borne, Air Borne, Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping
UNIT I  SPACE BORNE RADAR AND LIDAR ALTIMETER
Principle and Properties of LASER - Production of Laser – Components of LASER – LiDAR – Types of LiDAR: Range Finder, DIAL and Doppler LiDAR - Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography, Moon Topography - Merits of ALS in comparison to Levelling, echo sounding, GPS leveling, Photogrammetry and Interferometry

UNIT II  AIRBORNE LASER SCANNERS

UNIT III  DATA ACQUISITION AND PRE-PROCESSING
Laser Classification – Class I to Class IV Laser – Eye Safety - Synchronization of GPS, IMU and ALS Data - Reflectivity of terrain objects – Flight Planning – Determination of various data acquisition parameters – Swath Width, Point Density, No. of Strips, Area Covered, Point Spacing - Data Processing – Determination of optimal flight trajectory - Quality Assurance

UNIT IV  POST PROCESSING of LiDAR Data

UNIT V  TERRESTRIAL LASER SCANNERS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Understand the components of laser and various platforms of laser scanning
CO2 Summarize the components of Airborne Laser Scanner and concept of ranging principles
CO3 Analyse the flight planning parameters and pre-processing of acquired data
CO4 Post process the data to derive DSM and DEM and its applications
CO5 Understand the components of TLS and its applications

TEXTBOOKS:

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CE3024 HYDROGRAPHIC SURVEYING

COURSE OBJECTIVES
- To provide the necessary knowledge and practical instrument operational and data processing skills needed for them to confidently accomplish a bathymetric survey in the real world
- To develop students’ critical and creative thinking, as well as cooperative attitudes & behaviour of working with others.

UNIT I INTRODUCTION, TIDES AND DATUMS
Overview of hydrographic surveying concepts- bathymetric and nautical charts- Basic tidal theory-tidal observations and predictions - common types of recording tide gauges - different vertical datums - Indian tides.

UNIT II SOUNDINGS
Overview of depth data types- Working principle of echo sounders - characteristics and nature of underwater acoustic signals – transducers - error sources and calibrations- Advanced instrumentation.

UNIT III NAVIGATION AND POSITION FIXING
Horizontal positioning methods and requirements - concept of line and surface of position - positioning and navigation using satellite positioning systems - differential GPS and Real-time kinematic (RTK)

UNIT IV PLANNING AND DATA PROCESSING
General considerations for planning of an inshore hydrographic survey - ground and track control - practical soundings in inshore and coastal surveys - data processing and chart compilation - hydrographic software packages for data collection - processing and plotting.
## UNIT V  MARINE ENVIRONMENTAL MEASUREMENTS

Methods of measuring and recording of currents - composition of the sea bed - and solids in suspension - Case Studies (The role of the hydrographic surveyor on different marine projects)

**TOTAL: 45 PERIODS**

### COURSE OUTCOMES:

On completion of the course, the student is expected to be able to

- **CO1** Learn the fundamentals of hydrographic surveying
- **CO2** Identify the appropriate techniques for different types of survey
- **CO3** Understand the various options available during the Navigation
- **CO4** Analyze the data collected from a survey and assess its quality against the project requirements
- **CO5** Discuss the different roles for a hydrographic surveyor on marine projects

### TEXTBOOK:


### REFERENCES


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VERTICAL V: TRANSPORTATION INFRASTRUCTURE

CE3025 AIRPORTS AND HARBOURS LT P C 3 0 0 3

COURSE OBJECTIVE:
- To introduce the students about airport planning, design, construction and planning design principles of seaport

UNIT I AIRPORT PLANNING 7
Air transport characteristics - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area

UNIT II AIRPORT COMPONENTS 9
Airport Classification, Planning of Airfield Components – Runway, Taxiway, Apron, Hangar-Passenger Terminals- Geometric design of runway and taxiways-Runway pavement Design-Difference between Highway and airport pavements- Introduction to various design methods- Airport drainage.

UNIT III AIRPORT DESIGN 10

UNIT IV SEAPORTS COMPONENTS AND CONSTRUCTION 10

UNIT V SEAPORT REGULATIONS AND EIA 9
Wave action on Coastal Structures and Shore Protection and Reclamation – Coastal Regulation Zone, 2011-EIA – methods of impact analysis and its process

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Gain an insight on the planning and site selection of Airport Planning and design.
CO2 Knowledge on Design of various Airport components
CO3 Analyze and design the elements for orientation of runways and passenger facility systems.
CO4 Understand the various features in Harbours and Ports, their construction, coastal protection works
CO5 Knowledge on various Environmental Regulations and Acts

TEXTBOOKS:

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#### PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO   | Critical analysis of Civil Engineering problems and innovation | 2   | 3   | 3   | 2   | 2   | 3                |
| PSO2  | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 2   | 3   | 2   | 3   | 3   | 3                |

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**CE3026 TRAFFIC ENGINEERING AND MANAGEMENT**

**L T P C**

3 0 0 3

**COURSE OBJECTIVE**

- To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety

**UNIT I TRAFFIC SURVEYS AND ANALYSES**

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems - presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

**UNIT II TRAFFIC FLOW AND ROADWAY CAPACITY**

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Speed-Flow- Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value- Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes

**UNIT III COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES**

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle...
segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self- Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT IV DESIGN OF ROAD INTERSECTIONS
Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNIT V DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS
Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; Pedestrians: Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; Cycle Tracks: Principles of design, Design criteria, Design standards for Rural Expressways.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards
CO2 Understand the principles of traffic flow characteristics and their relationships
CO3 Understand various traffic management measures in addressing the demand Pricing and ITS applications.
CO4 Designing various types of control and regulatory measures to meet an efficient traffic network.
CO5 Understand various type of facilities and plan for Non Motorised Transport

TEXT BOOKS:
3. Srinivasa Kumar, “Introduction to Traffic Engineering”, Universities Press, 2018

REFERENCES
1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
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CE3027 URBAN PLANNING AND DEVELOPMENT L T P C

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COURSE OBJECTIVE:
- To enable students to have the knowledge on planning process and to introduce to the students about the regulations and laws related to Urban Planning.

UNIT I INTRODUCTION
Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas – Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

UNIT II PLANNING PROCESS AND THEORIES

UNIT III DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION
Types of plans – Regional Plan, Master Plan, Structure Plan, Detailed Development Plan, New Town/ Satellite town- Development Plan, urban nodes, Smart City Plan - Scope and Content of Regional Plan (RP), Master Plan (MP), and the Detailed Development Plan (DDP), Methodologies for the preparation of the RP, MP, and the DDP – Case Studies.
UNIT IV   PLAN IMPLEMENTATION
Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

UNIT V   URBAN AND REGIONAL PLANNING LEGISLATIONS, REGULATIONS AND DESIGNS
Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Understand the basic issues and meaning of terminologies in urban planning
CO2 Understand the different types of theories of urban planning and city development.
CO3 Understand the different types of plan, their strategies and their preparation process.
CO4 Comprehend the planning standards, evaluate the constraints and the financial mechanism
CO5 Knowledge on various town and country planning acts and their functions.

TEXTBOOKS:
3. Singh V.B, Revitalised Urban Administration in India, Kalpaz publication, Delhi, 2001

REFERENCES
1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai
3. Chennai City Municipal Corporation Act, 1919 and Tamil Nadu District Municipalities Act, 1920
5. The Tamil Nadu Combined Development and Building Rules, 2019
7. http://moud.gov.in

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PROGRAM OUTCOMES (PO)

PROGRAM SPECIFIC OUTCOMES (PSO)
CE3028 SMART CITIES L T P C 3 0 0 3

COURSE OBJECTIVE:
- To help the learners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

UNIT I INTRODUCTION 6
Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

UNIT II SMART PHYSICAL INFRASTRUCTURE 12
Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc

UNIT III SUSTAINABILITY AND SMART PLANNING 10
Relationship Between Sustainability and Smart planning - Place making project guidelines- Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES 8
Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities

UNIT V SMART CITIES PROJECT MANAGEMENT 9
Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Understand the basics of Urbanisation and the role of smart cities.
CO2 Gain knowledge on implementation of smart physical infrastructure.
CO3 Understand the role of smart planning for sustainable development.
CO4 Comprehend the knowledge of Technologies in Smart City planning
CO5 Reviewing the case studies of smart city projects.

REFERENCES
1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017
2. Sameer Sharma,“Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.
3. Binti Singh, Manoj Parmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
5. https://smartnet.niua.org/learn/library

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| PSO1 | Knowledge of Civil Engineering discipline | CO1 3 3 3 3 2 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | CO2 3 3 2 2 3 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | CO3 2 3 3 2 3 3 |

**CE3029 INTELLIGENT TRANSPORTATION SYSTEMS**

**Course Objective:**
- To learn the fundamentals of ITS.
- To study the ITS functional areas.
- To have an overview of ITS implementation in developing countries.

**UNIT I - INTRODUCTION TO ITS**

**UNIT II - DATA COLLECTION THROUGH ITS**
Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT).

**UNIT III - ITS IN TRAFFIC MANAGEMENT**
ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections．

**UNIT IV - ITS IN TRANSPORTATION PLANNING**
ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight-in Motion.
UNIT V  ITS APPLICATION IN LOGISTICS
Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Understand the fundamentals of ITS and its benefits.
CO2 Gain knowledge on data collection using sensors and its applications.
CO3 Acquainted with the knowledge of ITS in Traffic Management
CO4 Application of ITS in Transportation Planning
CO5 Able to gain knowledge on application of ITS in Logistics

TEXT BOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVE:
- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

UNIT I  PAVEMENT MATERIALS AND SUBGRADE ANALYSIS  8

UNIT II  DESIGN OF FLEXIBLE PAVEMENTS  10

UNIT III  DESIGN OF RIGID PAVEMENTS  9
Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT IV  PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE  10

UNIT V  STABILIZATION OF PAVEMENTS  8

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Get knowledge about types of rigid and flexible pavements.
CO2 Able to design of rigid pavements
CO3 Able to design of flexible pavements.
CO4 Determine the causes of distress in rigid and flexible pavements.
CO5 Understand stabilization of pavements, testing and field control.

TEXTBOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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**PROGRAM SPECIFIC OUTCOMES (PSO)**

| PSO1 | Knowledge of Civil Engineering discipline | 3 | 3 | 3 | 3 | 2 | 3 |
| PSO2 | Critical analysis of Civil Engineering problems and innovation | 2 | 3 | 3 | 3 | 1 | 3 |
| PSO3 | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 1 | 1 | 2 | 2 | 2 |   |

**CE3031 TRANSPORTATION PLANNING PROCESS**

**L T P C**

**3 0 0 3**

**COURSE OBJECTIVE:**
- To impart knowledge in the rudiments and stages in Transportation Planning Process

**UNIT I TRANSPORTATION PLANNING PROCESS**

8 Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology; analyses of data and presentation of results.

**UNIT II TRIP GENERATION STAGE**

9 Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

**UNIT III TRIP DISTRIBUTION STAGE**

10 Definition and objective: Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

**UNIT IV MODAL SPLIT-STAGE**

9 Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model

**UNIT V TRAFFIC ASSIGNMENT STAGE**

9 Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees

**COURSE OUTCOMES**

CO1 Understand the principles of the transportation planning process and methods of data collection.

CO2 Acquainted with the trip production, trip attraction models and calibration.

TOTAL: 45 PERIODS
CO3 Acquainted with the trip production, trip attraction models and calibration.
CO4 Able to understand trip distribution models and its application.
CO5 Gain knowledge on the mode choice behaviour and mode split models.

**TEXTBOOKS:**

**REFERENCES**

**COs- PO’s & PSO’s MAPPING**

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| PSO2 Critical analysis of Civil Engineering problems and innovation | 2 | 1 | 1 | 2 | 2 |
| PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3 | 1 | 2 | 2 | 2 |
CE3032  CLIMATE CHANGE ADAPTATION AND MITIGATION  L  T  P  C  3  0  0  3

COURSE OBJECTIVE:

- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT I  INTRODUCTION  9

UNIT II  ELEMENTS RELATED TO CLIMATE CHANGE  7

UNIT III  IMPACTS OF CLIMATE CHANGE  10
Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV  MITIGATING CLIMATE CHANGE  9

UNIT V  ALTERNATE FUELS AND RENEWABLE ENERGY  10

TOTAL: 45 PERIODS

COURSE OUTCOMES

The students completing the course will have

CO1 an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change

CO2 understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

CO3 ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

CO4 Gain in-depth knowledge on climate models

CO5 Post process the model outputs for climate impact assessment, know about adaptation strategies

TEXTBOOKS:

REFERENCES:
2. Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”, TERI Publishers, 2005

COS- PO’s & PSO’s MAPPING

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CCE331 AIR AND NOISE POLLUTION CONTROL ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVE:
- To impart knowledge on the sources, effects and control techniques of air pollutants and noise pollution.

UNIT I GENERAL
Atmosphere as a place of disposal of pollutants – Air Pollution – Definition - Air Pollution and Global Climate - Units of measurements of pollutants - Air quality criteria - emission standards - National ambient air quality standards - Air pollution indices - Air quality management in India.

UNIT II SOURCES, CLASSIFICATION AND EFFECTS
Sources and classification of air pollutants - Man made - Natural sources - Type of air pollutants - Pollution due to automobiles - Analysis of air pollutants - Chemical, Instrumental and biological methods. Air pollution and its effects on human beings, plants and animals - Economic effects of air pollution - Effect of air pollution on meteorological conditions - Changes on the Meso scale, Micro scale and Macro scale.
UNIT III SAMPLING, METEOROLOGY AND AIR QUALITY MODELLING
Sampling and measurement of particulate and gaseous pollutants - Ambient air sampling - Stack sampling. Environmental factors - Meteorology - temperature lapse rate and stability – Adiabatic lapse rate - Wind Rose - Inversion –Wind velocity and turbulence - Plume behavior - Dispersion of air pollutants- Air Quality Modeling.

UNIT IV AIR POLLUTION CONTROL MEASURES
Control - Source correction methods - Control equipments - Particulate control methods – Bag house filter - Settling chamber - cyclone separators - inertial devices - Electrostatic precipitator - scrubbers - Control of gaseous emissions - Absorption - Absorption equipments - adsorption and combustion devices (Theory and working of equipments only).

UNIT V NOISE POLLUTION AND ITS CONTROL
Sources of noise – Units and Measurements of Noise - Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise – General Control Measures – Effects of noise pollution – auditory effects, non-auditory effects. Noise Menace– Prevention and Control of Noise Pollution – Control of noise at source, control of transmission, protection of exposed person - Control of other types of Noise Sound Absorbent

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to

CO1 Understand various types and sources of air pollution and its effects
CO2 Know the dispersion of air pollutants and their modeling
CO3 Know about the principles and design of control of particulate pollutants
CO4 Understand the principles and design of control of gaseous pollutant
CO5 Know the sources, effects and control of vehicular, indoor air and noise pollution

TEXTBOOKS:

REFERENCES:
2. Air Pollution act, India, 1987
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986

COs- PO's & PSO's MAPPING

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Note: The average value of this course to be used for program articulation matrix
COURSE OBJECTIVES:

- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To participate in the performance of an environmental assessment process (EIA or SEA), given the disciplinary knowledge and skills in natural sciences and engineering the student have achieved in other courses.

UNIT I INTRODUCTION


UNIT II IMPACT IDENTIFICATION AND PREDICTION


UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT

Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN

Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V CASE STUDIES

Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

COURSE OUTCOMES:

On completion of the course, the student is expected to be able to:

CO1 carry out scoping and screening of developmental projects for environmental and social assessments
CO2 explain different methodologies for environmental impact prediction and assessment
CO3 assess socio-economic investigation of the environment in a project
CO4 plan environmental impact assessments and environmental management plans
CO5 knowledge to prepare environmental impact assessment reports for various projects

REFERENCES:

3. World Bank –Source book on EIA

**COs- PO’s & PSO’s MAPPING**

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**CCE334 INDUSTRIAL WASTEWATER MANAGEMENT**

**L T P C**

3 0 0 3

**COURSE OBJECTIVES:**
- To impart knowledge on the concept and application of Industrial pollution prevention, cleaner technologies, industrial wastewater treatment and residue management.
- Understand principles of various processes applicable to industrial wastewater treatment
- Identify the best applicable technologies for wastewater treatment from the perspective of yield production.

**UNIT I INTRODUCTION**

8


**UNIT II INDUSTRIAL POLLUTION PREVENTION & WASTE MINIMISATION**

8


**UNIT III INDUSTRIAL WASTEWATER TREATMENT**

10


**UNIT IV WASTEWATER REUSE AND RESIDUAL MANAGEMENT**

9

UNIT V  CASE STUDIES
Industrial manufacturing process description, wastewater characteristics, source reduction options and waste treatment flow sheet for Textiles – Tanneries – Pulp and paper – metal finishing – Sugar and Distilleries

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students is expected to be able to,

CO1 Explain the source and types of industrial wastewater and their environmental impacts and choose the regulatory laws pertaining to environmental protection

CO2 Identify industrial wastewater pollution and implement pollution prevention, waste minimization in industries

CO3 Apply knowledge and skills to design industrial wastewater treatment schemes

CO4 Audit and analyze environmental performance of industries to internal, external client, regulatory bodies and design waste reuse management techniques

CO5 Conduct research to develop effective management systems for industrial wastewater that are technically sound, economically feasible and socially acceptable

REFERENCES:

COs- PO’s & PSO’s MAPPING

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Note: The average value of this course to be used for program articulation matrix.

CE3033  SOLID AND HAZARDOUS WASTE MANAGEMENT  L T P C
3 0 0 3

COURSE OBJECTIVE

- To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment.
UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS 9
Sources and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.

UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING 9

UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY 9
Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magentic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES 9
Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT V WASTE DISPOSAL 9
Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure landfills- leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders
CO2 Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems
CO3 Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.
CO4 Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context
CO5 Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

REFERENCES:

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| PSO2       | Critical analysis of Civil Engineering problems and innovation                |          | 2        | 2        | 2        | 2        | 2                                   |
| PSO3       | Conceptualization and evaluation of engineering solutions to Civil Engineering Issues | 3        | 3        |          |          |          | 3                                   |

CE3034 ENVIRONMENTAL POLICY AND LEGISLATIONS

COURSE OBJECTIVES:
- The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention
UNIT I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO

UNIT II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION
Indian Constitution and Environmental Protection - Constitutional provisions concerning Environment Articles 14, 15, (2) (b) 19 (e), 21, 31, 32, 38, 39, 42, 47, 48-A, 49, 51, 51-A: Indian Environmental Policy 2006 - Administrative machinery for pollution control - Common Law & Criminal Law - Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269, 270, 277, 284, 285, 286, 425 to 440) Section 133 of Cr.P.C.

UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION

UNIT IV MAJOR INDIAN LEGISLATIONS

UNIT V ENVIRONMENT AND DEVELOPMENT CASE LAWS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted
CO2 Understand the key principles of, and actors within, environmental laws
CO3 Understand the National Environmental Policy and Various Legislations enacted in line with Policy
CO4 Critically analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.
CO5 Understand and the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.

REFERENCES
1. Leelakrishnan P., Environmental Law in India, Butterworths,1998
COs- PO’s & PSO’s MAPPING

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CCE332 ENVIRONMENTAL HEALTH AND SAFETY

COURSE OBJECTIVE:
- To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System

UNIT I INTRODUCTION
9
Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE
10
Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses—Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS
11

UNIT IV HAZARDS AND RISK MANAGEMENT
8
UNIT V  ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students are expected to be able to understand:
CO1 Need for EHS in industries and related Indian regulations
CO2 Various types of Health hazards, effect, assessment and control methods
CO3 Various safety systems in working environments
CO4 The methodology for preparation of Emergency Plans and Accident investigation
CO5 EHS Management System and its elements

REFERENCES
1. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India
2. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012
5. Environmental and Health and Safety Management by Nicholas P. Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995

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VERTICAL VII: WATER RESOURCES

CE3035  IRRIGATION ENGINEERING AND DRAWING  L T P C
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COURSE OBJECTIVE:
• To expose the students to irrigation principles, concept of available water, storage and diversion structures, and canal irrigation with the design components, so that they could understand the necessity of irrigation which aims at providing water at the right quantity, at the right time and at the right place.

UNIT I  IRRIGATION PRINCIPLES
UNIT II  CROP WATER REQUIREMENT  7

UNIT III  DIVERSION AND IMPOUNDING STRUCTURES  7

UNIT IV  CANAL IRRIGATION AND IRRIGATION WATER MANAGEMENT  9

UNIT V  DRAWING
i. Tank Surplus Weir – Design principles - Drawings showing Plan, Elevation and Sections  6
ii. Gravity Dam – Design principles - Profile of gravity dam  6
iii. Canal Drop - Design principles - Drawings showing Plan, Elevation and Sections  6
iv. Canal Regulator - Design principles - Drawings showing Plan, Elevation and Sections  6
v. Canal Aqueduct - Syphon Aqueduct (Type III) - Design principles - Drawings showing Plan, Elevation and Sections  6

TOTAL: (L:30 + P:30) 60 PERIODS

COURSE OUTCOMES
On completion of the course, the student is expected to be able to:
CO1 Acquire an in-deapth understanding about the National Water Policy, soil-water- plant characteristics and the measurement of soil water.
CO2 Capture the basics of crop water requirement and hence to perform irrigation scheduling.
CO3 Understand the diversion and storage structures along with its components.
CO4 Design the irrigation canal and get a knowledge about the various irrigation methods and apply the concepts for irrigation water management.
CO5 Design and draw the irrigation structure showing the detailed plan, elevation and sections.

TEXTBOOKS:

REFERENCES:
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CE3036 GROUNDWATER ENGINEERING

COURSE OBJECTIVE:
- The objective of this course is enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

UNIT I HYDROGEOLOGICAL PARAMETERS

UNIT II WELL HYDRAULICS

UNIT III GROUNDWATER MANAGEMENT

UNIT IV GROUNDWATER QUALITY
Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water Industrial water – Irrigation water - Groundwater Pollution and legislation - Environmental Regulatory requirements
UNIT V GROUNDWATER CONSERVATION

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:

CO1 Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers

CO2 Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics

CO3 Explain the concept of groundwater model development and data base management for groundwater management

CO4 Describe the importance of artificial recharge and groundwater quality concepts

CO5 Apply the creative and innovative technique on conservation of groundwater

TEXTBOOKS

REFERENCES

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COURSE OBJECTIVE:
• To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

UNIT I SYSTEM APPROACH 9
Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNIT II LINEAR PROGRAMMING 9
Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

UNIT III DYNAMIC PROGRAMMING 9
Bellman’s optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion

UNIT IV SIMULATION 9
Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNIT V ADVANCED OPTIMIZATION TECHNIQUES 9
Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:
CO1 Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.
CO2 Apply the concept of linear programming for optimisation of water resources problems.
CO3 Explain the concept of dynamic programming and apply in water resource system.
CO4 Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy
CO5 Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

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CE3038 WATERSHED CONSERVATION AND MANAGEMENT

COURSE OBJECTIVES:
- To provide the technical and sociological understanding of a watershed.
- To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.

UNIT I WATERSHED CONCEPTS

UNIT II SOIL CONSERVATION MEASURES

UNIT III WATER HARVESTING AND CONSERVATION

UNIT IV GIS FOR WATERSHED MANAGEMENT

180
UNIT V WATERSHED MANAGEMENT


TOTAL: 45 PERIODS

COURSE OUTCOME:

- On Completion of the course the student is expected to

CO1 Recognize and Interpret the morphological features of a watershed.
CO2 State, design and sketch the soil conservation structures.
CO3 Describe the micro catchment and apply the concepts to design the small water harvesting structures.
CO4 Illustrate the application of modern tools and technology in the management of watershed.
CO5 Classify the management activities and to develop an integrated watershed development plan.

TEXTBOOKS:


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CE3039 INTEGRATED WATER RESOURCES MANAGEMENT

COURSE OBJECTIVE

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM

Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS

Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS


UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM

Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO3 Apply law and governance in the context of IWRM.

CO4 Discuss the linkages between water-health; develop a HIA framework.

CO5 Analyse how the virtual water concept pave way to alternate policy options.

TEXTBOOKS:


REFERENCES:


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**CE3040 URBAN WATER INFRASTRUCTURE**

**COURSE OBJECTIVE:**

- To impart knowledge and skills relevant to water management in the context of urbanization and relate engineering principles to water supply, storm water and wastewater management, along with related regulations and best management practices from around the world.

**UNIT I URBAN ECOSYSTEM**


**UNIT II URBAN HYDROLOGY**


**UNIT III URBAN STORM WATERMANAGEMENT**

UNIT IV  WATER CONSERVATION AND REUSE

UNIT V  WATER GOVERNANCE

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Explain various functional elements of urban ecosystem.
  CO2 Calculate urban runoff, compute supply and demand of water, draw hydrograph
  CO3 Compare advantages of Newer techniques of green infrastructure and illustrate benefits
  CO4 Assess the Operation and Maintenance needs of urban water systems
  CO5 Propose best management practices for Indian context

TEXT BOOKS:

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COURSE OBJECTIVES:
- To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surface and groundwater quality modelling.

UNIT I  MODELLING INSIGHTS
Engineers and Mathematical models—Water quality models – historical development - different types of models-- steps in model development - importance of model building.- calibration and verification of models- finite element, finite difference and finite volume methods.

UNIT II  POLLUTION TRANSPORT
Transport phenomena – advection, diffusion, dispersion- contamination transport in surface and subsurface water - Simple transport models – steady state and time variable solutions- conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport

UNIT III  SURFACE WATER QUALITY MODELLING

UNIT IV  GROUNDWATER QUALITY MODELLING

UNIT V  WATER QUALITY MANAGEMENT MODELS
Exposure to surface water and groundwater quality modelling software’s – MIKE 21, WASP, QUAL2E and MODFLOW – demonstration – case studies – Modeling multilayer groundwater flow system – Artificial recharge feasibility through modeling – Groundwater contamination, restoration and management.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the students are able to
  CO1 Know about the principles of water quality modelling.
  CO2 Understand the pollutant transport phenomena in surface and groundwater.
  CO3 Apply the knowledge of surface water quality modelling to predict the water quality of rivers, lakes and estuary.
  CO4 Predict the groundwater contamination transport.
  CO5 Predict water quality of surface and sub surface water using numerical solution.

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**VERTICAL VIII: OCEAN ENGINEERING**

**CE3042  OCEAN WAVE DYNAMICS  L T P C**

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**COURSE OBJECTIVE**

- To make the students be aware of ocean wave classification, the mass, momentum and wave energy transformations and wave kinematics that are happening in nature and enable them in the prediction and analysis of the wave data.

**UNIT I  CONSERVATION EQUATIONS OF FLUID FLOW  9**


**UNIT II  WAVE THEORIES  9**

Linear wave theory : Governing Equation, Boundary Conditions and solutions, Dispersion relation, Constancy of wave period. Introduction to non-linear wave theories - Stokes, Cnoidal and Solitary wave theory.

**UNIT III  WAVE KINEMATICS  9**

Wave celerity, water particle velocities, accelerations, displacements and pressures. Integral properties of waves: Mass flux, Energy and energy flux, Group speed, Momentum and momentum flux.

**UNIT IV  WAVE TRANSFORMATIONS  9**

Shoaling, bottom friction and damping, refraction, reflection and diffraction. Wave Breaking: Type of breaking, Surf similarity parameter. Keulegan-Carpenter number, Ursell Parameter, Scattering parameter, Reynolds Number
UNIT V     WAVE ANALYSIS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Understand the concept of mass, momentum and wave energy transformations
CO2 Classify the linear and nonlinear wave theories including the Stokes theory, solitary and cnoidal wave theories.
CO3 Explain the wave kinematics and its properties.
CO4 Understand the principles of wave transformation.
CO5 Analyze of the long term and short term waves

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COURSE OBJECTIVE:

- Students mainly focused in understanding the physical and engineering properties of marine soil deposits and select suitable marine foundation as per project requirements.

UNIT I  MARINE SOIL DEPOSITS  9
Marine environment, Physical and engineering properties of marine soils - Specific problems related to marine soil deposits.

UNIT II  SITE INVESTIGATION IN THE CASE OF MARINE SOIL DEPOSITS  9
Challenges of site investigation in marine environment, Different site investigation techniques, sampling techniques, Geophysical methods, Recent advancements in site investigation and sampling used for marine soil deposits.

UNIT III  BEHAVIOR OF SOILS SUBJECTED TO REPEATED LOADING  9
Effect of wave loading on foundations of marine structures, Behavior of marine deposits under cyclic loading, Cyclic behavior of soils based on fundamental theory of mechanics, Approximate engineering methods

UNIT IV  FOUNDATIONS IN MARINE SOIL DEPOSITS  9
Different offshore and nearshore foundations, Gravity platforms, Jack-up rigs, pile foundations. cassions, spudcans.

UNIT V  MARINE FOUNDATIONS SUBJECTED TO WAVE LOADING  9
Cyclic behavior of soils, empirical models, elastic-plastic models, FEM analysis of marine foundations subjected to wave loading.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to be able to

CO1 Understand the physical and engineering properties of marine soil deposits

CO2 explain the effect of wave loading on physical and engineering properties of marine soil deposits

CO3 execute investigation program for marine soil deposits

CO4 design suitable marine foundation as per project requirement

CO5 develop numerical model and design marine foundation subjected to wave loading

REFERENCES:


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COURSE OBJECTIVES:
- To provide the students the knowledge of coastal environment and to determine the characteristics of waves.
- To provide the students the knowledge of wave transformation, sediment transport, coastal protection measures and coastal structure design.

UNIT I  COASTAL ENVIRONMENT  
Beaches - Coastal features - Coastal Zonation - EEZ - Inshore and Offshore Areas - Mean Sea level - Basics of Tides and Waves - Coastal Morphology.

UNIT II  WAVES DYNAMICS  
Basics of waves - Classification - Wave Theory - Physical Characteristics of different types of waves - Linear Wave Theory - Wave celerity - Velocities - Accelerations - Displacements - Wave dynamics in shallow and deep water conditions.

UNIT III  NEARSHORE WAVE TRANSFORMATION  
Shoaling, refraction, diffraction and breaking – Interaction currents and waves - near shore currents - wave run-up and overtopping

UNIT IV  SEDIMENT DYNAMICS AND TRANSPORT  

UNIT V  SHORE PROTECTION  
Design of shore defense structures; Hard Engineering measures - Sea walls, Revetments, Bulkheads, Dikes, Groynes, Breakwaters; Soft Engineering measures – Artificial Reefs, Beach nourishment, Dune regeneration, Salt marsh Creation, Bioshields - Case studies

COURSE OUTCOME:
On successfully completing this course unit, students will be able to:
CO1 Understand the basic concepts of coastal environment.
CO2 Calculate sea state parameters (wave height, wave period, water levels) in shallow and deep water conditions.
CO3 Understand the principles of near-shore wave transformation.
CO4 Analysis the sediment and its transport processes.
CO5 Evaluate measures to protect beaches from erosion due to waves and currents.

TEXTBOOKS:

REFERENCES:
COs- PO’s & PSO’s MAPPING

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CE3045 OFFSHORE STRUCTURES

COURSE OBJECTIVE:
- Students mainly focused in understanding the offshore environment, types, suitability, and design concepts of offshore structures as per the appropriate requirements.

UNIT I INTRODUCTION TO OFFSHORE ENVIRONMENT
Ocean winds-characterization of wind regime-wind velocity profile. Ocean waves-wave parameters-Introduction to Airy's wave theory and its applications-brief about time and frequency domain analysis, brief introduction about ocean currents-tides, seaquakes, ice environment, Ice-sea interactions.

UNIT II TYPES OF OFFshore STRUCTURES
Offshore Structures-need for offshore structures.Types of Offshore Structures-components-materials used-design parameters-suitable environment conditions-construction practices-drawbacks-EIA for Offshore structures.

UNIT III FORCES ON OFFSHORE STRUCTURES

UNIT IV SUBMARINE PIPELINES AND RISERS

UNIT V ACCIDENTAL LOADS AND CORROSION
Fire, Blast and Collision-Behaviour of steel at elevated temperature-Fire rating for Hydrocarbon fire, Blast Mitigation-Blast walls-Collision of boats and energy absorption-Corrosion-Corrosion
mechanism - Types of corrosion - Offshore structure corrosion zones - Biological corrosion - Preventive measures of corrosion - Online corrosion monitoring - Corrosion fatigue

TOTAL: 45 PERIODS

COURSE OUTCOMES:
* On completion of the course, the student is expected to be able to

CO1 Understand the offshore environment and technical terms associated with it.
CO2 Explain the types and choose suitable offshore structures according to environmental conditions
CO3 Investigate various types of forces acting on the offshore structures
CO4 Adapt appropriate codes to design the submarine pipelines
CO5 Discuss about the accidental loads and corrosion on offshore structures

REFERENCES:

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CE3046 PORT AND HARBOUR ENGINEERING

COURSE OBJECTIVE
* The purpose of this course is to impart the concepts of port and harbour planning, design, implementation and maintenance.

UNIT I INTRODUCTION
Ports and harbors: Classification of ports & harbours – Port and harbor planning and layout – Meteorological, hydrographic and oceanographic data requirements and measurements for port and harbor design.

UNIT II PORT AND HARBOUR LAYOUT OPERATIONS
Port and harbour layout for vessels navigation and cargo handling - port buildings, navigation channels – shore infrastructure and utilities, land reclamation – Dredging - equipment, navigation improvement, pipelines and cables.

UNIT III DESIGN OF PORT
Types and classification of ports and harbours in India, Natural ports and manmade ports, major ports, minor ports; Design of port infrastructures with regards to cargo handling, cargo storage and integrated transport of goods.
UNIT IV  DESIGN OF HARBOUR
Design harbour Infrastructures - design of break water - shore attached and offshore breakwaters design - harbour basin design, approach channel design, turning basin design, with regards to cargo and passenger terminals

UNIT V  CONSTRUCTION ASPECTS AND SMART PORT
Planning and construction, expansion of existing jetties and renovation of port –Inland Port Infrastructure - Smart Port : Levels of transformation into a smart port, Artificial Intelligence and Machine Learning, Smart application for ports.

COURSE OUTCOMES
On the successful completion of the course, students will be able to
CO1 Understand the classification of port and harbor and study about the data requirement and measurements for port and harbour structures.
CO2 Discuss the layout operations for vessel navigation and cargo handling.
CO3 Explain the design guidelines for port structure.
CO4 Explain the design guidelines for harbour structure.
CO5 Describe the construction, maintenance and renovation aspects of ports and understand the concept of Smart Port and Smart application for ports

TEXTBOOKS

COs- PO's & PSO's MAPPING

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COASTAL HAZARDS AND MITIGATION

COURSE OBJECTIVES:
- To provide students understanding of the materials and processes associated with the major natural hazards: floods, earthquakes, tsunamis, landslides and other coastal hazards
- To be able to mitigate these hazards based on case studies and respond in the event of a disaster by appropriate strategies.

UNIT I INTRODUCTION
Introduction to Environmental and Human induced hazards - Natural vs. Man-made hazard - Hazard and disaster, vulnerability, resilience - coping mechanisms

UNIT II COASTAL HAZARDS

UNIT III LAW AND POLICY
Disaster management law and policy in India – changing pattern of disaster management in India – response and recovery framework - enabling institutions – institutional coordination

UNIT IV ADAPTATION AND MITIGATION
Coastal Hazards Adaptation Strategy - Adaptation indigenous knowledge - Sectoral adaptations - Disaster risk response frameworks - Mapping and planning for disaster - Community based disaster Mitigation Measures – Indigenous knowledge for disaster Mitigation - NDMA guidelines

UNIT V CASE STUDIES
Case studies of tsunami (2004 Indian Ocean tsunami), Earthquake (Latur), cyclones (Gaja, 2018 Tamilnadu), other cyclones, coastal erosion, oil spills, chemical disasters, nuclear disasters – vulnerability of coastal megacities - lessons from building back better.

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 Highlight the concepts of hazards and their related physical process
CO2 Remember the concepts of natural and manmade hazards.
CO3 Summarize the adaptation strategy and mitigation measure to coastal hazards
CO4 Explain the various laws and policies involved in - institutional coordination of India.
CO5 Manage the hazards based on case studies and respond in the event of a disaster by appropriate strategies.

REFERENCES
2. Rajib Shaw and RR Krishnamurthy, “Disaster Management: Global Challenges Local Solutions” University Press, 2009
3. National Disaster Management Agency – Guidelines issued by NDMA such as for earthquakes, tsunamis, cyclones, chemical disasters etc. www.ndma.gov.in
   Regularly issued guidelines and training materials especially for disaster management policy, reconstruction of buildings etc
5. United Nations office for Disaster Risk Reduction www.unisdr.org various publications and guidelines that are constantly updated
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### CE3048 COASTAL ZONE MANAGEMENT AND REMOTE SENSING

**COURSE OBJECTIVES**
- To be able to “see” the features and components of the coastal zone.
- To assess the various living and non-living resources
- To understand the need for coastal zone management and to develop an ICM plan.
- To provide the coastal and oceanographic applications of satellite remote sensing.

**UNIT I COASTAL ZONE**

**UNIT II COASTAL RESOURCES**
Types and functions of coastal and marine resources – Renewable and Non-Renewable resources – Living marine resources and Nonliving marine resources – Marine minerals-Placer deposits – Hydrocarbon deposits – Polymetallic nodules.

**UNIT III COASTAL ECOSYSTEM**
Marine ecosystem: Mangroves – Seagrass – Seaweeds - Coral reef – Large marine ecosystem - Climate effects on living marine resources- Biological monitoring of marine ecosystem- Human impacts on marine ecosystem.

**UNIT IV COASTAL REGULATIONS**
Introduction- What is ICM- Developing an ICM framework- Principles-Goals-defining boundaries – Coastal Regulation Zones (CRZ) for main land and Islands –Environmental Law and policy.
UNIT V  
REMOTE SENSING IN COASTAL ZONE MANAGEMENT  

Sensors and Platforms used for coastal application – Mapping of Coral Reefs, Macroalgae, Mangrove and Wetlands – Coastal Landuse / Land Cover Mapping – Coastal Regulation Zone Mapping – Case studies.

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to

CO1  Understand the science and basic of Coastal zone.
CO2  Assess the living marine resources and non-living marine resources.
CO3  Learn about importance of different ecosystem available in coastal and marine environment.
CO4  Understand the coastal regulations for mainland and islands.
CO5  Acquire knowledge about various satellites and sensors used for marine and coastal environment.

TEXTBOOKS:
2. NCSCM strategies and guide line for National implementation of Integrated Coastal zone management, 2013

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VERTICAL IX: DIVERSIFIED COURSES

CE3049 STEEL CONCRETE COMPOSITE STRUCTURES  L T P C
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COURSE OBJECTIVE

- To develop an understanding of the effect composite action and assess governing limit states for composite elements.

UNIT I INTRODUCTION TO COMPOSITE ACTION  9

UNIT II DESIGN OF COMPOSITE BEAM  9
Introduce composite beams, including shear studs – Determine the location of a beam’s neutral axis/axes depending on the level of composite action. Calculate shear stud strength and understand strength modifiers - deflection of composite beams.

UNIT III DESIGN OF COMPOSITE COLUMN  9
Types of Composite columns – design of encased columns – design of in-filled columns – axial, uni-axial and bi-axially loaded columns.

UNIT IV DESIGN OF COMPOSITE SLAB  9

UNIT V CASE STUDIES  9
Case studies on steel concrete composite construction in buildings - seismic behaviour of composite structures

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to

CO1 Describe the effect of composite action has on structural component behaviour.
CO2 Describe and assess governing limit states for composite beam.
CO3 Describe and assess governing limit states for composite slab.
CO4 Describe and assess governing limit states for composite column.
CO5 Study and evaluate the case studies related to steel concrete composite constructions of buildings.

TEXT BOOKS:

REFERENCES:
### COs- PO’s & PSO’s MAPPING

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### CE3050  
**FINANCE FOR ENGINEERS**  
**L T P C**  
**3 0 0 3**

**COURSE OBJECTIVE:**
- To study the concepts of Finance such as fundamentals of management of accounting, Time value of money, comparing alternatives proposals, evaluating alternative investments and management of funds.

**UNIT I  
FUNDAMENTALS OF MANAGEMENT ACCOUNTING**  
9

**UNIT II  
TIME VALUE OF MONEY**  
9

**UNIT III  
COMPARING ALTERNATIVES PROPOSALS**  
9

**UNIT IV  
EVALUATING ALTERNATIVE INVESTMENTS**  
9
- Real Estate - Investment Property, Equipment Replace Analysis, Depreciation – Tax before and after depreciation – GST– Input Tax Credit (ITC) – Assessment and Administration of GST – Inflation - Practical knowledge of risk and tax management.
UNIT V  FUNDS MANAGEMENT


TOTAL : 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Describe the basic principles of accounting
  CO2 Assess the value of money
  CO3 Evaluate alternate proposals
  CO4 Evaluate alternative investments
  CO5 Select best source of finance for a project

REFERENCES:

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COURSE OBJECTIVE:
- Students are expected to learn reasons for failure and damages of embankments and slopes, various methods of analysis of slopes and remedial techniques to protect the slopes.

UNIT I DESIGN CONSIDERATION 9
Design consideration, Factors influencing design, Types of earth and rock fill dams, Design details, Provisions to control pore pressure.

UNIT II SLOPE STABILITY AND SEEPAGE ANALYSIS 8

UNIT III HYDRAULIC FRACTURING 9

UNIT IV FAILURE AND DAMAGES 9
Failure and damages, Nature and importance of failures in embankment and foundation - Piping, Differential settlement, Foundation slides, Earthquake damage, creep and anisotropic effects, Reservoir wave action, Dispersive piping.

UNIT V SLOPE PROTECTION MEASURES 10
Special design problems, Slope protection, Filter design, Foundation treatment, Earth dams on pervious soil foundation, Application of Geosynthetic materials in filtration. Treatment of rock foundation, Construction Techniques, Quality control and performance measurement

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to

CO1 Assess the causes of failure and damage of embankments and slopes.

CO2 Apply the knowledge of engineering and analyze the stability of slopes for various seepage conditions and apply the concept in the design of earth and rock fill dams.

CO3 Apply the knowledge of engineering and assess the stability of dam against hydraulic fracturing and suggest suitable remedial measure.

CO4 Understand the nature of failures and damages in earth and rock fill dams and apply the concept in field to avoid distress.

CO5 Recommend suitable remedial measures to protect the slopes and implement quality control and monitor its performance

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PROGRAM SPECIFIC OUTCOMES (PSO)

| PSO1   | Knowledge of Geotechnical Engineering discipline | 3       | 3       | 3       | 3       | 3       | 3 |
| PSO2   | Critical analysis of Geotechnical Engineering problems and innovation | 2       | 2       | 2       | 3       | 3       | 2 |
| PSO3   | Conceptualization and evaluation of engineering solutions to geotechnical engineering issues | 2       | 2       | 3       | 3       | 3       | 3 |

CE3052  COMPUTATIONAL FLUID DYNAMICS

L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for
- Applying the fundamentals of CFD, and developing case specific governing equations,
- Performing finite difference and finite volume based analysis for steady and transient diffusion problems,
- Implementing various mathematical schemes under finite volume method for convention diffusion.
- Solving complex problems in the field of fluid flow and heat transfer with the support of high speed computers.
- Applying the various discretization methods, solution procedure and the concept of turbulence modelling.

UNIT I  GOVERNING EQUATIONS AND BOUNDARY CONDITIONS  9

UNIT II  FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION  9
UNIT III  FINITE VOLUME METHOD FOR CONVECTION DIFFUSION  9
Steady one-dimensional convection and diffusion – Central, upwind differencing schemes, properties of discretization schemes, Hybrid, Power-law, QUICK Schemes, Conservativeness, Boundedness, Transportiveness.

UNIT IV  FLOWFIELD ANALYSIS  9
Stream function and vorticity, Representation of the pressure gradient term, Staggered grid – Momentum equations, Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V  TURBULENCE MODELS AND MESH GENERATION  9
Turbulence models, mixing length model, Two equation (k-ε) models – High and low Reynolds number models, Mesh Generation and refinement Techniques – software tools.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1 Apply the fundamentals of CFD and develop case specific governing equations
CO2 Perform finite difference and finite volume based analysis for steady and transient diffusion problems
CO3 Implement various mathematical schemes under finite volume method for convention diffusion
CO4 Solve complex problems in the field of fluid flow and heat transfer with the support of high speed computers
CO5 Apply the various discretization methods, solution procedure and the concept of turbulence modelling

TEXT BOOKS:

REFERENCES:

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CE3053  RAINWATER HARVESTING  

COURSE OBJECTIVE:
- To impart knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources and relate the engineering principles and practices in estimation of runoff, storage, recharge into the ground and maintain the system through the best management practices followed around the world.

UNIT I  BASICS OF RWH  

UNIT II  HYDROLOGY AND GROUND WATER  

UNIT III  METHODS OF RAINWATER HARVESTING  

UNIT IV  DESIGN OF RAINWATER HARVESTING STRUCTURES  
Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures – Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system

UNIT V  MANAGEMENT OF RWH AND CASE STUDIES  
Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems – Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Understand the need and importance of water conservation through global and Indian practices of rainwater harvesting
  CO2 Understand and apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials
  CO3 Understand the various types of rainwater harvesting methods and apply it on the field
  CO4 Design the various RWH structures to harvest the rainwater in surface and subsurface
  CO5 Explain the difficulties of RWH, evaluation methods and maintenance through various case studies.
TEXT BOOKS

REFERENCES:
8. Handbook on rainwater harvesting storage options, Ministry of Water & Environment, Uganda

COs- PO’s & PSO’s MAPPING

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CE3054 TRANSPORT AND ENVIRONMENT

COURSE OBJECTIVE:
- The objective of this course is to create an awareness / overview of the impact of Transportation Projects on the environment and society.
UNIT I INTRODUCTION
Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

UNIT II METHODOLOGIES
Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

UNIT III ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT
Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, traffic impact studies, IRC guidelines.

UNIT IV ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN

UNIT V EIA CASE STUDIES
EIA Case Studies on Highway, Railway - EIA Case Studies on Transit Oriented Development (TOD), Compact Cities, Non-Motorised Transport (NMT)

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Understand the basic concepts of Environmental Impact of Assessment
CO2 Apply various methods of analyzing environmental Impact Analysis.
CO3 Gain knowledge on Stage Wise Assessment and Prediction of impact of transportation projects
CO4 Adopt environmental management plan and their impact on earth.
CO5 Reviewing various case studies on environmental impact assessment of transport projects.

TEXTBOOKS:
3. EIA Guidance Manual- Highway- MOEF & Govt of India, 2010

REFERENCES:
5. Manual on Norms & Standards for Environmental Clearance of large construction projects, MOEF & Govt of India
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<td>PSO1 Knowledge of Civil Engineering discipline</td>
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<td>PSO2 Critical analysis of Civil Engineering problems and innovation</td>
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<td>PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering Issues</td>
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CE3055 ENVIRONMENTAL QUALITY MONITORING

COURSE OBJECTIVES:
- To educate the students on the sample collection and various instrumental methods of monitoring the quality of air, water and solid waste.

UNIT I MONITORING AND CHARACRATERIZATION OF ENVIRONMENT
General approach to environmental analysis, Choice of Lab.Vs. Field analysis, Environmental monitoring-current and future status, Lab. Standards, Data quality objectives, statistics in environmental monitoring, Accuracy and precision, detection limit, types of errors, Automated Data acquisition and processing-sensors and transducers , Monitoring Network and real time monitoring

UNIT II ENVIRONMENTAL SAMPLING
Location, planning, sampling equipment’s for water, solids and air, sample storage for physical and chemical contaminants ,types of sampling, representative samples, sample preparation techniques-Solvent Extraction, SPE, Head space, Purge and trap and SPME

UNIT III WATER ANALYSIS
Techniques for analysis of major ions-UV-visible Spectrophotometer, Flame photometer, AAS, ICP (AES and MS), Trace organic pollutants(PCB, dioxins, pesticides) GC and HPLC (Columns Detectors and Application)

UNIT IV ATMOSPHEREIC ANALYSIS
Ambient air and flue gas, Gaseous pollutants-Determination of time weighted average concentration(Absorption trains, solid adsorbents and differential tubes), Direct reading instruments(fluorescence ,chemiluminescent,IR and Electrochemical sensors, GC-MS for trace organics, Particulate sampling methods- High volume sampler, personal sampler, PM 10 and 2.5, Metals Direct(XRF) and dissolution methods(AAS/AES)
Problem in analysis of soil and Waste -sampling, pretreatment -extraction and clean up, New extraction techniques, Automated soxhlet and solvent extraction,microwave digestion and sonication,SCF(CO2), Analysis for trace pollutants, Analysis of leachate.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Understand the basics of environmental monitoring
CO2 Able to select appropriate sampling protocol for chemical analysis
CO3 Understand various methods of analysis of pollutants in water
CO4 Select correct method for toxic pollutants estimation in air
CO5 Familiar with analysis of land and wastes

REFERENCES:

C0s- PO's & PSO's MAPPING

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MANDATORY COURSES I

MX3081 INTRODUCTION TO WOMEN AND GENDER STUDIES

COURSE OUTLINE

UNIT I CONCEPTS
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN’S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL
Rise of Feminism in Europe and America.
Women’s Movement in India.

UNIT IV GENDER AND LANGUAGE
Linguistic Forms and Gender.
Gender and narratives.

UNIT V GENDER AND REPRESENTATION
Advertising and popular visual media.
Gender and Representation in Alternative Media.
Gender and social media.

TOTAL : 45 PERIODS

MX3082 ELEMENTS OF LITERATURE

OBJECTIVE:
- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. COURSE CONTENTS
   Introduction to Elements of Literature

   1. Relevance of literature
      a) Enhances Reading, thinking, discussing and writing skills.
      b) Develops finer sensibility for better human relationship.
      c) Increases understanding of the problem of humanity without bias.
      d) Providing space to reconcile and get a cathartic effect.

   2. Elements of fiction
      a) Fiction, fact and literary truth.
      b) Fictional modes and patterns.
      c) Plot character and perspective.

   3. Elements of poetry
      a) Emotions and imaginations.
      b) Figurative language.
c) (Simile, metaphor, conceit, symbol, pun and irony).
d) Personification and animation.
e) Rhetoric and trend.

4. Elements of drama
   a) Drama as representational art.
   b) Content mode and elements.
   c) Theatrical performance.
   d) Drama as narration, mediation and persuasion.
   e) Features of tragedy, comedy and satire.

3. READINGS:

3.1 Textbook:
   3.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

4. OTHER SESSION:
   4.1* Tutorials:
   4.2*Laboratory:
   4.3*Project: The students will write a term paper to show their understanding of a particular piece of literature

5. *ASSESSMENT:
   5.1 HA:
   5.2 Quizzes-HA:
   5.3 Periodical Examination: one
   5.4 Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.
   5.5 Final Exam:

TOTAL: 45 PERIODS

OUTCOME OF THE COURSE:
- Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

MX3083 FILM APPRECIATION

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

Theme - A: The Component of Films
  A-1: The material and equipment
  A-2: The story, screenplay and script
  A-3: The actors, crew members, and the director
  A-4: The process of film making… structure of a film
Theme - B: Evolution of Film Language
B-1: Film language, form, movement etc.
B-2: Early cinema… silent film (Particularly French)
B-3: The emergence of feature films: Birth of a Nation
B-4: Talkies
Theme - C: Film Theories and Criticism/Appreciation
C-1: Realist theory; Auteurists
C-2: Psychoanalytic, Ideological, Feminists
C-3: How to read films?
C-4: Film Criticism / Appreciation
Theme – D: Development of Films
D-1: Representative Soviet films
D-2: Representative Japanese films
D-3: Representative Italian films
D-4: Representative Hollywood film and the studio system
Theme - E: Indian Films
E-1: The early era
E-2: The important films made by the directors
E-3: The regional films
E-4: The documentaries in India

READING:
A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

MX3084 DISASTER RISK REDUCTION AND MANAGEMENT L T P C
3 0 0 0

COURSE OBJECTIVE
- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced – Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills - Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - , Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR)
Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT
Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)
UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT


UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management. - Field work-Mock drill -

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES

COURSE OUTCOME:
CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)
CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
CO3: To develop disaster response skills by adopting relevant tools and technology
CO4: Enhance awareness of institutional processes for Disaster response in the country and
CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

CO’s – PO’s & PSO’s MAPPING

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MANDATORY COURSES II

MX3085 WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA  L T P C  3 0 0 0

COURSE OBJECTIVES:
- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE 2+4

Health: Definition - Importance of maintaining health - More importance on prevention than treatment
Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.


Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI - Importance and actions to be taken

UNIT II DIET 4+6

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.


Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet
Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes
Different cooking methods, merits and demerits of each method
UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine
Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS 3+4

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life - Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.


Sleep - Sleep and its importance for mental wellness - Sleep and digestion.
Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA 2+12

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:
1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by
   The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001
   1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
   2. Simple lifestyle modifications to maintain health
https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.

3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html


7. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/

8. Yoga https://www.healthifyme.com/blog/types-of-yoga/

Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda


10. CAM : https://www.hindawi.com/journals/ecam/2013/376327/

11. Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSE OUTCOMES:
After completing the course, the students will be able to:

- Learn the importance of different components of health
- Gain confidence to lead a healthy life
- Learn new techniques to prevent lifestyle health disorders
- Understand the importance of diet and workouts in maintaining health

MX3086 HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA L T P C 3 0 0 0

UNIT-I CONCEPTS AND PERSPECTIVES
Meaning of History
Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation versus evidence, concept of historical inevitability, Historical Positivism.
Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA
Introduction to the works of D.D. Kosambi, Dharmapal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT-III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA
Technology in pre-historic period
Beginning of agriculture and its impact on technology
Science and Technology during Vedic and Later Vedic times
Science and technology from 1st century AD to C-1200.

UNIT-IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA
Legacy of technology in Medieval India, Interactions with Arabs
Development in medical knowledge, interaction between Unani and Ayurveda and alchemy
Astronomy and Mathematics: interaction with Arabic Sciences
Science and Technology on the eve of British conquest

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UNIT-V  SCIENCE AND TECHNOLOGY IN COLONIAL INDIA
Science and the Empire
Indian response to Western Science
Growth of techno-scientific institutions

UNIT-VI  SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA
Science, Technology and Development discourse
Shaping of the Science and Technology Policy
Developments in the field of Science and Technology
Science and technology in globalizing India
Social implications of new technologies like the Information Technology and Biotechnology

TOTAL : 45 PERIODS

MX3087  POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY

L T P C 3 0 0 0

Pre-Requisite: None. (Desirable: Universal Human Values 1, Universal Human Values 2)

OBJECTIVES:

- This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

COURSE TOPICS:

Considerations for humane society, holistic thought, human being’s desires, harmony in self, harmony in relationships, society, and nature, societal systems. (9 lectures, 1 hour each)

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. (5 lectures)

(Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. (2 lectures)

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) (5 lectures)

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one’s lives. Relationship with nature. (6 lectures)

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. (3 lectures)

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. (4 lectures) (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)
Conclusion (2 lectures)

Total lectures: 39

Preferred Textbooks: See Reference Books

Reference Books: Authors mentioned along with topics above. Detailed reading list will be provided.

GRADING:

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**TOTAL : 45 PERIODS**

OUTCOME:

- The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

MX3088 STATE, NATION BUILDING AND POLITICS IN INDIA

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**OBJECTIVE:**

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

**TOPICS:**

Understanding the need and role of State and politics.

Development of Nation-State, sovereignty, sovereignty in a globalized world.

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government-unitary-federal, Presidential-Parliamentary,

The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies. Constitution making and the Constitution of India.

Goals, objective and philosophy.

Why a federal system?

National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari)

New social movements.

The changing nature of Indian Political System, the future scenario.

What can we do?

**TOTAL : 45 PERIODS**
OUTCOME OF THE COURSE:
It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

SUGGESTED READING:

MX3089 INDUSTRIAL SAFETY L T P C 3 0 0 0

OBJECTIVES
- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES
Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

UNIT III SAFETY ACTIVITIES

UNIT IV WORKPLACE HEALTH AND SAFETY
Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment-
Checklist Analysis- Root cause analysis- What-if Analysis- and Hazard Identification and Risk Assessment

TOTAL: 45 PERIODS

COURSE OUTCOMES
on completion of this course the student will be able:
- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES
5. Society of Safety Engineers, USA

ONLINE RESOURCES

CO’s – PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic concept of safety.</td>
<td>PO1 3 PO2 3 PO3 1 PO4 1 PO5 3 PO6 2 PO7 2 PO8 3 PO9 3 PO10 1 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<tr>
<td>CO2</td>
<td>Obtain knowledge of Statutory Regulations and standards.</td>
<td>PO1 2 PO2 3 PO3 2 PO4 1 PO5 3 PO6 2 PO7 3 PO8 3 PO9 2 PO10 1 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<td>CO3</td>
<td>Know about the safety Activities of the Working Place.</td>
<td>PO1 2 PO2 2 PO3 2 PO4 1 PO5 2 PO6 2 PO7 3 PO8 3 PO9 2 PO10 2 PO11 2 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<tr>
<td>CO4</td>
<td>Analyze on the impact of Occupational Exposures and their Remedies</td>
<td>PO1 3 PO2 3 PO3 2 PO4 2 PO5 3 PO6 2 PO7 3 PO8 2 PO9 2 PO10 1 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<td>CO5</td>
<td>Obtain knowledge of Risk Assessment Techniques.</td>
<td>PO1 3 PO2 3 PO3 2 PO4 2 PO5 3 PO6 2 PO7 3 PO8 3 PO9 2 PO10 1 PO11 3 PSO1 3 PSO2 3 PSO3 3</td>
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Industrial safety 3 3 3 2 1 3 2 2 3 2 1 3 3 3 3
COURSE OBJECTIVES:
The main objectives of this course are to:
  1. Understand the importance, principles, and search methods of AI
  2. Provide knowledge on predicate logic and Prolog.
  3. Introduce machine learning fundamentals
  4. Study of supervised learning algorithms.
  5. Study about unsupervised learning algorithms.

UNIT I  INTELLIGENT AGENT AND UNINFORMED SEARCH  6

UNIT II  PROBLEM SOLVING WITH SEARCH TECHNIQUES  6
Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - Game theory - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - Constraint Satisfaction Problems (CSP) - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP

UNIT III  LEARNING  6

UNIT IV  SUPERVISED LEARNING  6

UNIT V  UNSUPERVISED LEARNING  6
Unsupervised Learning – Principle Component Analysis - Neural Network: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – Clustering: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

PRACTICAL EXERCISES: 30 PERIODS
Programs for Problem solving with Search
1. Implement breadth first search
2. Implement depth first search
3. Analysis of breadth first and depth first search in terms of time and space
4. Implement and compare Greedy and A* algorithms.

Supervised learning
5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement the naïve Bayesian classifier.
Unsupervised learning

9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.

Note:
- Installation of gnu-prolog, Study of Prolog (gnu-prolog).
- The programs can be implemented in using C++/JAVA/ Python or appropriate tools can be used by designing good user interface
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

COURSE OUTCOMES:
CO1: Understand the foundations of AI and the structure of Intelligent Agents
CO2: Use appropriate search algorithms for any AI problem
CO3: Study of learning methods
CO4: Solving problem using Supervised learning
CO5: Solving problem using Unsupervised learning

TOTAL : 60 PERIODS

TEXT BOOK
2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed

REFERENCES

OCS352 IOT CONCEPTS AND APPLICATIONS

COURSE OBJECTIVES:
- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IoT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS
5

UNIT II COMPONENTS IN INTERNET OF THINGS
5
Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT
6
UNIT IV: OPEN PLATFORMS AND PROGRAMMING

- IOT deployment for Raspberry Pi /Arduino platform
- Architecture – Programming – Interfacing
- Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V: IOT APPLICATIONS

- Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT,
  Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

PRACTICAL EXERCISES:

- 1. Introduction to Arduino platform and programming
- 2. Interfacing Arduino to Zigbee module
- 3. Interfacing Arduino to GSM module
- 4. Interfacing Arduino to Bluetooth Module
- 5. Introduction to Raspberry PI platform and python programming
- 6. Interfacing sensors to Raspberry PI
- 7. Communicate between Arduino and Raspberry PI using any wireless medium
- 8. Setup a cloud platform to log the data
- 9. Log Data using Raspberry PI and upload to the cloud platform
- 10. Design an IOT based system

COURSE OUTCOMES:

CO1: Explain the concept of IoT.
CO2: Understand the communication models and various protocols for IoT.
CO3: Design portable IoT using Arduino/Raspberry Pi /open platform
CO4: Apply data analytics and use cloud offerings related to IoT.
CO5: Analyze applications of IoT in real time scenario.

TEXTBOOKS


REFERENCES

1. Perry Lea, “Internet of things for architects”, Packt, 2018

OCS353: DATA SCIENCE FUNDAMENTALS

COURSE OBJECTIVES:

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.
UNIT I
INTRODUCTION
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

UNIT II
DATA MANIPULATION

UNIT III
MACHINE LEARNING
The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

UNIT IV
DATA VISUALIZATION

UNIT V
HANDLING LARGE DATA
Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

30 PERIODS

PRACTICAL EXERCISES:
30 PERIODS

LAB EXERCISES
1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
   a) Frequency distributions
   b) Mean, Mode, Standard Deviation
   c) Variability
   d) Normal curves
   e) Correlation and scatter plots
   f) Correlation coefficient
   g) Regression
6. Use the standard benchmark data set for performing the following:
   a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b) Bivariate Analysis: Linear and logistic regression modelling.
7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Gain knowledge on data science process.
CO2: Perform data manipulation functions using Numpy and Pandas.
CO3: Understand different types of machine learning approaches.
CO4: Perform data visualization using tools.
CO5: Handle large volumes of data in practical scenarios.

TOTAL: 60 PERIODS

TEXT BOOKS

REFERENCES

CCS333 AUGMENTED REALITY/VIRTUAL REALITY

COURSE OBJECTIVES:
- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION

UNIT II VR MODELING

UNIT III VR PROGRAMMING
VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS

UNIT V AUGMENTED REALITY
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

30 PERIODS
PRACTICAL EXERCISES:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
10. Develop simple MR enabled gaming applications.

TOTAL: 60 PERIODS

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

CO1: Understand the basic concepts of AR and VR
CO2: Understand the tools and technologies related to AR/VR
CO3: Know the working principle of AR/VR related Sensor devices
CO4: Design of various models using modeling techniques
CO5: Develop AR/VR applications in different domains

TEXTBOOKS:
1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018

CO’s – PO’s & PSO’s MAPPING

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OPEN ELECTIVE III

OHS351 ENGLISH FOR COMPETITIVE EXAMINATIONS

Course Description:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.
COURSE OBJECTIVES:
- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students' confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

Learning Outcomes:
At the end of the course, learners will be able
CO1 expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
CO2 identify errors with precision and write with clarity and coherence
CO3 understand the importance of task fulfilment and the usage of task-appropriate vocabulary
CO4 communicate effectively in group discussions, presentations and interviews
CO5 write topic based essays with precision and accuracy

Teaching Methods:
Instructional methods will involve discussions, taking mock tests on various question papers – Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion – Using multimedia.
Evaluative Pattern:
Internal Tests – 50%
End Semester Exam - 50%

TEXTBOOKS:

REFERENCES:

Websites
http://civilservicesmentor.com/, http://www.educationobserver.com
http://www.cambridgeenglish.org/in/

COs- PO's & PSO's MAPPING

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1-low, 2-medium, 3-high, "-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

OMG352 NGOS AND SUSTAINABLE DEVELOPMENT

COURSE OBJECTIVES
- To understand the importance of sustainable development
- To acquire a reasonable knowledge on the legal frameworks pertaining to pollution control and environmental management
- To comprehend the role of NGOs in attaining sustainable development

UNIT I ENVIRONMENTAL CONCERNS
Introduction to sustainable development goals, Global responsibility of environmental concern, Importance of environmental preservation, Environmental threats, Pollution and its types, Effects of Pollution, Pollution control, Treatment of wastes

UNIT II ROLE OF NGOS
Role of NGO’s in national development, NGO’s and participatory management, Challenges and limitations of NGO’s, Community Development programmes, Role of NGO’s in Community Development programmes, Participation of NGO’s in environment management, Corporate Social responsibility, NGO’s and corporate social responsibility

UNIT III SUSTAINABLE DEVELOPMENT
Issues and Challenges of Sustainable Development, Bioenergy, Sustainable Livelihoods and Rural Poor in Sustainable Development, Protecting ecosystem services for sustainable development, Non-
renewable sources of energy and its effect, Renewable sources of energy for sustainability, Nuclear resources and Legal Regulation of Hazardous Substances, Sustainable Development: Programme and Policies, Sustainability assessment and Indicators

UNIT IV NGO’S FOR SUSTAINABILITY

Civil Society Initiatives in Environment Management, Civil Society Initiatives for Sustainable Development, Global Initiatives in Protecting Global Environment, World Summit on Sustainable Development (Johannesburg Summit 2002), Ecological economics, Environmental sustainability, Social inclusion, Health for all, education for all, Food security and Water security, NGOs and Sustainable Development strategies

UNIT V LEGAL FRAMEWORKS

Need for a Legal framework and its enforcement, Legal measures to control pollution, Environmental Legislations in India, Mechanism to implement Environmental Laws in India, Legal Protection of Forests Act 1927, Legal Protection of Wild Life, Role of NGO’s in implementing environmental laws, Challenges in the implementation of environmental legislation

COURSE OUTCOMES:

Upon completion of this course, the student will:

CO1 Have a thorough grounding on the issues and challenges being faced in attaining sustainable development

CO2 have a knowledge on the role of NGOs towards sustainable development

CO3 present strategies for NGOs in attaining sustainable development

CO4 recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment

CO5 understand the environmental legislations

REFERENCES


OMG353 DEMOCRACY AND GOOD GOVERNANCE

UNIT I
Structure and Process of Governance: Indian Model of Democracy, Parliament, Party Politics and Electoral Behaviour, Federalism, the Supreme Court and Judicial Activism, Units of Local Governance

UNIT II
Regulatory Institutions – SEBI, TRAI, Competition Commission of India,

UNIT III
Lobbying Institutions: Chambers of Commerce and Industries, Trade Unions, Farmers Associations, etc.
UNIT IV
Contemporary Political Economy of Development in India: Policy Debates over Models of Development in India, Recent trends of Liberalisation of Indian Economy in different sectors, E-governance

UNIT V
Dynamics of Civil Society: New Social Movements, Role of NGO's, Understanding the political significance of Media and Popular Culture.

REFERENCES:
4. Saima Saeed: Screening the Public Sphere: Media and Democracy in India,2013

CME365 RENEWABLE ENERGY TECHNOLOGIES

<table>
<thead>
<tr>
<th>COURSE OBJECTIVES</th>
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<tbody>
<tr>
<td>- To know the Indian and global energy scenario</td>
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<td>- To learn the various solar energy technologies and its applications.</td>
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<td>- To educate the various wind energy technologies.</td>
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<td>- To explore the various bio-energy technologies.</td>
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<td>- To study the ocean and geothermal technologies.</td>
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UNIT I ENERGY SCENARIO
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status- Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT II SOLAR ENERGY

UNIT III WIND ENERGY

UNIT IV BIO-ENERGY

UNIT V OCEAN AND GEOTHERMAL ENERGY

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course the students would be able to
CO1 Discuss the Indian and global energy scenario.
CO2 Describe the various solar energy technologies and its applications.
CO3 Explain the various wind energy technologies.
CO4 Explore the various bio-energy technologies.
CO5 Discuss the ocean and geothermal technologies.

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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Low (1) ; Medium (2) ; High (3)

OME354 APPLIED DESIGN THINKING L T P C 3 0 0 3

COURSE OBJECTIVES:
The course aims to
- Introduce tools & techniques of design thinking for innovative product
- development Illustrate customer-centric product innovation using on simple
- use cases Demonstrate development of Minimum usable Prototypes
- Outline principles of solution concepts & their evaluation
- Describe system thinking principles as applied to complex systems

UNIT I DESIGN THINKING PRINCIPLES
Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] - Case studies

UNIT II ENDUSER-CENTRIC INNOVATION
Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit
UNIT III  APPLIED DESIGN THINKING TOOLS  9
Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design

UNIT IV  CONCEPT GENERATION  9
Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts

UNIT V  SYSTEM THINKING  9
System Thinking, Understanding Systems, Examples and Understandings, Complex Systems

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1 Define & test various hypotheses to mitigate the inherent risks in product innovations.
CO2 Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
CO3 Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching
CO4 Apply system thinking in a real-world scenario

TEXT BOOKS
1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
3. Proposion Design: How to Create Products and Services Customers Want, Wiley

REFERENCES
1. https://www.ideou.com/pages/design-thinking#process
4. https://blog.forgefor ward.in/evaluating-product-innovations-e8178e58b86e
5. https://blog.forgefor ward.in/user-guide-for-product-innovation-rubric-857181b2b53dd
6. https://blog.forgefor ward.in/star t-up-failure-is-like-true-true-812cde9b85

MF3003  REVERSE ENGINEERING  LT P C  3 0 0 3

COURSE OBJECTIVES:
- The main learning objective of this course is to prepare students for:
- Applying the fundamental concepts and principles of reverse engineering in product design and development
- Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Applying the concept and principles of material identification and process verification in reverse engineering of product design and development.
- Analysing the various legal aspect and applications of reverse engineering in product design and development.
- Understand about 3D scanning hardware & software operations and procedure to generate 3D model
UNIT I  INTRODUCTION & GEOMETRIC FORM  

UNIT II  MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION  

UNIT III  DATA PROCESSING  

UNIT IV  3D SCANNING AND MODELLING  

UNIT V  INDUSTRIAL APPLICATIONS  

TOTAL : 45 PERIODS

COURSE OUTCOMES:  
Upon completion of this course, the students will be able to:  
CO1 Apply the fundamental concepts and principles of reverse engineering in product design and development.  
CO2 Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.  
CO3 Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.  
CO4 Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.  
CO5 Analyze the various legal aspect  
CO6 Applications of reverse engineering in product design and development.

TEXT BOOKS:  

REFERENCES:  
COURSE OBJECTIVES:
- To be acquainted with sustainability in manufacturing and its evaluation.
- To provide knowledge in environment and social sustainability.
- To provide the student with the knowledge of strategy to achieve sustainability.
- To familiarize with trends in sustainable operations.
- To create awareness in current sustainable practices in manufacturing industry.

UNIT I  ECONOMIC SUSTAINABILITY

UNIT II  SOCIAL AND ENVIRONMENTAL SUSTAINABILITY
Social sustainability – Introduction-Work management -Human rights - Societal commitment - Customers -Business practices -Modelling and assessing social sustainability. Environmental issues pertaining to the manufacturing sector: Pollution - Use of resources -Pressure to reduce costs - Environmental management: Processes that minimize negative environmental impacts - environmental legislation and energy costs - need to reduce the carbon footprint of manufacturing Operations-Modelling and assessing environmental sustainability

UNIT III  SUSTAINABILITY PRACTICES
Sustainability awareness - Measuring Industry Awareness-Drivers and barriers -Availability of sustainability indicators -Analysis of sustainability practicing -Modeling and assessment of sustainable practicing -Sustainability awareness -Sustainability drivers and barriers - Availability of sustainability indicators- Designing questionnaires- Optimizing Sustainability Indexes-Elements – Cost and time model.

UNIT IV  MANUFACTURING STRATEGY FOR SUSTAINABILITY
Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme - Manufacturing strategy in business success strategy formation and formulation - Structured strategy formulation - Sustainable manufacturing system design options - Approaches to strategy formulation - Realization of new strategies/system designs.

UNIT V  TRENDS IN SUSTAINABLE OPERATIONS

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Discuss the importance of economic sustainability.
CO2: Describe the importance of sustainable practices.
CO3: Identify drivers and barriers for the given conditions.
CO4: Formulate strategy in sustainable manufacturing.
CO5: Plan for sustainable operation of industry with environmental, cost consciousness.

TEXT BOOKS:
REFERENCES:

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AU3791         ELECTRIC AND HYBRID VEHICLES         L T P C
                          3 0 0 3

COURSE OBJECTIVES:
- The objective of this course is to prepare the students to know about the general aspects of Electric and Hybrid Vehicles (EHV), including architectures, modelling, sizing, and sub system design and hybrid vehicle control.

UNIT I     DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES

UNIT II     ENERGY SOURCES

UNIT III     MOTORS AND DRIVES
Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

UNIT IV     POWER CONVERTERS AND CONTROLLERS
Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes
UNIT V  HYBRID AND ELECTRIC VEHICLES
Main components and working principles of a hybrid and electric vehicles. Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the student will be able to
CO1 Understand the operation and architecture of electric and hybrid vehicles
CO2 Identify various energy source options like battery and fuel cell
CO3 Select suitable electric motor for applications in hybrid and electric vehicles.
CO4 Explain the role of power electronics in hybrid and electric vehicles
CO5 Analyze the energy and design requirement for hybrid and electric vehicles.

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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OAS352 SPACE ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:
• Use the standard atmosphere tables and equations.
• Find lift and drag coefficient data from NACA plots.
• Apply the concept of static stability to flight vehicles.
• Describe the concepts of stress, strain, Young’s modulus, Poisson’s ratio, yield strength.
• Demonstrate a basic knowledge of dynamics relevant to orbital mechanics.

UNIT I STANDARD ATMOSPHERE
History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II AERODYNAMICS
Aerodynamic forces – Lift generation Viscosity and its implications - Shear stress in a velocity profile - Lagrangian and Eulerian flow field - Concept of a streamline – Aircraft terminology and geometry - Aircraft types - Lift and drag coefficients using NACA data.
UNIT III PERFORMANCE AND PROPULSION
Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations - thrust/power available and thrust/power required.

UNIT IV AIRCRAFT STABILITY AND STRUCTURAL THEORY

UNIT V SPACE APPLICATIONS
History of space research - spacecraft trajectories and basic orbital manoeuvres - six orbital elements - Kepler’s laws of orbits - Newton’s law of gravitation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Illustrate the history of aviation & developments over the years
CO2 Ability to identify the types & classifications of components and control systems
CO3 Explain the basic concepts of flight & Physical properties of Atmosphere
CO4 Identify the types of fuselage and constructions.
CO5 Distinguish the types of Engines and explain the principles of Rocket

TEXT BOOKS:

REFERENCE:

OIM351 INDUSTRIAL MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
• To introduce fundamental concepts of industrial management
• To understand the approaches to the study of Management
• To learn about Decision Making, Organizing and leadership
• To analyze the Managerial Role and functions
• To know about the Supply Chain Management

UNIT I INTRODUCTION

UNIT II FUNCTIONS OF MANAGEMENT
UNIT III  ORGANIZATIONAL BEHAVIOUR 9

UNIT IV  GROUP DYNAMICS 9

UNIT V  MODERN CONCEPTS 9
Management by Objectives (MBO) - Management by Exception (MBE),Strategic Management - Planning for Future direction - SWOT Analysis -Evolving development strategies, information technology in management Decisions support system-Management Games Business Process Re-engineering(BPR) –Enterprises Resource Planning (ERP) - Supply Chain Management (SCM) - Activity Based Management (AM) - Global Perspective - Principles and Steps Advantages and disadvantage

COURSE OUTCOMES:
CO1: Understand the basic concepts of industrial management
CO2: Identify the group conflicts and its causes.
CO3: Perform swot analysis
CO4 : Analyze the learning curves
CO5 : Understand the placement and performance appraisal

REFERENCES:

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OIE354  QUALITY ENGINEERING 3 0 0 3

COURSE OBJECTIVES
- Developing a clear knowledge in the basics of various quality concepts.
- Facilitating the students in understanding the application of control charts and its techniques.
- Developing the special control procedures for service and process-oriented industries.
- Analyzing and understanding the process capability study.
- Developing the acceptance sampling procedures for incoming raw material.

UNIT I  INTRODUCTION 9
UNIT II  CONTROLCHARTS  9
Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X, R and S charts, attribute control charts - p, np, c and u- Construction and application.

UNIT III  SPECIAL CONTROL PROCEDURES  9
Warning and modified control limits, chart for individual measurements, multi-vari chart, Xchart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT IV  STATISTICAL PROCESS CONTROL  9
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V  ACCEPTANCESAMPLING  9
The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL-STD-414E & IS2500 standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to:

CO1: Control the quality of processes using control charts for variables in manufacturing industries.
CO2: Control the occurrence of defective product and the defects in manufacturing companies.
CO3: Control the occurrence of defects in services.
CO4: Analyzing and understanding the process capability study.
CO5: Developing the acceptance sampling procedures for incoming raw material.

CO’s – PO’s & PSO’s MAPPING

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OSF351  FIRE SAFETY ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES
• To enable the students to acquire knowledge of Fire and Safety Studies
• To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance
• To learn about fire area, fire stopped areas and different types of fire-resistant doors
• To learn about the method of fire protection of structural members and their repair due to fire damage.
• To develop safety professionals for both technical and management through systematic and quality-based study programmes

UNIT I  INHERENT SAFETY CONCEPTS  9
Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behavior of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials.
UNIT II  PLANT LOCATIONS  9
Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements-standard heating condition, Indian standard test method, performance criteria.

UNIT III  WORKING CONDITIONS  9
Fire separation between building- principle of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors;

UNIT IV  FIRE SEVERITY AND REPAIR TECHNIQUES  9
Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures-Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V  WORKING AT HEIGHTS  9

TOTAL : 45 PERIODS

COURSE OUTCOMES
On completion of the course the student will be able to

CO1: Understand the effect of fire on materials used for construction

CO2: Understand the method of test for non-combustibility and fire resistance; and will be able to select different structural elements and their dimensions for a particular fire resistance rating of a building.

CO3: To understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.

CO4: To decide the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.

CO5: Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

TEXT BOOKS

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CO’s- PO’s & PSO’s MAPPING

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OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application.

UNIT I INTRODUCTION TO NDT & VISUAL TESTING

Concepts of Non-destructive testing—relative merits and limitations–NDT Versus mechanical testing, Fundamentals of Visual Testing—vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods—mirrors, magnifiers, boroscopes and fibroscopes—light sources and special lighting.

UNIT II LIQUID PENETRANT & MAGNETIC PARTICLE TESTING

Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developers and cleaners, Methods & Interpretation.
Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation of test indications.

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY

Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.

UNIT IV ULTRASONIC TESTING & AET

Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique, Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration.

UNIT V
RADIOGRAPHY TESTING
9
Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure charts, Penetrameters, safety in radiography.

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Realize the importance of NDT in various engineering fields.
CO2 Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.
CO3 Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing.
CO4 Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.
CO5 Interpret the results of Radiography testing and also have the ability to analyse the influence of various parameters on the testing.

TEXT BOOKS:

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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Selecting sensors to develop mechatronics systems.
- Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
- Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
- Applying PLC as a controller in mechatronics system.
- Designing and develop the apt mechatronics system for an application.

UNIT I INTRODUCTION AND SENSORS

UNIT II 8085 MICROPROCESSOR

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

UNIT IV PROGRAMMABLE LOGIC CONTROLLER
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
- CO1: Select sensors to develop mechatronics systems.
- CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
- CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor.
- CO4: Apply PLC as a controller in mechatronics system.
- CO5: Design and develop the apt mechatronics system for an application.

TEXT BOOKS

REFERENCES
CO’s- PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

ORA351 FOUNDATION OF ROBOTICS

COURSE OBJECTIVES:
- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Vision application in robots.
- To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

UNIT I FUNDAMENTALS OF ROBOT

UNIT II ROBOT KINEMATICS
Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS
Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grapper, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.
UNIT V  PROGRAMMING AND APPLICATIONS OF ROBOT

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL : 45 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to:

CO1: Interpret the features of robots and technology involved in the control.
CO2: Apply the basic engineering knowledge and laws for the design of robotics.
CO3: Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.
CO4: Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.
CO5: Demonstrate the image processing and image analysis techniques by machine vision system.

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

OAE352  FUNDAMENTALS OF AERONAUTICAL ENGINEERING

COURSE OBJECTIVES:

- To acquire the knowledge on the Historical evaluation of Airplanes
- To learn the different component systems and functions
- To know the concepts of basic properties and principles behind the flight
- To learn the basics of different structures & construction
- To learn the various types of power plants used in aircrafts
UNIT I  HISTORY OF FLIGHT  8
Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II  AIRCRAFT CONFIGURATIONS AND ITS CONTROLS  10
Different types of flight vehicles, classifications- Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying- Typical systems for control actuation.

UNIT III  BASICS OF AERODYNAMICS  9

UNIT IV  BASICS OF AIRCRAFT STRUCTURES  9

UNIT V  BASICS OF PROPULSION  9
Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production- Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1 Illustrate the history of aircraft & developments over the years
CO2 Ability to identify the types & classifications of components and control systems
CO3 Explain the basic concepts of flight & Physical properties of Atmosphere
CO4 Identify the types of fuselage and constructions.
CO5 Distinguish the types of Engines and explain the principles of Rocket

TEXT BOOKS

REFERENCE
1. SADHU SINGH, “INTERNAL COMBUSTION ENGINES AND GAS TURBINE”-, SS Kataraia & sons, 2015

OGI351  REMOTE SENSING CONCEPTS  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

UNIT I  REMOTE SENSING AND ELECTROMAGNETIC RADIATION  9
UNIT II  
EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL  

UNIT III  
ORBITS AND PLATFORMS  
Motions of planets and satellites – Newton’s law of gravitation - Gravitational field and potential - Escape velocity - Kepler’s law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Lagrange Orbit.

UNIT IV  
SENSING TECHNIQUES  

UNIT V  
DATA PRODUCTS AND INTERPRETATION  
Photographic and digital products – Types, levels and open source satellite data products — selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

COURSE OUTCOMES:
• On completion of the course, the student is expected to

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TOTAL:45 PERIODS

TEXTBOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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<tr>
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**COURSE OBJECTIVES:**
- To introduce the students the principles of agricultural crop production and the production practices of crops in modern ways.
- To delineate the role of agricultural engineers in relation to various crop production practices.

**UNIT I**
**INTRODUCTION**
Benefits of urban agriculture - economic benefits, environmental benefits, social and cultural benefits, educational, skill-building and job training benefits, health, nutrition and food accessibility benefits.

**UNIT II**
**VERTICAL FARMING**

**UNIT III**
**SOIL LESS CULTIVATION**
Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyard gardens - tactical gardens - street landscaping - forest gardening, greenhouses, urban beekeeping

**UNIT IV**
**MODERN CONCEPTS**
Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops

**UNIT V**
**WASTE MANAGEMENT**
Concept, scope and maintenance of waste management - recycle of organic waste, garden wastes - solid waste management - scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**
- **CO1** Demonstrate the principles behind crop production and various parameters that influences the crop growth on roof tops
- **CO2** Explain different methods of crop production on roof tops
- **CO3** Explain nutrient and pest management for crop production on roof tops
- **CO4** Illustrate crop water requirement and irrigation water management on roof tops
- **CO5** Explain the concept of waste management on roof tops
TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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OEN351 DRINKING WATER SUPPLY AND TREATMENT

COURSE OBJECTIVE:
- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I SOURCES OF WATER
UNIT II CONVEYANCE FROM THE SOURCE

UNIT III WATER TREATMENT
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – sand filters - Disinfection – Construction, Operation and Maintenance aspects.

UNIT IV ADVANCED WATER TREATMENT

UNIT V WATER DISTRIBUTION AND SUPPLY

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: an understanding of water quality criteria and standards, and their relation to public health
CO2: the ability to design the water conveyance system
CO3: the knowledge in various unit operations and processes in water treatment
CO4: an ability to understand the various systems for advanced water treatment
CO5: an insight into the structure of drinking water distribution system

TEXTBOOKS :

 REFERENCES :

CO’s- PO’s & PSO’s MAPPING

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Note: The average value of this course to be used for program articulation matrix.
COURSE OBJECTIVES

- To provide knowledge about electric machines and special machine
- To understand the basics of power converters
- To know the concepts of controlling DC and AC drive systems
- To understand the architecture and power train components.
- To impart knowledge on vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)

UNIT I ROTATING POWER CONVERTERS

UNIT II STATIC POWER CONVERTERS
Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.

UNIT III CONTROL OF DC AND AC MOTOR DRIVES
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives.

UNIT IV HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS

UNIT V MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power split mode - parallel mode - engine brake mode - regeneration mode - series parallel mode

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Able to understand the principles of conventional and special electrical machines.
CO2: Acquired the concepts of power devices and power converters
CO3: Able to understand the control for DC and AC drive systems.
CO4: Learned the electric vehicle architecture and power train components.
CO5: Acquired the knowledge of mechanics of electric vehicles and control of electric vehicles.

REFERENCES:
CO’s- PO’s & PSO’s MAPPING

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OEI353 INTRODUCTION TO PLC PROGRAMMING

UNIT I INTRODUCTION TO PLC
Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, , PLC Special I/O, PLC Types.

UNIT II PLC INSTRUCTIONS
PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters, Examples.

UNIT III PLC PROGRAMMING
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions

UNIT IV COMMUNICATION OF PLC AND SCADA
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

UNIT V CASE STUDIES
Stepper Motor Control- Elevator Control-CNC Machine Control- conveyor control-Interlocking Problems

TOTAL:45 PERIODS
SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)

1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Communication Network Used for PLC/SCADA.

COURSE OUTCOMES:
CO1 Know the basic requirement of a PLC input/output devices and architecture. (L1)
CO2 Ability to apply Basics Instruction Sets used for ladder Logic and Function Block Programming. (L2)
CO3 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO4 Able to develop a PLC logic for a specific application on real world problem. (L5)
CO5 Ability to Understand the Concepts of Communication used for PLC/SCADA.(L1)

TEXT BOOKS:
1. Frank Petruzzula, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication

REFERENCES:
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles andApplications, Pearson publication

List of Open Source Software/ Learning website:
1. https://nptel.ac.in/courses/108105063

CO’s- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>PO, PSO CO</th>
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OCH351        NANO TECHNOLOGY              L T P C
UNIT I        INTRODUCTION                  3 0 0 3
General definition and size effects–important nano structured materials and nano particles-
importance of nano materials- Size effect on thermal, electrical, electronic, mechanical, optical and
magnetic properties of nanomaterials- surface area - band gap energy and applications.
Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials- Nano
catalysis.
UNIT II  SYNTHESIS OF NANOMATERIALS
Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III  NANO COMPOSITES
Definition- importance of nanocomposites- nano composite materials-classification of composites-metal/metal oxides, metal-polymer- thermoplastic based, thermostet based and elastomer based-influence of size, shape and role of interface in composites applications.

UNIT IV  NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES
Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice- clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.

UNIT V  APPLICATIONS OF NANO MATERIALS
Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots-Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1 understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications.
CO2 able to acquire knowledge about the different types of nano material synthesis
CO3 describes about the shape, size, structure of composite nano materials and their interference
CO4 understand the different characterization techniques for nanomaterials
CO5 develop a deeper knowledge in the application of nanomaterials in different fields.

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>Course Outcomes</th>
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<td>understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications</td>
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<td>acquire knowledge about the different types of nano material synthesis</td>
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<td>describes about the shape, size, structure of composite nano materials and their interference</td>
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<td>understand the different characterization techniques for nanomaterials</td>
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<td>CO5</td>
<td>develop a deeper knowledge in the application of nanomaterials in different fields</td>
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OCH352 FUNCTIONAL MATERIALS L T P C 3 0 0 3

COURSE OBJECTIVE:
- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I INTRODUCTION 9

UNIT II MOLECULAR SELF ASSEMBLY 9

UNIT III BIO-INSPired MATERIALS 9

UNIT IV SMART OR INTELLIGENT MATERIALS 9
Criteria for Smartness, Significance of Smart Materials, Representative Examples like Smart Gels and Polymers, Electro/Magneto Rheological Fluids, Smart Electroceramics, Technical Limitations and Challenges, Functional Nanocomposites, Polymer-carbon nanotube composites.

UNIT V MATERIALS FOR POLYMER ELECTRONICS 9
Polymers for Electronics, Organic Light Emitting Diodes, Working Principle of OLEDs, Illustrated Examples, Organic Field-Effect Transistors Operating Principle, Design Considerations, Polymer FETs vs Inorganic FETs, Liquid Crystal Displays, Engineering Aspects of Flat Panel Displays, Intelligent Polymers for Data Storage, Polymer-based Data Storage-Principle, Magnetic Vs. Polymer-based Data Storage.

TOTAL: 45 PERIODS
COURSE OUTCOME:
- Students will be able to differentiate among various functional properties and select appropriate material for certain functional applications, analyze the nature and potential of functional material.

TEXT BOOK:

REFERENCE:

OFD352 TRADITIONAL INDIAN FOODS L T P C
3 0 0 3

COURSE OBJECTIVE:
- To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.

UNIT I HISTORICAL AND CULTURAL PERSPECTIVES
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING

UNIT III TRADITIONAL FOOD PATTERNS
Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods

UNIT IV COMMERCIAL PRODUCTION OF TRADITIONAL FOODS
Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS OF TRADITIONAL FOODS
Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments /illnesses.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 To understand the historical and traditional perspective of foods and food habits
CO2 To understand the wide diversity and common features of traditional Indian foods and meal patterns.
TEXT BOOKS:

OFD353 INTRODUCTION TO FOOD PROCESSING

COURSE OBJECTIVE:
• The course aims to introduce the students to the area of Food Processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects. This course will enable students to appreciate the importance of food processing with respect to the producer, manufacturer and consumer.

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE
Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, seaweeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

UNIT II METHODS OF FOOD HANDLING AND STORAGE
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT III LARGE-SCALE FOOD PROCESSING
Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

UNIT IV FOOD WASTES IN VARIOUS PROCESSES
Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT V FOOD HYGIENE
Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training& Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.

COURSE OUTCOMES:
On completion of the course the students are expected to
CO1 Be aware of the different methods applied to processing foods.
CO2 Be able to understand the significance of food processing and the role of foodand beverage industries in the supply of foods.

TOTAL: 45 PERIODS
COURSE OBJECTIVES:

- To provide the basic fundamental knowledge of different forms of Intellectual Property Rights in national and international level.
- To provide the significance of the Intellectual Property Rights about the patents, copyrights, industrial design, plant and geographical indications.
- This paper is to study significance of the amended patent act on pharma industry.

UNIT I
INTRODUCTION- INTELLECTUAL PROPERTY RIGHTS
Introduction, Types of Intellectual Property Rights - patents, plant varieties protection, geographical indicators, copyright, trademark, trade secrets.

UNIT II
PATENTS
Patents - Objective, Introduction, Requirement for patenting - Novelty, Inventive step (Non-obviousness) and industrial application (utility), Non-patentable inventions, rights of patent owner, assignment of patent rights, patent specification (provisional and complete), parts of complete specification, claims, procedure for obtaining patents, compulsory license.

UNIT III
PLANT VARIETY-TRADITIONAL KNOWLEDGE –GEOGRAPHICAL INDICATIONS
Plant variety - Justification, criteria for protection of plant variety and protection in India. Traditional knowledge - Concept of traditional knowledge, protection of traditional knowledge under Intellectual Property frame works in national level and Traditional knowledge digital library (TKDL). Geographical Indications – Justification for protection, National and International position.

UNIT IV
ENFORCEMENT AND PRACTICAL ASPECTS OF IPR

UNIT V
INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY

TOTAL:45 PERIODS

TEXT BOOKS:
REFERENCES:
2. Basic Principles of patent law – Basics principles and acquisition of IPR. Ramakrishna T. CIPRA, NLSIU, Bangalore, 2005

COURSE OUTCOMES
The student will be able to

CO1 Understand and differentiate the categories of intellectual property rights.
CO2 Describe about patents and procedure for obtaining patents.
CO3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
CO4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.
CO5 Provide different organizations role and responsibilities in the protection of IPR in the international level.
CO6 Understand the interrelationships between different Intellectual Property Rights on International Society

CO’s- PO’s & PSO’s MAPPING

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OTT351 BASICS OF TEXTILE FINISHING L T P C 3 0 0 3

COURSE OBJECTIVE:
- To enable the students to understand the basics and different types of finishes required for textile materials and machines used for finishing.

UNIT I RESIN FINISHING 9

UNIT II FLAME PROOF & WATERPROOF 9
Concept of Flame proof & flame retardancy. Flame retardant finishes for cotton, Concept of waterproof and water repellent Finishes, Durable & Semi durable and Temporary finishes, Concept of Antimicrobial finish.

UNIT III SOIL RELEASE AND ANTISTATIC FINISHES 9
UNIT IV MECHANICAL FINISHES

UNIT V STIFFENING AND SOFTENING
Concept of stiffening and softening of textile materials. Mechanism in the weight reduction of PET. Concept of Micro encapsulation techniques in finishing process, Nano finish, Plasma Treatment and Bio finishing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand the

CO1 Basics of Resin Finishing Process.
CO2 Concept of Flame proof & flame retardancy, waterproof and water repellent, Antimicrobial finishes.
CO3 Concept of Soil Release, Anti Pilling, UV Protection and Antistatic finishes.
CO4 Concept of Mechanical finishing.
CO5 Basics of Micro encapsulation techniques, Nano finish, Plasma Treatment.

TEXT BOOKS:

REFERENCES:
1. Microencapsulation in finishing, Review of progress of Colouration, SDC, 2001 62

OTT352 INDUSTRIAL ENGINEERING FOR GARMENT INDUSTRY
COURSE OBJECTIVE:
To enable the students to learn about basics of industrial engineering and different tools of industrial engineering and its application in apparel industry

UNIT I INTRODUCTION
Scope of industrial engineering in apparel Industry, role of industrial engineers.
Productivity: Definition - Productivity, Productivity measures .Reduction of work content due to the product and process, Reduction of ineffective time due to the management, due to the worker. Causes for low productivity in apparel industry and measures for improvement.

UNIT II WORK STUDY
Definition, Purpose, Basic procedure and techniques of work-study.
Work environment – Lighting, Ventilation, Climatic condition on productivity. Temperature control, humidity control, noise control measures. Safety and ergonomics on work station and work environment
Material Handling – Objectives, Classification and characteristics of material handling equipments, Specialized material handling equipments.

UNIT III METHOD STUDY
Definition, Objectives, Procedure, Process charts and symbols. Various charts – Charts indicating process sequence: Outline process chart, flow process chart (man type, material type and equipment type); Charts using time scale – multiple activity chart. Diagrams indicating movement – flow diagram, string diagram, cycle graph, chrono cycle graph, travel chart
**MOTION STUDY:** Principle of motion economy, Two handed process chart, micro motion analysis – therbligs, SIMO chart.

**UNIT IV WORK MEASUREMENT**
Definition, purpose, procedure, equipments, techniques. Time study - Definition, basics of time study- equipments. Time study forms, Stop watch procedure. Predetermined motion time standards (PMTS). Time Study rating, calculation of standard time, Performance rating – relaxation and other allowances. Calculation of SAM for different garments, GSD.

**UNIT V WORK STUDY APPLICATION**
Application of work study techniques in cutting, stitching and packing in garment industry. Workaids in sewing, Pitch diagram, Line balancing, Capacity planning, scientific method of training.

**COURSE OUTCOMES:**
Upon the completion of the course the student shall be able to understand
CO1: Fundamental concepts of industrial Engineering and productivity
CO2: Method study
CO3: Motion analysis
CO4: Work measurement and SAM
CO5: Ergonomics and its application to garment industry

**TEXTBOOKS:**

**REFERENCES**

**CO’s- PO’s & PSO’s MAPPING**

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
COURSE OBJECTIVES:

- To enable the students to learn about the basics of fibre forming, yarn production, fabric formation, coloration of fabrics and garment manufacturing

UNIT I  NATURAL FIBRES
Introduction: Definition of staple fibre, filament; Classification of natural and man-made fibres, essential and desirable properties of fibres. Production and cultivation of Natural Fibers: Cultivation of cotton, production of silk (sericulture), wool and jute – physical and chemical structure of these fibres..

UNIT II  REGENERATED AND SYNTHETIC FIBRES
Production sequence of regenerated and modified cellulosic fibres: viscose rayon, Acetate Rayon, high wet modulus and high tenacity fibres; synthetic fibres – chemical structure, fibre forming polymers, production principles.

UNIT III  BASICS OF SPINNING
Spinning – principle of yarn formation, sequence of machines for yarn production with short staple fibres and blends, principles of opening and cleaning machines; yarn numbering - calculations

UNIT IV  BASICS OF WEAVING
Woven fabric – warp, weft, weaving, path of warp; looms – classification, handloom and its parts, powerloom, automatic looms, shuttleless looms, special type of looms; preparatory machines for weaving process and their objectives; basic weaving mechanism - primary, secondary and auxiliary mechanisms,

UNIT V  BASICS OF KNITTING AND NONWOVEN

TOTAL : 45 PERIODS

COURSE OUTCOMES:
On completion of this course, the students shall have the basic knowledge on

CO1: Classification of fibres and production of natural fibres
CO2: Regenerated and synthetic fibres
CO3: Yarn spinning
CO4: Weaving
CO5: Knitting and nonwoven

TEXTBOOKS

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

OPE351 INTRODUCTION TO PETROLEUM REFINING AND PETROCHEMICALS

COURSE OBJECTIVE:
The course is aimed to:
- Gain knowledge about petroleum refining process and production of petrochemical products.

UNIT I ORIGIN, FORMATION AND REFINING OF CRUDE OIL

UNIT II CRACKING
Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen

UNIT III REFORMING AND HYDROTREATING
UNIT IV  INTRODUCTION TO PETROCHEMICALS  9
Petrochemicals - Cracking of Naphtha and Feed stock gas for the production of Ethylene, Propylene, Isobutylene and Butadiene. Production of Acetylene from Methane, and Extraction of Aromatics.

UNIT V  PRODUCTION OF PETROCHEMICALS  9
Production of Petrochemicals like Dimethyl Terephthalate(DMT), Ethylene Glycol, Synthetic glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol, Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and production of Carbon Black.

COURSE OUTCOMES:
On the completion of the course students are expected to

CO1: Understand the classification, composition and testing methods of crude petroleum and its products. Learn the mechanism of refining process.

CO2: Understand the insights of primary treatment processes to produce the precursors.

CO3: Study the secondary treatment processes cracking, vis-breaking and coking to produce more petroleum products.

CO4: Appreciate the need of treatment techniques for the removal of sulphur and other impurities from petroleum products.

CO5: Understand the societal impact of petrochemicals and learn their manufacturing processes.

CO6: Learn the importance of optimization of process parameters for the high yield of petroleum products.

TEXT BOOKS

REFERENCES

CPE334  ENERGY CONSERVATION AND MANAGEMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I  INTRODUCTION  9

UNIT II  ELECTRICAL SYSTEMS  9
UNIT III THERMAL SYSTEMS

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS
Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students can able to analyze the energy data of industries.
CO1: Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.
CO2: Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.
CO3: Skills on combustion thermodynamics and kinetics.
CO4: Apply calculation and design tube still heaters.
CO5: Studied different heat treatment furnace.
CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

REFERENCES:

OPT351 BASICS OF PLASTICS PROCESSING L T P C 3 0 0 3

COURSE OBJECTIVES
- Understand the fundamentals of plastics processing, such as the relationships between material structural properties and required processing parameters, and so on
- To gain practical knowledge on the polymer selection and its processing
- Understanding the major plastic material processing techniques (Extrusion, Injection molding, Compression and Transfer molding, Blow molding, Thermoforming and casting)
- To understand suitable additives for plastics compounding
- To Propose troubleshooting mechanisms for defects found in plastics products manufactured by various processing techniques
UNIT I  INTRODUCTION TO PLASTICS PROCESSING

UNIT II  EXTRUSION

UNIT III  INJECTION MOLDING
Injection molding – Principles and processing outline, machinery, accessories and functions, specifications, process variables, mould cycle. Types of clamping: hydraulic and toggle mechanisms. Start-up and shut down procedures-Cylinder nozzles- Press capacity projected area -Shot weight Basic theoretical concepts and their relationship to processing - Interaction of moulding process aspect effects in quoted variables. Basic mould types. Reciprocating vs. plunger type injection moulding. Thermoplastic vs. thermosetting injection moulding. Injection moulding vs. other plastic processing techniques. State-of-the art injection moulding techniques - Introduction to trouble shooting

UNIT IV  COMPRESSION AND TRANSFER MOLDING
Compression moulding – Basic principles of compression and transfer moulding-Meaning of terms- Bulk factor and flow properties, moulding materials, process variables and process cycle, Interaction between flow properties-Curing time-Mould temperature and Pressure requirements. Preforms and preheating- Techniques of preheating. Machines used-Types of compression moulding-positive, semi-positive and flash. Common moulding faults and their correction- Finishing of mouldings. Transfer moulding: working principle, equipment. Press capacity-Integral moulds and auxiliary ram moulds, moulding cycle, moulding tolerances, pot transfer, plunger transfer and screw transfer moulding techniques, advantages over compression moulding

UNIT V  BLOW MOLDING, THERMOFORMING AND CASTING

TOTAL  45 PERIODS

COURSE OUTCOMES
CO1 Ability to find out the correlation between various processing techniques with product properties.
CO2 Understand the major plastics processing techniques used in moulding (injection, blow, compression, and transfer), extrusion, thermoforming, and casting.
CO3 Acquire knowledge on additives for plastic compounding and methods employed for the same
CO4 Familiarize with the machinery and ancillary equipment associated with various plastic processing techniques.
CO5 Select an appropriate processing technique for the production of a plastic product.
REFERENCES

OEC351 SIGNALS AND SYSTEMS

COURSE OBJECTIVES:
- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS
Fourier series for periodic signals - Fourier Transform – properties - Laplace Transforms and Properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: determine if a given system is linear/causal/stable
CO2: determine the frequency components present in a deterministic signal
CO3: characterize continuous LTI systems in the time domain and frequency domain
CO4: characterize discrete LTI systems in the time domain and frequency domain
CO5: compute the output of an LTI system in the time and frequency domains

TOTAL: 45 PERIODS
TEXT BOOKS:

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OEC352    FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS      L  T  P  C
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COURSE OBJECTIVES:
- To give a comprehensive exposure to all types of devices and circuits constructed with
discrete components. This helps to develop a strong basis for building linear and digital
integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT I    SEMICONDUCTOR DEVICES
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics,
Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

UNIT II    AMPLIFIERS
Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis
of CE, CB, CC amplifiers- Gain and frequency response –Analysis of CS and Source follower – Gain
and frequency response- High frequency analysis.

UNIT III    MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – Tuned
amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV    FEEDBACK AMPLIFIERS AND OSCILLATORS
Advantages of negative feedback – Analysis of Voltage / Current, Series , Shunt feedback Amplifiers –
positive feedback–Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and
Crystal oscillators.
UNIT V  POWER AMPLIFIERS AND DC/DC CONVERTERS

Power amplifiers- class A-Class  B-Class AB-Class C-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 45 PERIODS

COURSE OUTCOMES :
At the end of the course the students will be able to
CO1:  Explain the structure and working operation of basic electronic devices.
CO2:  Design and analyze amplifiers.
CO3:  Analyze frequency response of BJT and MOSFET amplifiers
CO4:  Design and analyze feedback amplifiers and oscillator principles.
CO5:  Design and analyze power amplifiers and supply circuits

TEXT BOOKS :

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CBM348  FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT  L T P C
3 0 0 3

COURSE OBJECTIVES:
• To understand the global trends and development methodologies of various types of products and services
• To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
• To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
• To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
• To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
UNIT I  
BASICS OF PRODUCT DEVELOPMENT  
9

UNIT II  
REQUIREMENTS AND SYSTEM DESIGN  
9

UNIT III  
DESIGN AND TESTING  
9

UNIT IV  
SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  
9

UNIT V  
BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  
9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
CO1 Define, formulate, and analyze a problem
CO2 Solve specific problems independently or as part of a team
CO3 Gain knowledge of the Innovation & Product Development process in the Business Context
CO4 Work independently as well as in teams
CO5 Manage a project from start to finish

TEXT BOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:
### CBM333 ASSISTIVE TECHNOLOGY

#### COURSE OBJECTIVES:

The student should be made to:

- To know the hardware requirement various assistive devices
- To understand the prosthetic and orthotic devices
- To know the developments in assistive technology

#### UNIT I CARDIAC ASSIST DEVICES

Cardiac functions and parameters, principle of External counter pulsation techniques, intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves, cardiac pacemaker.

#### UNIT II HEMODIALYSERS

Physiology of kidney, Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

#### UNIT III HEARING AIDS

Anatomy of ear, Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

#### UNIT IV PROSTHETIC AND ORTHODIC DEVICES

Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

#### UNIT V RECENT TRENDS

Transcutaneous electrical nerve stimulator, bio-feedback, assistive devices in drug delivery

TOTAL : 45 PERIODS

#### COURSE OUTCOMES:

**On successful completion of this course, the student will be able to**

- **CO1:** Interpret the various mechanical techniques that will help in assisting the heart functions.
- **CO2:** Describe the underlying principles of hemodialyzer machine.
- **CO3:** Indicate the methodologies to assess the hearing loss.
- **CO4:** Evaluate the types of assistive devices for mobilization.
- **CO5:** Explain about TENS and biofeedback system.

#### TEXT BOOKS

REFERENCES
4. Cardiac Assist Devices, Daniel Goldstein (Editor), Mehmet Oz (Editor), Wiley-Blackwell April 2000 ISBN: 978-0-879-93449-1

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OMA352 OPERATIONS RESEARCH

COURSE OBJECTIVES:
This course will help the students to
- determine the optimum solution for Linear programming problems.
- study the Transportation and assignment models and various techniques to solve them.
- acquire the knowledge of optimality, formulation and computation of integer programming problems.
- acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
- determine the optimum solution for non-linear programming problems.

UNIT I LINEAR PROGRAMMING

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEMS

UNIT III INTEGER PROGRAMMING

UNIT IV DYNAMIC PROGRAMMING PROBLEMS

UNIT V NON - LINEAR PROGRAMMING PROBLEMS

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course, students will be able to

CO1 Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.

CO2 analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.

CO3 solve the integer programming problems using various methods.

CO4 conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.

CO5 determine the optimum solution for non linear programming problems.

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OMA353 ALGEBRA AND NUMBER THEORY L T P C
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COURSE OBJECTIVES:
• To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
• To examine the key questions in the Theory of Numbers.
• To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I GROUPS AND RINGS
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem.
Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.
UNIT II  FINITE FIELDS AND POLYNOMIALS  9
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III  DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS  9
Division algorithm - Base-b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT IV  DIOPHANTINE EQUATIONS AND CONGRUENCES  9
Linear Diophantine equations – Congruence’s – Linear Congruence’s - Applications : Divisibility tests - Modular exponentiation - Chinese remainder theorem – 2x2 linear systems.

UNIT V  CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS  9
Wilson’s theorem – Fermat’s Little theorem – Euler’s theorem – Euler’s Phi functions – Tau and Sigma functions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2 Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3 The students should be able to demonstrate their mastery by solving non-trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text

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OMA354  LINEAR ALGEBRA  L T P C 3 0 0 3

COURSE OBJECTIVES:
- To test the consistency and solve system of linear equations.
- To find the basis and dimension of vector space.
- To obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
- To find orthonormal basis of inner product space and find least square approximation.
- To find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.
UNIT I  MATRICES AND SYSTEM OF LINEAR EQUATIONS  9

UNIT II  VECTOR SPACES  9
Vector spaces over Real and Complex fields - Subspace – Linear space - Linear independence and dependence - Basis and dimension.

UNIT III  LINEAR TRANSFORMATION  9
Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem– Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation – Diagonalization.

UNIT IV  INNER PRODUCT SPACES  9
Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process - Least square approximation.

UNIT V  EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
After the completion of the course the student will be able to
CO1 Test the consistency and solve system of linear equations.
CO2 Find the basis and dimension of vector space.
CO3 Obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
CO4 Find orthonormal basis of inner product space and find least square approximation.
CO5 Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVE:
- Enable the Non-biological student’s to understand about the basics of life science and their pro and cons for living organisms.

UNIT I BASICS OF MICROBES AND ITS TYPES 9
Introduction to microbes, existence of microbes, inventions of great scientist and history, types of microorganisms – Bacteria, Virus, Fungi.

UNIT II MICROBIAL TECHNIQUES 9
Sterilization – types – physical and chemical sterilization, Decontamination, Preservation methods, fermentation, Cultivation and growth of microbes, Diagnostic methods.

UNIT III PATHOGENIC MICROBES 9
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengu, Malaria, Diarrhea, Tuberculosis, Typhoid, Covid, HIV.

UNIT IV BENEFICIAL MICROBES 9
Applications of microbes – Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.

UNIT V PRODUCTS FROM MICROBES 9
Fermented products – Fermented Beverages, Curd, Cheese, Mushroom, Agricultural products – Biopesticide, Biofertilizers, Vermicompost, Pharmaceutical products - Antibiotics, Vaccines

COURSE OUTCOME:
At the end of the course the students will be able to
CO1 Microbes and their types
CO2 Cultivation of microbes
CO3 Pathogens and control measures for safety
CO4 Microbes in different industry for economy.

TEXT BOOKS

COURSE OBJECTIVES:
- The objective is to offer basic concepts of biochemistry to students with diverse background in life sciences including but not limited to the structure and function of various biomolecules and their metabolism.

UNIT I CARBOHYDRATES 9
Introduction to carbohydrate, classification, properties of monosaccharide, structural aspects of monosaccharides. Introduction to disaccharide (lactose, maltose, sucrose) and polysaccharide (Heparin, starch, and glycogen) biological function of carbohydrate.

UNIT II LIPID AND FATTY ACIDS 9
Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipids, sphingolipid and glycerolipid. Biological function of lipid. Fatty acid, Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.
UNIT III  AMINO ACIDS AND PROTEIN.

UNIT IV  NUCLEIC ACIDS
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & RNA. Structure of Nitrogen bases in DNA and RNA along with the nomenclature- DNA double helix (Watson and crick) model, types of DNA, RNA.

UNIT V  VITAMINS AND HORMONES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Students will learn about various kinds of biomolecules and their physiological role.
CO2 Students will gain knowledge about various metabolic disorders and will help them to know the importance of various biomolecules in terms of disease correlation.

TEXT BOOKS

REFERENCES

OBT354  FUNDAMENTALS OF CELL AND MOLECULAR BIOLOGY  L T P C  3 0 0 3

COURSE OBJECTIVES:
• To provide knowledge on the fundamentals of cell biology.
• To understand the signalling mechanisms.
• Understand basic principles of molecular biology at intracellular level to regulate growth, division and development.

UNIT I  INTRODUCTION TO CELL
Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution, Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria, mycoplasma and prions.

UNIT II  CELL ORGANELLES
Molecular organisation, biogenesis and function Mitochondria, endoplasmic reticulam, golgi apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.
UNIT III  BIO-MEMBRANE TRANSPORT  9

UNIT IV  CELL CYCLE  9
Cell cycle- Cell division by mitosis and meosis, Comparision of meosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signaling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.

UNIT V  CENTRAL DOGMA  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Understanding of cell at structural and functional level.
CO2 Understand the central dogma of life and its significance.
CO3 Comprehend the basic mechanisms of cell division.

TEXTBOOKS:

REFERENCES:

OPEN ELECTIVE IV
OHS352 PROJECT REPORT WRITING  L T P C
3 0 0 3

COURSE OBJECTIVE
The Course will enable Learners to,
• Understand the essentials of project writing.
• Perceive the difference between general writing and technical writing
• Assimilate the fundamental features of report writing.
• Understand the essential differences that exist between general and technical writing.
• Learn the structure of a technical and project report.

UNIT II

UNIT III
Structure of the Project Report: (Part 1) Framing a Title – Content – Acknowledgement – Funding Details - Abstract – Introduction – Aim of the Study – Background - Writing the research question - Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework.

UNIT IV

UNIT V

TOTAL:45 PERIODS

COURSE OUTCOMES
By the end of the course, learners will be able to
CO1 Write effective project reports.
CO2 Use statistical tools with confidence.
CO3 Explain the purpose and intension of the proposed project coherently and with clarity.
CO4 Create writing texts to suit achieve the intended purpose.
CO5 Master the art of writing winning proposals and projects.

REFERENCES

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- Note: The average value of this course to be used for program articulation matrix.

OMA355 ADVANCED NUMERICAL METHODS L T P C
3 0 0 3

COURSE OBJECTIVE:
• To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

UNIT I ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM 9

UNIT II INTERPOLATION 9
Central difference: Stirling and Bessel’s interpolation formulae; Piecewise spline interpolation: Piecewise linear, piecewise quadratic and cubic spline; Least square approximation for continuous data (upto 3rd degree).

UNIT III NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS 9

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS 9
Laplace and Poisson’s equations in a rectangular region: Five point finite difference schemes - Leibmann’s iterative methods - Dirichlet’s and Neumann conditions – Laplace equation in polar coordinates: Finite difference schemes.

UNIT V FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS 9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: demonstrate the understandings of common numerical methods for nonlinear equations, system of linear equations and eigenvalue problems;
CO2: understand the interpolation theory;
CO3: understand the concepts of numerical methods for ordinary differential equations;
CO4: demonstrate the understandings of common numerical methods for elliptic equations;
CO5: understand the concepts of numerical methods for time dependent partial differential equations

TEXT BOOKS :

REFERENCES:
CO’s- PO’s & PSO’s MAPPING

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OMA356 RANDOM PROCESSES

COURSE OBJECTIVES:
- To introduce the basic concepts of probability, one and two dimensional random variables with applications to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in communication networks.
- To acquaint with specialized random processes which are apt for modelling the real time scenario.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

UNIT I RANDOM VARIABLES

UNIT II RANDOM PROCESSES

UNIT III SPECIAL RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1 Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO2 Apply the concept random processes in engineering disciplines.
CO3 Understand and apply the concept of correlation and spectral densities.
CO4 Get an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.

CO5 Analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS

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OMA357 QUEUEING AND RELIABILITY MODELLING

COURSE OBJECTIVES:
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the concept of queueing models and apply in engineering.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.
- To study the system reliability and hazard function for series and parallel systems.
- To implement Markovian Techniques for availability and maintainability which opens up new avenues for research.

UNIT I RANDOM PROCESSES

UNIT II MARKOVIAN QUEUEING MODELS
Markovian queues – Birth and death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms.
UNIT III ADVANCED QUEUEING MODELS
M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E_k/1 as special cases – Series queues – Open Jackson networks.

UNIT IV SYSTEM RELIABILITY

UNIT V MAINTAINABILITY AND AVAILABILITY
Maintainability and Availability functions – Frequency of failures – Two Unit parallel system with repair – k out of m systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:

CO1 Enable the students to apply the concept of random processes in engineering disciplines.
CO2 Students acquire skills in analyzing various queueing models.
CO3 Students can understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
CO4 Students can analyze reliability of the systems for various probability distributions.
CO5 Students can be able to formulate problems using the maintainability and availability analyses by using theoretical approach.

TEXT BOOKS

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OMG354 PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS

COURSE OBJECTIVES:
- To know the basic concept and function of Production and Operation Management for entrepreneurship.
- To understand the Production process and planning.
- To understand the Production and Operations Management Control for business owners.

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT

Functions of Production Management - Relationship between production and other functions – Production management and operations management, Characteristics of modern production and operation management, organisation of production function, recent trends in production /operations management - production as an organisational function, decision making in production Operations research

UNIT II PRODUCTION & OPERATION SYSTEMS

Production Systems- principles – Models - CAD and CAM- Automation in Production - Functions and significance- Capacity and Facility Planning: Importance of capacity planning- Capacity measurement – Capacity Requirement Planning (CRP) process for manufacturing and service industry

UNIT III PRODUCTION & OPERATIONS PLANNING

Facility Planning – Location of facilities – Location flexibility – Facility design process and techniques – Location break even analysis-Production Process Planning: Characteristic of production process systems – Steps for production process- Production Planning Control Functions – Planning phase-Action phase- Control phase - Aggregate production planning

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS


UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT


COURSE OUTCOMES

Upon completion of this course the learners will be able:
CO1 To understand the basics and functions of Production and Operation Management for business owners.
CO2 To learn about the Production & Operation Systems.
CO3 To acquaint on the Production & Operations Planning Techniques followed by entrepreneurs in Industries.
CO4 To known about the Production & Operations Management Processes in organisations.
CO5 To comprehend the techniques of controlling , Production and Operations in industries.

REFERENCES
COURSE OBJECTIVE:
- To know various multivariate data analysis techniques for business research.

UNIT I INTRODUCTION
Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation.

UNIT II PREPARING FOR MULTIVARIATE ANALYSIS
Conceptualization of research model with variables, collection of data – Approaches for dealing with missing data – Testing the assumptions of multivariate analysis.

UNIT III MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS
Multiple Linear Regression Analysis – Inferences from the estimated regression function – Validation of the model. -Approaches to factor analysis – interpretation of results.

UNIT IV LATENT VARIABLE TECHNIQUES
Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES
Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

COURSE OUTCOMES:
CO1 Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.

CO2 Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.

CO3 Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.

CO4 Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.

CO5 Make better business decisions by using advanced techniques in data analytics.

REFERENCES:

COURSE OBJECTIVES:
- To introduce the development, capabilities, applications, of Additive Manufacturing (AM), and its business opportunities.
- To be acquainted with vat polymerization and material extrusion processes.
• To be familiar with powder bed fusion and binder jetting processes.
• To gain knowledge on applications of direct energy deposition, and material jetting processes.
• To impart knowledge on sheet lamination and direct write technologies.

UNIT I  INTRODUCTION

UNIT II  VAT POLYMERIZATION AND MATERIAL EXTRUSION

UNIT III  POWDER BED FUSION AND BINDER JETTING

UNIT IV  MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION

UNIT V  SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY
Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course students shall be able to:
CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
CO2: Acquire knowledge on process vat polymerization and material extrusion processes and its applications.
CO3: Elaborate the process and applications of powder bed fusion and binder jetting.
CO4: Evaluate the advantages, limitations, applications of material jetting and directed energy deposition processes.
CO5: Acquire knowledge on sheet lamination and direct write technology.

TEXT BOOKS:
REFERENCES:

CME343 NEW PRODUCT DEVELOPMENT

COURSE OBJECTIVES
- To introduce the fundamental concepts of the new product development
- To develop material specifications, analysis and process.
- To Learn the Feasibility Studies & reporting of new product development.
- To study the New product qualification and Market Survey on similar products of new product development
- To learn Reverse Engineering, Cloud points generation, converting cloud data to 3D model

UNIT I FUNDAMENTALS OF NPD

UNIT II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS
Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT III ESSENTIALS OF NPD

UNIT IV CRITERIONS OF NPD
New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

UNIT V REPORTING & FORWARD-THINKING OF NPD
Detailed study on PPAP with 18 elements reporting, APQP and its 5 Sections, APQP vs PPAP, Importance of SOP (Standard Operating Procedure) – Purpose & documents, deployment in shop floor. Prototyping & RPT - Concepts, Application and its advantages, 3D Printing – resin models, Sand cores for foundries; Reverse Engineering. Cloud points generation, converting cloud data to 3D model – Advantages & Limitation of RE, CE (Concurrent Engineering) – Basics, Application and its advantages in NPD (to reduce development lead time, time to Market, Improve productivity and product cost.)

TOTAL :45 PERIODS

COURSE OUTCOMES:
At the end of the course the students would be able to
CO1 Discuss fundamental concepts and customer specific requirements of the New Product development
CO2 Discuss the Material specification standards, analysis and fabrication, manufacturing process Develop Feasibility Studies & reporting of New Product development
CO3 Analyzing the New product qualification and Market Survey on similar products of new product development
CO4 Develop Reverse Engineering. Cloud points generation, converting cloud data to 3D model

TEXT BOOKS:
Product Development – Sten Jonsson
Product Design & Development – Karl T. Ulrich, Maria C. Young, Steven D. Eppinger

REFERENCES:
Revolutionizing Product Development – Steven C Wheelwright & Kim B. Clark
Change by Design
Toyota Product Development System – James Morgan & Jeffrey K. Liker
Winning at New Products – Robert Brands 3rd Edition
Product Design & Value Engineering – Dr. M.A. Bulsara &Dr. H.R. Thakkar

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OME355 INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES

COURSE OBJECTIVES:
The course aims to
- Outline Fundamental concepts in UI & UX
- Introduce the principles of Design and Building an mobile app
- Illustrate the use of CAD in product design
- Outline the choice and use of prototyping tools
- Understanding design of electronic circuits and fabrication of electronic devices

UNIT I UI/UX
UNIT II       APP DEVELOPMENT  9
SDLC - Introduction to App Development - Types of Apps - web Development - understanding Stack - Frontend - backend - Working with Databases - Introduction to API - Introduction to Cloud services - Cloud environment Setup - Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III       INDUSTRIAL DESIGN  9
Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV       MECHANICAL RAPID PROTOTYPING  9
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V       ELECTRONIC RAPID PROTOTYPING  9
Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1 Create quick UI/UX prototypes for customer needs
CO2 Develop web application to test product traction / product feature
CO3 Develop 3D models for prototyping various product ideas
CO4 Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

MF3010       MICRO AND PRECISION ENGINEERING  LT P C 3 0 0 3

COURSE OBJECTIVES:
At the end of this course the student should be able to
- Learn about the precision machine tools
- Learn about the macro and micro components.
- Understand handling and operating of the precision machine tools.
- Learn to work with miniature models of existing machine tools/robots and other instruments.
- Learn metrology for micro system

UNIT I       INTRODUCTION TO MICROSYSTEMS  9
Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical, electrical properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems.
UNIT II   FABRICATION PROCESSES FOR MICRO-SYSTEMS:  9
Additive, subtractive, forming process, microsystems-Micro-pumps, micro-turbines, micro engines, micro-robot, and miniature biomedical devices

UNIT III  INTRODUCTION TO PRECISION ENGINEERING  9
Machine tools, holding and handling devices, positioning fixtures for fabrication/assembly of microsystems. Precision drives: inch worm motors, ultrasonic motors, stick-slip mechanism and other piezo-based devices.

UNIT IV  PRECISION MACHINING PROCESSES  9
Precision machining processes for macro components - Diamond turning, fixed and free abrasive processes, finishing processes.

UNIT V  METROLOGY FOR MICRO SYSTEMS  9
Metrology for micro systems - Surface integrity and its characterization.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Select suitable precision machine tools and operate
CO2 Apply the macro and micro components for fabrication of micro systems.
CO3 Apply suitable machining process
CO4 Able to work with miniature models of existing machine tools/robots and other instruments.
CO5 Apply metrology for micro system

TEXT BOOKS:

REFERENCES:

OMF354  COST MANAGEMENT OF ENGINEERING PROJECTS  LT P C
3 0 0 3

COURSE OBJECTIVES:
Summarize the costing concepts and their role in decision making
Infer the project management concepts and their various aspects in selection
Interpret costing concepts with project execution
Develop knowledge of costing techniques in service sector and various budgetary control techniques
Illustrate with quantitative techniques in cost management

UNIT I  INTRODUCTION TO COSTING CONCEPTS  9
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.'
UNIT II  INTRODUCTION TO PROJECT MANAGEMENT  9
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts

UNIT III  PROJECT EXECUTION AND COSTING CONCEPTS  9
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

UNIT IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  9

UNIT V  QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand the costing concepts and their role in decision making.
CO2: Understand the project management concepts and their various aspects in selection.
CO3: Interpret costing concepts with project execution.
CO4: Gain knowledge of costing techniques in service sector and various budgetary control techniques.
CO5: Become familiar with quantitative techniques in cost management.

TEXT BOOKS:

REFERENCES:

AU3002  BATTERIES AND MANAGEMENT SYSTEM  L T P C
3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to make the students
• To understand the working and characteristics of different types of batteries and their management.

UNIT I  ADVANCED BATTERIES  9
Li-ion Batteries-different formats, chemistry, safe operating area, efficiency, aging. Characteristics-SOC,DOD, SOH. Balancing-Passive Balancing Vs Active Balancing. Other Batteries-NCM and NCA Batteries. NCR18650B specifications.

UNIT II  BATTERY PACK  9
Battery Pack- design, sizing, calculations, flow chart, real and simulation Model.Peak power – definition, testing methods-relationships with Power, Temperature and ohmic Internal Resistance. Cloud based and Local Smart charging.

UNIT III  BATTERY MODELLING  9
Battery Modelling Methods-Equivalent Circuit Models, Electrochemical Model, Neural Network Model. ECM Comparisons- Rint model, Thevenin model, PNGV model. State space Models- Introduction. Battery Modelling software/simulation frameworks

UNIT IV  BATTERY STATE ESTIMATION  9

UNIT V  BMS ARCHITECTURE AND REAL TIME COMPONENTS  9
Battery Management System- need, operation, classification. BMS ASIC-bq76PL536A-Q1 Battery Monitor IC- CC2662R-Q1 Wireless BMS MCU. Communication Modules- CAN Open-Flex Ray-CANedge1 package.ARBIN Battery Tester. BMS Development with Modeling software and Model-Based Design.

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of this course, students will be able to
CO1 Acquire knowledge of different Li-ion Batteries performance.
CO2 Design a Battery Pack and make related calculations.
CO3 Demonstrate a Battery Model or Simulation.
CO4 Estimate State-of-Charges in a Battery Pack.
CO5 Approach different BMS architectures during real world usage.

TEXT BOOKS

REFERENCES
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet
COURSE OBJECTIVES:

- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I  INTRODUCTION TO MEASUREMENTS AND SENSORS  9

UNIT II  VARIABLE RESISTANCE AND INDUCTANCE SENSORS  9
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III  VARIABLE AND OTHER SPECIAL SENSORS  9
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV  AUTOMOTIVE ACTUATORS  9

UNIT V  AUTOMATIC TEMPERATURE CONTROL ACTUATORS  9
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL :45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to

- **CO1** List common types of sensor and actuators used in vehicles.
- **CO2** Design measuring equipment’s for the measurement of pressure force, temperature and flow.
- **CO3** Generate new ideas in designing the sensors and actuators for automotive application
- **CO4** Understand the operation of the sensors, actuators and electronic control.
- **CO5** Design temperature control actuators for vehicles.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To interpret the missile space stations, space vs earth environment.
- To explain the life support systems, mission logistics and planning.
- To deploy the skills effectively in the understanding of space vehicle configuration design.
- To explain Engine system and support of space vehicle
- To interpret nose cone configuration of space vehicle

UNIT I  FUNDAMENTAL ASPECTS
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II  SELECTION OF ROCKET PROPULSION SYSTEMS
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III  ENGINE SYSTEMS, CONTROLS, AND INTEGRATION

UNIT IV  THRUST VECTOR CONTROL
TVC Mechanisms with a Single Nozzle – TVC with Multiple Thrust Chambers or Nozzles – Testing – Integration with Vehicle – SITVC method – other jet control methods - exhaust plume problems in space environment

UNIT V  NOSE CONE CONFIGURATION
Aerodynamic aspects on the selection of nose shape of a launch vehicle - design factors in the finalization of nose configuration with respect to payload - nose cone thermal protection system - separation of fairings - payload injection mechanism

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1 Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
CO2 Apply knowledge in selecting the appropriate rocket propulsion systems.
CO3 interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
CO4 Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
CO5 Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.

OAS353  SPACE VEHICLES  L T P C
3 0 0 3

COURSE OBJECTIVES:
Of this course are

- To introduce fundamental concepts of management and organization to students.
- To impart knowledge to students on various aspects of marketing, quality control and
marketing strategies.

- To make students familiarize with the concepts of human resources management.
- To acquaint students with the concepts of project management and cost analysis.
- To make students familiarize with the concepts of planning process and business strategies.

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANISATION  9


UNIT II  OPERATIONS AND MARKETING MANAGEMENT  9


UNIT III  HUMAN RESOURCES MANAGEMENT  9

Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development, Wage and Salary Administration, Promotion, Transfer, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating – Capability Maturity Model (CMM) Levels.

UNIT IV  PROJECT MANAGEMENT  9

Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing (simple problems).

UNIT V  STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES  9


TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, Students will be able to

CO1: Plan an organizational structure for a given context in the organization to carryout production operations through Work-study.

CO2: Survey the markets, customers and competition better and price the given products appropriately.

CO3: Ensure quality for a given product or service.

CO4: Plan, schedule and control projects through PERT and CPM.

CO5: Evaluate strategy for a business or service organisation.

TEXTBOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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OIM353 PRODUCTION PLANNING AND CONTROL

COURSE OBJECTIVES:
- To understand the concept of production planning and control act work study,
- To apply the concept of product planning,
- To analyze the production scheduling,
- To apply the Inventory Control concepts.
- To prepare the manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures.
Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course,
CO1: The students can able to prepare production planning and control act work study,
CO2: The students can able to prepare product planning,
CO3: The students can able to prepare production scheduling,
CO4: The students can able to prepare Inventory Control.
CO5: They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

REFERENCES

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OIE353 OPERATIONS MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVE:
- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.
• Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
• Relate the interdependence of the operations function with the other key functional areas of a firm.
• Teach analytical skills and problem-solving tools to the analysis of the operations problems.
• Apply scheduling and Lean Concepts for improving System Performance.

UNIT I  INTRODUCTION TO OPERATIONS MANAGEMENT
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain Management

UNIT II  FORECASTING, CAPACITY AND FACILITY DESIGN

UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS

UNIT IV  MATERIALS MANAGEMENT

UNIT V  SCHEDULING AND PROJECT MANAGEMENT
Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.
CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.
CO3: The students will able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.
CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.
CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

TEXT BOOKS

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OSF352 INDUSTRIAL HYGIENE

COURSE OBJECTIVES:
- Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
- Compare and contrast the roles of environmental and biological monitoring in work health and safety.
- Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.
- Discuss how personal protective equipment can be used to reduce risks associated with workplace exposures.
- Provide high-level advice on managing and controlling noise and noise-related hazards.

UNIT I : INTRODUCTION AND SCOPE

UNIT II : MONITORING FOR SAFETY, HEALTH & ENVIRONMENT

UNIT III : OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY EDUCATION

UNIT IV : OCCUPATIONAL SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT
UNIT V : INDUSTRIAL HAZARDS

i. Radiation: Types and effects of radiation on human body, Measurement and detection of radiation intensity. Effects of radiation on human body, Measurement – disposal of radioactive waste, Control of radiation

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to

CO1: Explain and apply human factors engineering concepts in both evaluation of existing systems and design of new systems

CO2: Specify designs that avoid occupation related injuries

CO3: Define and apply the principles of work design, motion economy, and work environment design.

CO4: Identify the basic human sensory, cognitive, and physical capabilities and limitations with respect to human-machine system performance.

CO5: Acknowledge the impact of workplace design and environment on productivity

TEXT BOOKS:

REFERENCES:
2. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2,

CO’s- PO’s & PSO’s MAPPING

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OSF353 CHEMICAL PROCESS SAFETY L T P C
3 0 0 3

COURSE OBJECTIVES

- Teach the principles of safety applicable to the design, and operation of chemical process plants.
- Ensure that potential hazards are identified and mitigation measures are in place to prevent unwanted release of energy.
- Learn about the hazardous chemicals into locations that could expose employees and others to serious harm.
- Focuses on preventing incidents and accidents during large scale manufacturing of chemicals and pharmaceuticals.
• Ensure that the general design of the plant is capable of complying with the dose limits in force and with the radioactive releases.

UNIT I  SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES  9
Types of storage-general considerations for storage layouts - atmospheric venting, pressure and temperature relief - relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation - pipe line transport - safety in chemical laboratories.

UNIT II  CHEMICAL REACTION HAZARDS  9
Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self - heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening.

UNIT III  SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS  9
Design principles - Process design development - types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during startup and shutdown - non destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.

UNIT IV  SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS  9
Properties of chemicals - Material Safety Data Sheets - the various properties and formats used - methods available for property determination. Operational activities and hazards - standards operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures - condition monitoring - control valves - safety valves - pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

UNIT V  SAFETY AND ANALYSIS  9
Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1 Differentiate between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.
CO2 Develop thorough knowledge about safety in the operation of chemical plants.
CO3 Apply the principles of safety in the storage and handling of gases.
CO4 Identify the conditions that lead to reaction hazards and adopt measures to prevent them.
CO5 Develop thorough knowledge about

TEXT BOOK

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OML352 ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the importance of various materials used in electrical, electronics and magnetic applications
- Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
- Gaining knowledge on the selection of suitable materials for the given application
- Knowing the fundamental concepts in Semiconducting materials
- Getting equipped with the materials used in optical and optoelectronic applications.

UNIT I DIELECTRIC MATERIALS
Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS
Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS
Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS
Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetal fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.
UNIT V  OPTICAL AND OPTOELECTRONIC MATERIALS


TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Understand various types of dielectric materials, their properties in various conditions.
CO2 Evaluate magnetic materials and their behavior.
CO3 Evaluate semiconductor materials and technologies.
CO4 Select suitable materials for electrical engineering applications.
CO5 Identify right material for optical and optoelectronic applications

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OML353  NANOMATERIALS AND APPLICATIONS L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- Gaining knowledge on dimensionality effects on different properties of nanomaterials
- Getting acquainted with the different processing techniques employed for fabricating nanomaterials
- Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
- Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.
UNIT I  NANOMATERIALS
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II  THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III  PROCESSING
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV  STRUCTURAL CHARACTERISTICS
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis

UNIT V  APPLICATIONS
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Evaluate nanomaterials and understand the different types of nanomaterials
CO2 Recognise the effects of dimensionality of materials on the properties
CO3 Process different nanomaterials and use them in engineering applications
CO4 Use appropriate techniques for characterising nanomaterials
CO5 Identify and use different nanomaterials for applications in different engineering fields.

TEXT BOOKS:

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OMR352   HYDRAULICS AND PNEUMATICS   L T P C
3003

COURSE OBJECTIVES:
- To knowledge on fluid power principles and working of hydraulic pumps
- To obtain the knowledge in hydraulic actuators and control components
- To understand the basics in hydraulic circuits and systems
- To obtain the knowledge in pneumatic and electro pneumatic systems
- To apply the concepts to solve the trouble shooting

UNIT I   FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS   9

UNIT II   HYDRAULIC ACTUATORS AND CONTROL COMPONENTS   9

UNIT III   HYDRAULIC CIRCUITS AND SYSTEMS   9
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV   PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS   9

UNIT V   TROUBLE SHOOTING AND APPLICATIONS   9

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
**CO1**: Analyze the methods in fluid power principles and working of hydraulic pumps
**CO2**: Recognize the concepts in hydraulic actuators and control components
**CO3**: Obtain the knowledge in basics of hydraulic circuits and systems
**CO4**: Know about the basics concept in pneumatic and electro pneumatic systems
**CO5**: Apply the concepts to solve the trouble shooting hydraulic and pneumatics
TEXT BOOKS

REFERENCES

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OMR353 SENSORS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
- To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
- To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
- To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
- To familiarize students with different signal conditioning circuits design and data acquisition system.

UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES

UNIT II DISPLACEMENT, PROXIMITY AND RANGING SENSORS

UNIT III FORCE, MAGNETIC AND HEADING SENSORS

UNIT IV OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS 9
Photo Conductive Cell, Photo Voltaic, Photo Resistive, LDR – Fiber Optic Sensors – Pressure – Diaphragm – Bellows - Piezolectric - Piezo-resistive - Acoustic, Temperature – IC, Thermistor, RTD, Thermocouple – Non Contact Sensor - Chemical Sensors - MEMS Sensors - Smart Sensors.

UNIT V SIGNAL CONDITIONING 9

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:

CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors. They can also analyze the sensor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.

CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.

CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

TEXT BOOKS

REFERENCES

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COURSE OBJECTIVES

- To introduce mobile robotic technology and its types in detail.
- To learn the kinematics of wheeled and legged robot.
- To familiarize the intelligence into the mobile robots using various sensors.
- To acquaint the localization strategies and mapping technique for mobile robot.
- To aware the collaborative mobile robotics in task planning, navigation and intelligence.

UNIT I INTRODUCTION TO MOBILE ROBOTICS


UNIT II KINEMATICS


UNIT III PERCEPTION


UNIT IV LOCALIZATION


UNIT V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS


COURSE OUTCOMES:

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

CO1: Evaluate the appropriate mobile robots for the desired application.
CO2: Create the kinematics for given wheeled and legged robot.
CO3: Analyse the sensors for the intelligence of mobile robotics.
CO4: Create the localization strategies and mapping technique for mobile robot.
CO5: Create the collaborative mobile robotics for planning, navigation and intelligence for desired applications.

TEXTBOOK


REFERENCES:

**MV3501 MARINE PROPULSION**

**COURSE OBJECTIVES:**
- To impart knowledge on basics of propulsion system and ship dynamic movements
- To educate them on basic layout and propulsion equipment’s
- To impart basic knowledge on performance of the ship
- To impart basic knowledge on Ship propeller and its types
- To impart knowledge on ship rudder and its types

**UNIT I BASICS SHIP PROPULSION SYSTEM AND EQUIPMENTS**
- law of floatation - Basics principle of propulsion- Earlier methods of propulsion- ship propulsion machinery- boiler, Marine steam engine, diesel engine, ship power transmission system, ship dynamic structure, Marine propulsion equipment - shaft tunnel, Intermediate shaft and bearing, stern tube, stern tube sealing etc. degree of freedom, Modern propelling methods- water jet propulsion , screw propulsion.

**UNIT II SHIPS MOVEMENTS AND SHIP STABILIZATION**
- Thrust augmented devices, Ship hull, modern ship propulsion design, bow thruster – Advantages, various methods to stabilize the ship- passive and active stabilizer, fin stabilizer, bilge keel - stabilizing and securing ship in port- effect of tides on ship – effect of river water and sea water sailing vessel, Load line and load line of marking- draught markings.

**UNIT III SHIPS SPEED AND ITS PERFORMANCE**
- Ship propulsion factors, factors affecting ships speed, various velocities of ship, hull drag, effects of fouling on ships hull, ship wake, relation between powers, Fuel consumption of ship, cavitations - effects of cavitation’s, ship turning radius.

**UNIT IV BASICS OF PROPELLER**
- Propeller dimension, Propeller and its types – fixed propeller, control pitch propeller, kort nozzle, ducted propeller, voith schneider, Parts of propeller, 3 blade - 5 blade - 6 blade propellers and its advantages, propeller boss hub, crown nut, propeller skew, pitch of propeller - Thrust creation by propeller. Propeller Material – Propeller balancing- static and dynamic.

**UNIT V BASICS OF Rudder**
- Rudder dimension, Area of rudder and its design, Rudder arrangements, Rudder fittings- Rudder pintle - Rudder types- Balanced rudder, semi balanced rudder, Spade rudder, merits and demerits of various types of rudders, Propeller and rudder interaction, Rudder stopper, movement of rudders, Basic construction of Rudder

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
Upon successful completion of the course, students should be able to:

CO1: Explain the basics of propulsion system and ship dynamic movements
CO2: Familiarize with various components assisting ship stabilization.
CO3: Demonstrate the performance of the ship.
CO4: Classify the Propeller and its types, Materials etc.
CO5: Categories the Rudder and its types, design criteria of rudder.

TEXT BOOKS:
1. GP. Ghose, “Basic Ship propulsion”, 2015

REFERENCES:

CO's - PO's & PSO's MAPPING

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OMV351 MARINE MERCHANT VESSELS LT P C
3 0 0 3

COURSE OBJECTIVES:
At the end of the course, students are expected to acquire
- Knowledge on basics of Hydrostatics
- Familiarization on types of merchant ships
- Knowledge on Shipbuilding Materials
- Knowledge on marine propeller and rudder
- Awareness on governing bodies in shipping industry

UNIT I INTRODUCTION to HYDROSTATICS

UNIT II TYPES OF SHIP
General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships – Oil tankers- Bulk carriers - Liquefied Natural Gas carriers - Liquefied Petroleum Gascarriers - Chemical tankers - Passenger ships

UNIT III SHIPBUILDING MATERIALS
Types of Steels used in Shipbuilding - High tensile steels, Corrosion resistant steels. Steel sandwich panels, Steel castings, Steel forgings - Other shipbuilding materials, Aluminium alloys, Aluminium alloy sandwich panels, Fire protection especially for Aluminium Alloys, Fiber Reinforced Composites
UNIT IV  MARINE PROPELLER AND RUDDER
Types of rudder, construction of Rudder-Types of Propeller, Propeller material-Cavitations and its effects on propeller

UNIT V  GOVERNING BODIES FOR SHIPPING INDUSTRY
Role of IMO (International Maritime Organization), SOLAS (International Convention for the Safety of Life at Sea), MARPOL (International Convention for the Prevention of Pollution from Ships), MLC (Maritime Labour Convention), STCW 2010 (International Convention on Standards of Training, Certification and Watch keeping for Seafarers), Classification societies Administration authorities

COURSE OUTCOMES:
Upon completion of this course, students would
CO1 Acquire Knowledge on floatation of ships
CO2 Acquire Knowledge on features of various ships
CO3 Acquire Knowledge of Shipbuilding Materials
CO4 Acquire Knowledge to identify the different types of marine propeller and rudder
CO5 Understand the Roles and responsibilities of governing bodies

TEXT BOOKS:
2. Dr.DA Taylor, “Merchant Ship Naval Architecture” I. Mar EST publications, 2006

REFERENCES:
2. MARPOL Consolidated Edition, Bhandakar Publications, 2018

OMV352 ELEMENTS OF MARINE ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES:
At the end of the course, students are expected to
• Understand the role of Marine machinery systems
• Be familiar with Marine propulsion machinery system
• Acquaint with Marine Auxiliary machinery system
• Have acquired basics of Marine Auxiliary boiler system
• Be aware of ship propellers and steering system

UNIT I  ELEMENTARY KNOWLEDGE ON MARINE MACHINERY SYSTEMS
Marine Engineering Terminologies, Parts of Ship, Introduction to Machinery systems on board ships
– Propulsion Machinery system, Electricity Generator system, Steering gear system, Air compressors & Air reservoirs, Fuel oil and Lubricating Oil Purifiers, Marine Boiler systems

UNIT II  MARINE PROPULSION MACHINERY SYSTEM
Two stroke Large Marine slow speed Diesel Engine – General Construction, Basic knowledge of Air starting and reversing mechanism, Cylinder lubrication oil system, Main lubricating oil system and cooling water system

UNIT III MARINE AUXILIARY MACHINERY SYSTEM
Four stroke medium speed Diesel engine – General Construction, Inline, V-type arrangement of engine, Difference between slow speed and medium speed engines – advantages, limitations and applications

UNIT IV MARINE BOILER SYSTEM
Types of Boiler – Difference between Water tube boiler and Fire tube boiler, Need for boiler on board ships, Uses of steam, Advantages of using steam as working medium, Boiler mountings and accessories – importance of mountings, need for accessories

UNIT V SHIP PROPELLERS AND STEERING MECHANISM
Importance of Propeller and Steering gear, Types of propellers - Fixed pitch propellers, Controllable pitch propellers, Water jet propellers, Steering gear systems - 2-Ram and 4 Ram steering gear, Electric steering gear

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students should able to,
CO1 Distinguish the role of various marine machinery systems
CO2 Relate the components of marine propulsion machinery system
CO3 Explain the importance of marine auxiliary machinery system
CO4 Acquire knowledge of marine boiler system
CO5 Understand the importance of ship propellors and steering system

TEXT BOOKS:

REFERENCES:
1. Alan L.Rowen, “Introduction to Practical Marine Engineering, Volume 1&2, The Institute of Marine Engineers (India), Mumbai, 2006
2. A.S.Tambwekar, “Naval Architecture and Ship Construction”, The Institute of Marine Engineers (India), Mumbai, 2015

CRA332 DRONE TECHNOLOGIES

COURSE OBJECTIVES:
- To understand the basics of drone concepts
- To learn and understand the fundamentals of design, fabrication and programming of drone
- To impart the knowledge of an flying and operation of drone
- To know about the various applications of drone
- To understand the safety risks and guidelines of fly safely

UNIT I INTRODUCTION TO DRONE TECHNOLOGY
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations -management tool -Sensors-Onboard storage capacity - Removable storage devices- Linked mobile devices and applications

UNIT IV DRONE COMMERCIAL APPLICATIONS 9
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

UNIT V FUTURE DRONES AND SAFETY 9
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Createthe programs for various drones

TEXT BOOKS

REFERENCES

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1 – Slight, 2 – Moderate, 3 – Substantial
COURSE OBJECTIVE:
- To impart the knowledge on basic components, data preparation and implementation of Geographical Information System.

UNIT I  FUNDAMENTALS OF GIS  9

UNIT II  SPATIAL DATA MODELS  9

UNIT III  DATA INPUT AND TOPOLOGY  9

UNIT IV  DATA QUALITY AND STANDARDS  9
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V  DATA MANAGEMENT AND OUTPUT  9
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Have basic idea about the fundamentals of GIS.
  CO2 Understand the types of data models.
  CO3 Get knowledge about data input and topology
  CO4 Gain knowledge on data quality and standards
  CO5 Understand data management functions and data output

TEXTBOOKS:

REFERENCE:
CO’s- PO’s & PSO’s MAPPING

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OAI352 AGRICULTURE ENTREPRENEURSHIP DEVELOPMENT L T P C

COURSE OBJECTIVES
- To introduce the importance of Agri-business management, its characteristics and principles
- To impart knowledge on the functional areas of Agri-business like Marketing management, Product pricing methods and Market potential assessment.

UNIT I ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT
Entrepreneur Development (ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics- Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.

UNIT II AGRIPRNEURSHIP IN GLOBAL ARENA: LEGAL PERSPECTIVE
Importance of agribusiness in Indian economy - International trade-WTO agreements- Provisions related to agreements in agricultural and food commodities - Agreements on Agriculture (AOA)- Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS).

UNIT III ENTREPRENEURSHIP MANAGEMENT: FINANCIAL PERSPECTIVE
Project cycle-Project appraisal and evaluation techniques- undiscounted measures-Payback period-proceeds per rupee of outlay, Discounted measures-Net Present Value (NPV)-Benefit-Cost Ratio (BCR)-Internal Rate of Return (IRR)-Net benefit investment ratio (N/K ratio)-sensitivity analysis.

UNIT IV ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.

UNIT V ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis-Government schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) - overview of agricultural engineering industry, characteristics of Indian farm machinery industry.

COURSE OUTCOMES
CO1 Judge about agricultural finance, banking and cooperation
CO2 Evaluate basic concepts, principles and functions of financial management
CO3 Improve the skills on basic banking and insurance schemes available to customers
CO4 Analyze various financial data for efficient farm management
CO5 Identify the financial institutions

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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OEN352 BIODIVERSITY CONSERVATION

COURSE OBJECTIVE:
- The identification of different aspects of biological diversity and conservation techniques.

UNIT I INTRODUCTION 9
Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY 9
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III MICROBIAL DIVERSITY 9
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis.

UNIT IV MEGA DIVERSITY 9
Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio-economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNIT V CONSERVATIONS OF BIODIVERSITY 9
In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

**TOTAL: 45 PERIODS**

**TEXT BOOKS:**

**REFERENCES:**

**COURSE OUTCOMES**
Upon successful completion of this course, students will:

**CO1:** An insight into the structure and function of diversity for ecosystem stability.

**CO2:** Understand the concept of animal diversity and taxonomy

**CO3:** Understand socio-economic issues pertaining to biodiversity

**CO4:** An understanding of biodiversity in community resource management.

**CO5:** Student can apply fundamental knowledge of biodiversity conservation to solve problems associated with infrastructure development.

**CO’s- PO’s & PSO’s MAPPING**

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1. low, 2-medium, 3-high, ‘-‘- no correlation

Note: The average value of this course to be used for program articulation matrix.

**OEE353 INTRODUCTION TO CONTROL SYSTEMS**

**COURSE OBJECTIVES**
- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems
- To analyze the stability of linear systems in frequency domain and time domain
- To develop linear models mainly state variable model and transfer function model

**UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS**
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

**UNIT II TIME RESPONSE ANALYSIS & ROOTLOCUSTECHNIQUE**

UNIT III FREQUENCY RESPONSE ANALYSIS 9
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS 9

UNIT V STATE VARIABLE ANALYSIS 9
Concept of state – State Variable & State Model – State models for linear & continuous time systems—Solution of state & output equation—controllability & observability.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Ability to
CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.
CO5: Assess the state models for linear and continuous Systems.

TEXTBOOKS

REFERENCES
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA.

CO’s- PO’s & PSO’s MAPPING

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OEI354 INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS LT P C
3 0 03

COURSE OBJECTIVES:
- To educate on design of signal conditioning circuits for various applications.
• To Introduce signal transmission techniques and their design.
• Study of components used in data acquisition systems interface techniques
• To educate on the components used in distributed control systems
• To introduce the communication buses used in automation industries.

UNIT I INTRODUCTION

UNIT II AUTOMATION COMPONENTS
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)
5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1 Design a signal conditioning circuits for various application (L3).
CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:
REFERENCES:

List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063

CO's- PO's & PSO's MAPPING

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OCH353  ENERG Y TECHNOLOGY  L T P C
UNIT I  INTRODUCTION  8
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II  CONVENTIONAL ENERGY  8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III  NON-CONVENTIONAL ENERGY  10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV  BIOMASS ENERGY  10
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V  ENERGY CONSERVATION

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to
CO1: Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
CO2: Students will excel as professionals in the various fields of energy engineering
CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.
CO4: Explain the technological basis for harnessing renewable energy sources.
CO5: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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<td>Compare different renewable energy technologies and choose the most appropriate based on local conditions.</td>
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CO4 Explain the technological basis for harnessing renewable energy sources.

CO5 Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

OVERALL CO

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

OCH354 SURFACE SCIENCE

COURSE OBJECTIVE:
- To enable the students to analyze properties of surfaces and correlate them to structure, chemistry, and physics and surface modification technique.

UNIT I SURFACE STRUCTURE AND EXPERIMENTAL PROBES
Relevance of surface science to Chemical and Electrochemical Engineering, Heterogeneous Catalysis and Nanoscience; Surface structure and reconstructions, absorbate structure, Band and Vibrational structure, Importance of UHV techniques, Electronic probes and molecular beams, Scanning probes and diffraction, Qualitative introduction to electronic and vibrational spectroscopy

UNIT II ADSORPTION, DYNAMICS, THERMODYNAMICS AND KINETICS AT SURFACES
Interactions at the surface, Physisorption, Chemisorption, Diffusion, dynamics and reactions of atoms/molecules on surfaces, Generic reaction mechanism on surfaces, Adsorption isotherms, Kinetics of adsorption, Use of temperature desorption methods

UNIT III LIQUID INTERFACES
Structure and Thermodynamics of liquid-solid interface, Self-assembled monolayers, Electrified interfaces, Charge transfer at the liquid-solid interfaces, Photoelectrochemical processes, Gratzel cells

UNIT IV HETEROGENEOUS CATALYSIS
Characterization of heterogeneous catalytic processes, Microscopic kinetics to catalysis, Overview of important heterogeneous catalytic processes: Haber-Bosch, Fishcher-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS
COURSE OUTCOME:
- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena.

TEXT BOOK:

REFERENCE:

OFD354 FUNDAMENTALS OF FOOD ENGINEERING  L T P C
3 0 0 3

COURSE OBJECTIVES
The course aims to
- acquaint and equip the students with different techniques of measurement of engineering properties.
- make the students understand the nature of food constituents in the design of processing equipment.

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers.

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger’s, Kick’s and Bond’s equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping).

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT V
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis.
mode of operation, and applications; Membrane separation methods, demineralization by electrode
dialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food
materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to
develop new technologies for processing and preservation.

TEXTBOOKS:
Prentice-Hall, NY, USA.
Equipment. Springer Science+Business Media, New York, USA.

OFD355 FOOD SAFETY AND QUALITY REGULATIONS L T P C
S L T P C 3 0 0 3

COURSE OBJECTIVES:
• To characterize different type of food hazards, physical, chemical and biological in the industry
and food service establishments
• To help become skilled in systems for food safety surveillance
• To be aware of the regulatory and statutory bodies in India and the world
• To ensure processed food meets global standards

UNIT I
Introduction to food safety and security: Hygienic design of food plants and equipments, Food
Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food
Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing,
storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice,
birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

UNIT II
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control.
Sensory evaluation of food and statistical analysis. Water quality and other utilities.

UNIT III
Critical Quality control point in different stages of production including raw materials and processing
materials. Food Quality and Quality control including the HACCP system. Food inspection and Food
Law, Risk assessment – microbial risk assessment, dose response and exposure response
modelling, risk management, implementation of food surveillance system to monitor food safety, risk
communication

UNIT IV
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in
Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE),
International Plant Protection Convention (IPPC)
UNIT V
Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
CO2 Awareness on regulatory and statutory bodies in India and the world

REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
4. Microbiological safety of Food by Hobbs BC, 1973

OPY353 NUTRACEUTICALS L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different \textit{in vitro} methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrototopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT IV ROLE IN HEALTH AND DISEASE
The health benefit of - Soy protein, Spirulina, Tea, Olive oil, plant sterols, Broccoli, omega3 fatty acid and eicosanoids. Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.
UNIT V    SAFETY ISSUES
Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues
International and national.

TOTAL: 45 PERIODS

TEXT BOOKS:
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006

REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE OUTCOMES
CO1 acquire knowledge about the Nutraceuticals and functional foods, their classification and benefits.
CO2 acquire knowledge of phytochemicals, zoochemicals and microbes in food, plants, animals and microbes
CO3 attain the knowledge of the manufacturing practices of selected nutraceutical components and formulation considerations of functional foods.
CO4 distinguish the various In vitro and In vivo assessment of Antioxidant activity of compounds from plant sources.
CO5 gain information about the health benefits of various functional foods and nutraceuticals in the prevention and treatment of various lifestyle diseases.
CO6 Attain the knowledge of the regulatory and safety issues of nutraceuticals at national and international level.

CO's- PO's & PSO's MAPPING

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OTT354    BASICS OF DYEING AND PRINTING
L T P C
3 0 0 3
COURSE OBJECTIVE:
- To enable the students to learn about the basics of Pretreatment, dyeing, printing and machinery in textile processing.

UNIT I INTRODUCTION
Impurities present in different fibres, Inspection of grey goods and lot preparation. Shearing,

UNIT II PRE TREATMENT

UNIT III DYEING

UNIT IV PRINTING
Definition of printing – Difference between printing and dying- Classification thickeners – Requirements to be good thickener, printing paste Preparation - different styles of printing.

UNIT V MACHINERIES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO1: Basics of grey fabric
CO2: Basics of pre treatment
CO3: Concept of Dyeing
CO4: Concept of Printing
CO5: Machinery in processing industry

TEXT BOOKS:

REFERENCES:
2. Dr. N N Mahapatra., “Textile dyeing”, Wood head publishing India, 2018
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series

CO's- PO's & PSO's MAPPING

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

FT3201 FIBRE SCIENCE

COURSE OBJECTIVE
- To enable the students to learn about the types of fibre and its properties

UNIT I INTRODUCTION TO TEXTILE FIBRES
Definition of various forms of textile fibres - staple fibre, filament, bicomponent fibres. Classification of Natural and Man-made fibres, essential and desirable properties of Fibres. Production and cultivation of Natural Fibers: Cotton, Silk, Wool - Physical and chemical structure of the above fibres.

UNIT II REGENERATED FIBRES
Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel, Tencel

UNIT III SYNTHETIC FIBRES
Production Sequence of Synthetic Fibers: polymer-Polyester, Nylon, Acrylic and polypropylene. Mineral fibres: fibre glass, carbon. Introduction to spin finishes and texturization

UNIT IV SPECIALITY FIBRES
Properties and end uses of high tenacity and high modulus fibres, high temperature and flame retardant fibres, Chemical resistant fibres

UNIT V FUNCTIONAL SPECIALITY FIBRES
Properties and end uses: Fibres for medical application – Biodegradable fibres based on PLA, Super absorbent fibres elastomeric fibres, ultra-fine fibres, electrospun nano fibres, metallic fibres – Gold and Silver coated.

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1 Understand the process sequence of various fibres
CO2 Understand the properties of various fibres

TEXT BOOKS:
OTT355                  GARMENT MANUFACTURING TECHNOLOGY       L T P C
                                      3 0 0 3

COURSE OBJECTIVE:
- To enable the students to understand the basics of pattern making, cutting and sewing.
- To expose the students to various problems & remedies during garment manufacturing

UNIT I                  PATTERN MAKING, MARKER PLANNING, CUTTING
Anthropometry, specification sheet, pattern making – principles, basic pattern set drafting, grading, marker planning, spreading & cutting

UNIT II                  TYPES OF SEAMS, STITCHES AND FUNCTIONS OF NEEDLES
Different types of seams and stitches; single needle lock stitch machine – mechanism and accessories; needle – functions, special needles, needlepoint

UNIT III                 COMPONENTS AND TRIMS USED IN GARMENT
Sewing thread-construction, material, thread size, packages, accessories – labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons

UNIT IV                  GARMENT INSPECTION AND DIMENSIONAL CHANGES
Raw material, in process and final inspection; needle cutting; sewability of fabrics; strength properties of apparel; dimensional changes in apparel due to laundering, dry-cleaning, steaming and pressing.

UNIT V                  GARMENT PRESSING, PACKING AND CARE LABELING
Garment pressing – categories and equipment, packing; care 327abelling of apparels

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand
CO1: Pattern making, marker planning, cutting
CO2: Types of seams, stitches and functions of needles
CO3: Components and trims used in garment
CO4: Garment inspection and dimensional changes
CO5: Garment pressing, packing and careabelling

TEXT BOOKS:
2. Gerry Cooklin, “Introduction to Clothing Manufacture” Blackwell Science Ltd., 1995. 64

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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OPE353 INDUSTRIAL SAFETY L T P C

3 0 0 3

COURSE OBJECTIVES:
- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
- Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards

UNIT I INTRODUCTION
Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE
Definition of the term occupational health and hygiene - Categories of health hazards - Exposure pathways and human responses to hazardous and toxic substances - Advantages and limitations of

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 9

UNIT IV HAZARDS AND RISK MANAGEMENT 9

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the student is expected to be able to:
CO1 Describe, with example, the common work-related diseases and accidents in occupational setting
CO2 Name essential members of the Occupational Health team
CO3 What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES L T P C
3 0 0 3

COURSE OBJECTIVES:
- To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I FLUID MECHANICS CONCEPTS 9
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton’s Law of viscosity. Fluid statics-Pascal's law, Hydrostatic equilibrium, Barometric equation and pressure measurement(problems),Basic equations of fluid flow - Continuity equation, Euler's equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numericals.

UNIT II FLOW MEASUREMENTS & MECHANICAL OPERATIONS 9

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER 9
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV BASICS OF MASS TRANSFER 9

UNIT V MASS TRANSFER OPERATIONS 9
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction).Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method.Drying- drying operations, batch and continuous drying. Conceptual numerical.

COURSE OUTCOMES:
At the end of the course the student will be able to:
CO1 State and describe the nature and properties of the fluids.
CO2 Study the different flow measuring instruments, the principles of various size reductions, conveying equipment’s, sedimentation and mixing tanks.
CO3 Comprehend the laws governing the heat and mass transfer operations to solve the problems.
CO4 Design the heat transfer equipment suitable for specific requirement.

TEXTBOOKS
2. Fluid Mechanics K L Kumar S Chand & Company Ltd 2008

REFERENCES
2. Unit Operations of Chemical Engineering, Vol I &II Chattopadhyaya Khanna Publishers, Delhi-6 1996

COURSE OBJECTIVES
- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
- Understand the basics as well as the advanced applications of various plastic materials in the industry
- To understand the preparation methods of thermosetting materials
- Select suitable specialty plastics for different end applications

UNIT I INTRODUCTION TO PLASTIC MATERIALS 9
Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)
UNIT II  ENGINEERING THERMOPLASTICS AND APPLICATIONS  9
Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)

UNIT III  THERMOSETTING PLASTICS  9
Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV  MISCELLANEOUS PLASTICS FOR END APPLICATIONS  9
Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications

UNIT V  PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS  9
Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 To study the importance, advantages and classification of plastic materials
CO2 Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
CO3 To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
CO4 Know the manufacture, properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU
CO5 To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES

OPT353  PROPERTIES AND TESTING OF PLASTICS  L T P C
3 0 0 3

COURSE OBJECTIVES
- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
To study about the environmental effects and prevent polymer degradation.

UNIT I INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS

UNIT II MECHANICAL PROPERTIES
Mechanical properties: Tensile, compression, flexural, shear, tear strength, hardness, impact strength, resilience, abrasion resistance, creep and stress relaxation, compression set, dynamic fatigue, ageing properties, Basic concepts of stress and strain, short term tests: Viscoelastic behavior (simple models: Kelvin model for creep and stress relaxation, Maxwell-Voigt model, strain recovery and dynamic response), Effect of structure and composition on mechanical properties, Behavior of reinforced polymers

UNIT III THERMAL RHEOLOGICAL PROPERTIES
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

UNIT IV ELECTRICAL AND OPTICAL PROPERTIES
Electrical properties: volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

UNIT V ENVIRONMENTAL AND CHEMICAL RESISTANCE

COURSE OUTCOMES
CO1 Understand the relevance of standards and specifications.
CO2 Summarize the various test methods for evaluating the mechanical properties of the polymers.
CO3 To know the thermal, electrical & optical properties of polymers.
CO4 Identify various techniques used for characterizing polymers.
CO5 Distinguish the processability tests used for thermoplastics, thermosets and elastomers.

REFERENCES

OEC353 VLSI DESIGN

COURSES OBJECTIVES:
- Understand the fundamentals of IC technology components and their characteristics.
- Understand combinational logic circuits and design principles.
- Understand sequential logic circuits and clocking strategies.
- Understand Interconnects and Memory Architecture.
- Understand the design of arithmetic building blocks.

UNIT I MOS TRANSISTOR PRINCIPLES
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor DC transfer Characteristics ,small signal analysis of MOSFET.

UNIT II COMBINATIONAL LOGIC CIRCUITS

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE
Interconnect Parameters – Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS
Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course the student will be able to
CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combinational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.

TEXTBOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
The student should be made to:
- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT I  INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS  9

UNIT II  SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES  9
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermolectric photovoltaic energy harvests, Thermopiles.

UNIT III  WIRELESS HEALTH SYSTEMS  9

UNIT IV  SMART TEXTILE  9

UNIT V  APPLICATIONS OF WEARABLE SYSTEMS  9
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- CO1: Describe the concepts of wearable system.
- CO2: Explain the energy harvestings in wearable device.
- CO3: Use the concepts of BAN in health care.
- CO4: Illustrate the concept of smart textile
- CO5: Compare the various wearable devices in healthcare system

TEXT BOOKS
REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM356 MEDICAL INFORMATICS

Preamble:
1. To study the applications of information technology in health care management.
2. This course provides knowledge on resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.

UNIT I INTRODUCTION TO MEDICAL INFORMATICS 9
Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9
Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

UNIT III COMPUTERISED PATIENT RECORD 9
Introduction - conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING 9
Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis inclinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9
Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health- Medical education and healthcare information, computer assisted instruction in medicine.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1 Explain the structure and functional capabilities of Hospital Information System.
CO2 Describe the need of computers in medical imaging and automated clinical laboratory.
CO3 Articulate the functioning of information storage and retrieval in computerized patient record system.
CO4 Apply the suitable decision support system for automated clinical diagnosis.
CO5 Discuss the application of virtual reality and telehealth technology in medical industry.

**TEXT BOOKS:**

**REFERENCE:**

**CO’s- PO’s & PSO’s MAPPING**

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**OBT355 BIOTECHNOLOGY FOR WASTE MANAGEMENT**

**UNIT I BIOLOGICAL TREATMENT PROCESS**

**UNIT II WASTE BIOMASS AND ITS VALUE ADDITION**
Types of waste biomass – Solid waste management - Nature of biomass feedstock – Biobased economy/process – Value addition of waste biomass – Biotransformation of biomass – Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

**UNIT III BIOCONVERSION OF WASTES TO ENERGY**
Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies

**UNIT IV CHEMICALS AND ENZYME PRODUCTION FROM WASTES**
Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases - Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

**UNIT V BIOCOMPOSTING OF ORGANIC WASTES**
Overview of composting process - Benefits of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should be able
CO1 To learn the various methods biological treatment
CO2 To know the details of waste biomass and its value addition
CO3 To develop the bioconversion processes to convert wastes to energy
CO4 To synthesize the chemicals and enzyme from wastes
CO5 To produce the biocompost from wastes
CO6 To apply the theoretical knowledge for the development of value added products

TEXT BOOKS

REFERENCES

OBT356 LIFESTYLE DISEASES

UNIT I INTRODUCTION 9
Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER 9
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES 9
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse -- Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY 9
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES 9
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

337
COURSE OBJECTIVES
The aim of this course is to
- Create higher standard of knowledge on healthcare system and services
- Prioritize advanced technologies for the diagnosis and treatment of various diseases

UNIT I PUBLIC HEALTH

UNIT II CLINICAL DISEASES
Communicable diseases: Chickenpox / Shingles, COVID-19, Tuberculosis, Hepatitis B, Hepatitis C, HIV / AIDS, Influenza, Swine flu. Non Communicable diseases: Diabetes mellitus, atherosclerosis, fatty liver, Obesity, Cancer

UNIT III VACCINOLOGY
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment.

UNIT IV OUTPATIENT & IN PATIENT SERVICES
Radiotherapy, Nuclear medicine, surgical units, OT Medical units, G & Obs. units Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation, Neurology, Gastroenterology, Endoscopy, Pulmonology, Cardiology.

UNIT V BASICS OF IMAGING MODALITIES

REFERENCES
VERTICAL 1: FINTECH AND BLOCK CHAIN

CMG331 FINANCIAL MANAGEMENT LT P C 3 0 0 3

COURSE OBJECTIVES
- To acquire the knowledge of the decision areas in finance.
- To learn the various sources of Finance
- To describe about capital budgeting and cost of capital.
- To discuss on how to construct a robust capital structure and dividend policy
- To develop an understanding of tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANAGEMENT 9
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization - Time Value of money - Risk and return concepts.

UNIT II SOURCES OF FINANCE 9
Long term sources of Finance - Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III INVESTMENT DECISIONS: 9
Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock - Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION 9
Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - Determinants of Dividend Policy

UNIT V WORKING CAPITAL DECISION 9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
2. Prasanna Chandra, Financial Management,
COURSE OBJECTIVES:
- Describe the investment environment in which investment decisions are taken.
- Explain how to Value bonds and equities
- Explain the various approaches to value securities
- Describe how to create efficient portfolios through diversification
- Discuss the mechanism of investor protection in India.

UNIT I THE INVESTMENT ENVIRONMENT 9
The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, securitization market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

UNIT II FIXED INCOME SECURITIES 9
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT III APPROACHES TO EQUITY ANALYSIS 9
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalization models, and price-earnings multiple approach to equity valuation.

UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India

UNIT V INVESTOR PROTECTION 9
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism

TOTAL : 45 PERIODS

REFERENCES

CMG333 BANKING, FINANCIAL SERVICES AND INSURANCE LT P C 3 0 0 3

COURSE OBJECTIVES
- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM 9
Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector – RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.
UNIT II MANAGING BANK FUNDS/ PRODUCTS

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY

UNIT IV FINANCIAL SERVICES

UNIT V INSURANCE

TOTAL: 45 PERIODS

REFERENCES:

CMG334 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS LT P C
3 0 0 3

UNIT I INTRODUCTION TO BLOCKCHAIN
Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY

UNIT III ETHEREUM
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network.

UNIT IV WEB3 AND HYPERLEDGE

UNIT V EMERGING TRENDS

TOTAL: 45 PERIODS

REFERENCE
2. Peter Borovykh, Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

CMG335 FINTECH PERSONAL FINANCE AND PAYMENTS

UNIT I CURRENCY EXCHANGE AND PAYMENT

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE
A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering

UNIT III INSURETECH
InsurTech Introduction , Business model disruption AI/ML in InsurTech ● IoT and InsurTech ● Risk Modeling ● Fraud Detection Processing claims and Underwriting Innovations in Insurance Services

UNIT IV PEER TO PEER LENDING
P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding, Crowdfunding Architecture and Technology , P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations

UNIT V REGULATORY ISSUES

TOTAL: 45 PERIODS

REFERENCES:
CMG336  INTRODUCTION TO FINTECH  LT P C  3 0 0 3

COURSE OBJECTIVES:
- To learn about history, importance and evolution of Fintech
- To acquire the knowledge of Fintech in payment industry
- To acquire the knowledge of Fintech in insurance industry
- To learn the Fintech developments around the world
- To know about the future of Fintech

UNIT I  INTRODUCTION  9
Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT II  PAYMENT INDUSTRY  9
FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III  INSURANCE INDUSTRY  9

UNIT IV  FINTECH AROUND THE GLOBE  9

UNIT V  FUTURE OF FINTECH  9
How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

TOTAL : 45 PERIODS

REFERENCES
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

VERTICAL 2: ENTREPRENEURSHIP
CMG337 FOUNDATIONS OF ENTREPRENERUSHIP L T P C
3 0 0 3

COURSE OBJECTIVES
- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
- To empower the learners to run a Technology driven business efficiently and effectively

UNIT I INTRODUCTION TO ENTREPRENEURSHIP
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT II BUSINESS OWNERSHIP & ENVIRONMENT

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship --- Success Stories of Technopreneurs - Case Studies

UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO1 Learn the basics of Entrepreneurship
CO2 Understand the business ownership patterns and environment
CO3 Understand the Job opportunities in Industries relating to Technopreneurship
CO4 Learn about applications of technopreneurship and successful technopreneurs
CO5 Acquaint with the recent and emerging trends in entrepreneuruship

TOTAL : 45 PERIODS
TEXT BOOKS:

REFERENCES:
4) David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
7) Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship

CMG338 TEAM BUILDING & LEADERSHIP MANAGEMENT FOR BUSINESS L T P C
3 0 0 3

COURSE OBJECTIVES
• To develop and strengthen the Leadership qualities and motivation of learners.
• To impart the Leadership skills and traits essential to become successful entrepreneurs.
• To apply the principles and theories of Team Building in managing Technology oriented businesses.
• To empower the learners to build robust teams for running and leading a business efficiently and effectively

UNIT I INTRODUCTION TO MANAGING TEAMS
Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) - Multicultural Teams.

UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS
Team-based Organisations- Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III INTRODUCTION TO LEADERSHIP
Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership - Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT IV LEADERSHIP IN ORGANISATIONS

UNIT V LEADERSHIP EFFECTIVENESS

**TOTAL 45 : PERIODS**

**COURSE OUTCOMES:**
Upon completion of this course, the student should be able to:

**CO1** Learn the basics of managing teams for business.

**CO2** Understand developing effective teams for business management.

**CO3** Understand the fundamentals of leadership for running a business.

**CO4** Learn about the importance of leadership for business development.

**CO5** Acquaint with emerging trends in leadership effectiveness for entrepreneurs.”

**REFERENCES :**

**CMG339 CREATIVITY & INNOVATION IN ENTREPRENEURSHIP**

**COURSE OBJECTIVES**

- To develop the creativity skills among the learners
- To impart the knowledge of creative intelligence essential for entrepreneurs
- To know the applications of innovation in entrepreneurship.
- To develop innovative business models for business.

**UNIT I CREATIVITY**

Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment-Creative Technology- Creative Personality and Motivation.

**UNIT II CREATIVE INTELLIGENCE**

Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training- Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

**UNIT III INNOVATION**


**UNIT IV INNOVATION AND ENTREPRENEURSHIP**

UNIT V INNOVATIVE BUSINESS MODELS
TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO1 Learn the basics of creativity for developing Entrepreneurship
CO2 Understand the importance of creative intelligence for business growth
CO3 Understand the advances through Innovation in Industries
CO4 Learn about applications of innovation in building successful ventures
CO5 Acquaint with developing innovative business models to run the business efficiently and effectively

Suggested Readings:
Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.
UNIT IV  PROMOTION AND DISTRIBUTION MANAGEMENT  9
Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) -
Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal
Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics
Management- Introduction to Retailing and Wholesaling.

UNIT V  CONTEMPORARY ISSUES IN MARKETING MANAGEMENT  9
Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship
Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer
Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business
Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing -
E-Marketing or Online Marketing.

TOTAL 45 : PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to :
CO1 Have the awareness of marketing management process
CO2 Understand the marketing environment
CO3 Acquaint about product and pricing strategies
CO4 Knowledge of promotion and distribution in marketing management.
CO5 Comprehend the contemporary marketing scenarios and offer solutions to marketing
issues.

REFERENCES:
3 Marketing Management- An Indian perspective, Vijay Prakash Anand, Biztantra, Second edition,
2016.
4. Marketing Management Global Perspective, Indian Context, V.S.Ramaswamy & S.Namakumari,

CMG341  HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To introduce the basic concepts, structure and functions of human resource management for
entrepreneurs.
- To create an awareness of the roles, functions and functioning of human resource
department.
- To understand the methods and techniques followed by Human Resource Management
practitioners.

UNIT I  INTRODUCTION TO HRM  9
Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles-
Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit -
Challenges in HRM.

UNIT II  HUMAN RESOURCE PLANNING  9
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation-
Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR -
Recent Trends

UNIT III  RECRUITMENT AND SELECTION  9
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment -
Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.
UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT

UNIT V CONTROLLING HUMAN RESOURCES

COURSE OUTCOMES:
Upon completion of this course the learners will be able:

CO1 To understand the Evolution of HRM and Challenges faced by HR Managers

CO2 To learn about the HR Planning Methods and practices.

CO3 To acquaint about the Recruitment and Selection Techniques followed in Industries.

CO4 To known about the methods of Training and Employee Development.

CO5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES

CMG342 FINANCING NEW BUSINESS VENTURES

COURSE OBJECTIVES
- To develop the basics of business venture financing.
- To impart the knowledge essential for entrepreneurs for financing new ventures.
- To acquaint the learners with the sources of debt and quity financing.
- To empower the learners towards fund rasiing for new ventures effectively.

UNIT I ESSENTIALS OF NEW BUSINESS VENTURE

UNIT II INTRODUCTION TO VENTURE FINANCING

UNIT III SOURCES OF DEBT FINANCING

UNIT IV SOURCES OF EQUITY FINANCING
Own Capital, Unsecured Loan - Government Subsidies , Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.
UNIT V METHODS OF FUND RAISING FOR NEW VENTURES


TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students should be able to:

CO1 Learn the basics of starting a new business venture.

CO2 Understand the basics of venture financing.

CO3 Understand the sources of debt financing.

CO4 Understand the sources of equity financing.

CO5 Acquaint with the methods of fund raising for new business ventures.

REFERENCES:
1) Principles of Corporate Finance by Brealey and Myers et al.,12th ed, McGraw Hill Education (India) Private Limited, 2018

VERTICAL 3: PUBLIC ADMINISTRATION

CMG343 PRINCIPLES OF PUBLIC ADMINISTRATION L T P C
3 0 0 3

UNIT I
1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration

UNIT II
1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT III
1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT IV
1. Bureaucratic Approach: Max Weber
2. Human Relations Approach: Elton Mayo
3. Ecological Approach: Riggs

UNIT V
1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers

TOTAL: 45 PERIODS

REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

CMG344  
CONSTITUTION OF INDIA

UNIT I
1. Constitutional Development Since 1909 to 1947
3. Constituent Assembly

UNIT II
1. Fundamental Rights
2. Fundamental Duties
3. Directive Principles of State Policy

UNIT III
1. President
2. Parliament
3. Supreme Court

UNIT IV
1. Governor
2. State Legislature
3. High Court

UNIT V
1. Secularism
2. Social Justice
3. Minority Safeguards

TOTAL: 45 PERIODS

REFERENCES:
3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi

CMG345  
PUBLIC PERSONNEL ADMINISTRATION

UNIT I

351
1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

UNIT II
1. Generalist Vs Specialist
2. Civil Servants’ Relationship with Political Executive
3. Integrity in Administration.

UNIT III
1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

UNIT IV
1. All India Services
2. Service Conditions
3. State Public Service Commission

UNIT V
1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

REFERENCES:
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations

TOTAL: 45 PERIODS
Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard, Peter Drucker

TOTAL: 45 PERIODS

REFERENCES:
1. Crozior M: The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis: Organization Theory (MAC)

UNIT I
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV
Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V
Corruption – Ombudsman, Lok Pal & Lok Ayuktha

TOTAL: 45 PERIODS

REFERENCES:
1. S.R. Maheswari: Indian Administration
2. Khera, S.S: Administration in India
3. Ramesh K. Arora: Indian Public Administration
4. T.N. Chaturvedi: State administration in India
5. Basu, D.D: Introduction to the Constitution of India

UNIT I

UNIT II
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System’s Approach – Dror’s Optimal Model

UNIT III

TOTAL: 45 PERIODS
UNIT IV
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT V
Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

TOTAL: 45 PERIODS

REFERENCES:
4. Pradeep Saxena : Public Policy Administration and Development

VERTICAL 4: BUSINESS DATA ANALYTICS

CMG349 STATISTICS FOR MANAGEMENT  L T P C 3 0 0 3

COURSE OBJECTIVE:
• To learn the applications of statistics in business decision making.

UNIT I INTRODUCTION  9
Basic definitions and rules for probability, Baye’s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION  9
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETRIC TESTS  9
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS  9

UNIT V CORRELATION AND REGRESSION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 To facilitate objective solutions in business decision making.
CO2 understand and solve business problems
CO3 To apply statistical techniques to data sets, and correctly interpret the results.
CO4 To develop skill-set that is in demand in both the research and business environments
CO5 To enable the students to apply the statistical techniques in a work setting.

REFERENCES:

CMG350 DATAMINING FOR BUSINESS INTELLIGENCE L T P C 3 0 0 3

COURSE OBJECTIVES:
- To know how to derive meaning form huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.

UNIT I INTRODUCTION
Data mining, Text mining, Web mining, Data warehouse.

UNIT II DATA MINING PROCESS
Datamining process – KDD, CRISP-DM, SEMMA
Prediction performance measures

UNIT III PREDICTION TECHNIQUES
Data visualization, Time series – ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES
Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI
Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Learn to apply various data mining techniques into various areas of different domains.
CO2 Be able to interact competently on the topic of data mining for business intelligence.
CO3 Apply various prediction techniques.
CO4 Learn about supervised and unsupervised learning technique.
CO5 Develop and implement machine learning algorithms

REFERENCES:
1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
7. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011
9. Elizabeth Vitt, Michael Lukevich Stacia Misner, Business Intelligence, Microsoft, 2011
COURSE OBJECTIVES:

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I  INTRODUCTION TO HR ANALYTICS
People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II  HR ANALYTICS I: RECRUITMENT
Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.

UNIT III  HR ANALYTICS - TRAINING AND DEVELOPMENT
Training & Development Metrics : Percentage of employees trained- Internally and externally trained - Training hours and cost per employee - ROI.

UNIT IV  HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION
Employee Engagement Metrics : Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V  HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT
Workforce Diversity and Development Metrics : Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

COURSE OUTCOMES:

CO1 The learners will be conversant about HR metrics and ready to apply at work settings.
CO2 The learners will be able to resolve HR issues using people analytics.

REFERENCES:

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<td>CMG352</td>
<td>MARKETING AND SOCIAL MEDIA WEB ANALYTICS</td>
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**COURSE OBJECTIVE:**
- To showcase the opportunities that exist today to leverage the power of the web and social media

**UNIT I MARKETING ANALYTICS**
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

**UNIT II COMMUNITY BUILDING AND MANAGEMENT**
History and Evolution of Social Media - Understanding Science of Social Media - Goals for using Social Media - Social Media Audience and Influencers - Digital PR - Promoting Social Media Pages - Linking Social Media Accounts - The Viral Impact of Social Media.

**UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS**
Social Media Policies - Etiquette, Privacy - ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

**UNIT IV WEB ANALYTICS**
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

**UNIT V SEARCH ANALYTICS**
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

**COURSE OUTCOME:**
- The Learners will understand social media, web and social media analytics and their potential impact.

**REFERENCES:**
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress, 2004

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<td>CMG353</td>
<td>OPERATION AND SUPPLY CHAIN ANALYTICS</td>
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COURSE OBJECTIVE:

- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I
INTRODUCTION

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

UNIT II
WAREHOUSING DECISIONS

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III
INVENTORY MANAGEMENT

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV
TRANSPORTATION NETWORK MODELS


UNIT V
MCDM MODELS

Analytic Hierarchy Process (AHP), Data Envelopment Analysis (DEA), Fuzzy Logic and Techniques, the analytical network process (ANP), TOPSIS.

TOTAL: 45 PERIODS

COURSE OUTCOME:

CO1 To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:

UNIT II FINANCIAL MARKET ANALYSIS 9
Estimation and prediction of risk and return (bond investment and stock investment) – Time series- examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS 9
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS 9

UNIT V CREDIT RISK ANALYSIS 9
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

COURSE OUTCOME
CO1 The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

COURSE OBJECTIVE:
- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS 9

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING 9
Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

UNIT III  SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES

UNIT IV  SUSTAINABLE CONSTRUCTION MATERIALS

UNIT V  SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS

TOTAL: 45 PERIODS

COURSE OUTCOME:
On completion of the course, the student is expected to be able to

CO1 Understand the environment sustainability goals at global and Indian scenario.
CO2 Understand risks in development of projects and suggest mitigation measures.
CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:
5. New Building Materials and Construction World magazine
7. Munier N, "Introduction to Sustainability", Springer2005

CO’s- PO’s & PSO’s MAPPING

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CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT

COURSE OBJECTIVES:
- To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS
- Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT
- Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT
- Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT
- Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture
UNIT V  EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS
Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

COURSE OUTCOME
• On completion of the course, the student is expected to be able to
CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture
CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources
CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

REFERENCES:
1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020

CO’s- PO’s & PSO’s MAPPING

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1 – Low; 2 – Medium; 3 – High; ‘-‘ – No correlation

CES333  SUSTAINABLE BIOMATERIALS  L T P C
3 0 0 3

COURSE OBJECTIVES
• To impart knowledge of biomaterials and their properties
• To learn about Fundamentals aspects of Biopolymers and their applications
• To learn about bioceramics and biopolymers
• To introduce the students about metals as biomaterials and their usage as implants
• To make the students understand the significance of bionanomaterials and its applications.

UNIT I  INTRODUCTION TO BIOMATERIALS  9

UNIT II BIO POLYMERS
Molecular structure of polymers -Molecular weight - Types of polymerization techniques—Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Poly(methyl methacrylate) (PMMA)-Poly(lactic acid) (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethane- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III BIO CERAMICS AND BIOCOMPOSITES
General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon- Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites-Polymer Matrix Composite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)–glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV METALS AS BIOMATERIALS
Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V NANOBiomaterials

TOTAL : 45 PERIODS

COURSE OUTCOMES
CO1 Students will gain familiarity with Biomaterials and they will understand their importance.
CO2 Students will get an overview of different biopolymers and their properties
CO3 Students gain knowledge on some of the important Bioceramics and Biocomposite materials
CO4 Students gain knowledge on metals as biomaterials
CO5 Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES
6. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018
COURSE OBJECTIVES

- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I  SUSTAINABLE ENERGY SOURCES  9
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II  ELECTROCHEMICAL DEVICES  9
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O₂ battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO₂, LiFePO₄, LiMn₂O₄) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III  FUEL CELLS  9

UNIT IV  PHOTOVOLTAICS  9

UNIT V  SUPERCAPACITORS  9
Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs
composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES**

**CO1** Students will acquire knowledge about energy sustainability.

**CO2** Students understand the principles of different electrochemical devices.

**CO3** Students learn about the working of fuel cells and their application.

**CO4** Students will learn about various Photovoltaic applications and the materials used.

**CO5** The students gain knowledge on different types of supercapacitors and the performance of various materials

**REFERENCES**

5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

**CES335 GREEN TECHNOLOGY L T P C**

**3 0 0 3**

**COURSE OBJECTIVE:**

- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

**UNIT I ** PRINCIPLES OF GREEN CHEMISTRY

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

**UNIT II ** POLLUTION TYPES

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

**UNIT III ** GREEN REAGENTS AND GREEN SYNTHESIS

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

**UNIT IV ** DESIGNING GREEN PROCESSES

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention
UNIT V GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5: To understand advanced technology in green synthesis

TEXT BOOKS

REFERENCE
1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

CES336 ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS

COURSE OBJECTIVES:
- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I: ENVIRONMENTAL MONITORING AND STANDARDS

UNIT II: MONITORING OF ENVIRONMENTAL PARAMETERS

UNIT III: ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING
Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV : ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISKASSESSMENT
UNIT V: AUTOMATED DATA ACQUISITION AND PROCESSING

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks - Sensors and transducers - classification of transducers - data acquisition system - types of data acquisition systems - data management and quality control; regulatory overview.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students will know

CO1 Basic concepts of environmental standards and monitoring.
CO2 the ambient air quality and water quality standards;
CO3 the various instrumental methods and their principles for environmental monitoring
CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 the various ways of raising environmental awareness among the people.
CO6 Know the standard research methods that are used worldwide for monitoring the environment.

TEXTBOOKS
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc

REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

CO's- PO's & PSO's MAPPING

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CES337 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

COURSE OBJECTIVES:
- To create awareness on the energy scenario of India with respect to world
- To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
- Familiarisation on the concept of sustainable development and its benefits
- Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development
- Acquainting with energy policies and energy planning for sustainable development
UNIT I  ENERGY SCENARIO 9
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II  ENERGY AND ENVIRONMENT 9
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III  SUSTAINABLE DEVELOPMENT 9

UNIT IV  RENEWABLE ENERGY TECHNOLOGY 9

UNIT V  ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1 Understand the world and Indian energy scenario
CO2 Analyse energy projects, its impact on environment and suggest control strategies
CO3 Recognise the need of Sustainable development and its impact on human resource development
CO4 Apply renewable energy technologies for sustainable development
CO5 Fathom Energy policies and planning for sustainable development.

REFERENCES:
7. https://www.niti.gov.in/verticals/energy

CES338  ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT  L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
• To create awareness on energy audit and its impacts
• To acquaint the techniques adopted for performance evaluation of thermal utilities
• To familiarise on the procedures adopted for performance evaluation of electrical utilities
• To learn the concept of sustainable development and the implication of energy usage

UNIT I  ENERGY AND ENVIRONMENT  9
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II  ENERGY AUDITING  9
Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III  ENERGY EFFICIENCY IN THERMAL UTILITIES  9
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV  ENERGY CONSERVATION IN ELECTRICAL UTILITIES  9
Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V  SUSTAINABLE DEVELOPMENT  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1 Understand the prevailing energy scenario
CO2 Familiarise on energy audits and its relevance
CO3 Apply the concept of energy audit on thermal utilities
CO4 Employ relevant techniques for energy improvement in electrical utilities
CO5 Understand Sustainable development and its impact on human resource development

REFERENCES: