ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS 2021
B. TECH. AGRICULTURAL ENGINEERING
CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
I. To train and educate students with general knowledge and skills in agricultural water management, agricultural production process, farm machinery and farm management.
II. To provide a sound theoretical knowledge in engineering principles applied to agriculture.
III. To prepare students for a successful agricultural engineering career integrating all aspects of engineering in agriculture.
IV. To develop innovative capacity of students for increasing agricultural production with scarce water resources available.
V. To impart positive and responsive out their mission as engineers. reach attitudes, initiative and creative thinking in their mission as engineers.
VI. To understand ethical issues and responsibility of serving the society and the environment at large.

PROGRAM OUTCOMES (POs)
Graduates of the programme B.Tech. Agricultural Engineering will be able to:
1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.

11. **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.

12. **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)**

Graduates of the programme B.Tech. Agricultural Engineering will be able to

1. To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill.

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

3. To inculcate entrepreneurial skills through strong Industry-Institution linkage.

**PEOs / POs MAPPING:**

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### Mapping of Course Outcomes and Programme Outcomes

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**YEAR I**

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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
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* Skill Based Course

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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.
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* Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)
** Summer training has to be completed during the summer vacation, after the completion of Semester IV.

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* Open Elective – I shall be chosen from the emerging technologies
* Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC-II)
* NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA
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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

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

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

### Semester VIII/VII*

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

**Total Credits: 165**

### Mandatory Courses I*

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

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

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<th>VERTICAL IV</th>
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<tr>
<td>Food Processing</td>
<td>Farm Machinery and Energy</td>
<td>Watershed planning and Protected cultivation</td>
<td>IT and Agricultural Business management</td>
</tr>
<tr>
<td>Refrigeration and cold Storage</td>
<td>Farm Power and Machinery Management</td>
<td>Groundwater and Well Engineering</td>
<td>Integrated Farming System</td>
</tr>
<tr>
<td>Food and Dairy Engineering</td>
<td>Testing and Evaluation of farm Machinery and equipment</td>
<td>Design of Micro-irrigation system</td>
<td>Agri Business Management</td>
</tr>
<tr>
<td>Process Engineering of Fruits and Vegetables</td>
<td>Biochemical and Thermochemical conversion of biomass</td>
<td>Sustainable Agriculture and Food Security</td>
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<tr>
<td>Storage and Packaging Technology</td>
<td>Waste and by product utilization</td>
<td>Protected Cultivation</td>
<td>Systems Analysis in Agricultural Engineering</td>
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<tr>
<td>Food Process Equipment and Design</td>
<td>Human Engineering and Safety in Farm Machinery Operations</td>
<td>On-farm water management</td>
<td>IT in Agricultural System</td>
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<tr>
<td>Food Plant Design and Management</td>
<td>Precision Farming Equipment</td>
<td>Irrigation Water Quality and Waste Water Management</td>
<td>Automation in Agriculture</td>
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<tr>
<td>Emerging Technologies in Food Processing</td>
<td>Solar and Wind energy system</td>
<td>Climate change and Adaptation</td>
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**Registration of Professional Elective Courses from Verticals:**

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

### VERTICAL I: FOOD PROCESSING

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### VERTICAL II: FARM MACHINERY AND ENERGY

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VERTICAL III: WATER MANAGEMENT AND PROTECTED CULTIVATION

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VERTICAL IV: IT AND AGRICULTURAL BUSINESS MANAGEMENT

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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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Total: 165
**ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)**

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

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

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

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

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

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- Integrated Energy Planning for Sustainable Development
- Energy Efficiency for Sustainable Development
(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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INDUCTION PROGRAMME

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 don’ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules
This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:
Guide to Induction program from AICTE

HS3152 PROFESSIONAL ENGLISH I L T P C 3 0 0 3

COURSE OBJECTIVES :

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

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

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

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8
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 9
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 9
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 9
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 9
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

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

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

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

COs- PO’s & PSO’s MAPPING

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

MA3151 MATRICES AND CALCULUS

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

UNIT I MATRICES


UNIT II DIFFERENTIAL CALCULUS


UNIT III FUNCTIONS OF SEVERAL VARIABLES


UNIT IV INTEGRAL CALCULUS

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

UNIT V MULTIPLE INTEGRALS 9+3

TOTAL : 60 PERIODS

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

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 :

COs- PO's & PSO’s MAPPING

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COURSE OBJECTIVES:

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

UNIT I  MECHANICS  9

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

UNIT III  OSCILLATIONS, OPTICS AND LASERS  9

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

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

TOTAL : 45 PERIODS

OUTCOMES:
After completion of this course, the students should be able to
CO1 Understand the importance of mechanics.
CO2 Express their knowledge in electromagnetic waves.
CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4 Understand the importance of quantum physics.
CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.
TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:

COs- PO’s & PSO’s MAPPING

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

CY3151 ENGINEERING CHEMISTRY

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

UNIT I WATER AND ITS TREATMENT
UNIT II  NANOCHEMISTRY  9
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  9
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  9

UNIT V  ENERGY SOURCES AND STORAGE DEVICES  9
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

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

TEXT BOOKS:

REFERENCES:
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GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C

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/

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

GE3152 தமிழ் மரபு L T P C
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அனுக்கு ரை தமிழ் திறமையளவு: 3
தமிழ் மரபு திறமையளவு - மாநிலம் மரபு திறமை - தமிழ் கலை திறமைப்பட்டியல் -
தமிழ் எழுத்துச் செயலிக்கும் கூறு - கலை திறமைச் செயலிக்கும் கூறு வருவாறு திறமை -
தமிழ் நூலின் கல்வியானது முதல் பெண் முகம்மற்றும் தமிழ் தமிழரின் வல்லான இலக்கியம் ஆழ்வொர்கள் மற்றும் நொயன்மொர்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்சி – தமிழ் இலக்கிய வளர்சியில் பொருநூறு மற்றும் பொருநூற்றின் ஆதிக்க பங்கழிக்குப் பங்கழிக்கின்றன.
## UNIT I  LANGUAGE AND LITERATURE


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


## UNIT III  FOLK AND MARTIAL ARTS

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

## UNIT IV  THINAI CONCEPT OF TAMILS

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

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

### TOTAL : 15 PERIODS

### TEXT-CUM-REFERENCE BOOKS

1. தமிழ்நாட்டின் பரவலாயத்துறை - மக்களும் பண்பொடும் - உ.து. பிள்மள (தவளியீடு: திறந்ததல் பரவலாயத்துறை மக்களும் பண்பொடும் குறிப்பிட்டு காட்டும்).
2. காலண்டேக் களிசை - புதிய செயல்பாடு செய்வது நடைத்தது. (சின்னம் பொருத்திய).
3. பேசு - செய்வது சுத்திக்குழிப்பாடு செய்வது காட்டுத் துறை (தாங்காசியர் மாது விழா பொருத்திய).
4. பொன்மைக் - எக்கும் சுத்திக்குழிப்பாடு (தாங்காசியர் மாது விழா பொருத்திய).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)
(Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C
0 0 4 2

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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BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.
  1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
  2. Simple harmonic oscillations of cantilever.
  3. Non-uniform bending - Determination of Young's modulus
  4. Uniform bending – Determination of Young's modulus
  5. Laser- Determination of the wave length of the laser using grating
  6. Air wedge - Determination of thickness of a thin sheet/wire
  7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
     b) Compact disc- Determination of width of the groove using laser.
  8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
  9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
  11. Photoelectric effect
  12. Michelson Interferometer.
  13. Melde’s string experiment
  14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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

CO’s-PO’s & PSO’s MAPPING

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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles
  1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
  2. Determination of types and amount of alkalinity in water sample.
3. Split the first experiment into two
4. Determination of total, temporary & permanent hardness of water by EDTA method.
5. Determination of DO content of water sample by Winkler’s 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

**COURSE OUTCOMES:**

**CO1** To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.

**CO2** To determine the amount of metal ions through volumetric and spectroscopic techniques

**CO3** To analyse and determine the composition of alloys.

**CO4** To learn simple method of synthesis of nanoparticles

**CO5** To quantitatively analyse the impurities in solution by electroanalytical techniques"

**TEXT BOOKS:**


**COs- PO’s & PSO’s MAPPING**

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**GE3172**

**ENGLISH LABORATORY**

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**COURSE OBJECTIVES:**

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

**UNIT I** **INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION**

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

UNIT II NARRATION AND SUMMATION 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

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

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

COs- PO’s & PSO’s MAPPING

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- 1-low, 2-medium, 3-high, '-'-no correlation
- **Note:** The average value of this course to be used for program articulation matrix.
COURSE OBJECTIVES:
- To engage learners in meaningful language activities to improve their reading and writing skills.
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing.
- To develop analytical thinking skills for problem solving in communicative contexts.
- To demonstrate an understanding of job applications and interviews for internship and placements.

UNIT I  MAKING COMPARISONS  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

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

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

REFERENCES:

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

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

MA3251 STATISTICS AND NUMERICAL METHODS

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<td>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.</td>
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<td>To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.</td>
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<tr>
<td>To introduce the basic concepts of solving algebraic and transcendental equations.</td>
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<tr>
<td>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.</td>
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<tr>
<td>To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.</td>
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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
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting -

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

TOTAL: 60 PERIODS

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

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

TEXT BOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:

- To introduce the students to principles of agricultural and horticultural crop production
- Understand the crop selection and establishment procedures.
- Learn about the different management practices during crop establishment and growth.
- To introduce the production practices of agricultural and horticultural crops.
- To delineate the role of agricultural engineers in relation to various crop production practices.

UNIT I  AGRICULTURE AND CROP PRODUCTION

Introduction to agriculture and its crop production sub-sectors - field crop production and horticulture; Factors affecting crop growth and production: genetic (internal) and environmental (external) factors; Crop management through environmental modification and adaptation of crops to the existing environment through crop cultural practices.

UNIT II  CROP SELECTION AND ESTABLISHMENT

Regional and seasonal selection of crops; Systems of crop production; Competition among crop plants; Spacing and arrangement of crop plants; Field preparation for crops including systems of tillage; Establishment of an adequate crop stand and ground cover, including selection and treatment of seed, and nursery growing.

UNIT III  CROP MANAGEMENT

Crop water Management; Crop nutrition management - need for supplementation to soil supplied nutrients, sources, generalized recommendations, methods and timing of application of supplemental nutrients including fertigation scheduling; Crop protection including management of weeds, pests and pathogens; Integrated methods of managing water, nutrients and plant protection; Types and methods of harvest.

UNIT IV  PRODUCTION PRACTICES OF AGRICULTURAL CROPS

Generalized management and cultivation practices for important groups of field crops in Tamil Nadu: cereal crops, grain legumes, oil seed crops, sugarcane, and fiber crops, and special purpose crops such as those grown for green manure and fodder.

UNIT V  PRODUCTION PRACTICES OF HORTICULTURAL CROPS

Important groups of horticultural crops in Tamil Nadu such as vegetable crops, fruit crops, flower crops; Cultivation practices of representatives of each group; Special features of production of horticultural crops - green house cultivation.

Practical


COURSE OUTCOMES:

CO1 Students completing this course would have acquired knowledge on the basic principles of crop production.

TOTAL (L: 30 + P:30) = 60 PERIODS
CO2 Students will be able to select suitable crops and decide upon its establishment procedures.

CO3 Students will get knowledge on the different crop management practices.

CO4 The students will have the required knowledge in the area of production of agricultural and horticultural crops.

CO5 Students will be able to delineate their role in relation to various crop production practices.

TEXTBOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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<tr>
<th>PO/PSO</th>
<th>Course Outcome</th>
<th>Overall Correlation of COs to POs</th>
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<td>PO12 Life Long Learning</td>
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<tr>
<td>PSO1 To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<td>PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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BE3252 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING

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COURSE OBJECTIVES:

- To introduce the basics of electric circuits and analysis
- To impart knowledge in domestic wiring
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To introduce the functional elements and working of sensors and transducers.

UNIT I   ELECTRICAL CIRCUITS

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

UNIT II   MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS

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

UNIT III   ELECTRICAL MACHINES


UNIT IV   ANALOG ELECTRONICS


UNIT V   SENSORS AND TRANSDUCERS

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

COURSE OUTCOMES:

After completing this course, the students will be able to

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

TEXT BOOKS:
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
REFERENCES:

COs- PO’s & PSO’s MAPPING

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<thead>
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GE3251

ENGINEERING GRAPHICS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Drawing engineering curves.
- Drawing freehand sketch of simple objects.
- Drawing orthographic projection of solids and section of solids.
- Drawing development of solids
- 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.
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)

TOTAL: (L=30+P=60) 90 PERIODS

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

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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

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

**NCC Credit Course Level 1**

**NX3251 (ARMY WING) NCC Credit Course Level - I**

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**TOTAL: 30 PERIODS**

**NCC Credit Course Level 1**

**NX3252 (NAVAL WING) NCC Credit Course Level - I**

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**TOTAL : 30 PERIODS**

**NCC Credit Course Level 1 (AIR FORCE WING)**

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GE3252 TAMILS AND TECHNOLOGY L T P C
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UNIT I WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY
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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY
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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழ்க் வரலோறு – மக்களும் பண் பொடும் – மக. மக. பிள்மள (தவளியீடு: தமிழ்நொடுபொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கீழடி – மவமகநதிக்கமரயில் எங்ககொலநகர் நொகரிகம் (ததொல்லியல் துமற்தவளியீடு)
3. பொருமந – ஆற்றங்கமரயில் தஞ்சகாய தஞ்சகொன்னிகம் (ததொல்லியல் துமற்தவளியீடு)
4. பொருமந – ஆற்றங்கமரயில் தஞ்சகொன்னிகம் (ததொல்லியல் துமற்தவளியீடு)
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)

12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL – Reference Book)

GE3271 ENGINEERING PRACTICES LABORATORY

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

- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES

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

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

Wood Work Study:
- Studying joints in door panels and wooden furniture
- 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:

CO1 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.

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

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

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

COs- PO's & PSO's MAPPING

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54
BE3272  BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION ENGINEERING LABORATORY  

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

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

TOTAL: 60 PERIODS

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

CO1: Use experimental methods to verify the Ohm’s law and Kirchhoff’s Law and to measure three phase power
CO2: Analyze experimentally the load characteristics of electrical machines
CO3: Analyze the characteristics of basic electronic devices
CO4: Use LVDT to measure displacement

COs- PO’s & PSO’s MAPPING

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CO3272  COMMUNICATION LABORATORY

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
12 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
12 Speaking: discussing news stories-talking about frequency-talking about travel problems - discussing travel procedures - talking about travel problems - making arrangements - discussing plans and decisions - discussing purposes and reasons - understanding common technology terms - Writing: writing emails (formal & semi-formal).

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

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

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

TOTAL: 60 PERIODS

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

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

COs- PO's & PSO’s MAPPING

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• 1-low, 2-medium, 3-high, ‘-’- no correlation
• Note: The average value of this course to be used for program articulation matrix.
MA3301  FOURIER SERIES AND LINEAR PROGRAMMING  L T P C  3 1 0 4

COURSE OBJECTIVES:
- 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 a wide variety of situations.
- To have knowledge in solving linear programming problems.
- To acquaint knowledge to solve transportation and assignment problems.
- To familiar with the method of solving nonlinear programming problems.

UNIT I  FOURIER SERIES  9+3
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value - Parseval's identity—Harmonic analysis.

UNIT II  FOURIER TRANSFORMS  9+3

UNIT III  LINEAR PROGRAMMING PROBLEMS  9+3
Mathematical formulation - Graphical method - Simplex method - Artificial variable techniques - Big M Method - Two phase Simplex method - Duality - Dual Simplex method.

UNIT IV  TRANSPORTATION AND ASSIGNMENT PROBLEMS  9+3

UNIT V  NON-LINEAR PROGRAMMING PROBLEMS  9+3

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1 Apply Fourier series techniques used in a wide variety of situations in which the functions used are not periodic and to solve boundary value problems.
CO2 Apply the Fourier transform techniques to solve boundary value problems.
CO3 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.
CO4 Analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.
CO5 Determine the optimum solution for non-linear programming problems.

TEXT BOOKS:

REFERENCES:

COs- PO's & PSO's MAPPING

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**AI3301 PRINCIPLES OF SOIL SCIENCE AND ENGINEERING**  
**L T P C**  
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**COURSE OBJECTIVES:**
- To expose the students to the fundamental knowledge on Soil physical parameters, Permeability – Compaction, Bearing Capacity and types and methods of soil survey and interpretative groupings

**UNIT I INTRODUCTION AND SOIL PHYSICS**  

**UNIT II SOIL CLASSIFICATION AND SURVEY**  

**UNIT III PHASE RELATIONSHIP AND SOIL COMPACTION**  
Phase relations- Gradation analysis- Atterberg Limits and Indices- Engineering Classification of soil – Soil compaction- factors affecting compaction- field and laboratory methods.

**UNIT IV ENGINEERING PROPERTIES OF SOIL**  
Shear strength of cohesive and cohesionless - Mohr-Coulomb failure theory- Measurement of shear strength, direct shear, Triaxial and vane shear test- -Permeability- Coefficient of Permeability-Darcy’s law-field and lab methods - Assessment of seepage - Compressibility.

**UNIT V BEARING CAPACITY AND SLOPE STABILITY**  
58
Bearing capacity of soils - Factors affecting Bearing Capacity - Shallow foundations - Terzaghi’s formula - BIS standards - Slope Stability - Analysis of infinite and finite slopes - friction circle method - slope protection measures.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Understand the fundamental knowledge of soil physical parameters.
CO2 Perform soil survey and classify soil based on its characteristics
CO3 Explain the phase relationship and soil compaction.
CO4 Analyze Engineering properties of soil
CO5 Understand Concepts of bearing capacity and slope stability.

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:

- The students would be exposed to the fundamental knowledge in Evaporation, Filtration, Sedimentation, Processing, Sieve analysis, Crystallization and Distillation in processing of agricultural produce.

UNIT I EVAPORATION AND CONCENTRATION
6

UNIT II MECHANICAL SEPARATION
6

UNIT III SIZE REDUCTION
6

UNIT IV CONTACT EQUILIBRIUM SEPARATION
6

UNIT V CRYSTALLISATION AND DISTILLATION
6

TOTAL: 30 PERIODS

PRACTICAL
1. Determination of thermal efficiency and economy of evaporator
2. Determination of separation efficiency of centrifugal separator
3. Determination of collection efficiency in cyclone separator
4. Determination of efficiency of liquid-solid separation by filtration
5. Determination of absorption efficiency in a packing tower
6. Performance evaluation of a sieve and determination of particle size of granular foods by sieve analysis
7. Determination of energy requirement in size reduction using the burr mill
8. Determination of energy requirement in size reduction using the ball mill and hammer mill
9. Determination of mixing index for solids
10. Determination of economy and thermal efficiency of rotary flash evaporator for concentration of juice
11. Performance evaluation of a steam distillation process

TOTAL: 30 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Examine the evaporation process and types of evaporators for food industry
CO2 Analyze the principles of filtration and mechanical separation equipment
CO3 Identify size