PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

- **PEO1**: Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards
- **PEO2**: Expertise in the area of Thermal, Chemical Reactions, Structural Stability, Environmental Impacts
- **PEO3**: Practice their Professions through evaluation, communications, ethics and social responsibility

PROGRAM COURSE OUTCOMES (POs):

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<td>1</td>
<td><strong>Engineering knowledge</strong>: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
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<tr>
<td>2</td>
<td><strong>Problem analysis</strong>: 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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<tr>
<td>3</td>
<td><strong>Design/development of solutions</strong>: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.</td>
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<td><strong>Conduct investigations of complex problems</strong>: 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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<tr>
<td>5</td>
<td><strong>Modern tool usage</strong>: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.</td>
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<td>6</td>
<td><strong>The engineer and society</strong>: 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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<td><strong>Environment and sustainability</strong>: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
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<td><strong>Ethics</strong>: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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<td><strong>Individual and team work</strong>: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
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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)

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<td>Analyse and assess fire safety of buildings and industries to design and specify fire protection systems.</td>
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<tr>
<td>PSO2</td>
<td>Assess hazards and risks in process and manufacturing industries and devise remedial measures and safety management systems.</td>
</tr>
<tr>
<td>PSO3</td>
<td>Assess the occupational health and environmental issues associated with industrial and other activities to design control measures with traditional and modern computational tools based on codes and statutes.</td>
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PEO’s – PO’s & PSO’s MAPPING:

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$§$Skill Based Course

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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.

$§$ Skill Based Course
### SEMESTER III

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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 MCI)

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

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

* 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.

**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: 163**
## ELECTIVE – MANAGEMENT COURSES

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*Mandatory Courses are offered as Non-Credit courses

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

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<td>HEALTH AND RADIATION SAFETY</td>
<td>SAFETY IN INDUSTRIES</td>
<td>ENVIRONMENTAL SAFETY ENGINEERING</td>
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<td>Process Instrumentation and Control</td>
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<td>First Aid and Emergency Procedures</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)
**VERTICAL 1: HAZARD MANAGEMENT AND SAFETY STANDARD**

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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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</table>
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.

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 of Regulations 2021.

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

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
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<td><strong>Fintech and Block Chain</strong></td>
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<td><strong>Public Administration</strong></td>
<td><strong>Business Data Analytics</strong></td>
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<td>Statistics for Management</td>
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<td>Team Building and Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining for Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
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<td>Banking, Financial Services and Insurance</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
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<td>Introduction to Blockchain and Its Applications</td>
<td>Principles of Marketing Management for Business</td>
<td>Administrative Theories</td>
<td>Marketing and Social Media Web Analytics</td>
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<td>Indian Administrative System</td>
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<td>Integrated Energy Planning for Sustainable Development</td>
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<td>-</td>
<td>-</td>
<td>Energy Efficiency for Sustainable Development</td>
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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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**VERTICAL 2: ENTREPRENEURSHIP**

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### VERTICAL 4: BUSINESS DATA ANALYTICS

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## VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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<td>4</td>
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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 under privileged.

(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
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: Why/ 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; instructions; 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.
LEARNING OUTCOMES:
At the end of the course, learners will be able
- To use appropriate words in a professional context
- To gain understanding of basic grammatical structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To read and interpret information presented in tables, charts and other graphic forms
- 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)
   Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

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

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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 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

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


TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

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:

PH3151 ENGINEERING PHYSICS L T P C 3 0 0 3

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
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
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
- Understand the importance of mechanics.
- Express their knowledge in electromagnetic waves.
- Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
- Understand the importance of quantum physics.
- 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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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

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of the course, the students will be able:

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selection requirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

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GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING

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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 तमिळ மரம் L T P C 1 0 0 1

அலகு I மரபு மரம் என்று: 3
தமிழ் பொருளிகள் ஒப்பப்பட்டு – நிலைத் தமிழில் - முதல் தொட பத்ரமணம் – முதல் வடிவமைக்கப்பட்டு - கருத்து குறிப்பிட்டு சமஸ் ரவுப்பு தரவு – தம் வடிவமைத்து பார்வை உருவ – நிலைத் தமிழில் மூன்றாம்கம் கதைக்கதைகள் – பொருளிகள் கருத்து வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டுசியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் கருத்து பட்டியல் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு ப

அலகு II மரம் - பொருள் கதைக்கதை - முதல் தொடாம் கதைக்கதை - பதாம் கருத்து குறிப்பிட்டு பாயிற்று முதல் பாயிற்று கருத்து பட்டியல், முதலிலும் கருத்து சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு பகுதியில் - கருத்து குறிப்பிட்டு வருவாக சேவைத் தரவு ப

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அருக்கு மருத்துவத்தில் பொட்டியும் இந்திய அலகுக் கடல்கடந்த நகரங்களும் அறக்கமொடு தலக்கியத்தில் தமிழகத்தின் அலகு கூத்து ததருக்கூத்து அலகு தமிழர்களின் சிமலசுடுமண் அவர்கள் நடுகல்

அண்டி III  நிலைப்புற கல்விகள் மற்றும் நார் வரலைவுகள்: 3
(ஏழுகுத்து, கர்த்தரம்ம, கர்த்தராஜ், வாரிணிகம், தொவரங்கள் கேமை, விழாமாளம், விழாமாளம், தென்றுள்ளூர் வரலைவுகள்)

அண்டி IV  வரலைவுக் கிளைகள் வரலைவுகள்: 3
(லைக்குப் பார்த்தும் கிளைகள் - சமையலப் பண்பு அகத்தும் தமிழகத்தின் வரலைவு - தனிக்குப் பார்த்தும் கிளைகள் வரலைவு, கணியொன் கருகொட்டம் குது வலிக்குறுத்து - சங்கத்தக்குள் எண்ணன் மனம் இறக்கும் - கல்விகள் சிலம்பொட்டம் வரலைவு.)

அண்டி V  முழுமையான தோராய நூற்றாண்டு மன்மை பரப்பாற்றக்கூட்டு கிளைகளில் பொட்டியும்: 3
(முழுமையான பரப்பாற்றக்கூட்டு கிளைகளில் பார்த்தும் - கிளைகளில் பிளவுகின்று சிலம்பொட்டம் நாகம் - கைப்பார்வைகள் தமிழாகம் - கைப்பார்வைகள், எமூகம் பக்கத்தியவுக்கு நேர்மை வங்குல்லின்)

TEXT-CUM-REFERENCE BOOKS
1. தென்மையான மன்மை - லைக்கு பார்த்து மன்மை - தொகை (சின்னீஸ்: தென்மையான மன்மை லைக்கு பார்த்து மன்மை).
2. கால்கவுரை சுமை - சுமையில் விளை தோளம். (சின்னீஸ்: பெசியீச்).
3. சுமை - சுமையில் எடுத்துக் கொள்ளுவது என்று என்று சுமையில் (சின்னீஸ்: சுமை எடுத்துக்கொள்ளுவது).
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)

GE3152 HERITAGE OF TAMILS L T P C
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, Leather puppetry, 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.

TEXT-CUM-REFERENCE BOOKS

1. தமிழ் மொழியின் தனிஃப்பு - அர்த்தமான பட்டமரியல் - தொகுக்கொல (சுந்தரம்: தமிழ் மொழியின் தனிஃப்பு - அர்த்தமான பட்டமரியல்) (சுந்தரம்: தமிழ் மொழியின் தனிஃப்பு - அர்த்தமான பட்டமரியல்).
2. தொகுக்கொல்லுக்கு தமிழ் - இராச்சிய வித்யாசம். (சிவாலியர் பிரசுரம்).
3. தமிழ் - கூட்டம்: பதப்புத்தரப்பு - செய்யுத்தரம் கோலைய தலைக்குடிவு (சிவாலியர் பிரசுரம் கோலைய தலைக்குடிவு).
4. பாராமையும் - அவ்வாராமையும் தாக்குக்குடிவு. (தமிழில்லியர் கோலைய தலைக்குடிவு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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TOTAL : 15 PERIODS
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/

COs- PO’s & PSO’s MAPPING

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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
- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.

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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 (TiO$_2$/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

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

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

GE3172  ENGLISH LABORATORY  L T P C  0 0 2 1

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  6
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 6
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 6
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 6
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 6
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
• To listen to and comprehend general as well as complex academic information
• To listen to and understand different points of view in a discussion
• To speak fluently and accurately in formal and informal communicative contexts
• To describe products and processes and explain their uses and purposes clearly and
accurately
• 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.

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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.
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  6
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 – Error correction; 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.

OUTCOMES:

At the end of the course, learners will be able
- To compare and contrast products and ideas in technical texts.
- To identify and report cause and effects in events, industrial processes through technical texts.
- To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
- To present their ideas and opinions in a planned and logical manner.
- 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.

CO-PO & PSO 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.

MA3251 STATISTICS AND NUMERICAL METHODS

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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:

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

TEXT BOOKS:

REFERENCES:
PH3251 MATERIALS SCIENCE  L T P C 3 0 0 3

COURSE OBJECTIVES:

- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I  CRYSTALLOGRAPHY  9

UNIT II  ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS  9

UNIT III  SEMICONDUCTORS AND TRANSPORT PHYSICS  9

UNIT IV  OPTICAL PROPERTIES OF MATERIALS  9

UNIT V  NANOELECTRONIC DEVICES  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the students should be able to
• know basics of crystallography and its importance for varied materials properties
• gain knowledge on the electrical and magnetic properties of materials and their applications
• understand clearly of semiconductor physics and functioning of semiconductor devices
• understand the optical properties of materials and working principles of various optical devices
• appreciate the importance of functional nanoelectronic devices.

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 the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I  ELECTRICAL CIRCUITS
- DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Independent and Dependent Sources – 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)

UNIT II  ELECTRICAL MACHINES

UNIT III  ANALOG ELECTRONICS

UNIT IV  DIGITAL ELECTRONICS
- Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V  MEASUREMENTS AND INSTRUMENTATION

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

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GE3251

ENGINEERING GRAPHICS
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

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  6 +12
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  6+12
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
• Use BIS conventions and specifications for engineering drawing.
• Construct the conic curves, involutes and cycloid.
• Solve practical problems involving projection of lines.
• Draw the orthographic, isometric and perspective projections of simple solids.
• 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.

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

GE3252 தொல்லியல் வகைப்பாடுப் பொருட்கள் குறியீடுகள்: 3
அலகு I கட்டுமான வடிவமப்பு மற்றும் கட்டிடமதொழில்நுட்பம்:
3
சின்ன காட்சிகள் வடிவமப்பு கட்டுமானம் - பலகை வடிவமப்பு கட்டிடமதொழில்நுட்பம் - கட்டுமான ரீதியான பன்னாட்டு கட்டிடமதொழில்நுட்பம் - காட்டுமான வடிவமப்பு காட்சிகளும், காட்டுமான வடிவமப்பு காட்சிகளில் பயணத்தை பின்பு பொறுப்புகள் துறையும் - காட்டுமான காட்சிகள் - காட்சிகள் காட்கொலையங்கள் - மொதிரி கட்டமைப்புப்

அலகு II ஆலையங்குக்கு முன்பான கட்டுமான வடிவமப்பு:
3
சின்ன காட்சிகள் ஆலையங்குக்கு முன்பான கட்டுமானத் துறையும் கட்டுமானத் துறையும் வடிவமப்பு கட்டுமானம் - காட்சிகள் கட்டுமான வடிவமப்பு காட்சிகளும் - மொதிரி கட்டமைப்புத்

L T P C C 1 0 0 1
அறிவியல் தமிழ் மற்றும் கைித்தமிழ்:

3 அறிவியல் தமிழின் வளர்சி – கணித்தமிழ் வளர்சி – தமிழ் நூல்கள் மின்பதியில்

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலை – மக்களும் பண்புடம் – த.க. பிரதான. (தமிழில்: தமிழ்ப் பாடல் பண்பிள்

2. கல்வித் தமிழ் – புத்தாண்டு தோ. குழந்தை. (தமிழ் பிரதான).

3. முன்னம் – தமிழக பிறகுவன் கதாக்காரன் சிறு தருணம் (தொல்லியல் தமிழ் பிறந்தோட பிரதான).

4. பிறந்தோட – அறிவியல் கைித்தமிழ். (தொல்லியல் தமிழ் பிரதான).

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)


TOTAL : 15 PERIODS
GE3252 TAMILS AND TECHNOLOGY

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.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

TEXT-CUM-REFERENCE BOOKS
1. சிற்பம் மற்றும் மறைவு – மாணாரம் மறைவு – மாணாரம் மறைவு (தமிழுடைய  சிற்பம் மற்றும் பாரமேசம் பாரம்மேசம்).
2. முடிந்தை தமிழ் – முடிந்தை முடிந்தை. (தீர்த்த முடிந்தை).
3. சிற்பம் – சிற்பம் மறைவு – சிற்பம் மறைவு (தமிழுடைய  சிற்பம் மறைவு).
4. வரலொறு பொடும் – வரலொறு பொடும். (தமிழுடைய  பொடும் பொடும்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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TOTAL : 15 PERIODS
# NCC CREDIT COURSE LEVEL 1*

**NX3251**  
**ARMY WING**  
**NCC CREDIT COURSE LEVEL - I**  

<table>
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<td>Aims, Objectives &amp; Organization of NCC</td>
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<td>Incentives</td>
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<td>NCC 3</td>
<td>Duties of NCC Cadet</td>
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<tr>
<td>NCC 4</td>
<td>NCC Camps: Types &amp; Conduct</td>
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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  

**TOTAL: 30 PERIODS**

---

## 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  

#### NI 3  
Unity in Diversity & Role of NCC in Nation Building

**TOTAL: 30 PERIODS**

---

## 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  

#### PD 1  
Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving

**TOTAL: 30 PERIODS**

---

## LEADERSHIP

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

#### L 1  
Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code

**TOTAL: 30 PERIODS**

---

## 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  

#### SS 1  
Basics, Rural Development Programmes, NGOs, Contribution of Youth

**TOTAL: 30 PERIODS**
NCC CREDIT COURSE LEVEL 1*

NX3252

(NAVAL WING) NCC CREDIT COURSE LEVEL - I

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53
### NCC CREDIT COURSE LEVEL 1*

**NCC CREDIT COURSE LEVEL – I**

**NX3253**

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**TOTAL : 30 PERIODS**
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. 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.
2. Wiring various electrical joints in common household electrical wire work.
3. 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.
4. 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:
   a) 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

   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/quadrac)
   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 air conditioner.

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:
1. Draw pipe line plan; 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.
2. Wire various electrical joints in common household electrical wire work.
3. 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.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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</table>
BE3271  BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY  
L T P C  
0 0 4 2

COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

LIST OF EXPERIMENTS
1. Verification of ohms and Kirchhoff’s Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Use experimental methods to verify the Ohm’s and Kirchhoff’s Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

Mapping of COs with POs and PSOs

<table>
<thead>
<tr>
<th>COs/POs&amp;P</th>
<th>SOs</th>
<th>1</th>
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1 – Slight, 2 – Moderate, 3 – Substantial
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 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

- Speak effectively in group discussions held in a formal/semi formal contexts.
- Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions.
- Write emails, letters and effective job applications.
- Write critical reports to convey data and information with clarity and precision.
- 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.

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### MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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**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**

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**

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**

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**


**UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS**


**TOTAL: 60 PERIODS**

**OUTCOMES:**
Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- 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.
• Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

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ME3351 ENGINEERING MECHANICS L T P C 3 0 0 3

COURSE OBJECTIVES:
1. To Learn the use scalar and vector analytical techniques for analyzing forces in statically determinate structures
2. To introduce the equilibrium of rigid bodies, vector methods and free body diagram
3. To study and understand the distributed forces, surface, loading on beam and intensity.
4. 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.
5. To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I STATICS OF PARTICLES 9

UNIT II EQUILIBRIUM OF RIGID BODIES 9
Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point, Varignon’s Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis,
Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given
Force into a Force - Couple system, Further Reduction of a System of Forces, Equilibrium in Two
and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 9
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 FRICTION 9
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction,
Rolling Resistance, Ladder friction.

UNIT V DYNAMICS OF PARTICLES 9
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics - Newton’s Second Law
of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a
Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and
Momentum, Impact of bodies.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Illustrate the vector and scalar representation of forces and moments
2. Analyse the rigid body in equilibrium
3. Evaluate the properties of distributed forces
4. Determine the friction and the effects by the laws of friction
5. Calculate dynamic forces exerted in rigid body

TEXTBOOKS:
1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi,
   Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education.,

REFERENCES:
1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning,
   2008.

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Low (1) : Medium (2) : High (3)
COURSE OBJECTIVES:

1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions.
2. To impart basic knowledge of the dynamics of fluids and boundary layer concept.
3. 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.
4. To exposure to the significance of boundary layer theory and its thicknesses.
5. To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold’s transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II FLOW THROUGH PIPES AND BOUNDARY LAYER 9+3
Reynold’s Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV TURBINES 9+3

UNIT V PUMPS 9+3
Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies – Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it’s variations - Work saved by fitting air vessels - Rotary pumps.

OUTCOMES:
On completion of the course, the student is expected to be able to
1. Understand the properties and behaviour in static conditions. Also to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
2. Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also to understand the concept of boundary layer and its thickness on the flat solid surface.
3. Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
4. Explain the working principles of various turbines and design the various types of turbines.
5. Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps.

TOTAL: 60 PERIODS
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Low (1); Medium (2); High (3)

SF3301 PRINCIPLES OF SAFETY MANAGEMENT

COURSE OBJECTIVES:
1. Understanding of the principles of safety management.
2. Enable the students to learn about various functions and activities in organization.
3. Enable students to conduct safety audit and write audit report effectively in auditing situations.
4. Have knowledge about sources of information for safety promotion and training.
5. Familiarize students with evaluation of safety performance.

UNIT I INTRODUCTION AND NEEDS OF SAFETY

UNIT II SAFETY ORGANIZATION INTRODUCTION
UNIT III       SAFETY EDUCATION AND TRAINING


UNIT IV       SAFETY PERFORMANCE MONITORING


UNIT V        ACCIDENT INVESTIGATION AND REPORTING


TOTAL : 45 PERIODS

OUTCOMES

Students able to know
CO 1 To understand the functions and activities of safety engineering department.
CO 2 To carry out a safety audit and prepare a report for the audit.
CO 3 To prepare an accident investigation report.
CO 4 To estimate the accident cost using supervisors report and data.
CO 5 To identify various agencies, support in situations and government organizations involved in safety training and promotion

TEXTBOOKS


REFERENCES:


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COURSE OBJECTIVES:

1. Understand the basic principles of operation of rotating electric machines (Generators and Motors), their classification and basic efficiency and performance characteristics.
2. Brief the legislative requirements for electrical safety- national/international laws/codes of practices/ standards and/or regulations.
3. Use a “Status Check” survey to assess the facility’s electrical safety program and where necessary develop strategies for improvement.
4. Identify persons who may be exposed to a source of electrical energy directly or indirectly.
5. Describe the essential parts of a Flash Hazard Analysis and list the data required analysis.

UNIT I
ELEMENTARY IDEAS OF DC MACHINES, TRANSFORMERS AND RELAYS9

UNIT II
SYNCHRONOUS, INDUCTION MOTOR, AND THEIR ELECTRICAL CIRCUIT BREAKERS

UNIT III
ELECTRICAL GROUNDING, EARTHLING AND INSULATION

UNIT IV
SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE

UNIT V
ELECTRICITY AND FIRE SAFETY
power factor improvement – equipments – Importance of P.F. improvement – Disadvantages of low power factor – Causes of low P.F. – Personal Protective equipments (PPE’s) used in connection with safe use of electricity like Hand Gloves, Rubber Shoes, Waist belt, , earthing rod, Goggles etc., Safe working clearances for different voltage levels, fire extinguishers used for different applications, knowledge of Static electricity, Lightning protection, Electrical Safety Audit, elementary knowledge of first aid.

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Students able to
CO 1 Explain Indian electricity rules and acts and their significance
CO 2 Understand the need of electrical safety in different locations
CO 3 Understand the need of electrical safety during installation of equipment's
CO 4 Explain the necessity of electrical safety in Hazardous zones
CO 5 Understand electrical safety in distributed systems

TEXT BOOKS:

REFERENCES:

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SF3303 PRINCIPLES OF CHEMICAL ENGINEERING L T P C
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COURSE OBJECTIVES
Understand the overall view of the chemical engineering subjects

UNIT I
Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.

UNIT II
Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology;
Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III

Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flow sheet representation of process plants. Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry.

UNIT IV

Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and the reengineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering; Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V

Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

OUTCOMES

CO 1 On completion of the course, students will attain knowledge in fluid behavior and solid properties,

CO 2 Understand the concept of chemical engineering principles

TEXT BOOKS

1. SalilK. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw-Hill Education

REFERENCES


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SF3311  ELECTRICAL TECHNOLOGY LABORATORY  L T P C  0 0 4 2

COURSE OBJECTIVES:
1. Understand the laws governing electric circuits
2. Study the load and speed characteristics of D.C motors
3. Do load test on single phase transformer

LIST OF EXPERIMENTS
1. Verification of Kirchhoff’s Laws
2. Verification of Superposition Theorem
4. Measurement of power in an A.C. circuit by 3 ammeters and 3 voltmeter method
5. Load test on a DC series motor
6. Speed characteristics of DC shunt motor
7. Regulation of a Transformer
8. Load characteristics of a 3 phase induction motor
10. Study of insulation testing and ground testing.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course the student will be able to:
CO1: Understand the laws governing electric circuits
CO2: Study the load and speed characteristics of D.C motors
CO3: Do load test on single phase transformer
CO4: Study the load and speed characteristics of A.C motors
CO5: Understand the functions of protective relays and circuit breakers.
CO6: Impart knowledge on electric circuits, DC motors, single phase transformers, AC motors, Protective relays and circuit breakers.

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GE3361  PROFESSIONAL DEVELOPMENT  L T P C  0 0 2 1

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.

69
• 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:**

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  

**10 Hours**

**MS EXCEL:**

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  

**10 Hours**

**MS POWERPOINT:**

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  

**10 Hours**

**TOTAL: 30 PERIODS**

**OUTCOMES:**

On successful completion the students will be able to

• Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
• Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
• Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
OBJECTIVES

- To introduce the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To provide necessary basics in probability and random processes that are relevant in applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

UNIT I PROBABILITY AND RANDOM VARIABLES 9 + 3
Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT II TWO- DIMENSIONAL RANDOM VARIABLES 9 + 3
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III VECTOR SPACES 9 + 3
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION 9 + 3
Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors –Diagonalization.

UNIT V INNER PRODUCT SPACES 9 + 3
Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

TOTAL : 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non-trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

TEXT BOOKS

REFERENCES

SF3401 OCCUPATIONAL HEALTH AND HYGIENE

COURSE OBJECTIVES:
1. Anticipate, recognize, evaluate and control hazardous conditions and practices affecting people, property and the environment.
2. Communicate and interact effectively with technical and non-technical audiences.
3. Integrate ethical, social, current, and global issues and responsibilities in their practice as a professional in the field.
4. Work individually or on a team to critically analyze, interpret, and provide leadership to address and manage problems in occupational safety and health.
5. Recognize that the practice of occupational safety and health requires ongoing learning, and undertake appropriate activities to address this need.

UNIT I OCCUPATIONAL HAZARD AND CONTROL PRINCIPLES
Nine
Concept and spectrum of health functional units and activities of occupational health services occupational and work related disease Levels of prevention of diseases notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, and anthrax Lead-Nickel, chromium and manganese toxicity gas poisoning such as CO, ammonia, coal and dust , their effects and prevention Industrial toxicology local and systemic and chronic effects, temporary and cumulative effects - threshold limit values, calculation of TLVs - carcinogens, mutagens, teratogens. Instruments for Radiation detection and measurement. Early recognition of radiation hazard. Personal monitoring devices, Medical support. Hazards associated with the following radiations and preventive measures Laser, infra-red, ultra violet and ELF.

UNIT II PHYSICAL HAZARD MEASUREMENT, EVALUATION AND CONTROL
Nine
Recognition, evaluation and control of physical hazards. Vibration description and measurement of vibration. Vibration control methods. Effects of whole body vibration on human body and control measures. Noise noise measurement, evaluation, noise control methods hearing loss causes Biological effects of noise exposure. Thermal stress heat disorders and health effects such as heat exhaustion, hear cramp etc. WBGT index, acclimatization. Ventilation systems purpose of ventilation general principles ventilation requirements. Physiological and comfort level. Natural ventilation Dilution ventilation Mechanical ventilation Local exhaust ventilation Ventilation

UNIT III PRINCIPLES OF FIRST AID 9

UNIT IV FIRST-AID PRACTICE IN INDUSTRY 9

UNIT V OCCUPATIONAL AND PSYCHOLOGICAL HAZARDS 9

TOTAL: 45 PERIODS

OUTCOMES:
Students able to

CO 1 An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to occupational safety and health.

CO 2 An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.

CO 3 An ability to communicate effectively with a range of audiences.

CO 4 An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.

CO 5 An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

TEXT BOOKS:

REFERENCES:

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CE3491 STRENGTH OF MATERIALS

COURSE OBJECTIVES:
- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

UNIT III TORSION
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

UNIT IV DEFLECTION OF BEAMS

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame’s theory.
TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course the students would be able to
1. Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
2. Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
3. Apply basic equation of torsion in designing of shafts and helical springs
4. Calculate slope and deflection in beams using different methods.
5. Analyze thin and thick shells for applied pressures.

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SF3402 FIRE ENGINEERING AND PROTECTION L T P C

COURSE OBJECTIVES:
1. Anticipate, identify and evaluate hazardous conditions and practices.
2. Develop hazard control designs, methods, procedures, and programs.
3. Illustrate the basic concepts and techniques of modern reliability engineering tools.
4. To provide the students an illustration of significance of the Fire Engineering profession in the protection life, property and environment.
5. To understand the importance of life safety in building fire and method of evacuation.

UNIT I PROPERTIES OF COMBUSTION
Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition- pilot ignition, spontaneous ignition, Types of combustion- rapid, spontaneous, explosion; Development of fire- incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion.; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material.
UNIT II BEHAVIOUR OF BUILDING ELEMENTS UNDER ACTION OF FIRE

Product of combustion-flame, heat, smoke, fire gases; spread of fire in rooms and buildings; Effect of heat exposure to human body Smoke - constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, smoke movement in buildings, modeling of smoke movement; Smoke control in buildings natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design. Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO2, HCN, SO2, NH3, Nitrogen oxide.

UNIT III OPERATION HANDLING AND MAINTENANCE OF FIRE SERVICE EQUIPMENTS AND ACCESSORIES

Introduction to fire fighting vehicles and appliances- Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms - Delivery Hose, Hose reel, Hose fittings- coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants;; Ladders- Uses and maintenance of small gear and miscellaneous equipments used during fire fighting; Lamps and lighting sets; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.

UNIT IV HYDRAULIC SYSTEM

Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction; friction losses in pipes, fire hoses and fixtures, parallel and series connections; Flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics. Fire ground operations - preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.

UNIT V FIRE SUPPRESSION & PROTECTION

Introduction, Definitions, Water as an extinguishing agent, Basic Components of a Fire Protection system, Classification of fire protection systems-Active & Passive: Active FPS Definitions, classifications- Water Based (Vs) Non water based & Fixed (Vs) Portable/Mobile, Types:- Fire Extinguishers, Fire hydrants, Sprinklers, standpipe systems, Fire detectors, water spray systems - definitions, types, operation, applications & limitations, selection, installation & maintenance as per relevant national and international standards(IS, OISD, NFPA etc)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students able to
CO 1 Explain the basics of fire engineering.
CO 2 Classify the types of combustion and its products.
CO 3 Demonstrate the operation of fire service equipment’s and practical fire fighting.
CO 4 Categorize the buildings and design the evacuation methods
CO 5 Apply acquired knowledge on real life problems

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SF3403 SAFETY IN CONSTRUCTION

OBJECTIVES:
1. know causes of accidents related to construction activities and human factors associated with these accidents
2. Understand the construction regulations and quality assurance in construction
3. Have the knowledge in hazards of construction and their prevention methods
4. know the working principles of various construction machinery
5. gain knowledge in health hazards and safety in demolition work

UNIT I INTRODUCTION
Introduction to construction industry and safety issues in construction-Human factors in construction safety management- Roles of various groups and stakeholders in ensuring safety in construction industry-Framing of contract conditions on safety and related matters-Relevance of ergonomics in construction safety.

UNIT II SAFETY IN CONSTRUCTION OPERATIONS

UNIT III CONSTRUCTION MACHINERY

UNIT IV CONSTRUCTION ACT AND CODE OF PRACTICES
UNIT V  SAFETY IN DEMOLITION WORK  
Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision ,safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods–Case studies in construction sites against the fire accidents.

OUTCOMES
On completion of this course, the student will be able to
CO 1  Visualize the safety issues at different stages of construction activity.
CO 2  Understand the safety requirements in various construction operations and develop guidelines to ensure safety at construction site.
CO 3  Understand the safety requirements in material handling and equipment and develop guidelines to ensure safety at construction site.
CO 4  Learn the legal provisions with respect to the health and welfare of workers at construction site.
CO 5  List out construction regulations and Indian standards for construction and demolition work

TOTAL: 45 PERIODS

REFERENCES:
5. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules.

CO's- PO’s & PSO's MAPPING

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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

OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

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

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

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

REFERENCES:

CO-PO & PSO MAPPING

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#### PERSONALITY DEVELOPMENT  
9

#### LEADERSHIP  
7

| 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  
13

| 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 |

#### DISASTER MANAGEMENT  
13

| 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  
3

| EA 1 | Environmental Awareness and Conservation                            | 3 |

#### GENERAL AWARENESS  
4

| GA 1 | General Knowledge                                                  | 4 |

#### ARMED FORCES  
6

| AF 1 | Armed Forces, Army, CAPF, Police                                   | 6 |

#### ADVENTURE  
1

| AD 1 | Introduction to Adventure Activities                               | 1 |

#### BORDER & COASTAL AREAS  
2

| BCA 1 | History, Geography & Topography of Border/Coastal areas             | 2 |

**TOTAL: 45 PERIODS**

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

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<td>DM 1</td>
<td>Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation</td>
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<td>DM 2</td>
<td>Initiative Training, Organising Skills, Do's &amp; Don’t's, Natural Disasters, Man Made Disasters</td>
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<td>DM 3</td>
<td>Fire Service &amp; Fire Fighting</td>
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**ENVIRONMENTAL AWARENESS & CONSERVATION**

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<td>EA 1</td>
<td>Environmental Awareness and Conservation</td>
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**GENERAL AWARENESS**

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<td>GA 1</td>
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**GENERAL SERVICE KNOWLEDGE**

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<td>Armed Forces &amp; IAF Capsule</td>
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<td>Aircrafts - Types, Capabilities &amp; Role</td>
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**ADVENTURE**

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<td>Introduction to Adventure Activities</td>
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**BORDER & COASTAL AREAS**

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<td>BCA 1</td>
<td>History, Geography &amp; Topography of Border/Coastal areas</td>
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COURSE OBJECTIVES
1. Evaluate the different pollutants in the atmosphere using air sampling equipment.
2. Evaluate heat stress in industries.
3. Measure different physical hazards such as noise, illumination etc.

LIST OF EXPERIMENTS:
1. Study of Personal Protective equipment.
2. Study of occupational diseases with photographic models.
3. Demonstration of Air sampling equipment.
5. Sampling and estimation of dust using personal sampler.
8. Vision testing.
9. Lung functions testing.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course the student will be able to:
CO1: The students will be able to Study of Personal Protective equipment.
CO2: The students will be able to Study of occupational diseases with photographic models.
CO3: The students will be able to Measurement of Noise.
CO4: The students will be able to Measurement of illumination.
CO5: The students will be able to Measurement of thermal stress.

CO’s – PO’s & PSO’s MAPPING

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</table>
COURSE OBJECTIVE:
1. To study the mechanical properties of metals, wood and spring by testing in laboratory.
2. To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS 30

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY 30

LIST OF EXPERIMENTS
1. (a) Determination of coefficient of discharge of a venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the student is expected to be able to
1. Determine the tensile, torsion and hardness properties of metals by testing
2. Determine the stiffness properties of helical and carriage spring
3. Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
4. Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
5. Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.

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</table>

Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:

1. To illustrate the working principles of various metal casting processes.
2. To learn and apply the working principles of various metal joining processes.
3. To analyse the working principles of bulk deformation of metals.
4. To learn the working principles of sheet metal forming process.
5. To study and practice the working principles of plastics molding.

UNIT I METAL CASTING PROCESSES

UNIT II METAL JOINING PROCESSES

UNIT III BULK DEFORMATION PROCESSES

UNIT IV SHEET METAL PROCESSES

UNIT V MANUFACTURE OF PLASTIC COMPONENTS

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Explain the principle of different metal casting processes.
2. Describe the various metal joining processes.
3. Illustrate the different bulk deformation processes.
4. Apply the various sheet metal forming process.
5. Apply suitable molding technique for manufacturing of plastics components.
TEXT BOOKS:

REFERENCES:

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Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:
1. To Selecting appropriate tools, equipment’s and machines to complete a given job.
2. To Performing various welding process using GMAW and fabricating gears using gear making machines.
3. To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analysing the defects in the cast and machined components.

LIST OF EXPERIMENTS
1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
8. Cutting spur and helical gear using milling machine.
13. Cutting force calculation using dynamometer in milling machine
14. Cutting force calculation using dynamometer in lathe machine

LIST OF EQUIPMENT FOR BATCH OF 30 STUDENTS

<table>
<thead>
<tr>
<th>S.No.</th>
<th>NAME OF THE EQUIPMENT</th>
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<tbody>
<tr>
<td>1.</td>
<td>Centre Lathes</td>
<td>7 Nos.</td>
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<td>2.</td>
<td>Shaper</td>
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<tr>
<td>3.</td>
<td>Horizontal Milling Machine</td>
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<tr>
<td>5.</td>
<td>Surface Grinding Machine</td>
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<td>8.</td>
<td>Lathe Tool Dynamometer</td>
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<td>12.</td>
<td>Arc welding transformer with cables and holders</td>
<td>2 Nos.</td>
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<tr>
<td>13.</td>
<td>Oxygen and Acetylene gas cylinders, blow pipe and other welding outfit</td>
<td>1 No.</td>
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</table>

TOTAL: 60 PERIODS
OUTCOMES: At the end of the course the students would be able to

1. Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.
2. The students able to make the work piece as per given shape and size using machining process such as rolling, drawing, turning, shaping, drilling and milling.
3. The students become make the gears using gear making machines and analyze the defects in the cast and machined components.

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

SF3511 COMPUTER AIDED DESIGN LABORATORY

OBJECTIVES:

1. Develop skill to use software to create 2D and 3D models.
2. Understanding the basic principles in drafting techniques
3. To get the knowledge and practicing the advanced drafting software.

LIST OF EXPERIMENT:

1. INTRODUCTION to CAD
2. AutoCAD – BASICS
   2.1 Starting with AutoCAD
   2.2 Layout and sketching
   2.3 Drawing environment
   2.4 Elements of drawing
   2.4.1 Draw commands
   2.5 3D functions
3. 2D – FIGURES for practice USING AutoCAD 2013
4. ISOMETRIC DRAWING for practice USING AutoCAD2013
5. 3-D SOLID FIGURES USING ACAD 2013
6. INTRODUCTION TO CREO 3.0
   6.1 Learning Different Operations like Threading, Sweep, Sweptblend.
   6.2 Modeling
   6.3 Assembling Equipment needed: Computers and Software: Autocad 2013 and CREO – 3.0

OUTCOMES:

CO 1 Ability to use the software packers for drafting and modeling
CO 2 Ability to create 2D and 3D models of Engineering Components
CO 3 Ability to understand the dimensioning and different fits and tolerance techniques.
CO’s – PO’s & PSO’s MAPPING

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SF3601 CHEMICAL TECHNOLOGY AND REACTION ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:
1. To introduce the principles of chemical engineering thermodynamics and illustrate their applications in the design of chemical process plants.
2. An ability to identify, formulate, and solve engineering problems. An understanding of professional and ethical responsibility. An ability to communicate effectively.
3. To provide chemical engineering students with a strong technical education and communication skills that will enable them to have successful careers in a wide range of industrial and professional environments.
4. To prepare chemical engineering students for rapidly changing technological environments with the core knowledge central to multidisciplinary development and personal improvement throughout their professional careers.
5. To instill in chemical engineering students a strong sense of humanistic values and professionalism such that they can conduct ethically and knowledgeably regarding technological impact in societal issues.

UNIT I SIMPLE INORGANIC SUBSTANCES

Inorganic chemical technology: Chlor-alkali industries-soda ash-caustic soda-chlorine hydrochloric acid. Manufacture of bricks-Steps only, Characteristics of good sand- Functions of sand, Chemical composition of cement, Method of manufacture of cement – Dry process(Flow chart only), Preparation of cement mortar.

UNIT II SIMPLE ORGANIC SUBSTANCES

Organic chemical technology: Manufacturing processes for pulp and paper, sugar, industrial alcohol by fermentation-absolute alcohol, beers, wines, oils and fats, soaps and detergents, agrochemicals.

UNIT III MECHANISM OF REACTION

Classification of reactions, variables affecting rate of reaction, definition of reaction rate. Kinetics of homogeneous reactions - concentration dependent term of a rate equation, temperature dependent term of a rate equation, theories of reaction - collision theory, transition theory, Arrhenius equation.

UNIT IV PERFORMANCE OF REACTOR

Ideal reactors- Design for homogeneous systems, batch, stirred tank and tubular Flow reactor, design of reactors for multiple reactions, combination reactor system, size comparison of reactors. Elementary ideas of non-ideal reactor performance, residence time distribution curves E, F and C...
UNIT V  
SELECTION OF REACTORS
Size comparison of Single reactors, multiple reactor system, Reactions in Parallel and Series, Yield and Selectivity

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO 1 Knowledge of phase equilibria in two-component and multi-component systems
CO 2 Ability to analyze chemical reactors and reaction systems
CO 3 Designing experiments involving chemical reactors, and analyzing and interpreting data
CO 4 Design and sizing of industrial scale reactor on the basis of kinetic data obtained at lab scale
CO 5 Ability to design reactors for heterogeneous catalytic reaction.

TEXT BOOKS:

REFERENCES:

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

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### PERSONALITY DEVELOPMENT
- **PD 3**: Group Discussion: Team Work  
- **PD 4**: Career Counselling, SSB Procedure & Interview Skills  
- **PD 5**: Public Speaking  

### BORDER & COASTAL AREAS
- **BCA 2**: Security Setup and Border/Coastal management in the area  
- **BCA 3**: Security Challenges & Role of cadets in Border management  

### ARMED FORCES
- **AF 2**: Modes of Entry to Army, CAPF, Police  

### COMMUNICATION
- **C 1**: Introduction to Communication & Latest Trends  

### INFANTRY
- **INF 1**: Organisation of Infantry Battalion & its weapons  

### MILITARY HISTORY
- **MH 1**: Biographies of Renowned Generals  
- **MH 2**: War Heroes - PVC Awardees  
- **MH 3**: Study of Battles - Indo Pak War 1965, 1971 & Kargil  
- **MH 4**: War Movies  

### NAVAL ORIENTATION
- **NO 3**: Modes of Entry - IN, ICG, Merchant Navy  
- **AF 2**: Naval Expeditions & Campaigns  

### NAVAL COMMUNICATION
- **NC 1**: Introduction to Naval Communications  
- **NC 2**: Semaphore  

### NAVIGATION
- **N 1**: Navigation of Ship - Basic Requirements  
- **N 2**: Chart Work  

### SEAMANSHIP
- **MH 1**: Introduction to Anchor Work  
- **MH 2**: Rigging Capsule  
- **MH 3**: Boatwork - Parts of Boat  
- **MH 4**: Boat Pulling Instructions  
- **MH 5**: Whaler Sailing Instructions  

### FIRE FIGHTING FLOODING & DAMAGE CONTROL
- **FFDC 1**: Fire Fighting  

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**TOTAL: 45 PERIODS**
FFDC 2  Damage Control  2
SHIP MODELLING  3
SM  Ship Modelling Capsule  3

TOTAL : 45 PERIODS

NCC Credit Course Level 3*

NX3653  (AIR FORCE WING) NCC Credit Course Level - III

L T P C
3 0 0 3

PERSONALITY DEVELOPMENT  9
PD 3  Group Discussion: Team Work  2
PD 4  Career Counselling, SSB Procedure & Interview Skills  3
PD 5  Public Speaking  4

BORDER & COASTAL AREAS  4
BCA 2  Security Setup and Border/Coastal management in the area  2
BCA 3  Security Challenges & Role of cadets in Border management  2

AIRMANSHIP  1
A 1  Airmanship  1

BASIC FLIGHT INSTRUMENTS  3
FI 1  Basic Flight Instruments  3

AERO MODELLING  3
AM 1  Aero Modelling Capsule  3

GENERAL SERVICE KNOWLEDGE  2
GSK 4  Latest Trends & Acquisitions  2

AIR CAMPAIGNS  6
AC 1  Air Campaigns  6

PRINCIPLES OF FLIGHT  6
PF 1  Principles of Flight  3
PF 2  Forces acting on Aircraft  3

NAVIGATION  5
NM 1  Navigation  2
NM 2  Introduction to Met and Atmosphere  3

AERO ENGINES  6
E 1  Introduction and types of Aero Engine  3
E 2  Aircraft Controls  3

TOTAL : 45 PERIODS
OBJECTIVE:
1. To understand the practical aspects of the various unit operations employed in chemical industry.
2. To know the Heat transfer principles in chemical industry.
3. To verify the various techniques and chemical processes.

LIST OF EXPERIMENTS
1. Sieve Analysis - To analyse a given sample using a set of standard sieves and thus to determine the specific surface area, the volume surface mean diameter and the mass mean diameter by differential analysis and cumulative analysis.
2. Verification of the laws of crushing in a Ball mill and calculation of critical speed.
3. Study of the working of Plate and frame filter press.
4. Free settling - To find out the drag coefficient of a falling sphere in a Fluid and verification of Stoke’s law.
5. Sedimentation - To study batch sedimentation of slurry and to determine the area of the continuous thickener.
6. Heat transfer from steam to air - Determination of overall heat transfer coefficient.
7. Verification of material balance equation and Rayleigh's equation for simple distillation.
8. Steam distillation.
9. Leaching - Leaching a mixture of salt and sand.
10. Study of the kinetics of chemical reaction in a batch reactor.
11. Adsorption isotherms.
12. Frequency response of first and second order systems.

TOTAL: 60 PERIODS

OUTCOMES:
On completion of this course the student will be able to:
CO1: Determine the surface characteristics of solid particles and the energy requirements for size reduction equipments.
CO2: Calculate the area required for a continuous thickener
CO3: Compare the efficiency of different types of distillation

CO's – PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
1. Get good value for money in relation to impacts on public accounts
2. Health and safety objectives are useful to create a health and safety program that aims at reducing harm to your employees. In turn this is then will help to reduce the number of injuries and illnesses within your workplace.
3. Increase the visibility of the business health and safety expectations across all stakeholders, including suppliers and customers
4. Your organization may find it appropriate to have more than one objective, depending on the health and safety environment of the workplace. These objectives should be written with the aim of meeting the organizations health and safety policy.
5. set the stage for measuring performance and identifying opportunities for improvement.

UNIT I RAILWAY ENGINEERING 9

UNIT II HIGHWAY ENGINEERING 9
Introduction of Highway Engineering: Classification of highways and urban road patterns. Typical cross section of roads. Factors controlling the alignment of roads. Basic geometric design - stopping and overtaking sight distances.

UNIT III TRAFFIC ENGINEERING 9

UNIT IV HARBOUR AND DOCK ENGINEERING 9

UNIT V AIR TRANSPORTATION ENGINEERING 9
Classification of air transportation, Types of air craft engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion - Applications – Air way accidents & safety

COURSE OUTCOMES:
Students able to
CO 1 Apply the knowledge of railway track components, materials and fixtures and fastenings
CO 2 Solve problems of railway track geometrics, train resistance, points and crossings, Signaling and control system.
CO 3 Understand elements of highway safety and approaches to accident Studies
CO 4 Understand elements of highway safety and approaches to accident Studies
CO 5 Explain the significance of ports and harbours as a mode of transport. ... Ozha&Ozha, “Dock and Harbour Engineering

TEXT BOOKS:
2. B.S.Dhillon, Transportation systems, reliability and safety” CRC Press,
REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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SF3702 HUMAN FACTORS ENGINEERING

L T P C
3 0 0 3

COURSE OBJECTIVES:
1. Describe the meaning and importance of human factors engineering
2. Relate human sensory, cognitive, and physical capabilities and limitations to the design of human machine systems
3. Select and correctly use appropriate human-machine system analysis and design tools
4. Apply sound human-machine system design principles to develop written and graphical design specifications.
5. Recognize and construct proper recommendations to correct human factors deficiencies in human machine systems in written and/or graphical form

UNIT I HUMAN FACTORS BASICS

UNIT II HUMAN PERFORMANCE IN THE WORKPLACE

UNIT III ENGINEERING ANTHROPOMETRY AND WORK PLACE DESIGN
Human Variability and Statistics, anthropometric data, Structural and Functional data, Use of anthropometric data in design, General; Principles for workplace design; clearance requirement of the largest users, reach requirements of the smallest users, special requirements of maintenance people, adjustability requirements, visibility and normal line of sight, component arrangement, Design of standing and seated work areas, work surface; height, depth & inclination.
UNIT IV BIOMECHANICS OF WORK

UNIT V WORK PHYSIOLOGY
Muscle structure and metabolism, Circulatory and respiratory system, the respiratory system, Lung capacity, Lung capacity measurement using Spirometry. Measurement of workloads. Physical work capacity and whole body fatigue, causes and Control of whole body fatigue. Bio Energies, Stress and workloads. RSPM assessment

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:
5. John B West, "Respiratory Physiology" WolterKulver Lippincott Williams & Wilkins

CO’s- PO’s & PSO’s MAPPING

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TOTAL: 45 PERIODS
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.

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.

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

SF3711 INDUSTRIAL TRAINING (FIRE SAFETY) L T P C 0 0 4 2

COURSE OBJECTIVE:
To
1) Expose students to fire safety experience and knowledge which is required in industry, where these are not taught in the lecture rooms.
2) Apply the fire safety knowledge taught in the lecture rooms in real industrial situations and get a feel of the work environment.
3) Expose students to the fire safety responsibilities and ethics.

The objective of the Industrial Training is to enable the students to get practical knowledge towards the handling of safety and fire equipment in a reputed industry or institution. The training involves hands on training of safety equipments in industry, case study in safety measurements / arrangements which have been used in industry/institute and emerging techniques in fire safety. Groups of not more than four members in a group will carry out the training.

The students are required to undergo Industrial Training during the winter vacation of around 10-15 Days / 90 Hrs in a reputed industry or institution. The students who wish to undergo industrial training, the industry chosen for undergoing the training should be at least a private limited company. The students shall submit and present the progress report at the Institute at least thrice in this duration for internal assessment. The presentation will be attended by a committee. Alternately, the teacher may visit the Industry to get the feedback of the students.

The final end semester exam of the Industrial Training will be conducted by an external examiner and one internal examiner appointed by the Institute. External examiner will be from the panel of examiners submitted by the concerned institute approved by the Anna University. Assessment of Industrial Training will be based on seminar, viva-voce, report and certificate of Industrial Training or Institutional Project Work obtained by the student from the industry or Institute.

The internal marks distributions for the students who have undergone Industrial Training consist of 50 marks from the industry concern and 100 marks by the committee members consisting of faculty members of concerned department of the parent institute.

The teachers engaged for Institutional Project work shall have a workload of 2 hours per group (at least 4 students) per week.

Course outcome
CO 1 Participate in the projects in industries during his or her industrial training.
CO 2 Describe use of advanced tools and techniques encountered during industrial training and visit.
CO 3 Interact with industrial personnel and follow engineering practices and discipline prescribed in industry.

TOTAL: 60 PERIODS
OBJECTIVES
1. To learn about testing standards for the test on DCP, foam.
2. To perform tests in portable extinguishers to understand the function.
3. Properties of building materials can be performed.

LIST OF EXPERIMENTS
1. Determination of flash point, fire point and pour point of hydrocarbons.
2. Tests on dry chemical powder as per relevant Indian standard specifications.
3. Performance tests on portable DCP fire extinguishers (cartridge type).
4. Performance tests on portable CO2 fire extinguisher.
5. Tests on foam as per relevant Indian standard specifications.
6. Test of non-combustibility of building materials.

OUTCOMES
On completion of this course the student will be able to:
CO1: Understand the method of conducting experiments.
CO2: Observe and analyse data and arrive at conclusions.
CO3: Demonstrate understanding of the method of tests for DCP.
CO4: Demonstrate understanding of the method of tests for CO2.

TOTAL: 60 PERIODS

SF3811
PROJECT WORK
OBJECTIVE:
The objectives of this course are to:
1. To make them understand the concepts of project work for planning to execution of projects.
2. To make them understand the feasibility analysis in project work and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals.
4. Make them capable to analyze, apply and appreciate contemporary project work tools and methodologies.

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. The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external
and internal examiners constituted by the Head of the Department.

**OUTCOMES:**
On completion of this course, the students will be able to:
CO1: Understand project characteristics and various stages of a project.
CO2: Understand the conceptual clarity about project organization and feasibility analyses and Technical.
CO3: Analyze the learning and understand techniques for Project work planning, scheduling and Execution.
CO4: Apply the fire safety risk plan and analyse the role of stakeholders.
CO5: Understand the report preparation and presentation.
CO6: Understand the How present in conference and facing the queries.
COURSE OBJECTIVES:
1. Establishing methods for improving operations and controlling production costs
2. Developing ways of reducing costs. Researching ways of improving efficiency of processes
3. Improving production processes and simultaneously ensuring worker safety
4. Has the ability to use modern engineering tools, software and equipment to analyze problems.
5. Will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues

UNIT I INTRODUCTION

UNIT II MANUFACTURING COST ANALYSIS
Manufacturing Cost Analysis: Fixed & variable costs, Direct, indirect & overhead costs, & Job costing, Recovery of overheads, Standard costing, Cost control, Cost variance Analysis - Labour, material, overhead in volume, rate & efficiency, Break even Analysis, Marginal costing & contribution, Numericals. Materials Management: Strategic importance of materials in manufacturing industries, Relevant costs, Inventory control models - Economic order quantity (EOQ), Economic batch quantity (EBQ) with & without shortage, Purchase discounts, Sensitivity analysis, Inventory control systems - P, Q, Ss Systems, Service level, Stock out risk, determination of order point & safety stock, Selective inventory control - ABC, FSN, SDE, VED and three dimensional, Numericals.

UNIT III QUALITY MANAGEMENT
Quality Management: Definition of quality, Various approaches, Concept of quality assurance systems, Costs of quality, Statistical quality Control (SQC), Variables & Attributes, X, R, P & C - charts, Acceptance sampling, OC - curve, Concept of AOQL, Sampling plan - Single, Double & sequential, Introduction to TQM & ISO - 9000. Production Planning & Control (PPC) : Introduction to Forecasting - Simple & Weighted moving average methods, Objectives & variables of PPC, Aggregate planning - Basic Concept, its relations with other decision areas, Decision options – Basic & mixed strategies, Gantt chart, Introduction to JIT.

UNIT IV MANAGEMENT INFORMATION SYSTEMS
Management Information Systems (MIS) : What is MIS? Importance of MIS, Organizational & information system structure, Role of MIS in decision making, Data flow diagram, Introduction to systems analysis & design, Organizing information systems. Product Design and Development: Various Approaches, Role 3S's – Standardization, Simplification, Specialization, Introduction to value engineering and analysis, Role of Ergonomics in Product Design

UNIT V PRODUCTION SCHEDULING

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Students able to
CO 1 Make forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques.
CO 2 Understand the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances.
CO 3 The student will be able to identify/control the appropriate process parameters, and possible defects of manufacturing processes so as to remove them.
CO 4 The student will be able to develop simplified manufacturing processes with the aim of reduction of cost and manpower.
CO 5 An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

TEXT BOOKS:

REFERENCES:

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SF3002 SAFETY MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
1. Demonstrate the approaches and techniques to assess and improve process and/or product quality and reliability.
2. Introduce the new safety process, principles and Technical leadership.
3. Illustrate the basic concepts and techniques of modern safety engineering tools.
4. Understand process control and safety procedure and their application.
5. learn the concept of accident management.

UNIT- I
Hinrichs Axioms of Industrial Safety, Concepts of Safety, Organization for Safety, Organization, Definition, Need & Principles Organizing for Health and Environmental, Activities, Organization Structure, Function & Responsibilities

UNIT- II

UNIT- III

UNIT- IV
Role of Occupier and Factory Manager, Factory Safety Committee, Structure and Functions and Working Tenure Details.

UNIT- V
Accident Prevention: Definition: Incident, Accident, Injury, Dangerous occurrence, Unsafe Act, Unsafe Conditions, Hazards, Error, Oversight, Mistake, NearMiss, Electricity& Hazards of Electricity, Explosives and Transportation Safety.

COURSE OUTCOMES:
Students able to
CO1 Attain the basic concepts of safety, fundamental knowledge of Principles Organizing for Health and Environmental.
CO2 Use control charts to analyze for improving the process safety.
CO3 Describe different safety management
CO4 Acquire basic knowledge of functional safety management
CO5 Understand the concepts of accident prevention.

TEXT BOOKS
2. Factories Act 1948

MAPPING OF CO’S WITH PO’S AND PSO’S
• Every course objective must be mapped with 1,2,3,-, scale against the correlation PO’s and PSO’S

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COURSE OBJECTIVES:
CO1: An overview of a few emerging techniques in safety engineering and Management
CO2: Familiarizes the concepts on Layer of Protection Analysis.
CO3: Understand the knowledge related to risk assessment
CO4: Educate the students towards the safety measures in organizations
    CO5: Teach the ignition behaviors and various stages of flame and fire.

UNIT I  INTRODUCTION TO DOMINO INCIDENT INVESTIGATION AND MORT ANALYSIS
9
Domino incident investigation - technique, logic diagram, input requirements, output, example. Unavailability analysis of protective systems - technique, logic diagram, input requirements, example. Reliability analysis of automatic control systems - PES safety system development logic diagram system analysis, calculation of fractional dead time, application, strengths and weaknesses.

UNIT II  BASIC CONCEPTS ON LOPA
9
Layer of Protection Analysis (LOPA) - Overview of relevant standards and guidelines, risk tolerance criteria. Preparation of LOPA-LOPA methodology, the LOPA team.Scenario development - components, inherently safe considerations.Initiating causes / effects - identification, estimation of frequencies. Independent protection layers - IPL criteria, allocation of IPL credit - basic process control systems, operator response, pressure relief device, safety instrumented system.

UNIT III  SECURITY RISK ASSESSMENT AND PROTECTION
9
Security for chemical process industries - Assessments and regulatory environment, methods for assessing security vulnerability, emerging security regulations, government development and industry activities that relate to security for process facilities. Strategies and counter measures – prevention of intentional releases and theft of chemical releases at process facilities. Case study.

UNIT IV  BEHAVIOUR BASED SAFETY IN ORGANIZATIONS
9
Behavior- Based Safety (BBS) - Fundamentals of BBS Management - people based safety, BBSexperience, Outcomes of BBS work, psychology of BBS, Implementation problems in BBS, Behavioral safety Observation Process. Mangers role in developing BBS culture.BBS steering committee. Main steps of True BBS approach.

UNIT V  SAFETY MANAGEMENT SYSTEMS
9
Safety Management Systems: SHEMS, OHSAS 18001 and OSHA´s PSM - Policy, planning, training, implementation, management control and review.

TOTAL: 45 PERIODS

COURSE OUTCOMES
On completion of this course the student will be able to:
CO1: Analyze domino effects and conduct MORT analysis
CO2: Analyze the layer of protection required for process industries
CO3: Gain knowledge on essential elements of plant security
CO4: Understand the concept of behavior based safety

TEXT BOOK:
DAS AKHIL KUMAR “Principles of Fire Safety Engineering: Understanding Fire and Fire Protection”

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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SF3004 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

COURSE OBJECTIVES:
1. understand the global trends and development methodologies of various types of products and services
2. 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
3. understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
4. understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
5. 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 FUNDAMENTALS OF PRODUCT DEVELOPMENT


UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING 9
Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes,

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

UNIT V BUSINESS DYNAMICS – ENGINEERING 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students 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:

CO’s- PO’s & PSO’s MAPPING

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SF3005 HAZARD ANALYSIS AND RISK ASSESSMENT  

COURSE OBJECTIVES:
1. To learn the various techniques for hazard identification, reliability analysis, estimation of frequency of occurrence of hazards, consequence analysis, risk quantification and human reliability analysis.
2. To provide knowledge in Quantitative Risk Analysis Process Industries
3. To provide in-depth knowledge of risk Control and Management
4. To familiarize the student with various types of Hazard Identification techniques
5. Identify various Hazards related to the work practices and activity using various technique.

UNIT I HAZARD IDENTIFICATION AND RISK ANALYSIS  
Hazard and risk, Types of hazards - fire, explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards : Inventory analysis, Fire and explosion hazard rating of process plants - Preliminary hazard analysis, Hazard and Operability study (HAZOP), Case studies.

UNIT II RISK CONTROL & MANAGEMENT  
Plant availability and process reliability: ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation. The logic tree approach, set theory and Boolean algebra, application to probability, Boolean manipulation. Event tree analysis – notation. Failure mode and Effect Analysis (FMEA)- methodology, criticality analysis, corrective action and follow-up.

UNIT III ENVIRONMENTAL HEALTH RISKS  

UNIT IV HAZARDS MONITORING AND EMERGENCY MANAGEMENT  
Quantification of risk: QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP, Presentation of measures of risk – risk contour, F-N curve. Calculation of individual risk and societal risk. Human reliability analysis (HRA) factors leading to human error, characteristics of HRA techniques, Technique for Human Error Rate Prediction (THERP), Accident Sequence Evaluation Program (ASEP).

UNIT V DISASTER MANAGEMENT IN INDIA AND RELIEF  
History of disasters - various disasters in various countries - Disasters in India Relief and rehabilitation in disasters at local, national and global levels, Gaps in disaster management identified on analysis Worldwide Aid and Agencies, Study of different case studies on natural disaster & manmade disaster.

COURSE OUTCOMES:

TOTAL: 45 PERIODS
Upon completion of this course the student would be able to:
CO1 Attain the ability to use the hazard indices, HAZOP, PHA and What if analysis for the identification of hazards in a process
CO2 Attain the ability to assess probability of occurrence of an event using fault tree and event tree analysis
CO3 Estimate the consequences of fire, explosion and toxic gas release using suitable empirical models
CO4 Quantify the risk involved in a process
CO5 Identify various Hazards related to the work practices and activity using various technique.

TEXT BOOKS

REFERENCES:
4. Government of India, Ministry of Home Affairs, National Disaster Management Division, Disaster Management in India – A Status Report, 2004

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COURSE OBJECTIVES:
1. Learn about the various hazards associated with the manufacturing processes employed in engineering industries and methods used to safeguard the operators and others.
2. Understand the concepts of global scenario of Health & safety.
3. Analyse the gaps between reference standards & pertinent conditions of safety in India.
4. Students should be able to analyse and solve basic agronomical issues.
5. Be efficient in the operation of industrial hygiene equipment.

UNIT I  INTRODUCTION TO MANUFACTURING PROCESSES  9

UNIT II  HAZARDS SAFETY MEASURES IN MANUFACTURING INDUSTRY  9

UNIT III  CONCEPTS OF FIRE SAFETY IN INSTALLATIONS  9

UNIT IV  FUNDAMENTALS OF MATERIAL HANDLING  9

UNIT V  SAFETY IN OIL AND GAS PLANT  9

COURSE OUTCOMES:
On completion of the course the student will be able to
CO1: Explain the various hazards associated with hot working of metals and methods of control
CO2: Know about various hazards associated with cold working and cutting of metals and methods of control
CO3: Relate various hazards associated with welding and cutting of metals and methods of control
CO4: Analyse various material handling methods and systems; the hazards and methods of control
CO5: Build the stability of a control system in A to Z of Environmental Audit.

TEXT BOOKS:
REFERENCES:

SF3007 ADVANCED SAFETY SYSTEMS IN INDUSTRY

OBJECTIVES
1. Give an overview of a few emerging techniques in safety engineering and management.
2. Understand the concept of behavior based safety.
3. Analyze the layer of protection required for process industries.
4. To aware of industrial fire production system and its usage.
5. Understand the concept of behavior based safety.

UNIT I SAFETY SYSTEM DEVELOPMENT IN INDUSTRY 9
Domino incident investigation technique, logic diagram, input requirements, output, example.
Unavailability analysis of protective systems-technique, logic diagram, input requirements, example.
Reliability analysis of automatic control systems-PES safety system development logic diagram system analysis, calculation of fractional dead time, application, strengths and weaknesses.

UNIT II PROTECTION ANALYSIS IN INDUSTRY 9
Layer of Protection Analysis (LOPA) - Overview of relevant standards and guidelines, risk tolerance criteria. Preparation of LOPA - LOPA methodology, the LOPA team. Scenario development -components, inherently safe considerations. Initiating causes/effects - identification, estimation of frequencies. Independent protection layers - IPL criteria, allocation of IPL credit - basic process control systems, operator response, pressure relief device, safety instrumented system, safety instrumented function.
UNIT III SAFETY IN CHEMICAL PROCESS INDUSTRIES 9
Security for chemical process industries-Assessments and regulatory environment, methods for assessing security vulnerability, emerging security regulations, government development and industry activities that relate to security for process facilities.

UNIT IV SAFETY SECURITY IN PROCESS INDUSTRIES 9
Site security for process industries - Essential elements - threat analysis, security counter measures, mitigation and emergency response. Specific security measures - information security, cyber security, physical security, policies and procedures, training, mitigation and response, inherently safer processes. Case study.

UNIT V SAFETY MANAGEMENT SYSTEMS 9

TOTAL: 45 PERIODS

TEXT BOOK:

REFERENCES:
3. Handbook of Fire and Explosion Protection Engineering Principles. For Oil, Gas, Chemical andRelated by Dennis P. Nolan (Auth.)

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES
1. To enable the students to acquire knowledge of Fire and Safety Studies
2. To learn about the emergency tender and its codes
3. To learn about fire area, fire stopped areas and different types of fire extinguishers
4. To know about the method of fire protection of structural members and their repair due to fire damage.
5. To develop safety professionals for both technical and management through various building codes.

UNIT I  SPECIFICATION OF RESCUE AND FIRE  9

UNIT II  SALVAGE TENDER  9
Salvage Tender Emergency Tender, Rescue tender, DCP Tender IS-10993, IS-949 Fire Science - Basic Principles Basic Principles of Combustion Process

UNIT III  FIRE EXTINCTION/SUPPRESSION TECHNOLOGY  9

UNIT IV  CODE OF PRACTICE FOR CONSTRUCTION  9
Code of practice for construction of temporary structures and pandals IS-8758 Codes relating to fire ratings of materials used.

UNIT V  LAWS IN FIRE PREVENTION  9

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
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 BOOK
1. Hand book on Building Fire Codes by G.B. Menon IIT Kanpur
2. Fire Safety In Building by V K Jain 3rd edition New Age International Publishers

REFERENCES
1. Principles Of Fire Safety Engineering by Das Akhil Kumar PHI Learning Pvt Ltd
4. Industrial Safety, Health And Environment Management Systems Paperback – 1 January 2000 by R. K. Jain (Author), Sunil S. Rao (Author)

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SF3009  
FIRE ENGINEERING  
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COURSE OBJECTIVES:
1. Study about the product of combustion and their characteristics.
2. Study about the use, operation and maintenance requirements of equipment, vehicles and accessories used in fire services.
3. Understand the fundamentals of fire hydraulics and fire ground operations.
4. Focuses on fire detection, suppression and mitigation and fire safety engineering which focuses on human behavior and maintaining a tenable environment for evacuation from a fire.
5. Learn about Planning affixed fire fighting installation for different occupancy

UNIT I  
PHYSICS AND CHEMISTRY OF FIRE  

UNIT II  
EVACUATION SYSTEM AND CONTROL  
Process of emergency evacuation - special features of personnel movement, Parameter characteristics of the movement of people-practical methods of designing evacuation passages and exists. Evacuation exits and routes - stages of evacuation; Exit Requirements- Planning of evacuation routes and exits - Seating arrangement - Passages and corridors; Smoke control during building design.

UNIT III  
FIRE PROTECTION SYSTEMS IN BUILDINGS  
Classification of building based on occupancy; Fire zone; classification of type of construction according to fire resistance; General fire safety requirements applicable to all individual occupancies. Sitting of detectors as per relevant standards (ISI); Selection and planning of alarm system as per relevant standards (ISI).

UNIT IV  
FIRE EXITS MANAGEMENT  
9
General exit requirements as per NBC; Internal staircases; Pressurisation of stair staircases; horizontal exits; fire tower; ramps; fire lifts; external fire escape ladders; Planning of location and calculation of capacity, number and width of exit as per NBC for different occupancy classification.

UNIT - V  FIRE PROTECTING EQUIPMENTS AND SYSTEMS

Selection and distribution of portable extinguishers (for class A and B fires) and other fire protection equipments and systems for different occupancy classification as per NBC; Planning of fixed fire fighting installation for different occupancy classification- sprinkler system; total flooding system; CO2 system; foam system; Fire training and education- Arson - Fire safety audits - Risk assessment.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students able to:

CO1: Understand the basic theory of fire chemistry, the development of fire and its characteristics, and about different types of fire.

CO2: Describe and determine the effect of the product of combustion and their characteristics.

CO3: Develop and analyse operation and maintenance requirements of equipment, vehicles and accessories used in fire services.

CO4: Understand the fundamentals of fire hydraulics and fire ground operations.

CO5: Suppression and mitigation and fire safety engineering which focuses on human behavior and maintaining a tenable environment for evacuation from a fire.

TEXT BOOKS


References

2. BIS, “NBC Part 4- Fire and Life safety”, Bureau of Indian Standards, New Delhi, 2005.

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SF3010   FIRE RISK ANALYSIS AND ACCIDENT INVESTIGATION   L T P C
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COURSE OBJECTIVE:
CO1: Educate students about how to reduce work place hazards and to encourage the standard of Safety health & environment programmed.
CO2: Train and motivate students in maintaining and improving the quality of the environment and Preventing and abating environment pollution.
CO3: Create awareness among students about Fire safety and Fire prevention
CO4: Educate students about how to reduce work place hazards and to encourage the standard of Safety
CO5: Familiarize students with the design, installation, working and use of Different types of Fire Protection systems

UNIT I    APPLICATION OF FIRE RISK ANALYSIS: 9
Basic field of application, Methods of application Probability Concept: Basic concept of Probability Theory, Independence and conditionality, Random Variables and Probability Distributions, Key parameters of probability Distributions, Commonly used Probability Distributions.

UNIT II   STATISTICS & EXTREME VALUE THEORY 9

UNIT III  RELIABILITY 9

UNIT IV   UTILITY THEORY 9

UNIT V    COMPUTER SIMULATION FOR FIRE PROTECTION 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: To apply concept of probability theory in fire analysis
CO2: To apply concept of factor affecting fire damages
CO3: To apply concept of Fire Protection Engineering
CO4: To apply concept of Fire Protection and Insurance
CO5: To apply concept of simulation software in calculations

TEXT BOOKS:
1. An introduction to fire dynamics – Dougal Drysdale
2. Enclosed Fire Dynamics – Bjorn Karlsson, Jammes G Quintiere

REFERENCES:
COURSE OBJECTIVES:
1. Familiarization and demonstration of fixed installation at visit to high rise building.
2. Practical training about Care and maintenance of sprinklers. Use of Automatic fire alarm system, fire exit drill
3. Simulated Practices to control life and properties damages from natural disaster.
4. Familiarization and demonstration of different Automatic Fire Detection cum Alarm System
5. Familiarization and demonstration of fixed fire fighting installations.

UNIT I
INTRODUCTION
Personal Protective Equipment: Need for Personal Protection Equipment, Selection, Use, Care & Maintenance
Respiratory and Non-respiratory Personal Protective Equipment, Head Protection, Ear Protection, Face and

UNIT II
FIXED FIRE FIGHTING INSTALLATION
Introduction of Sprinkler System and their care and maintenance and operational Procedure, Elementary
requirements of Drenchers, Rising Mains, Hose Reels And Down-comer, Fire pump control panel. Types of FF Installations- water based, non water based. Fixed Foam installation, Foam pours, foam makers, HVWS, MVWS, Total flooding system CO2, FM-200 etc

UNIT III
AUTOMATIC FIRE DETECTION CUM ALARM SYSTEM:
Introduction of Types of Detectors- Smoke, Heat, Flame/Gas Detectors, Operating principles, F.D.A. Panel
M.C.P. & P.A. with talk back

UNIT IV
MEANS OF ESCAPE
Classification of escape routes with reference to N.B.C. Fire exit drill. places of relative safety, places of ultimate safety, Width of exits requirement and calculations.

UNIT V
LIGHTING, VENTILATION & WORK RELATED STRESS:

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1: Identify and take necessary precautions on fire and safety hazards and report according to work policy and procedures.
CO2: Record accident details correctly according to accident/injury procedures.
CO3: Identify, handle and store / dispose-off dangerous goods and substances according to policy and procedures following safety regulations and requirements.
CO4: Identify and observe policies and procedures in regard to illness or accident.
CO5: Report supervisor/ Competent of authority in the event of accident or sickness.

TEXT BOOKS:
1. Introduction to Mathematical Fire Modeling, Second Edition By Marc L. Janssens

REFERENCES:
1. Handbook of fire and Explosion Protection Engineering Principles for Oil, Gas, Chemical and Related Facilities - Dennis. P. Nolan
3. Hazards in Process Industries – Hidup Suatu Pendakian
5. Industrial Safety - National Safety Council of India

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SF3012 FIRE FIGHTING AND SAFETY EQUIPMENT

COURSE OBJECTIVES:
1. Describe the meaning and importance of human factors engineering
2. Relate human sensory, cognitive, and physical capabilities and limitations to the design of human-machine systems
3. Select and correctly use appropriate human-machine system analysis and design tools.
4. Apply sound human-machine system design principles to develop written and graphical design specifications.
5. Recognize and construct proper recommendations to correct human factors deficiencies in human-machine systems in written and/or graphical form.

UNIT I GENERAL PRINCIPLES OF FIRE PREVENTION AND PROTECTION MEASURES

Planning and Construction of the building: Site planning considering the nature of the plant, building, equipment and process from the stand point of safety and fire protection, where corrosive, poisonous, explosive and easily combustible materials are handled and processed. Type Of construction fire wall, barricades etc. Fire separation, fire steps, segregation, isolation.
UNIT II  INTERNAL PLANNING AND COMBUSTION OF PLANTS AND BUILDINGS  9
Layout of hazardous pipe lines, vessels and equipment, planning of strategic points and selection of fire extinguishing device, Automatic, fire doors, fire, doors, wire glass windows, fire walls, parapeted to prevent spread of fire through roofs, vertical cut offs, Exits, guard & guarding, floor platforms, path roadways, stairs ventilation.

UNIT III  FIRE PROTECTION ARRANGEMENT: FIRE APPLIANCES:  9
Fire warning system (Manual & Automatic) fixed fire-fighting installations: Foam system; Gas/vapor system; Dry powder system; Special safety protection equipment-Explosion detection, venting and suppression system, Inergen clean agent system and F.M. 200.

UNIT IV  SAFETY EQUIPMENT  9
Different Extinguishing properties & application like water, foam, carbon die oxide, dry chemical powder, halogenated agent and halon alternatives. Lighting: lighting arrangement and minimum light require in domestic, commercial, industrial and public assembly occupancies etc. Emergency lighting system

UNIT V  SAFETY AND FIRE PROTECTION ORGANIZATION:  9
House-keeping and management; Plant fire brigade and fire fitting facilities, petrol, systems. Detailed analysis of fire case studies: especially those fires were large number of people have been involved. Interaction and relative value of the components of escape route design, especially smoke movement and control.

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

TOTAL: 45 PERIODS

TEXT BOOKS:
1. General fire hazards and fire protection by J.J. Williams
2. Fire prevention Notes for Industrial premises by F.P.A.

REFERENCES:
1. Fire prevention hand book by Kesteren fire Brigade
2. Fire prevention standard recommendations by Earnest Beam Ltd
3. Automation- A challenge to fire protection Engineers by Warre J. Baker
4. Fire Protection- Technical information and Useful general knowledge by Mather and Platt

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

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SF3013 FIRE PREVENTION AND PROTECTION MEASURES L T P C 3 0 0 3

COURSE OBJECTIVES:
1. Study about the Planning and Construction of the building.
2. Learn about the strategic points and selection of fire extinguishing device.
3. Focus on Special safety protection equipment and Explosion detection.
4. Design and analysis of especially smoke movement and control.
5. Understand the Portable extinguishers and fire fighting systems in industrial fire protection systems.

UNIT I GENERAL PRINCIPLES OF FIRE PREVENTION AND PROTECTION MEASURES 9
Planning and Construction of the building: Site planning considering the nature of the plant, building, equipment and process from the standpoint of safety and fire protection, where corrosive, poisonous, explosive and easily combustible materials are handled and processed. Type Of construction fire wall, barricades etc. Fire separation, fire steps, segregation, isolation.

UNIT II INTERNAL PLANNING AND COMBUSTION OF PLANTS AND BUILDINGS 9
Layout of hazardous pipe lines, vessels and equipment, planning of strategic points and selection of fire extinguishing device, Automatic, fire doors, fire, doors, wire glass windows, fire walls, parapeted to prevent spread of fire through roofs, vertical cut offs, Exits, guard & guarding, floor platforms, path roadways, stairs ventilation. Protection and devices for fire due to lightening.

UNIT III FIRE PROTECTION ARRANGEMENT 9
Fire appliances: Fire warning system (Manual & Automatic) fixed fire-fighting installations: Foam system; Gas/vapor system; Dry powder system; Special safety protection equipment-Explosion detection, venting and suppression system, Inergen clean agent system and F.M. 200. Different Extinguishing properties & application like water, foam, carbon die oxide, dry chemical powder, halogenated agent and halon alternatives. Lighting: lighting arrangement and minimum light require in domestic, commercial, industrial and public assembly occupancies etc. Emergency lighting system

UNIT IV SAFETY AND FIRE PROTECTION ORGANIZATION 9
House-keeping and management; Plant fire brigade and fire fitting facilities, petrol, systems. Detailed analysis of fire case studies: especially those fires were large number of people have been involved. Interaction and relative value of the components of escape route design, especially smoke movement and control.

UNIT V INDUSTRIAL FIRE PROTECTION SYSTEMS 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:

Students able to:

CO1: Understand the Fire separation, fire steps, segregation of different types of fire.

CO2: Identify the effect of the product of combustion and their characteristics.

CO3: Understand the basic concepts of fire as a chemical reaction, the major phases of fire, and the main factors that influence fire spread and fire behavior.

CO4: Identify the types of common fire department apparatus, equipment, and personal safety equipment used for fire fighting.

CO5: Know the detail about special fire suppression systems like deluge and emulsifier.

TEXT BOOKS
1. J.J. Williams - “General fire hazards and fire protection”
2. F.P.A. - “Fire prevention Notes for Industrial premises”

REFERENCES
1. “Fire prevention standard” recommendations by Earnest Beam Ltd
2. Warre J. Baker - Automation- “A challenge to fire protection Engineers”.
4. H.N.S.O - “Fire protection in factory, buildings”
5. William K. Bare - “Introduction by science and fire protection”.

CO’s- PO’s & PSO’s MAPPING

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SF3014 DESIGN OF FIRE FIGHTING AND PROTECTION SYSTEM L T P C
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COURSE OBJECTIVES:
1. expose the students to the concepts functional design of building
2. expose the students to the for thermal aspects and energy
3. expose the students to the in tropical climates i.e. in Indian context.
4. make the student capable of performing fenestration design for natural ventilation
5. make the student capable of performing fenestration design for daylighting & design of space for external and internal noise control.

UNIT I INTRODUCTION 9
Provisions & applicable standards of detection and alarm system, Introduction of detection devices, alarm and detection system, Type of detectors, Method of selection. Cost analysis, design, installation, testing and commissioning of alarm and detectionsystem. Provisions & applicable standards of foam..

UNIT II HVAC SYSTEM 9
Classification and property of foam, gases and dry chemical powder.: Design Consideration. Basic psychometrics, Air conditioning process & system.Methods of Air Conditioning. Water Supply, Hydraulic

UNIT III FIRE PROTECTION: 9
Identification, Hydraulic Calculation and Design of foam system: Installation identification, Hazard classification, Type of protection, Hazard description, Flammable or combustible liquids area to be protected, Flammable or combustible liquids identification, foam application method, Description, number and placement of foam application devices, Selection of foam agent, Rate of application of foam solution, Rate of foam concentrate, Rate of water application, Duration of discharge, Quantity of foam and water required.

UNIT IV PLANNED MAINTENANCE: 9
Planning vis-a-vis adhoc maintenance, schedule & contingency maintenance, levels of planning, planned inspection, Maintenance cycle, maintenance profile, repair & replacement models, statistical methods, decision models, optimal renewal cycle, budgeting

UNIT V DESIGN ON MAINTENANCE 9
Effect of design on maintenance, Diagnosis, appraisal, structural defects & various methods of repair, Role of building maintenance in construction process Maintenance generators, Expression of Standards, selection of level of maintenance and fixing standards.

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
1. Industrial Fire Protection Engineering – Robert G.Zalosh

REFERENCES:
1. Hydro Carbon Processing Unit Volume I,II
2. An Introduction to Fire Dynamics – Dougual Drysdale
4. Evaporation from plain liquid surface into a turbulent boundary layer – By BrightonP.W.N
5. Factory Mutual loss prevention data sheet, 1-20 protection against fire protection

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COURSE OBJECTIVES:
1. Basic idea about the fundamentals of fire phenomena and firefighting.
2. Provide the students an illustration of significance of the Fire Engineering Profession in the Protection life, property and environment.
3. Learn the basic various heat transfer process.
4. Basic knowledge about flame and its characteristics of flame behaviors
5. Teach the ignition behaviors and various stages of flame and fire.

UNIT I  FIRE SCIENCE AND AERODYNAMICS

UNIT II  FLAMMABILITY AND PREMIXED FLAMES
Limits of Flammability and Premixed Flames: Limits of Flammability, The structure of a premixed flame, Heat losses from premixed flames, Measurement of burning velocities, Variation of burning velocity with experimental parameters.

UNIT III  FIRE FLAME AND PUMPS
Diffusion Flames and Fire Plumes: Laminar jet flames, Turbulent jet flames, Flames from natural fires, some practical applications. Steady Burning of Liquid and Solid Fuels.

UNIT IV  BEHAVIOR OF IGNITION

UNIT V  STAGES OF FIRE
The Pre-Flashover Compartment Fire: The growth period and the definition of flashover, Growth to flashover. The Post-Flashover Compartment Fire: Regimes of burning, Fully-developed firebehaviour, Temperatures achieved in full-developed fire, Fire resistance and fire severity, Methods of calculating fire resistance, Projection of flames from burning compartments, spread of fire from compartment.

COURSE OUTCOMES:
CO1: Understand the fire opposition and its procedure
CO2: Analysis of fire behavior and fire problems.
CO3: Get the knowledge about stage of fire flowing and detail about ignition.
CO4: Understand methods of calculating fire resistance from burning compartments.
CO5: We learn details about premixed flames and its characteristics.

TEXT BOOKS:
2. A text book for tunnel fire dynamics, HaukurIngason, yingzhenli, AndersLonnermark

REFERENCES:
1. Text book for fire safety engineering design of structure for john A.Purkis, Bsc (eng),PhD, MICE,MIFS at Butterworth Heinemann, first published 1996.
2. An Introduction to Fire Dynamics written by Dougal Drysdale3. SFPE Hand Book for Fire
Protection Engineering, NFPA

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SF3016 EXPLOSIVE TECHNOLOGY AND SAFETY

OBJECTIVES
1. To teach the fundamental principles of explosives and the safety aspects of explosives operations, storage and transportation
2. To teach the fire building and its mechanisms and behaviors
3. To teach the explosive prediction and controlling elements
4. To aware of industrial fire production system and its usage
5. To learn testing and fire explosives of an industry

UNIT I PHYSICS AND CHEMISTRY OF FIRE

UNIT II MECHANISM OF SOUND AND SHOCK

UNIT III BUILDING FIRE SAFETY

UNIT IV EXPLOSION PROTECTING SYSTEMS

UNIT V INDUSTRIAL FIRE PROTECTION SYSTEMS

TOTAL: 45 PERIODS
TEXT BOOK:

REFERENCES:
1. Handbook of Fire and Explosion Protection Engineering Principles. For Oil, Gas, Chemical and Related by Dennis P. Nolan (Auth.)

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SF3017 FOOD AND INDUSTRIAL BIO SAFETY  L T P C  3 0 0 3

COURSE OBJECTIVES:
1. Impart students with basic knowledge relating to food safety and principles of preservation.
2. Introduce them to the concept of processing and preservation of fruits and vegetables
3. Select and correctly use appropriate human-machine system analysis and design tools
4. Apply sound human-machine system design principles to develop written and graphical design specifications
5. Recognize and construct proper recommendations to correct human factors deficiencies in human machine systems in written and/or graphical form.

UNIT I FOOD SAFETY  9
Objectives of preservation and processing - Scope of preservation industry in India. Physical, chemical and microbiological changes in fruits and vegetables - Factors affecting growth of microorganisms and the control measures. Key terms, factors affecting food safety, recent concerns Food laws, standards and regulations, Food additives and contaminants.

UNIT II PRINCIPLES AND METHODS OF PRESERVATION  9
Asepsis - Use of low temperature, Use of high temperature-Removal of moisture, Removal of air, Use of chemical preservatives, Fermentation- Irradiation, Gas preservation, Newer methods. Chutney and sauces- definition, method of preservation, steps in preparation of chutney and sauces. Fruit beverages- definition and classification, method of preservation (with special emphasis on pasteurization, use of chemical preservatives, sugar), role of various ingredients.
UNIT III SAFETY IN COLD FORMING AND HOT WORKING OF METALS
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal shears-press brakes – Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures – Safety in Gas Furnace Operation, Cupola, Crucibles, Ovens, Foundry Health Hazards, Work Environment, Material Handling in Foundries, Foundry Production Cleaning And Finishing Foundry Processes.

UNIT IV SAFETY IN METAL WORKING AND WOOD WORKING MACHINE
General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards. Inspection of material handling equipments.

UNIT V INDUSTRIAL SAFETY
Advances in Industrial Ergonomics and safety, Work and protective clothing, Theory and practice of Industrial safety, Industrial Noise and Vibration, Machine Guarding and Industrial machine safety, Manual material handling, Modeling for safety and health.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1: Explain various preservation and post harvest changes and spoilage of food products
CO2: Describe the operation principles involved in food preservation
CO3: Sketch food quality, safety and regulations
CO4: Important legislations related to health, Safety and Environment.

TEXT BOOKS:
2. Dr. Vincent Matthew Ciriello (Prediction of the maximum acceptable weight of lift from the frequency of lift, journal of industrial ergonomics,( 2014), pg .225-237

REFERENCES:

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COURSE OBJECTIVES:
1. help the social groups and individuals to acquire knowledge of pollution and environmental degradation
2. Effectively communicate on Health safety and environment, facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering environment.
3. The main objectives of the Indian Factories Act, 1948 are to regulate the working conditions in factories, to regulate health, safety welfare, and annual leave and enact special provision in respect of young persons, women and children
4. Workers who are employed in any work within the vicinity of any port for the aim of loading, unloading, movement, or storage of cargoes
5. The primary objective of the Workmen Compensation Act, 1923, is to provide financial relief to employees’ families in case of their death or injury at the workplace.

UNIT I FACTORIES ACT

UNIT II DOCK WORKERS (SAFETY, HEALTH AND WELFARE) ACT

UNIT III EXPLOSIVES ACT

UNIT IV WORKMEN’S COMPENSATION ACT
Water Act and Air Act: Definitions, powers and functions of Boards, prevention and control of pollution, consent administration. Environment (Protection) Act and Rules-Definitions, powers of central government, power of giving directions, authorities. MSIHC Rules- Definitions, Duties of Authorities, Notification of major accidents, safety Reports, safety audit, on- site & out-site emergency plans.

UNIT V POWER TO MAKE RULES
Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment
Note: Case laws may be referred if necessary, but those are beyond the scope of this course.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO 1 Master core concepts and methods from ecological and physical sciences and their application in environmental problem solving
CO 2 Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes..
CO 3 Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions. Understand elements of highway safety and approaches to accident Studies.

CO 4 Appreciate key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.

CO 5 Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.

TEXT BOOKS:
2. Gayle Woodside and Dianna Koeurek, “Environmental Safety and Health Engineering” 1997

REFERENCES:
2. Ganguly & Changeriya, ”Health Safety and Environment
5. Environmental Acts & relevant Rules as abo

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SF3019 FIRST AID AND EMERGENCY PROCEDURES

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COURSE OBJECTIVES
1. Help the students understand the fundamentals and relevance of first aid And Deal with Emergency situations
2. Enable students to understand know the limits of basic first aid and Legal Perspective of First Aid, Safety at the workplace and highlights of accident Prevention
3. Empower students with the expertise of experimentation; in know the Limits of basic first aid.
4. Expose students to a wide range of duties of the employer as a First Aider.
5. Equip the students with necessary engineering skills to understand and demonstrate essential Lifesaving skills

UNIT I INTRODUCTION
Aims and Objectives of First Aid principles-Role of the first aider-sequence of action on arrival at scene. Vital signs-breathing-pulse. Introduction to the body-basic anatomical terms-body cavities-head-cranium - thorax-abdomen and pelvis.

UNIT II INJURIES-FRACTURES
Seizures (epileptic fits, convulsions) features- management, stroke. Head injuries-fractures of the base-vault and sides of skull.

UNIT III  SIGNS AND SYMPTOMS  
9

UNIT IV  CLASSIFICATION OF WOUNDS  
8
Eye-eye injuries-foreign body in eye-eye trauma-corrosive chemical in eye-arc eye. Wounds bleeding-classification-types of wounds-case of wounds -bleeding from special sites. Broad and narrow fold bandages-hand bandages-slings.

UNIT V  CLASSIFICATION OF FRACTURES  
10

TOTAL = 45 PERIODS

TEXT BOOKS
1. American Red Cross First Aid-Responding to Emergencies, 4th Ed. (2007) the textbook is a very integral part of this course. Material in the text is frequently referred to and used in class, and students are responsible for all information within designated chapters for exams.
2. .V. Yudenich, Accident First Aid, Mir Publishers, Moscow

REFERENCES:
2) First aid text book: American National Red Cross
4) Internet Access: Access and usage instructions will come from; http://paris.mcgrawhill.com/sites/0077349695/student_view0

COURSE OUTCOMES
On completion of this course, the students will be able to
CO1: Gaining knowledge of principles of first aid
CO2: Gaining knowledge on human anatomy and safety tools during emergency
CO3: Understanding the nervous systems and modern engineering tool’s Application
CO4: Handling of emergency and engineering in life long process
CO5: Identify a range of common illnesses and injuries.

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OBJECTIVES
1. Study Medical waste management
2. Learn about and technologies in health care waste management.
3. Fundamentals of Environment and Health Care Waste Management Regulation
5. Understand various waste disposal procedures and management.

UNIT I WASTE MANAGEMENT

UNIT II DEFINITIONS, TYPES AND CATEGORIES OF WASTE

UNIT III HANDLING HEALTH CARE

UNIT IV IMPACT OF HEALTH CARE WASTE ON HUMAN HEALTH

UNIT V IMPACT OF HEALTH CARE WASTE ON OUR ENVIRONMENT

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. V.J. Landrum, Medical Waste Management and disposal, Elsevier, 1991

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OBJECTIVES:
1. Learn the different modes of heat transfer and the concept of mass transfer operations employed in chemical industry.
2. Impart the knowledge of mass transfer operations and equipment.
3. Understand the fundamentals of heat transfer mechanisms in fluids and solids and their applications in various heat transfer equipment in process industries.
4. Learn the thermal analysis and sizing of heat
5. Understand the concepts of heat transfer through extended surfaces

UNIT I CONDUCTION 9

UNIT II CONVECTION 9

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 9

UNIT IV RADIATION 9

UNIT V MASS TRANSFER AND ABSORPTION 9
Mass Transfer Fick's law, equimolar diffusion, diffusion of vapors through a stagnant medium, applications. Applications of mass transfer calculations to gas dissolution in molten metal’s Absorption Equilibrium and operating line concept in absorption calculations, types of contactors, design of packed and plate type absorbers; Operating characteristics of stage wise and deferential contactors.

OUTCOMES:
On completion of this course the student will be able to:

CO 1 Identify the different modes of heat transfer and carry out the conduction calculations in various geometries.

CO 2 Calculate the design requirements of heat transfer in co-current and counter-current heat exchanger operations.

CO 3 Identify the best possible separation method with the given parameters

CO 4 Select the most suitable equipment for absorption, distillation, liquid-liquid extraction and solid-liquid extraction.

CO 5 Develop an understanding of various Physico-chemical separation techniques

TOTAL: 45 PERIODS

TEXT BOOKS
2. Heat and Mass Transfer by Rudramoorthy and Mayilsamy, Pearson Education.

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SF3022 RADIATION PROTECTION

COURSE OBJECTIVES:
1. Provides fundamental physical concept to understand radiation
2. Explain the interaction of radiation with matter and biological effects
3. Explain various dosimetry quantities and how to obtain them from radiation measurements
4. Provides a fundamental grounding in the theory and principles of radiation protection
5. Provides knowledge to build methodology to protect workers, the public, and the environment from radioactivity and radiation using these theory and principles.

UNIT I REVIEW OF ATOMIC, NUCLEAR AND RADIATION PHYSICS

Atomic structure basic -periodic table - atomic radiation (x-ray, Auger electrons and electron conversion) -Molecules-Nuclear structure & stability basics-radio activity (spontaneous & induced) and radiation emission (alpha, beta, gamma, internal conversion, fission fragments) - nuclear reaction basis -solids and energy band

UNIT II INTERACTION OF RADIATION WITH MATTER AND BIOLOGICAL EFFECTS

Interaction of particles (Electron, Alpha and Heavy ions) with matter- charged particle tracks type- Interaction of photons (Gamma and X-rays) with matter- Neutron interaction, fission and criticality- Basic biology (of human cell, fetus and human organs)- physical, chemical (pre & delayed) and track formation in water-chemical and biological effects (acute, delayed somatic, micro and macro level, genetic, cataract, cancer life shortening etc.-)

UNIT III RADIATION SOURCES, DETECTION, MEASUREMENTS AND DOSIMETRY

Category of radiation sources based on types (X-ray, Gamma, Neutron, Beta, Alpha and Heavy ions) and method of generation (Isotopic, Reactor based, Accelerator Based)- Radiation detectors (Gas filled, Semiconductor, Scintillation, Solid state, Emulsion, Activation) Gamma and Neutron spectrometry (using Scintillation and Semiconductor detectors)- Dosimetric quantities and its definition and units (Equivalent, Effective, Committed Equivalent and Committed Effective Doses)- Dose response (Relationships Affecting Factors)- Relative Biology Effectiveness- Dose rates- Oxygen Enhancement Ratio- Chemical modifiers - Dose fractionation in Radiotherapy

UNIT IV REVIEW OF STATISTICS FOR RADIATION PROTECTION


UNIT V RADIATION PROTECTION PRINCIPLES, STANDARDS & REGULATIONS

Radiation protection criteria and exposure limit (objective, elements& methodology) – introduction to external and internal radiation protection- NCRP, ICRP, and AERB and its reports, guidelines and regulations - introduction to selected ICRP models (No.30&66: respiratory system, respiratory track, gastro intestinal, bones, reference man and radioactive cloud)-organs activity and transformation number-specific absorbed fraction & effective energy- committed quantities- collective dose quantities- limit on intake and exposure (occupational, nonoccupational, and individual)- Current exposure limits of NCRP, ICRP and AERB and ICRU operational quantities -Probability of causation Risk estimate

TOTAL: 45 PERIODS
COURSE OUTCOMES:
On completion of this course the student will be able to:
CO1 - Relate the dosimetry quantities and radiation protection standards to its scientific basis and examine its applicability to national and international regulations and guidance.
CO2 - Explain radioactivity and radiation interactions (physical & biological) and how to relate the radiation measurements to dosimetry units
CO3 - Apply the knowledge gained to categorize sources of radiation and contrast their relative hazards with reference to rules and regulations in the area of radiation protection
CO4 - Analyze the biological effects and evaluate the risks of exposure to ionizing radiation
CO5 - Build procedures along with cost analysis for protecting workers, the public, and the environment from radioactivity and radiation.

REFERENCES:
3. Various NCRP, ICRP, ICRU and AERB Reports

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OBJECTIVES
1. Reasonably practicable measures to prevent accidents in nuclear installations
2. Mitigate their consequences should they occur.
3. Ensure with a high level of confidence that, for all possible accidents taken into account in the Design of the installation.
4. Accelerate and enlarge the contribution of atomic energy to peace, health and Prosperity Throughout the world.
5. Shut down the reactor, maintain it in a shutdown condition, and prevent the Release of radioactive material during events and accidents.

UNIT I INTRODUCTION TO RADIOACTIVE MATERIALS

UNIT II DISPOSAL OF RADIOACTIVE MATERIALS
Sources and characteristics of radioactive waste and their types and their method of disposal, Handling and prevention of radiation emergencies and Storage requirements of radioactive materials; The Convention on Nuclear Safety Implementing measures;

UNIT III SAFETY HAZARDS IN RADIOACTIVE
Firefighting and rescue operations in the presence of radiation hazard. Pre planning of Radiation incident. Nuclear materials in industrial, medical and weapons applications; Safe handling of nuclear materials;

UNIT IV SAFETY IN NUCLEAR POWER STATION
Responsibility for Safety; Radiation Safety in Nuclear Power Stations; Optimization of Protection; Prevention of Accidents; Emergency Preparedness and Response; Safety considerations during the various phases of the installation; safety in removal of Heat.

UNIT V RADIOACTIVE ELEMENT DECAY PROCESS

OUTCOMES:
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.

TEXT BOOK:
2. Principles of Radiation Dosimetry, G .W.White ,John Wiley and Sons,
3. Radioactive Wastes,their Treatment and disposal ,J.C.Collins,E.F.NSpon Ltd.,
5. Industrial Safety, F.A.Patty(Ed.2007).

REFERENCEBOOK:
2. Effects of Nuclear Weapons,S.Glasstone.
4. Fire Service Problem, Published by the United States Atomic Energy Commission.

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COURSE OBJECTIVES

1. To introduce the concepts of thermal and fired equipment.
2. To study the basis, design and construction of boilers.
3. To study of typical fuel firing systems in the boiler.
4. To study of materials requirements for pressure parts.
5. To study of various boiler auxiliaries system.

UNIT – I INTRODUCTION

Principal equipment in Thermal Power Plant, Historical developments of Boiler, Utility, Industrial boilers, Morden trends in boiler design, Basic knowledge of different types of Thermal Fired Equipment, sub critical and super critical boilers - Coal, Oil, Gas, Pulverised fuel cyclone, FBC, CFBC, MSW, and Stoker firing, Boiler efficiency, auxiliary power consumption, Performance data, Performance Correction Curves

UNIT – II BASIS OF BOILERS AND DESIGN


UNIT – III FIRING SYSTEM- FUEL AND MILLING

Coal / Oil / Natural Gas in any combination, Lignite, Blast Furnace Gas / Coke Oven Gas / Corex Gas Carbon Monoxide / Tail gas, Asphalt, Black Liquor, Bagasse, Rice Husk, Washery Rejects, Wheat / Rice straw MSW, wind box, Burner, Type of Stokers, Pulverisers - Bowl mill, Tube mill, Direct firing, Indirect firing, Wall firing (Turbulent / Vortex Burners), Tangential firing (Jet Burners), Fire Ball.

UNIT – IV PRESSURE PARTS AND DESIGN AND MATERIALS

Economiser, Drums, Water Walls, Headers, Links, Super Hater, Super Heaters, Reheaters, Tubes, Spiral Tubes, Surface area, Free Gas Area, Metal temperature, LMTD, Acid Due Point Temperature, Carbon steel, Low alloy steel, Titanium alloy steel

UNIT – V BOILER AUXILIARIES

Air preheaters (APH) – bi sector APH, Tri sector APH, Cold PA System, Hot PA System, Tubular APH, Steam coil Air preheater, FANS – Axial, Radial, Performance curves, MILLS– Tube, Vertical mills, Air quality Control systems, DustCollection System - Mechanical Precipitator, Electrostatic Precipitator, FGD, SCR, SNCR

TOTAL: 45 PERIODS

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

1. Explain the concepts of thermal and fired equipment.
2. Discuss the basis, design and construction of boilers.
3. Describe of typical fuel firing systems in the boiler.
4. Discuss the materials requirements for pressure parts.
5. Discuss of various boiler auxiliaries system.

TEXT BOOKS:

1. A Course in Power Plant Engineering; Dhanapat Rai and Sons - Domkundwar
2. Power Plant Engineering by B. Vijaya Ramnath C. Elanchezhian, L. Saravanakumar

REFERENCES:
2. Steam Generators and Waste Heat Boilers: For Process and Plant Engineers (Mechanical Engineering) by V. Ganapathy
3. Steam Generators: Description and Design by Donatello Annaratone
4. An Introduction to Coal and Wood Firing Steam Generators (Power Plants Engineering) by J Paul Guyer
5. Advances in Power Boilers (JSME Series in Thermal and Nuclear Power Generation) by Mamoru Ozawa and Hitoshi Asano | 28 January 2021

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

SF3024 FACILITY LAYOUT AND SAFETY IN MATERIAL HANDLING

OBJECTIVE:
1. Explain the basic principles in facilities planning, location, layout designs and material handling systems.
2. Provide students with the basic concepts related to the interactions between the production system parameters and their impact on materials handling systems design.
3. Provide students with methods for the generation of plant layouts.
4. Provide students with information on materials handling systems design for various aspects of the manufacturing and service industry.
5. Explain the basic principles in material handling and Equipment selection.

UNIT I PLANT LOCATION

UNIT II FACILITY LAYOUT DESIGN
Need for Layout study, Factors influencing plant layout, Objectives of a good facility layout, Classification of layout, Layout procedure – Nadler’s ideal system approach, Immer’s basic steps, Apple’s layout procedure, Reed’s layout procedure – Layout planning – Systematic Layout Planning
– Information gathering, flow analysis and activity analysis, relationship diagram, space requirements and availability, designing the layout. Utilities planning

UNIT III COMPUTERISED LAYOUT PLANNING 9

UNIT IV DESIGNING PRODUCT LAYOUT 9
Line balancing - Objectives, Line balancing techniques – Largest Candidate rule- Kilbridge and Wester method- RPW method- COMSOAL.

UNIT V MATERIAL HANDLING AND PACKAGING 9
Objectives and benefits of Material handling, Relationship between layout and Material handling, Principles of material handling, Unit load concept, Classification of material handling equipments, Equipment selection, Packaging.

TOTAL: 45 PERIODS

OUTCOMES
CO1: Students must analyse, design and apply layout principles for layout product, material handling and packaging.
CO2: Describe and determine the effect of product, process, and schedule design parameters on plant layout and materials handling systems design.
CO3: Develop and analyse plant layouts using manual and computer aided software methodologies.
CO4: Identify and select various types of material handling equipment.
CO5: Design material handling systems for a variety of scenarios pertaining to manufacturing and service industry.

TEXT BOOK:

REFERENCES:
5. Facilities Planning Hardcover – James A. Tompkins (Author), John A. White (Author), Yavuz A. Bozer (Author), J. M. A. Tanchoco (Author)

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:

1. The aim of the course is to analysis of process parameters and design of control systems for open loop and closed loop systems and their application in chemical industries.
2. To provide a structured management approach to control safety risks in operations. Effective safety management must take into account the organization’s specific structures and processes related to safety of operations.
3. Demonstrate a mastery of Health safety and environment knowledge and safety management skills, to reach higher levels in their profession.
4. Effectively communicate on Health safety and environment, facilitating collaboration with experts across various disciplines so as to create and execute safe methodology in complex engineering environment.
5. Demonstrate professional expertise to the industrial and societal needs at national and global level subject to legal requirements.

UNIT I          FUNCTIONS OF INSTRUMENTS AND MEASUREMENT SYSTEM  9
Elements of measurement - Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy, Calibration principle, Static and dynamic characteristics of measuring instruments. Measurement of temperature. Pressure and vacuum measurement - Manometers.

UNIT II        MEASUREMENT OF PRESSURE  9

UNIT III       ELEMENTS OF GENERALIZED PROCESS CONTROL  9
Open loop and close loop systems - Transfer function modeling -block diagram representation of mechanical, thermal and liquid level systems. Effect of damping factors on transient response - Characteristics of proportional, integral, derivative, PI, PD and PID controllers.

UNIT IV   PROCESS CONTROL  9
Introduction to stability - Definition via impulse response function - Routh- Hurwitz stability criterion. Control system components - Hydraulic controllers - Pneumatic controllers - PLC.

UNIT V      ADVANCED CONTROL SYSTEMS  9
Introduction to advanced control systems, cascade control, feed forward control, Smith predictor, control of distillation towers and heat exchangers, introduction to computer control of chemical processes.

COURSE OUTCOMES:

TOTAL: 45 PERIODS
**Students able to**
CO1: Acquire knowledge about the measurement principles and techniques of measuring temperature and pressure.
CO2: Identify suitable methods for the measurement of Flow, level, pH and humidity.
CO3: Understand the open loop and closed loop control system
CO4: Analyze the stability of a control system
CO5: Knowledge of various hazards associated with hot working of metals and methods of Control.

**TEXT BOOKS:**

**REFERENCES:**

**MAPPING OF CO'S WITH PO'S AND PSO'S**
- Every course objective must be mapped with 1, 2, 3, - , scale against the correlation PO's and PSO'S

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

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CME342  ERGONOMICS IN DESIGN  L  T  P  C  3  0  0  3

COURSE OBJECTIVES
1. To introduce to industrial design based on ergonomics.
2. To consider ergonomics concept in manufacturing
3. To apply ergonomics in design of controls and display.
4. To apply environmental factors in ergonomics design.
5. To develop aesthetics applicable to manufacturing and product

UNIT – I  INTRODUCTION
9
An approach to industrial design, Elements of design structure for industrial design in engineering application in modern manufacturing systems- Ergonomics and Industrial Design: Introduction to Ergonomics, Communication system, general approach to the man-machine relationship, Human component of work system, Machine component of work system, Local environment-light, Heat, Sound.

UNIT – II  ERGONOMICS AND PRODUCTION
9
Introduction, Anthropometric data and its applications in ergonomic, working postures, Body Movements, Work Station Design, Chair Design. Visual Effects of Line and Form: The mechanics of seeing, Psychology of seeing, Figure on ground effect, Gestalt’s perceptions - Simplicity, Regularity, Proximity, Wholeness. Optical illusions, Influences of line and form.

UNIT – III  DESIGN PRINCIPLES FOR DISPLAY AND CONTROLS
9
Displays: Design Principles of visual Displays, Classification, Quantitative displays, Qualitative displays, check readings, Situational awareness, Representative displays, Design of pointers, Signal and warning lights, colour coding of displays, Design of multiple displays Controls: Design considerations, Controls with little efforts – Push button, Switches, rotating Knobs. Controls with muscular effort – Hand wheel, Crank, Heavy lever, Pedals. Design of controls in automobiles, Machine Tools

UNIT – IV  ENVIRONMENTAL FACTORS
9
Colour: Colour and light, Colour and objects, Colour and the eye – after Image, Colour blindness, Colour constancy, Colour terms – Colour circles, Munsel colour notation, reactions to colour and colour combination – colour on engineering equipments, Colour coding, Psychological effects, colour and machine form, colour and style

UNIT – V  AESTHETIC CONCEPTS
9
Concept of unity, Concept of order with variety, Concept of purpose, Style and environment, Aesthetic expressions - Symmetry, Balance, Contrast, Continuity, Proportion. Style - The components of style, House style, Style in capital good. Introduction to Ergonomic and plant layout software’s, total layout design.

TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to
1. Appreciate ergonomics need in the industrial design.
2. Apply ergonomics in creation of manufacturing system
3. Discuss on design of controls and display.
4. Consider environmental factors in ergonomics design.
5. Report on importance of aesthetics to manufacturing system and product

TEXT BOOKS:
1. Ergonomics in Design: Methods and Techniques (Human Factors and Ergonomics) by Marcelo M. Soares, Francisco Rebelo
2. Ergonomics in Product Design by Sendpoints Publishing Co. Ltd.
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SF3026 SAFETY ASPECTS OF INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:
1. To understand the global trends and development methodologies of various types of products and services
2. 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
3. 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
4. To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
5. 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 FUNDAMENTALS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

UNIT III DESIGN AND TESTING
UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY

TOTAL: 45 PERIODS

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:

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SF3027  SAFETY IN ENGINEERING INDUSTRY

COURSE OBJECTIVE:
1. Know the safety rules and regulations, standards and codes applicable for engineering Industry.
2. Study various mechanical machines and their safety importance.
3. Understand the principles of machine guarding and operation of protective devices.
4. Know the working principle of mechanical engineering processes such as metal Forming and joining Process and their safety risks.
5. Developing the knowledge related to health and welfare measures in engineering Industry.

UNIT I SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES

General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

UNIT II PRINCIPLES OF MACHINE GUARDING


UNIT III SAFETY IN WELDING AND GAS CUTTING

Gas welding and oxygen cutting, resistance welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrester – leak detection- pipe line safety-storage and handling of gas Cylinders.

UNIT IV SAFETY IN COLD FORMING AND HOT WORKING OF METALS

Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot- operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, Foundry production cleaning and finishing foundry processes.

UNIT V SAFETY IN FINISHING, INSPECTION AND TESTING

Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

TOTAL: 45 PERIODS

COURSE OUTCOME:
At the end of the course, the students will be able to
CO1: To outline the safety rules, standards and codes in various mechanical engineering processes.
CO2: To explain various machine guarding systems for lathe, drilling, boring and milling Machines.
CO3: To develop safe procedures for welding, gas cutting, storage and handling of gas cylinders.
CO4: To describe and suggest safety measures for cold forming and hot working of metals.
CO5: To specify the, safety and welfare measures to be taken during finishing, Inspection and Testing of various Mechanical processes.

TEXT BOOK

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SF3028 SAFETY IN PETROLEUM AND PETROCHEMICAL INDUSTRIES L T P C 3 0 0 3

COURSE OBJECTIVES:
1. Illustrate the basic concepts various process employed in petroleum refining and Manufacturing of petrochemicals.
2. Understand the fire prevention and fire protection methods employed in storage tank farms, depots, and terminals.
3. Learn the on- shore and off-shore drilling.
4. Learn the transportation facilities in petroleum industry.
5. Understand the Petroleum and Oil & Gas explorations rules and regulations in India.

UNIT I PETROLEUM REFINERY
Simplifed Flow diagrams of a typical refinery - distillation unit, catalytic cracker, reformer, treating unit (hydro forming, gas purification, Sulphur recovery, lubricating oil unit) Simplified Flow diagrams of Petrochemical Industry - steam cracking, butadiene extraction, ethane recovery, butyl rubber polymerization.

UNIT II PETROLEUM HAZARDS
Potential fire hazards in petroleum and petrochemical industries (ignition by local sources, spark, flame, hot surface, ignition of oil mists and fumes.). Storage tank farms of petroleum and petrochemical industries - Identification of Hazards, Type of Tanks, Design, Layout, Fire prevention measures including lightning protection. Fire protection arrangements in large tank farms, Design concepts of various fixed fire protection systems like Foam-Water Systems, Halogen & DCP systems. Lock out procedures. Salient features of codes / standards: NFPA, API, OISD and SHELL.

UNIT III PETROLEUM TRANSPORTATIONS
Fire protection facilities in Oil Refineries, Depots & Terminals- Transportation of petroleum and petrochemical products (safety considerations, statutory considerations). Design and Construction

UNIT IV PETROLEUM WELL DRILLING OPERATION 9

UNIT V OIL & GAS RULES AND REGULATION 9
Petroleum and Oil & Gas rules and regulations in India, The Oil fields regulations and development Act, New Exploration Licensing Policy (NELP), Functions of directorate general of hydrocarbons, Petroleum and Natural Gas Regulatory Board.

TOTAL: 45 PERIODS

OUTCOMES:
Students able to
CO1-Identify the various processes employed in petroleum refining and petrochemical industries
CO2-Attain ability to design fire protection systems for storage tank farms
CO3-Attain ability to design fire protection facilities in oil refineries, depots and terminals
CO4-Demonstrate an ability to recognize the hazards involved in on-shore and off-shore drilling
CO5-Know the oil and gas explorations rules and regulations in India

TEXT BOOK:

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COURSE OBJECTIVES:
1: Basic terminology in safety, types of injuries, safety pyramid
2: Accident patterns, theories of accident-causation
3: Planning for safety budget, safety culture
4: Introduction to OSHA regulations
5: Role of stakeholders in safety

UNIT - I  INTRODUCTION TO HEALTH, SAFETY AND ENVIRONMENT  9

UNIT - II  PERSONAL PROTECTIVE EQUIPMENT (PPE) AND SAFETY TRAINING  9

UNIT-III  HAZARDS OF CONSTRUCTION AND THEIR PREVENTION – I  9
Safety in material handling and equipments-Safety in storage & stacking of construction materials.

UNIT-IV  SAFETY POLICIES  9
Safety in these of construction equipments- Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools in construction. Temporary power supply.

UNIT-V  ENFORCEMENT OF HEALTH AND SAFETY LAWS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1: Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty
CO2: Safety during construction, alteration, demolition works – Earthwork, steel construction, temporary structures, masonry & concrete construction, cutting & welding
CO3: SoPs (Safe Operating Procedures) – Construction equipment, materials handling-disposal & hand tools
CO4: Understand Other hazards – fire, confined spaces, electrical safety
CO5: BIM & safety

TEXT BOOKS:
2. V.J. Davies and K. Tomasim, Construction Safety Handbook

REFERENCES:
2. LingerL, Modern Method of Material Handling
4. National Building Code of India
5. Relevant Indian Standards published by BIS

CO’s- PO’s & PSO’s MAPPING

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SF3030 SAFETY IN AUTOMOTIVE DESIGN AND CONTROL

OBJECTIVES
1. Reduce the occurrence of vehicle accidents and its consequences.
2. Provide exposure to the students about safety and health provisions related to Hazardous Processes as laid Out in Factories act 1948.
3. Familiarize students with powers of inspectorate of factories.
4. Students to learn about Environment act 1948 and rules framed under the act.
5. Provide wide exposure to the students about various legislations applicable To an industrial Unit

UNIT I ENGINES


UNIT II DIFFERENTIAL


UNIT III ELECTRICAL SYSTEM

Ignition Systems, Magnet ignition, Battery Ignition, Electronic Ignition, Merits and Demerits, Working, Self Starter, Dynamo voltage regulator, Battery construction, operation and maintenance; pollution, Air-pollution, Euro norms, Pollution Control techniques.
UNIT IV LUBRICATING SYSTEM
Types, Components, Lubricating oil, Cooling System, Detail of Components, Study of Systems, Types, Miscellaneous, Special Gadgets and accessories for Fire Fighting vehicles, Automobile Accidents, CMV Rules regarding safety devices for Drivers, Passengers, Fire fighting vehicles & Appliances. Construction & operation of fire fighting vehicles & appliances, Construction & Operation of Fire boats & other Water borne applications, Rules & regulations of RTO; Laboratory testing of vehicles; Road testing of vehicles. Automobile safety devices

UNIT V POLLUTION CONTROL IN PROCESS INDUSTRIES

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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CSF331 DISASTER MANAGEMENT

OBJECTIVES:
CO1: Provide students an exposure to disasters, their significance and types.
CO2: Ensure that students begin to understand the relationship between Vulnerability, Disasters, Disaster prevention and risk reduction
CO3: Study a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
CO4: Enhance awareness of institutional processes 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

UNIT I INTRODUCTION TO DISASTERS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, Class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, Complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) 9
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- Institutional Processes and Framework at State and Central Level- State Disaster Management Authority (SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, Embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9
Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmers And legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9
Landslide Hazard Zonation: Case Studies, 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Student will be able to
CO1Differentiate the types of disasters, causes and their impact on environment and Society
CO2Assess vulnerability and various methods of risk reduction measures as well as Mitigation.
CO3Draw the hazard and vulnerability profile of India, Scenarios in the Indian context. Know the Disaster damage assessment and management.
CO4Awareness of institutional processes in the country and to develop rudimentary
CO5Ability to respond to their surroundings with potential disaster response in areas where they live.
Complete preparedness, response and recovery in order to reduce the impact of Disasters.

TEXT BOOKS:
REFERENCES

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SF3031 ENVIRONMENTAL PROTECTION AND WASTE MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
1. understand the basic problems in Environment Pollution
2. know the cause and prevention of Water Pollution
3. educate the students about the Solids Waste Management
4. familiarizes the concepts on Environmental Auditing and Management
5. teach the students in E-Waste Technology and Recycling Methods

UNIT I INTRODUCTION TO ENVIRONMENT POLLUTION
Air Pollution Management, Air Pollution Measurement, Air quality monitoring, Air Pollution modeling, Air Pollution control Technology & method, Equipment Selection, Equipment design, Particulate Emission control, Sources corrective methods, Air quality Management concept.

UNIT II WATER POLLUTION AND MANAGEMENT
Water pollution Management concepts of water pollution, characteristics of waste water, standards of Pollution parameters methodology of waste water treatment, Water Treatment process, Sedimentation, Coagulation and flocculation, Filtration, Advanced water Treatment processes, Industrial water pollution Management.

UNIT III SOLIDS WASTE MANAGEMENT AND TREATMENT
Solid and hazardous waste Management & risk analysis; sources, Classification and composition of MSW (Municipal Solid Waste), Waste Minimization of MSW, Thermal treatment (Combustion) of MSW, Hazardous Waste Transport & Treatment facilities, Treatment system for hazardous waste & Handling of treatment plant residues.

UNIT IV INTRODUCTION TO ENVIRONMENTAL AUDITING AND MANAGEMENT

UNIT V E-WASTE TECHNOLOGY AND RECYCLING METHODS


OUTCOMES:
On completion of this course the student will be able to

CO1 Give qualitative description of fire sequence, ignition, flames spreading, heat release rate, mass burning rate, time dependency of heat release rate and effect of the enclosure on heat release rate etc.

CO2 Recognize the importance of fire plumes, flames, mean flame height, flame height co relations plumes co relations, ceiling jets etc.

CO3 Develop understanding on pressure profiles and air-flow in buildings

CO4 Attain knowledge about smoke filing, pressure build in the fire enclosure, transient smoke filing models, effect of sprinklers on smoke filing and its correlations, fire safety engineering system for handling and control of combustion gases and CFD models.

CO5 Recognize the importance of Hazardous substances waste Electrical and Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical.

TEXT BOOKS

2. Environmental Management Handbook for Hydrocarbon Processing Indus; James B. Well
3. Environmental Safety and Health Engineering by Gayle wood side and Dianna Koeurek

REFERENCES

1. Waste Management by Rajiv K. Sinha
2. Hazardous Waste Management by J.M. Goel
5. Perspectives in Nuclear Toxic and Hazardous Waste by Kadambari Sharma.
6. Water Pollution, Cases Effects and Control by P.K. Goel
7. A to Z of Environmental Audit, A. Mehrotra
9. A text book on Biotechnology by H. D. Kumar

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TOTAL: 45 PERIODS
Course Objective:
1. To make the students familiar with sources of air
2. To provide the knowledge on demand of good water and population forecast
3. To understand the design of basic components of water supply lines
4. To expose the students to understand the characteristics of water and its measurement
5. To depict the information on water treatment processes and its design

UNIT I

UNIT II
QUANTITY OF WATER:
Per-capita demand, design period, population forecast, fluctuation in demand General requirement: Sources of water, necessity of treatment, water quality standards for various water uses, Intake structures – Different types & design criteria, pumping and transportation of water Principles and design of aeration systems – two film theory, water in air system, air in water system

UNIT III
DISINFECTION:

UNIT IV
ADSORPTION PROCESS:
Types, factors affecting adsorption, kinetics and equilibrium – different isothermequations and their applications. Advanced water treatment: Ion exchange, electro-dialysis, Reverse Osmosis, Ultra filtration Distribution system design and analysis, distribution reservoirs and service reservoirs.

UNIT V
SOIL POLLUTION:
Soil pollutants (Inorganic, organic, pesticides, radionuclides) - sources and effects on nature and properties of soil, claps, plants and terrestrial animals. Thermal pollution, Nuclear hazards Other environmental Issues: Sustainable development, Bio gas, Natural gas, Biodiversity, Urban problems related to energy, water scarcity, Water conservation, rain water harvesting, artificial recharge, watershed management, carbon trading, carbon foot print

COURSE OUTCOMES:
Upon successful completion of this course, students will be able to
CO1 Understand the principles and operation of water treatment systems
CO2 Appraise the suitability of the design of treatment plants and unit processes
CO3 Evaluate process operations and performance
CO4 Understand coagulation, flocculation, and sedimentation, filtration, and disinfection processes.
CO5 Apply water distribution processes.

TOTAL: 45 PERIODS
REFERENCES:

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SF3033 ENERGY ENVIRONMENT ETHICS AND SOCIETY L T P C

COURSE OBJECTIVES:
1. Moral awareness proficiency in recognizing moral problems in engineering like plagiarism and patenting
2. Enable the students to create an awareness on Engineering Ethics and Human to instill Moral and Social Values and Loyalty and to appreciate the rights of others
3. Convincing moral reasoning (comprehending, assessing different views
4. Ethics is the branch of philosophy that concerns itself with the good and evil nature (morality) of actions
5. It contains moral and social principles (rules) for doing business.

UNIT I ENERGY
Linkage with development, world energy scenario, fossil fuel resource- estimates and Vduration, India's energy scenario; Finite/ depleting energy resources, coal, oil, gas, nuclear fission, promises and present status of nuclear fusion energy; Renewable energy, solar, hydro, wind, biomass, ocean, tidal, wave and geothermal. Synergy between energy and environment, global environment issues, greenhouse gas emission, global warming, green energy solutions.

UNIT II SOCIETY AND ENVIRONMENT
Exponential growth in population, environmentally optimum sustainable population, free access resources and the tragedy of commons; environment problems and impact of P.A.T (Population, Affluence and Technology), environmentally beneficial and harmful technologies environment
impact assessment policies and auditing interaction between environment, life support systems and socio-culture system.

UNIT III  ECOSYSTEM
Definition, concepts, structure, realm of ecology, lithosphere, hydrosphere biosphere, atmosphere-troposphere-stratosphere; energy balance to earth, matter and nutrient recycling in ecosystems; nitrogen, oxygen, carbon and water cycles, food producers, consumers and decomposers, food chains-, biodiversity, threat and conservation of biodiversity. Worldviews and environmentally sustainable economic growth, introduction to Design For Environment (DFE), product lifecycle assessment for environment and ISO 14000; triple bottom-line of economic, environment and social performance; environmental ethics, its world impact and challenges...

UNIT IV  ETHICS AND MORAL VALUES
Ethical situations, objectives of ethics and its study, role morality and conflicts; values, policies and Organization Culture; Non-professional, quasi- and hardprofessionals; preventive, personal, common and professional ethics; different ethical value criteria like utilitarian, virtue, right and duty ethics with discussion on the case of priority for improvement of urban (high traffic) or rural (low traffic) intersections causing equal number of fatalities; codes of ethics and their limitations; Institute of engineers code for corporate member, IEEE and ACM professional-code

UNIT V  ENGINEERING ETHICS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO 1 Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

CO 2 Ability to identify the gap based to a survey of the relevant literature

CO 3 Ability to undertake field and laboratory experiments in a systematic way

CO 4 Ability to work independently on a scientific question and arrive at a conclusion

CO 5 Ability to communicate the work undertaken effectively.

TEXT BOOKS:

REFERENCES:
1. Miller G. T Jr; Living in the environment; Cengage Publisher
2. Govindrajan, Natrajan, Santikumar; Engineering Ethics; PHI pub.
3. Raynold G.W. "Ethics in Information Technology; Cengage.
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SF3034 EPIDEMIC CONTROL AND MODELLING L T P C
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COURSE OBJECTIVES:
1. Provides fundamental understanding of epidemics
2. Introduce the mathematical concepts and modeling of epidemic spread
3. Introduce the concepts for forecasting and of epidemic spread
4. Provides the methodology of epidemic management and control
5. Aware in Model Validation in Epidemic

UNIT I BASIC UNDERSTANDING OF EPIDEMIC 9
Definitions of epidemic and its outbreak, Severity of epidemic, environmental condition, host population characteristics, socio-cultural aspects. Types of epidemics sources (point, area, continuous), methods of propagation (contact based, vector based) Investigation, control and prevention, Management strategies, Epidemic Curve, Incubation period and its use, host population characteristics, socio-cultural aspects

UNIT II MATHEMATICAL MODELLING OF EPIDEMIC 9
General introduction to mathematical concepts and main classes of epidemic models (population vs individual based; deterministic vs stochastic, spatial models, Basic concepts and ideas of modelling: (i) presentation of main classes of epidemic models (population vs individual based, deterministic vs stochastic, spatial models), (ii) construction of SIR-like models with various structures. Systems of governing differential Equations, parameterization, simple numerical methods.

UNIT III FORECASTING AND EARLY WARNING OF EPIDEMICS 9
Mathematical modelling for the preparedness against unnaturally-born outbreaks, useof modeling, inclusion of parameters representing preventive and control measures, interventions evaluation. Complex systems, Phenomenological, Mechanistic and dynamical models, Infectious disease dynamics, Reproductive number R and its estimation, Systems of governing differential Equations, parameterization, simple numerical methods, Historical study of incidences and prevalence rates, disease specific, age and sex specific morbidity and mortality rates, past history analysis

UNIT IV EPIDEMIC CONTROL AND MANAGEMENT 9
Decision-making tools in public health in general and in planning mitigation strategies inclusion of parameters representing preventive and control measures, interventions evaluation.

UNIT V MODEL VALIDATION AND CASE STUDIES 9
Case studies and examples of epidemic models Validation, epidemic (spread, early warning, forecasting) models, Indian case studies - SARS-Covid 19 and small pox- epidemic modelling experiences

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1 Acquire basic understanding of epidemic
CO2 Critically read and analyze research articles featuring modeling-based epidemiological studies
CO3 Provide the general ideas for constructing and analyzing simple models of epidemic spread and control
CO4 Interpret models outputs as information that help guide public health decision making
CO5 Provided basic understanding of model validation and case study Methodology

TEXT BOOKS:
1. Infectious Disease Epidemiology - a Model-based Approach, Andreas Handel, (Online book)
2. Epidemic Modelling: An Introduction, D. J. Daley, J. Gani,

REFERENCES:
1. Interdisciplinary Public Health Reasoning and Epidemic Modelling: The Case of Black Death, Dr. George Christakos et al, Springer-Verlag Berlin Heidelberg, Year: 2005
4. Modeling the transmission and prevention of infectious disease, Hurst, Christon J, Springer-Verlag, 2017
5. Charting the Next Pandemic: Modeling Infectious Disease Spreading in the Data Science Age, Springer Year: 2019

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SF3035 REMOTE SENSING IN ENVIRONMENTAL SAFETY L T P C 3 0 0 3

OBJECTIVES
1. To impart knowledge on principles and applications of remote sensing, GIS for environmental safety.
2. To understand the usage of GIS software and sensing technology.
3. To make the students familiar with sources of processing data.
4. To provide the knowledge on demand of information system.
5. To understand environment monitoring systems.

UNIT I OVERVIEW OF REMOTE SENSING

UNIT II REMOTE SENSING TECHNOLOGY
Classification of Remote Sensing Systems, Energy recording technology, Aerial photographs, Photographic systems – Across track and along track scanning, Multispectral remote sensing, Thermal remote sensing, Microwave remote sensing – Active and passive sensors, RADAR, LIDAR, Satellites and their sensors, Indian space programme - Research and development.

UNIT III DATA PROCESSING

UNIT IV GEOGRAPHICAL INFORMATION SYSTEM
GIS Concepts – Spatial and non spatial data, Vector and raster data structures, Data analysis, Database management – GIS software.

UNIT V REMOTE SENSING AND GIS APPLICATIONS
Monitoring and management of environment, Conservation of resources, Sustainable land use, Coastal zone management – Limitations

OUTCOMES
On completion of the course, the student is expected to be able to
CO1 Gives knowledge about the platforms and remote sensors used for environment monitoring
CO2 Acquire knowledge about communication environmental sensing
CO3 Understand about the environmental data processing.
CO4 Gives knowledge about data collection and management
CO5 Impart knowledge about the GIS.

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TOTAL: 45 PERIODS
COURSE OBJECTIVES:
1. Demonstrate theoretical knowledge in management course
2. Describe the hydraulic and pneumatic operate rescue technique and its equipments.
3. Reduce damage to buildings, stock, and equipment. Protect the environment and the community
4. Information on rescue scene organization and management
5. Optional information on litter walkouts and ladder system used in low angle rope rescue operation

UNIT I GENERAL INTRODUCTION RESCUE EQUIPMENT
Emergency Rescue Tender, Water Tender, Foam tender, Multipurpose Tender Hydraulic Platform, Turn Table Ladder, Canteen Van and Ambulance; Fire Extinguishers: - Their types and Applications. Rescue by Ordinary Means

UNIT II HYDRAULICALLY AND PNEUMATICALLY OPERATED TOOLS AND EQUIPMENTS

UNIT III DIFFERENT TYPES OF KNOTS & HITCHES AND THEIR APPLICATIONS IN EMERGENCY CARRIES & DRAGS
Fireman carry, two men carry, three man carry, four man carry, chair carry, stretcher carry and different types of Drags. Rescue problems and their remedies, Rescue from High rise buildings, Rescue from major disasters Earthquake, Flood, Drought, Tsunami etc. Rescue from Fire incident

UNIT IV RESPIRATORY EQUIPMENTS
Rope, Rope Materials, Rope Braiding, Webbing, Carabiners, Swivels, Personal Protective Equipment, Composition of Air, Breathing, Breathing Rate, Calculation of the capacity & time duration of the B.A.Set. Artificial Respiration and their techniques, Renunciator, B.A. Set: - Their types, Constructional features, Working Principal and Applications, Gas Masks: Their types, Constructional features, Working Principal and Applications..

UNIT V RESCUE SYSTEM IN SAFETY

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO 1 An understanding of the care, strengths and weaknesses of rescue equipment.
CO 2 Proficiency in tying the basic rescue knots used with climbing rope and sling material.
CO 3 Competence in executing a counterbalance descent in a vertical environment and Competence in executing a counterbalance rise in a vertical environment
CO 4 Proficiency in raising a climber to a belay stance using select mechanical advantage systems.
An understanding of one's strengths and limitations as a climber in a technical rescue environment

**TEXT BOOKS:**
1. Safety And Technical Rescue Equipment, City Of Chicago Department Of Procurement Services, Rfq Number: 4682

**REFERENCES:**
4. Relevant ISI special appliances and equipments
5. Rescue - Civil defense handbook by HMSO

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**SF3037**

**ATMOSPHERIC GROUND AND OCEAN DISPERSION**

**COURSE OBJECTIVES:**
1. Explains the dynamics of atmospheric dispersion
2. Provides the fundamentals of atmospheric dispersion modeling
3. Explains the dynamics of ocean dispersion
4. Provides the basic knowledge of ocean dispersion modeling
5. Provides the basic knowledge of characteristics of ground and ground dispersion

**UNIT I**

**INTRODUCTION**
Atmospheric instability and convection-stability criteria, parcel method, oscillations, lifting & mixing and convective condensation levels, potential instability and latent instability; stability indices and analysis, cloud formation and types. Global and local wind circulation and profiles, Atmospheric stability and inversions, plume behavior and calculation, turbulent diffusion, concept of mixing height and determination of stability class.

**UNIT II**

**ADMSOPHERIC DISPERSION MODELING**
Modeling types & scales, steps in model formulation, types of input required for dispersion modelling, Preparation of meteorological data for air quality models (surface and upper air data). Emission quantification for point, area and line sources. The box model, Gaussian plume and puff model, commonly used regulatory models and their applications to industrial problems.

UNIT III DYNAMICS OCEAN
General introduction, physical properties of seawater, ocean heat transport and spatial-temporal variability. Water masses, formation and classification, Surface gravity waves, ocean currents and tides, currents and circulations in the oceans, Northeast and Southwest monsoon winds, Upwelling and sinking; mesoscale eddies; winter cooling and convection; tropical cyclones and upper ocean response; El-Nino and Southern Oscillation (ENSO); Indian Ocean Dipole.

UNIT IV OCEAN DISPERSION MODELING
Complex nature of ocean dispersion modeling, Modeling of dynamic transport and distribution of floating solid mass and oil over the sea surface. Modeling of the pollutant transport in the sea land interface regions.

UNIT V GROUND CHARACTERISTICS AND DISPERSION TROUGH GROUND
Soils & rocks - formation, profile and types, transport of liquid through different type of soil structures, short term and long-term diffusion of liquid through ground. Transport of chemicals and radioactive through ground diffusion and ground water transport. Safety analysis of deep underground depository of chemical and radioactive pollutants, Basis tectonics movement, dynamics earth quake and tsunami, prediction and early warning, Transport of industrial and waste dump yard discharges through soil, deep ground and ground water tablet.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students able to

CO1 Understand the basic dynamics of atmospheric dispersion for modeling
CO2 Understand the atmospheric dispersion for modeling methodology
CO3 Understand the basic dynamics of ocean dispersion for modeling
CO4 Understand the ocean dispersion for modeling methodology through oil pollutant transport
CO5 Understand the characteristics of ground and modeling of ground dispersion of pollutants

TEXT BOOKS:

1. Integrated Environmental Modeling, Ramaswami, A., John Wiley. 2005

REFERENCES:

2. Introduction to Environmental Soil Physics, Hillel, D., Elsevier Academic Press, Amsterdam, 2004
3. Introduction to Physical Oceanography: Robert Stewart

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GE3751 PRINCIPLES OF MANAGEMENT L T P C

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COURSE OBJECTIVES:
- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9
UNIT II  PLANNING  9

UNIT III  ORGANISING  9

UNIT IV  DIRECTING  9

UNIT V  CONTROLLING  9
System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
CO1: Upon completion of the course, students will be able to have clear understanding of managerial functions like planning, organizing, staffing, leading & controlling.
CO2: Have same basic knowledge on international aspect of management.
CO3: Ability to understand management concept of organizing.
CO4: Ability to understand management concept of directing.
CO5: Ability to understand management concept of controlling.

TEXT BOOKS:

REFERENCES:
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  9
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  9

UNIT III  TQM TOOLS & TECHNIQUES I  9

UNIT IV  TQM TOOLS & TECHNIQUES II  9
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  9

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.
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TEXT BOOK:

REFERENCES:

GE3753 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING

COURSE OBJECTIVES:
- Understanding the concept of Engineering Economics.
- Implement various micro economics concept in real life.
- Gaining knowledge in the field of macro economics to enable the students to have better understanding of various components of macro economics.
- Understanding the different procedures of pricing.
- Learn the various cost related concepts in micro economics.

UNIT I DEMAND & SUPPLY ANALYSIS
Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis. Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function - Supply elasticity.

UNIT II PRODUCTION AND COST ANALYSIS

UNIT III PRICING
Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT IV  FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT)  9
Balance sheet and related concepts - Profit & Loss Statement and related concepts - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.

UNIT V  CAPITAL BUDGETING (ELEMENTARY TREATMENT)  9
Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL: 45 PERIODS

COURSE OUTCOMES: Students able to
CO1: Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions
CO2: Evaluate the economic theories, cost concepts and pricing policies
CO3: Understand the market structures and integration concepts
CO4: Understand the measures of national income, the functions of banks and concepts of globalization
CO5: Apply the concepts of financial management for project appraisal

TEXT BOOKS:

REFERENCES:
5. Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009

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GE3754  HUMAN RESOURCE MANAGEMENT

OBJECTIVES:
• To provide knowledge about management issues related to staffing,
• To provide knowledge about management issues related to training,
• To provide knowledge about management issues related to performance
• To provide knowledge about management issues related to compensation
• To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT I  INTRODUCTION TO HUMAN RESOURCE MANAGEMENT  9

UNIT II  HUMAN RESOURCE PLANNING  9

UNIT III  TRAINING AND EXECUTIVE DEVELOPMENT  9
Types of training and Executive development methods – purpose – benefits.

UNIT IV  EMPLOYEE COMPENSATION  9

UNIT V  PERFORMANCE EVALUATION AND CONTROL  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Students would have gained knowledge on the various aspects of HRM
CO2: Students will gain knowledge needed for success as a human resources professional.
CO3: Students will develop the skills needed for a successful HR manager.
CO4: Students would be prepared to implement the concepts learned in the workplace.
CO5: Students would be aware of the emerging concepts in the field of HRM

TEXT BOOKS:

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GE3755 KNOWLEDGE MANAGEMENT

COURSE OBJECTIVES:
The student should be made to:
- Learn the Evolution of Knowledge management.
- Be familiar with tools.
- Be exposed to Applications.
- Be familiar with some case studies.

UNIT I  INTRODUCTION  9
Introduction: An Introduction to Knowledge Management - The foundations of knowledge
management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

UNIT III KNOWLEDGE MANAGEMENT-THE TOOLS 9
Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT APPLICATION 9
Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT V FUTURE TRENDS AND CASE STUDIES 9
Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life-cycles of an organization.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Understand the process of acquiring knowledge from experts
CO2: Understand the learning organization.
CO3: Use the knowledge management tools.
CO4: Develop knowledge management Applications.
CO5: Design and develop enterprise applications.

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TEXT BOOK:

REFERENCE:
COURSE OBJECTIVES

1. To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

2. To study the planning; organizing and staffing functions of management in professional organization.

3. To study the leading; controlling and decision making functions of management in professional organization.

4. To learn the organizational theory in professional organization.

5. To learn the principles of productivity and modern concepts in management in professional organization.

UNIT – I INTRODUCTION TO MANAGEMENT

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg’s Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT – II FUNCTIONS OF MANAGEMENT – I

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning – Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT – III FUNCTIONS OF MANAGEMENT – II

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT – IV ORGANIZATION THEORY

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow’s hierarchy of needs theory; Herzberg’s motivation-hygiene theory; McClelland’s three needs motivation theory; Vroom’s valence-expectancy theory – Change Management: Concept of Change; Lewin’s Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT – V PRODUCTIVITY AND MODERN TOPICS

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

CO2 Discuss the planning; organizing and staffing functions of management in professional organization.

CO3 Apply the leading; controlling and decision making functions of management in professional organization.

CO4 Discuss the organizational theory in professional organization.
Apply principles of productivity and modern concepts in management in professional organization.

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MANDATORY COURSES I

MX3081   INTRODUCTION TO WOMEN AND GENDER STUDIES   L T P C
                                     3 0 0 0

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   L T P C
                                     3 0 0 0

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:
   1.2 *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.
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.
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  
5. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

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

and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - - , Inter relations between Disasters and Sustainable development Goals.
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 SIDDHA

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

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
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 - Macrocsm 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
   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
   https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
3. 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,have%20time%20to%20cook.
4. 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/
   https://yogamedicine.com/guide-types-yoga-styles/
   Ayurveda: https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda
10. CAM: https://wwwhindawi.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 verses 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, Dharmpal, 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

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

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

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?

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:

iv. Sumantra Bose, Transforming India: Challenges to the World’s Largest Democracy,
Picador India, 2013.

v. Atul Kohli, Democracy and Discontent: India’s Growing Crisis of Governability, Cambridge

vi. M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI,


TOTAL : 45 PERIODS

MX3089 INDUSTRIAL SAFETY

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

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

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### Course Outcomes

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<td>Understand the basic concept of safety.</td>
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<td>CO2</td>
<td>Obtain knowledge of Statutory Regulations and standards.</td>
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<td>CO3</td>
<td>Know about the safety Activities of the Working Place.</td>
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<td>CO4</td>
<td>Analyze on the impact of Occupational Exposures and their Remedies.</td>
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<td>CO5</td>
<td>Obtain knowledge of Risk Assessment Techniques.</td>
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**Industrial safety** PO 3 3 3 2 1 3 2 2 3 2 1 3 3 3 3

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### OPEN ELECTIVE I AND II

OCS351 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS

L T P C 2 0 2 3

**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

**Introduction** - Foundations of AI - History of AI - The state of the art - Risks and Benefits of AI

- **Intelligent Agents** - Nature of Environment - Structure of Agent - Problem Solving Agents - Formulating Problems - **Uninformed Search** - Breadth First Search - Dijkstra's algorithm or uniform-cost search - Depth First Search - Depth Limited Search

### UNIT II PROBLEM SOLVING WITH SEARCH TECHNIQUES

**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
Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - Regression: Linear Regression - Logistic Regression

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

TOTAL : 30 PERIODS

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:
- 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.

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 BOOKS:
2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed,
REFERENCES

OCS352 IOT CONCEPTS AND APPLICATIONS

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
Evolution of Internet of Things – Enabling Technologies – IoT Architectures: oneM2M, IoT World
Forum (IoTWF) and Alternative IoT Models – Simplified IoT Architecture and Core IoT Functional
Stack – Fog, Edge and Cloud in IoT

UNIT II COMPONENTS IN INTERNET OF THINGS
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
IOT Protocols - IPv6, 6LoWPAN, MQTT, CoAP - RFID, Wireless Sensor Networks, BigData

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: 30 PERIODS
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
OUTCOMES:
CO 1: Explain the concept of IoT.
CO 2: Understand the communication models and various protocols for IoT.
CO 3: Design portable IoT using Arduino/Raspberry Pi/open platform
CO 4: Apply data analytics and use cloud offerings related to IoT.
CO 5: Analyze applications of IoT in real time scenario.

TOTAL: 60 PERIODS

TEXTBOOKS

REFERENCES
1. Perry Lea, “Internet of things for architects”, Packt, 2018

OCS353 DATA SCIENCE FUNDAMENTALS L T P C
2 0 2 3

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
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  7

UNIT II  VR MODELING  6

UNIT III  VR PROGRAMMING  6
VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV  APPLICATIONS  6

UNIT V  AUGMENTED REALITY  5
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

PRACTICAL EXERCISES:  30 PERIODS
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

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 ELCTIVE III

OHS351 ENGLISH FOR COMPETITIVE EXAMINATIONS

L T P C
3 0 0 3

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.

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

191
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
• Expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
• Identify errors with precision and write with clarity and coherence
• Understand the importance of task fulfilment and the usage of task-appropriate vocabulary
• Communicate effectively in group discussions, presentations and interviews
• Write topic based essays with precision and accuracy

CO-PO & PSO 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.
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%

TEXT BOOK:

REFERENCES:

Websites
http://civilservicesmentor.com/, http://www.educationobserver.com
http://www.cambridgeenglish.org/in/

OMG352

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

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

REFERENCE BOOKS

OMG353 DEMOCRACY AND GOOD GOVERNANCE
L T P C
3 0 0 3

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.

OME365  RENEWABLE ENERGY TECHNOLOGIES  L  T  P  C  3 0 0 3

COURSE OBJECTIVES
1. To know the Indian and global energy scenario
2. To learn the various solar energy technologies and its applications.
3. To educate the various wind energy technologies.
4. To explore the various bio-energy technologies.
5. To study the ocean and geothermal technologies.

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

OUTCOMES:
At the end of the course the students would be able to
- Discuss the Indian and global energy scenario.
- Describe the various solar energy technologies and its applications.
- Explain the various wind energy technologies.
- Explore the various bio-energy technologies.
- Discuss the ocean and geothermal technologies.

TEXT BOOKS:

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

OME354 APPLIED DESIGN THINKING L T P C
3 0 0 3

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                                                                     9
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

COURSE OUTCOMES
At the end of the course, learners will be able to:
● Define & test various hypotheses to mitigate the inherent risks in product innovations.
● Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
● Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching
● 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. Proposition Design: How to Create Products and Services Customers Want, Wiley

REFERENCES
1. https://www.ideou.com/pages/design-thinking#process
3. https://blog.forgefor ward.in/product-innovation-rubric-adf5ebdf7356
4. https://blog.forgefor ward.in/evaluating-product-innovations-e8178e58b86e
5. https://blog.forgefor ward.in/user-guide-for-product-innovation-rubric-857181b253dd
6. https://blog.forgefor ward.in/star tup-failure-is-like-true-lie-7812cdfe9b85

MF3003                REVERSE ENGINEERING                                                                                           LT P C
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  9 Hours

UNIT II  MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION  9 Hours

UNIT III  DATA PROCESSING  9 Hours

UNIT IV  3D SCANNING AND MODELLING  9 Hours

UNIT V  INDUSTRIAL APPLICATIONS  9 Hours

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
• Apply the fundamental concepts and principles of reverse engineering in product design and development.
• Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
• Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
• Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.
• Analyze the various legal aspect
• Applications of reverse engineering in product design and development.

TEXT BOOKS:
REFERENCES:

OPR351 SUSTAINABLE MANUFACTURING L T P C
3 0 0 3

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 9

UNIT II SOCIAL AND ENVIRONMENTAL SUSTAINABILITY 9
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 9
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 9
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 9

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:

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial
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
1. Understand the operation and architecture of electric and hybrid vehicles
2. Identify various energy source options like battery and fuel cell
3. Select suitable electric motor for applications in hybrid and electric vehicles.
4. Explain the role of power electronics in hybrid and electric vehicles
5. Analyze the energy and design requirement for hybrid and electric vehicles.

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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  6

History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II  AERODYNAMICS  10

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  9

Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations -thrust/power available and thrust/power required.

UNIT IV  AIRCRAFT STABILITY AND STRUCTURAL THEORY  10


UNIT V  SPACE APPLICATIONS  10

History of space research - spacecraft trajectories and basic orbital manoeuvres - six orbital elements - Kepler’s laws of orbits - Newtons law of gravitation.

TOTAL: 45 PERIODS

OUTCOMES:

- Illustrate the history of aviation & developments over the years
- Ability to identify the types & classifications of components and control systems
- Explain the basic concepts of flight & Physical properties of Atmosphere
- Identify the types of fuselage and constructions.
- 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

UNIT IV GROUPDYNAMICS

UNIT V MODERN CONCEPTS
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

TOTAL: 45 PERIODS

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

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203
OIE354 QUALITY ENGINEERING

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

UNIT II CONTROL CHARTS
Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- \( \bar{X} \), \( R \) and \( S \) charts, attribute control charts - \( p \), \( np \), \( c \) and \( u \)- Construction and application.

UNIT III SPECIAL CONTROL PROCEDURES
Warning and modified control limits, control chart for individual measurements, multi-vari chart, \( X \) chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT IV STATISTICAL PROCESS CONTROL
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V ACCEPTANCE SAMPLING
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
OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING 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 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 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

UNIT V RADIOGRAPHY TESTING
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
1. Realize the importance of NDT in various engineering fields.
2. Have a basic knowledge of surface NDE techniques which enables to carry out various inspection in accordance with the established procedures.
3. Calibrate the instrument and inspect for in-service damage in the components by means of Eddy current testing as well as Thermography testing.
4. Differentiate various techniques of UT and AET and select appropriate NDT methods for better evaluation.
5. Interpret the results of Radiography testing and also have the ability to analyse the influence of various parameters on the testing.

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OMR351 MECHATRONICS

L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Selecting sensors to develop mechatronics systems.
2. Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Applying PLC as a controller in mechatronics system.
5. 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.
CO 4: Apply PLC as a controller in mechatronics system.
CO 5: Design and develop the apt mechatronics system for an application.

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:

ORA351 FOUNDATION OF ROBOTICS

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<th>COURSE OBJECTIVES:</th>
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<td>1. To study the kinematics, drive systems and programming of robots.</td>
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<td>2. To study the basics of robot laws and transmission systems.</td>
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<td>3. To familiarize students with the concepts and techniques of robot manipulator, its kinematics.</td>
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<td>4. To familiarize students with the various Programming and Machine Vision application in robots.</td>
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<td>5. To build confidence among students to evaluate, choose and incorporate robots in engineering systems.</td>
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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

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 grabber, 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.

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:

OAE352  FUNDAMENTALS OF AERONAUTICAL ENGINEERING

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

OUTCOMES:
- Illustrate the history of aircraft & developments over the years
- Ability to identify the types & classifications of components and control systems
- Explain the basic concepts of flight & Physical properties of Atmosphere
- Identify the types of fuselage and constructions.
- Distinguish the types of Engines and explain the principles of Rocket

TEXT BOOKS

REFERENCES

OGI351  REMOTE SENSING CONCEPTS  L T P C
5  0  0  3

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  9

UNIT III  ORBITS AND PLATFORMS  9
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  9

UNIT V  DATA PRODUCTS AND INTERPRETATION  9
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
CO 1  Understand the concepts and laws related to remote sensing
CO 2  Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO 3  Acquire knowledge about satellite orbits and different types of satellites
CO 4  Understand the different types of remote sensors
CO 5  Gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS:

REFERENCES:
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**

1. Demonstrate the principles behind crop production and various parameters that influences the crop growth on roof tops
2. Explain different methods of crop production on roof tops
3. Explain nutrient and pest management for crop production on roof tops
4. Illustrate crop water requirement and irrigation water management on roof tops
5. Explain the concept of waste management on roof tops

**TEXT BOOKS:**


**REFERENCES:**


**CO-PO MAPPING**

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To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.

To inculcate entrepreneurial skills through strong Industry-Institution linkage.

OEN351 DRINKING WATER SUPPLY AND TREATMENT

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

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

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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OEE352 ELECTRIC VEHICLE TECHNOLOGY L T P C 3 0 0 3

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

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.

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REFERENCES:

OEI353  INTRODUCTION TO PLC PROGRAMMING  L T P C
                  3 0 0 3

COURSE OBJECTIVES:
1. Understand basic PLC terminologies digital principles, PLC architecture and operation.
2. Familiarize different programming language of PLC.
3. Develop PLC logic for simple applications using ladder logic.
4. Understand the hardware and software behind PLC and SCADA.
5. Exposures about communication architecture of PLC/SCADA.

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
9
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
9
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
9
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

UNIT V CASE STUDIES
9
Stepper Motor Control- Elevator Control-CNC Machine Control- conveyor control-Interlock Problems

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)
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

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

<table>
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OCH351 NANO TECHNOLOGY

UNIT I INTRODUCTION 8
General definition and size effects—important nano structured materials and nano particle- 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 8
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 10
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 10
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 9
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.

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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

COURSE ARTICULATION MATRIX

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<td>describes about the shape, size, structure of composite nano materials and their interference</td>
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<td>develop a deeper knowledge in the application of nanomaterials in different fields</td>
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TOTAL : 45 PERIODS
OBJECTIVE:
- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I INTRODUCTION

UNIT II MOLECULAR SELF ASSEMBLY

UNIT III BIO-INSPIRED MATERIALS

UNIT IV SMART OR INTELLIGENT MATERIALS
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
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

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:
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:
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  9
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, sea weeds, 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  9
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  12
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  6
Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT V  FOOD HYGIENE  9
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 OBJECTIVES:
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 food and beverage industries in the supply of foods.

TEXT BOOKS/REFERENCES:

OPY352  IPR FOR PHARMA INDUSTRY  L T P C
3 0 0 3
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 9
Introduction, Types of Intellectual Property Rights - patents, plant varieties protection, geographical indicators, copyright, trademark, trade secrets.

UNIT II PATENTS 9
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 9
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 9

UNIT V INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY 9

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 OUTCOME
The student will be able to
C1 Understand and differentiate the categories of intellectual property rights.
C2 Describe about patents and procedure for obtaining patents.
C3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
C4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.

C5 Provide different organizations role and responsibilities in the protection of IPR in the international level.

C6 Understand the interrelationships between different Intellectual Property Rights on International Society

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OTT351 BASICS OF TEXTILE FINISHING

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

UNIT II FLAME PROOF & WATERPROOF
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

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.

OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO: 2 Concept of Flame proof & flame retardancy, waterproof and water repellent, Antimicrobial finishes.
CO: 3 Concept of Soil Release, Anti Pilling, UV Protection and Antistatic finishes.
CO: 4 Concept of Mechanical finishing.

TOTAL: 45 PERIODS
CO: 5 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  L T P C
3 0 0 3

OBJECTIVES:
- 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 9
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 9
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 9
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 9
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 9
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.
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

REFERENCES
2. V.Ramesh Babu “Industrial Engineering in Apparel Production” Woodhead publishing India PVT ltd, 2012

Course Articulation Matrix:

<table>
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<th>Course Outcomes</th>
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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  9
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  9
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  9
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  9
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  9

TOTAL : 45 PERIODS

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

REFERENCES:

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
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
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
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.

TOTAL: 45 PERIODS

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

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 9

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES 9
Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS 9
Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

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  9

UNIT II  EXTRUSION  9

UNIT III  INJECTION MOLDING  9
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  9
Compression moulding – Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties, moulding materials, process variables and process cycle, Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements. Preforms and preheating- Techniques of preheating. Machines used-Types of compression mould- 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  9

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Ability to find out the correlation between various processing techniques with product properties.
- Understand the major plastics processing techniques used in moulding (injection, blow, compression, and transfer), extrusion, thermoforming, and casting.
- Acquire knowledge on additives for plastic compounding and methods employed for the same
- Familiarize with the machinery and ancillary equipment associated with various plastic processing techniques.
- Select an appropriate processing technique for the production of a plastic product

REFERENCES:

OEC351  SIGNALS AND SYSTEMS  L T P C
3 0 0 3

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  9

UNIT II  ANALYSIS OF CONTINUOUS TIME SIGNALS  9
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III  LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS  9
UNIT IV  ANALYSIS OF DISCRETE TIME SIGNALS  9
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT
- Z Transform & Properties

UNIT V  LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS  9

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
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:
2010.

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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 into 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

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

- Define, formulate, and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TOTAL: 45 PERIODS
TEXT BOOKS:
1. Book specially prepared by NASSCOM as per the MoU.

REFERENCES:

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OBM333 ASSISTIVE TECHNOLOGY L T P C
3 0 0 3

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 9
Cardiac functions and parameters, principle of External counter pulsation techniques, intra aortic balloon pump, Auxiliary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves, cardiac pacemaker.

UNIT II HEMODIALYSES 9
Physiology of kidney, Artificial kidney, Dialysis action, hemodialyser unit, membrane dialysis, portable dialyser monitoring and functional parameters.

UNIT III HEARING AIDS 9
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 9
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

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

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  9

UNIT II  TRANSPORTATION AND ASSIGNMENT PROBLEMS  9

UNIT III  INTEGER PROGRAMMING  9

UNIT IV  DYNAMIC PROGRAMMING PROBLEMS  9

UNIT V  NON-LINEAR PROGRAMMING PROBLEMS  9

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, students will be able to
- 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.
- Analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.
- Solve the integer programming problems using various methods.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Determine the optimum solution for non linear programming problems.

TEXT BOOKS:

REFERENCES:
OMA353  ALGEBRA AND NUMBER THEORY  L  T  P  C  3  0  0  3

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  9
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

OUTCOMES:
- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- 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

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

UNIT II VECTOR SPACES
Vector spaces over Real and Complex fields - Subspace – Linear space - Linear independence and dependence - Basis and dimension.

UNIT III LINEAR TRANSFORMATION
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
Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process - Least square approximation.

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION

TOTAL : 45 PERIODS
COURSE OUTCOMES:
After the completion of the course the student will be able to
1. Test the consistency and solve system of linear equations.
2. Find the basis and dimension of vector space.
3. Obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
4. Find orthonormal basis of inner product space and find least square approximation.
5. Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

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OBT352 BASICS OF MICROBIAL TECHNOLOGY L T P C 3 0 0 3

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 OUTCOMES:
At the end of the course the students will be able to
1. Microbes and their types
2. Cultivation of microbes
3. Pathogens and control measures for safety
4. Microbes in different industry for economy.

TEXT BOOKS

OBT353  BASICS OF BIOMOLECULES  L T P C
3 0 0 3

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.  9

UNIT IV  NUCLEIC ACIDS  9
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & amp; 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  9
Different types of vitamins, their diverse biochemical functions and deficiency related diseases. Overview of hormones. Hormone mediated signaling. Mechanism of action of steroid hormones,
epinephrine, glucagons and insulin. Role of vitamins and hormones in metabolism; Hormonal disorders; Therapeutic uses of vitamins and hormones.

OUTCOMES:
- Students will learn about various kinds of biomolecules and their physiological role.
- 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

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 functin 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

UNIT IV CELL CYCLE
Cell cycle- Cell division by mitosis and meiosis, Comparison of meiosis 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

OUTCOMES:
- Understanding of cell at structural and functional level.
- Understand the central dogma of life and its significance.
- Comprehend the basic mechanisms of cell division.

TEXTBOOKS:

REFERENCES:
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 I

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

OUTCOMES
By the end of the course, learners will be able to
- Write effective project reports.
- Use statistical tools with confidence.
- Explain the purpose and intension of the proposed project coherently and with clarity.
- Create writing texts to suit achieve the intended purpose.
- Master the art of writing winning proposals and projects.

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

OMA355 ADVANCED NUMERICAL METHODS

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UNIT I ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM

UNIT II INTERPOLATION
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

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS
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
Parabolic equations: Explicit and implicit finite difference methods - Weighted average approximation - Dirichlet's and Neumann conditions - First order hyperbolic equations - Method of characteristics - Different explicit and implicit methods; Wave equation: Explicit scheme - Stability of above schemes.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
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

OUTCOMES
Upon successful completion of the course, students should be able to:
- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- Get an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
- Analyze the response of random inputs to linear time invariant systems.
TEXT BOOKS

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OMA357 QUEUEING AND RELIABILITY MODELLING

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/Ek/1 as special cases – Series queues – Open Jackson networks.
UNIT IV      SYSTEM RELIABILITY  9
Reliability and hazard functions- Exponential, Normal, Weibull and Gamma failure distribution –

UNIT V      MAINTAINABILITY AND AVAILABILITY  9
Maintainability and Availability functions – Frequency of failures – Two Unit parallel system with
repair – k out of m systems.

TOTAL: 45 PERIODS

OUTCOMES
Upon successful completion of the course, students should be able to:
- Enable the students to apply the concept of random processes in engineering disciplines.
- Students acquire skills in analyzing various queueing models.
- Students can understand and characterize phenomenon which evolve with respect to time in
  a probabilistic manner.
- Students can analyze reliability of the systems for various probability distributions.
- Students can be able to formulate problems using the maintainability and
  availability analyses by using theoretical approach.

TEXT BOOKS
   Delhi,2010.

REFERENCES
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science
   Delhi,1983.

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OMG354    PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS  
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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  9
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  9
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  9
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  9
Process selection with PLC phases- Process simulation tools- Work Study – Significance –
Methods, evolution of normal/ standard time – Job design and rating - Value Analysis - Plant
Layout: meaning – characters — Plant location techniques - Types- MRP and Layout Design -
Optimisation and Theory of Constraints (TOC)– Critical Chain Project Management (CCPM)- REL
(Relationship) Chart – Assembly line balancing- – Plant design optimisation -Forecasting methods.

UNIT V  CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT  9
Material requirement planning (MRP)- Concept- Process and control - Inventory control systems
and techniques – JIT and Lean manufacturing - Network techniques - Quality Management:
Preventive Vs Breakdown maintenance for Quality – Techniques for measuring quality - Control
Chart (X , R , p , np and C chart ) - Cost of Quality, Continuous improvement (Kaizen) - Quality
awards - Supply Chain Management - Total Quality Management - 6 Sigma approach and Zero
Defect Manufacturing.

TOTAL 45 : PERIODS

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
1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing,


4. Muhlemann, Okland and Lockyer, Production and Operation Management, Macmillan
India,1992.


OBJECTIVES
- To introduce the interdisciplinary approach of water management.
- To develop knowledge base and capacity building on IWRM.

UNIT I  OVERVIEW OF IWRM  9

UNIT II  WATER USE SECTORS: IMPACTS AND SOLUTION  9
Water users: People, Agriculture, ecosystem and others - Impacts of the water use sectors on water resources - Securing water for people, food production, ecosystems and other uses - IWRM relevance in water resources management.

UNIT III  WATER ECONOMICS  9
Economic characteristics of water good and services – Economic instruments – Private sector involvement in water resources management - PPP experiences through case studies.

UNIT IV  RECENT TRENDS IN WATER MANAGEMENT  9
River basin management - Ecosystem Regeneration – 5 Rs - WASH - Sustainable livelihood - Water management in the context of climate change.

UNIT V  IMPLEMENTATION OF IWRM  9
Barriers to implementing IWRM - Policy and legal framework - Bureaucratic reforms and inclusive development - Institutional Transformation - Capacity building - Case studies on conceptual framework of IWRM.

TOTAL: 45 PERIODS

OUTCOMES
On completion of the course, the student will be able to apply appropriate management techniques towards managing the water resources.

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

CO2 Discuss on the different water uses; how it is impacted and ways to tackle these impacts.

CO3 Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO4 Illustrate the recent trends in water management.

CO5 Understand the implementation hitches and the institutional frameworks.

TEXT BOOKS

REFERENCES
2. IWRM Guidelines at River Basin Level (UNESCO, 2008).
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.

TOTAL: 45 PERIODS

OUTCOMES:

- 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.
- Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
- Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
- Make better business decisions by using advanced techniques in data analytics.

REFERENCES:
OBJECTIVE:

- To impart knowledge about the basics of lean principles, tools and techniques, and implementation in the construction industry.

UNIT I  INTRODUCTION  9
Introduction and overview of the construction project management - Review of Project Management & Productivity Measurement Systems - Productivity in Construction - Daily Progress Report - The state of the industry with respect to its management practices - construction project phases - The problems with current construction management techniques.

UNIT II  LEAN MANAGEMENT  9
Introduction to lean management - Toyota’s management principle - Evolution of lean in construction industry - Production theories in construction – Lean construction value - Value in construction - Target value design - Lean project delivery system - Forms of waste in construction industry - Waste Elimination.

UNIT III  CORE CONCEPTS IN LEAN  9

UNIT IV  LEAN TOOLS AND TECHNIQUES  9

UNIT V  LEAN IMPLEMENTATION IN CONSTRUCTION INDUSTRY  9
Lean construction implementation- Enabling lean through information technology - Lean in design - Design Structure - BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach.

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

CO1 Explains the contemporary management techniques and the issues in present scenario.

CO2 Apply the basics of lean management principles and their evolution from manufacturing industry to construction industry.

CO3 Develops a better understanding of core concepts of lean construction tools and techniques and their importance in achieving better productivity.

CO4 Apply lean techniques to achieve sustainability in construction projects.

CO5 Apply lean construction techniques in design and modeling.

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.

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:

OME343 NEW PRODUCT DEVELOPMENT

COURSE OBJECTIVES
1. To introduce the fundamental concepts of the new product development
2. To develop material specifications, analysis and process.
3. To Learn the Feasibility Studies & reporting of new product development.
4. 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
9

UNIT – II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS
9
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
9
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

OUTCOMES:
At the end of the course the students would be able to
1. Discuss fundamental concepts and customer specific requirements of the New Product development
2. Discuss the Material specification standards, analysis and fabrication, manufacturing process.
3. Develop Feasibility Studies & reporting of New Product development
4. Analyzing the New product qualification and Market Survey on similar products of new product development
5. Develop Reverse Engineering. Cloud points generation, converting cloud data to 3D model

TEXT BOOKS:
1. Product Development – Sten Jonsson
2. Product Design & Development – Karl T. Ulrich, Maria C. Young, Steven D. Eppinger

REFERENCES:
1. Revolutionizing Product Development – Steven C Wheelwright & Kim B. Clark
2. Change by Design
5. Product Design & Value Engineering – Dr. M.A. Bulsara &Dr. H.R. Thakkar

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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 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, learners will be able to:
- Create quick UI/UX prototypes for customer needs
- Develop web application to test product traction / product feature
- Develop 3D models for prototyping various product ideas
- 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
- Select suitable precision machine tools and operate
- Apply the macro and micro components for fabrication of micro systems.
- Apply suitable machining process
- Able to work with miniature models of existing machine tools/robots and other instruments.
- Apply metrology for micro system
TEXT BOOKS:

REFERENCES:

OMF354 COST MANAGEMENT OF ENGINEERING PROJECTS

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
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
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
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

UNIT – V QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT
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
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
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
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

UNIT V BMS ARCHITECTURE AND REAL TIME COMPONENTS
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
1. Acquire knowledge of different Li-ion Batteries performance.
2. Design a Battery Pack and make related calculations.
3. Demonstrate a BatteryModel or Simulation.
5. Approach different BMS architectures during real world usage.

TEXT BOOKS

REFERENCE BOOKS
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

OAU352     SENSORS AND ACTUATORS     L T P C
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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

UNIT II     VARIABLE RESISTANCE AND INDUTANCE SENSORS
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
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
UNIT V  AUTOMATIC TEMPERATURE CONTROL ACTUATORS

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
1. List common types of sensor and actuators used in vehicles.
2. Design measuring equipment’s for the measurement of pressure force, temperature and flow.
3. Generate new ideas in designing the sensors and actuators for automotive application
4. Understand the operation of the sensors, actuators and electronic control.
5. Design temperature control actuators for vehicles.

TEXT BOOKS:
4. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking

REFERENCES:
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  9
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  9
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  9
Propellant Budget – Performance of Complete or Multiple Rocket Propulsion Systems – Engine
Design – Engine Controls – Engine System Calibration – System Integration and Engine
Optimization.

UNIT IV  THRUST VECTOR CONTROL  9
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  9
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

OUTCOMES:
On successful completion of this course, the student will be able to
- Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
- Apply knowledge in selecting the appropriate rocket propulsion systems.
- interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
- Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
- Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle
design.

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 carry out 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.

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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.

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).

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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 9
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 9
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.

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.

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TEXT BOOKS

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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, Magnetostriiction, 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, bimetals 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

- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Select suitable materials for electrical engineering applications.
- Identify right material for optical and optoelectronic applications

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OML353 NANOMATERIALS AND APPLICATIONS    L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
2. Gaining knowledge on dimensionality effects on different properties of nanomaterials
3. Getting acquainted with the different processing techniques employed for fabricating nanomaterials
4. Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
5. Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.

UNIT I NANOMATERIALS               9
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     9
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III PROCESSING               9
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    9
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
1. Evaluate nanomaterials and understand the different types of nanomaterials
2. Recognise the effects of dimensionality of materials on the properties
3. Process different nanomaterials and use them in engineering applications
4. Use appropriate techniques for characterising nanomaterials
5. Identify and use different nanomaterials for applications in different engineering fields.

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COURSE OBJECTIVES:
1. To knowledge on fluid power principles and working of hydraulic pumps
2. To obtain the knowledge in hydraulic actuators and control components
3. To understand the basics in hydraulic circuits and systems
4. To obtain the knowledge in pneumatic and electro pneumatic systems
5. 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:
CO 1: Analyze the methods in fluid power principles and working of hydraulic pumps
CO 2: Recognize the concepts in hydraulic actuators and control components
CO 3: Obtain the knowledge in basics of hydraulic circuits and systems
CO 4: Know about the basics concept in pneumatic and electro pneumatic systems
CO 5: Apply the concepts to solve the trouble shooting hydraulic and pneumatics

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TEXT BOOKS

REFERENCES

OMR353 SENSORS L T P C 3 0 0 3

COURSE OBJECTIVES:
1. To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
2. To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
3. To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
4. To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
5. To familiarize students with different signal conditioning circuits design and data acquisition system.

UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES 9

UNIT II DISPLACEMENT, PROXIMITY AND RANGING SENSORS 9

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9
UNIT IV Optical, Pressure, Temperature and Other Sensors


UNIT V Signal Conditioning


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.

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS


REFERENCES:

COURSE OBJECTIVES
1. To introduce mobile robotic technology and its types in detail.
2. To learn the kinematics of wheeled and legged robot.
3. To familiarize the intelligence into the mobile robots using various sensors.
4. To acquaint the localization strategies and mapping technique for mobile robot.
5. 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.

TEXT BOOKS

REFERENCES:
COURSE OBJECTIVES:
1. To impart knowledge on basics of propulsion system and ship dynamic movements
2. To educate them on basic layout and propulsion equipment’s
3. To impart basic knowledge on performance of the ship
4. To impart basic knowledge on Ship propeller and its types
5. 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

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

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 BOOKS:

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OMV351 MARINE MERCHANT VESSELS LT P C
3 0 0 3

OBJECTIVES:
At the end of the course, students are expected to acquire
1. Knowledge on basics of Hydrostatics
2. Familiarization on types of merchant ships
3. Knowledge on Shipbuilding Materials
4. Knowledge on marine propeller and rudder
5. Awareness on governing bodies in shipping industry

UNIT I INTRODUCTION TO HYDROSTATICS 9
Archimedes Principle- Laws of floatation– Meta centre – stability of floating and submerged bodies-
Density, relative density - Displacement –Pressure –centre of pressure.

UNIT II TYPES OF SHIP 10
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 9
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 8
Types of rudder, construction of Rudder-Types of Propeller, Propeller material-Cavitations and its effects on propeller

UNIT V GOVERNING BODIES FOR SHIPPING INDUSTRY 9
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

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, students would
1. Acquire Knowledge on floatation of ships
2. Acquire Knowledge on features of various ships
3. Acquire Knowledge of Shipbuilding Materials

278
4. Acquire Knowledge to identify the different types of marine propeller and rudder
5. 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

OBJECTIVES:
At the end of the course, students are expected to
1. Understand the role of Marine machinery systems
2. Be familiar with Marine propulsion machinery system
3. Acquaint with Marine Auxiliary machinery system
4. Have acquired basics of Marine Auxiliary boiler system
5. Be aware of ship propellers and steering system

UNIT I ELEMENTARY KNOWLEDGE ON MARINE MACHINERY SYSTEMS 9
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 9
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 9
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 9
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 9
Importance of Propellor 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
OUTCOMES:
At the end of the course, students should be able to,
1. Distinguish the role of various marine machinery systems
2. Relate the components of marine propulsion machinery system
3. Explain the importance of marine auxiliary machinery system
4. Acquire knowledge of marine boiler system
5. Understand the importance of ship propellers 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:
1. To understand the basics of drone concepts
2. To learn and understand the fundamentals of design, fabrication and programming of drone
3. To impart the knowledge of flying and operation of drone
4. To know about the various applications of drone
5. 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
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
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
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

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
CO4: Createthe programs for various drones

CO-PO MAPPING:

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS


REFERENCES


OGI352  GEOGRAPHICAL INFORMATION SYSTEM  L T P C

3 0 0 3

OBJECTIVES:

To impart the knowledge on basic components, data preparation and implementation of Geographical Information System.

UNIT I  FUNDAMENTALS OF GIS

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.

TOTAL:45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CO – PO – PSO MAPPING: GEOGRAPHIC INFORMATION SYSTEM

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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


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.

UNITV  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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

1. Judge about agricultural finance, banking and cooperation
2. Evaluate basic concepts, principles and functions of financial management
3. Improve the skills on basic banking and insurance schemes available to customers
4. Analyze various financial data for efficient farm management
5. Identify the financial institutions

TEXT BOOKS:

REFERENCES:

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<td>To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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OEN352 BIODIVERSITY CONSERVATION

OBJECTIVE:
The identification of different aspects of biological diversity and conservation techniques.

UNIT I INTRODUCTION
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
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
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
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
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:

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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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 & ROOTLOCUS TECHNIQUE


UNIT III FREQUENCY RESPONSE ANALYSIS

Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV STABILITY CONCEPTS & ANALYSIS


UNIT V STATE VARIABLE ANALYSIS

Concept of state – State Variable & State Model – State models for linear & continuous time systems–Solution of state & output equation–controllability & observability.

TOTAL: 45 PERIODS

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.
OEI354   INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS   L  T  P  C
                                      3 0 0 3

COURSE OBJECTIVES:
1. To educate on design of signal conditioning circuits for various applications.
2. To introduce signal transmission techniques and their design.
3. Study of components used in data acquisition systems interface techniques
4. To educate on the components used in distributed control systems
5. 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)

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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

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<tr>
<th>CO’s- PO’s &amp; PSO’s MAPPING</th>
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OCH353 ENERGY TECHNOLOGY
UNIT I INTRODUCTION
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 9
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

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
## Course articulation matrix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statements</th>
<th>P O 1</th>
<th>P O 2</th>
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<td>Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.</td>
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<td>Students will excel as professionals in the various fields of energy engineering</td>
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<td>CO3</td>
<td>Compare different renewable energy technologies and choose the most appropriate based on local conditions.</td>
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<td>CO4</td>
<td>Explain the technological basis for harnessing renewable energy sources.</td>
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<td>CO5</td>
<td>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</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVE:
- To enable the students to analyze properties of a surfaces and correlate them to structure, chemistry, and physics and surface modification technique.

UNIT I  SURFACE STRUCTURE AND EXPERIMENTAL PROBES  9
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  9
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  9
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  9
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  9

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:
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 electro-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.
TEXT BOOKS:

OFD355 FOOD SAFETY AND QUALITY REGULATIONS L T P C
3 0 0 3

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

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 in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrotrostopological 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 OUTCOME - NUTRACEUTICALS

| CO 1 | Acquire knowledge about the nutraceuticals and functional foods, their classification and benefits. |
| CO 2 | Acquire knowledge of phytochemicals, zoochemicals and microbes in food, plants, animals and microbes |
| CO 3 | Attain the knowledge of the manufacturing practices of selected nutraceutical components and formulation considerations of functional foods. |
| CO 4 | Distinguish the various in vitro and in vivo assessment of antioxidant activity of compounds from plant sources. |
| CO 5 | Gain information about the health benefits of various functional foods and nutraceuticals in the prevention and treatment of various lifestyle diseases. |
| CO 6 | Attain the knowledge of the regulatory and safety issues of nutraceuticals at national and international level. |

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<tr>
<th>CO – PO MAPPING</th>
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<tr>
<td>NUTRACEUTICALS</td>
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<td>COURSE OUTCOME</td>
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295
OBJECTIVE:

- To enable the students to learn about the basics of Pretreatment, dyeing, printing and machinery in textile processing.

UNIT I  INTRODUCTION  9
Impurities present in different fibres, Inspection of grey goods and lot preparation. Shearing,

UNIT II  PRE TREATMENT  9

UNIT III  DYEING  9

UNIT IV  PRINTING  9
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  9

TOTAL: 45 PERIODS

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

COURSE ARTICULATION MATRIX:
1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
## Course Outcomes

<table>
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<th>Course Outcome</th>
<th>Statement</th>
<th>Program Outcome</th>
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<td>CO1</td>
<td>Classification of fibres and production of natural fibres</td>
<td>PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PO12, PSO1, PSO2, PSO3</td>
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<td>CO2</td>
<td>Regenerated and synthetic fibres</td>
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<td>Yarn spinning</td>
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## FT 3201 FIBRE SCIENCE

### COURSE OBJECTIVES
- To enable the students to learn about the types of fibre and its properties

### UNIT I INTRODUCTION TO TEXTILE FIBRES
9
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
9
Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel, Tencel

### UNIT III SYNTHETIC FIBRES
9
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
9
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
9
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**
TEXT BOOKS:

REFERENCES:

OTT355          GARMENT MANUFACTURING TECHNOLOGY         L T P C
                                      3          0          3

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  9
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  9
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  9
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  9
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  9
Garment pressing – categories and equipment, packing; care 298abelling of apparels

TOTAL: 45 PERIODS

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 care 298abelling
TEXT BOOKS:
2. Gerry Cooklin, “Introduction to Clothing Manufacture” Blackwell Science Ltd., 1995. 64

REFERENCES:

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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
UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS

UNIT IV HAZARDS AND RISK MANAGEMENT

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
After completion of this course, the student is expected to be able to:
- Describe, with example, the common work-related diseases and accidents in occupational setting
- Name essential members of the Occupational Health team
- 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

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
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

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER
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 BASICIS OF MASS TRANSFER

UNIT V MASS TRANSFER OPERATIONS
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:
- State and describe the nature and properties of the fluids.
- Study the different flow measuring instruments, the principles of various size reductions, conveying equipment’s, sedimentation and mixing tanks.
- Comprehend the laws governing the heat and mass transfer operations to solve the problems.
- Design the heat transfer equipment suitable for specific requirement.

TEXTBOOKS:
2. Fluid Mechanics K L Kumar S Chand & Company Ltd 2008

REFERENCE BOOKS
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
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:
- To study the importance, advantages and classification of plastic materials
- Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
- To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
- Know the manufacture, properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU
- To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES
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  9

UNIT II  MECHANICAL PROPERTIES  9
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  9
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  9
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  9

COURSE OUTCOMES
- Understand the relevance of standards and specifications.
- Summarize the various test methods for evaluating the mechanical properties of the polymers.
- To know the thermal, electrical & optical properties of polymers.
- Identify various techniques used for characterizing polymers.
- Distinguish the processability tests used for thermoplastics, thermosets and elastomers.

TOTAL : 45 PERIODS
REFERENCES:

OEC353 VLSI DESIGN L T P C 3 0 0 3

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 9
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 9

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES 9

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE 9
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 9
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

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.

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OBT370 WEARABLE DEVICES

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

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES
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 thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS

UNIT IV SMART TEXTILE
UNIT V APPLICATIONS OF WEARABLE SYSTEMS

Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES:

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OBM356 MEDICAL INFORMATICS L T P C 3 0 0 3

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
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
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 inclclinical 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:
1. Explain the structure and functional capabilities of Hospital Information System.
2. Describe the need of computers in medical imaging and automated clinical laboratory.
3. Articulate the functioning of information storage and retrieval in computerized patient record system.
4. Apply the suitable decision support system for automated clinical diagnosis.
5. Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

REFERENCES:

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OBT355  BIOTECHNOLOGY FOR WASTE MANAGEMENT  L T P C  3 0 0 3

COURSE OUTCOMES
After completion of this course, the students should be able
1. To learn the various methods biological treatment
2. To know the details of waste biomass and its value addition
3. To develop the bioconversion processes to convert wastes to energy
4. To synthesize the chemicals and enzyme from wastes
5. To produce the biocompost from wastes
6. To apply the theoretical knowledge for the development of value added products
UNIT I  BIOLOGICAL TREATMENT PROCESS  9

UNIT II  WASTE BIOMASS AND ITS VALUE ADDITION  9
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  9
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  9
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  9
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

TEXT BOOKS

REFERENCE BOOKS

OBT356  LIFESTYLE DISEASES  L T P C  3 0 0 3

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
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse – Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

OBT357 BIOTECHNOLOGY IN HEALTH CARE

COURSE OBJECTIVES
The aim of this course is to
1. Create higher standard of knowledge on healthcare system and services
2. 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

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCE BOOKS:

VERTICAL 1: FINTECH AND BLOCK CHAIN
CMG331 FINANCIAL MANAGEMENT LT P C 3 0 0 3

LEARNING OBJECTIVES
1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital.
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANGEMENT
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
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
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
UNIT V  WORKING CAPITAL DECISION


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES.
2. Prasanna Chandra, Financial Management,

CMG332  FUNDAMENTALS OF INVESTMENT  L T P C
3 0 0 3

OBJECTIVES:
1. Describe the investment environment in which investment decisions are taken.
2. Explain how to Value bonds and equities
3. Explain the various approaches to value securities
4. Describe how to create efficient portfolios through diversification
5. Discuss the mechanism of investor protection in India.

UNIT I  THE INVESTMENT ENVIRONMENT
The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on return.

UNIT II  FIXED INCOME SECURITIES
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
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT IV  PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India

UNIT V  INVESTOR PROTECTION
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:
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
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

REFERENCES:

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


REFERENCE

2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018
UNIT V REGULATORY ISSUES

REFERENCES:
5. IIBF, Digital Banking, Taxmann Publication, 2016

CMG336 INTRODUCTION TO FINTECH
OBJECTIVES:
1. To learn about history, importance and evolution of Fintech
2. To acquire the knowledge of Fintech in payment industry
3. To acquire the knowledge of Fintech in insurance industry
4. To learn the Fintech developments around the world
5. To know about the future of Fintech

UNIT I INTRODUCTION
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
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

UNIT IV FINTECH AROUND THE GLOBE
UNIT V  FUTURE OF FINTECH
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.

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

TOTAL:45 PERIODS

VERTICAL 2: ENTREPRENEURSHIP
CMG337 FOUNDATIONS OF ENTREPRENEURSHIP 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 - Characterisitcs 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

315
EMERGING TRENDS IN ENTREPRENEURSHIP


OUTCOMES:
Upon completion of this course, the student should be able to:
CO 1 Learn the basics of Entrepreneurship
CO 2 Understand the business ownership patterns and environment
CO 3 Understand the Job opportunites in Industries relating to Technopreneurship
CO 4 Learn about applications of tehnopreneurship and successful technopreneurs
CO 5 Acquaint with the recent and emerging trends in entreprenerushi

TEXT BOOKS:

REFERENCES:
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 AND LEADERSHIP MANAGEMENT FOR BUSINESS

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:
CO 1 Learn the basics of managing teams for business.
CO 2 Understand developing effective teams for business management.
CO 3 Understand the fundamentals of leadership for running a business.
CO 4 Learn about the importance of leadership for business development.
CO 5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs.

REFERENCES:

CMG339 CREATIVITY AND 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

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO 1 Learn the basics of creativity for developing Entrepreneurship
CO 2 Understand the importance of creative intelligence for business growth
CO 3 Understand the advances through Innovation in Industries
CO 4 Learn about applications of innovation in building successful ventures
CO 5 Acquaint with developing innovative business models to run the business efficiently and effectively

SUGGESTED READINGS:
1. Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
COURSE OBJECTIVES:
- To provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs
- To provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners.

UNIT I  INTRODUCTION TO MARKETING MANAGEMENT

UNIT II  MARKETING ENVIRONMENT

UNIT III  PRODUCT AND PRICING MANAGEMENT

UNIT IV  PROMOTION AND DISTRIBUTUION MANAGEMENT

UNIT V  CONTEMPORARY ISSUES IN MARKETING MANAGEMENT

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to:
CO1 Have the awareness of marketing management process
CO 2 Understand the marketing environment
CO 3 Acquaint about product and pricing strategies
CO 4 Knowledge of promotion and distribution in marketing management.
CO 5 Comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCES:
OBJECTIVES:
1. To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.
2. To create an awareness of the roles, functions and functioning of human resource department.
3. To understand the methods and techniques followed by Human Resource Management practitioners.

UNIT I INTRODUCTION TO HRM

UNIT II HUMAN RESOURCE PLANNING
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
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:
CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO 2 To learn about the HR Planning Methods and practices.
CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES:
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 equity financing.
- To empower the learners towards fund raising 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  

OUTCOMES:
Upon completion of this course, the students should be able to:
CO 1  Learn the basics of starting a new business venture.
CO 2  Understand the basics of venture financing.
CO 3  Understand the sources of debt financing.
CO 4  Understand the sources of equity financing.
CO 5  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

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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.
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

REFERENCES:
3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi

TOTAL: 45 PERIODS
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 Personn
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations

CMG346
ADMINISTRATIVE THEORIES
L T P C
3 0 0 3

UNIT I
Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a
discipline and Identity of Public Administration

UNIT II
Theories of Organization: Scientific Management Theory, Classical Model,
Human Relations Theory

UNIT III
Organization goals and Behaviour, Groups in organization and group dynamics, Organizational
Design.

UNIT IV
Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and
Modern: Process and techniques of decision-making

UNIT V
Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker

REFERENCES:
1. Crozior M : The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis : Organization Theory (MAC)
CMG347 INDIAN ADMINISTRATIVE SYSTEM

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

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

TOTAL: 45 PERIODS

CMG348 PUBLIC POLICY ADMINISTRATION

UNIT-I

UNIT-II
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System’s Approach – Dror’s Optimal Model

UNIT-III

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

OBJECTIVE:
- To learn the applications of statistics in business decision making.

UNIT I INTRODUCTION
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
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
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

UNIT V CORRELATION AND REGRESSION

TOTAL: 45 PERIODS

OUTCOMES:
- To facilitate objective solutions in business decision making.
- To understand and solve business problems
- To apply statistical techniques to data sets, and correctly interpret the results.
- To develop skill-set that is in demand in both the research and business environments
- To enable the students to apply the statistical techniques in a work setting.

REFERENCES:
OBJECTIVES:
- To know how to derive meaning from huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.

UNIT I INTRODUCTION 9
Data mining, Text mining, Web mining, Data warehouse.

UNIT II DATA MINING PROCESS 9
Datamining process – KDD, CRISP-DM, SEMMA
Prediction performance measures

UNIT III PREDICTION TECHNIQUES 9
Data visualization, Time series – ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES 9
Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI 9
Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization

TOTAL: 45 PERIODS

OUTCOMES:
1. Learn to apply various data mining techniques into various areas of different domains.
2. Be able to interact competently on the topic of data mining for business intelligence.
3. Apply various prediction techniques.
4. Learn about supervised and unsupervised learning technique.
5. 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 Luckchovich Stacia Misner, Business Intelligence, Microsoft, 2011
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

TOTAL: 45 PERIODS

OUTCOME:
- The learners will be conversant about HR metrics and ready to apply at work settings.
- The learners will be able to resolve HR issues using people analytics.

REFERENCES:
OBJECTIVE:
To showcase the opportunities that exist today to leverage the power of the web and social media.

UNIT I  MARKETING ANALYTICS  9
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis.

UNIT II  COMMUNITY BUILDING AND MANAGEMENT  9
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  9
Social Media Policies - Etiquette, Privacy - ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV  WEB ANALYTICS  9
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  9
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

TOTAL: 45 PERIODS

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, Celillo Group Media and CafePress 2004
UNIT II WAREHOUSING DECISIONS 9
P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III INVENTORY MANAGEMENT 9
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 9

UNIT V MCDM MODELS 9
Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic an Techniques, the analytical network process (ANP), TOPSIS.

TOTAL: 45 PERIODS

OUTCOME:
- To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:

CMG354 FINANCIAL ANALYTICS

OBJECTIVE:
- This course introduces a core set of modern analytical tools that specifically target finance applications.

UNIT I CORPORATE FINANCE ANALYSIS 9
Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.

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.

OUTCOME
• The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

CES331  SUSTAINABLE INFRASTRUCTURE DEVELOPMENT  L T P C
3 0 0 3

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
UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES


UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS


UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS


TOTAL: 45 PERIODS

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

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CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT

L T P C 3 0 0 3

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

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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

OUTCOMES:
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 – PO Mapping - SUSTAINABLE AGRICULTURE PRACTICES

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C ES333  SUSTAINABLE BIOMATERIALS

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
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 - Polymethylmethacrylate (PMMA) - Polylactic 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) - 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

OUTCOMES
- Students will gain familiarity with Biomaterials and they will understand their importance.
- Students will get an overview of different biopolymers and their properties
- Students gain knowledge on some of the important Bioceramics and Biocomposite materials
- Students gain knowledge on metals as biomaterials
- Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES
6. Vasif Hasirci, Nesrin Hasirci “Fundamentals of Biomaterials” Springer, 2018
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

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

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


UNIT IV   PHOTOVOLTAICS


UNIT V   SUPERCAPAICORS

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)- Oxides-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
OUTCOMES

- Students will acquire knowledge about energy sustainability.
- Students understand the principles of different electrochemical devices.
- Students learn about the working of fuel cells and their application.
- Students will learn about various Photovoltaic applications and the materials used.
- 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 BOOKS

1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

CES336 ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS L T P C 3 0 0 3

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

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<td>CO6</td>
<td>Know the standard research methods that are used worldwide for monitoring the environment.</td>
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</tbody>
</table>

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.

COURSE ARTICULATION MATRIX

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COURSE OBJECTIVES:
1. To create awareness on the energy scenario of India with respect to world
2. To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
3. Familiarisation on the concept of sustainable development and its benefits
4. Recognise the potential of renewable energy sources and its conversion technologies for attaining sustainable development
5. Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO
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
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT

UNIT IV RENEWABLE ENERGY TECHNOLOGY

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
1. Understand the world and Indian energy scenario
2. Analyse energy projects, its impact on environment and suggest control strategies
3. Recognise the need of Sustainable development and its impact on human resource development
4. Apply renewable energy technologies for sustainable development
5. Fathom Energy policies and planning for sustainable development.

REFERENCES:
7. https://www.niti.gov.in/verticals/energy
COURSE OBJECTIVES:
1. To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
2. To create awareness on energy audit and its impacts
3. To acquaint the techniques adopted for performance evaluation of thermal utilities
4. To familiarise on the procedures adopted for performance evaluation of electrical utilities
5. To learn the concept of sustainable development and the implication of energy usage

UNIT I ENERGY AND ENVIRONMENT
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
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
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
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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
1. Understand the prevailing energy scenario
2. Familiarise on energy audits and its relevance
3. Apply the concept of energy audit on thermal utilities
4. Employ relevant techniques for energy improvement in electrical utilities
5. Understand Sustainable development and its impact on human resource development

REFERENCES: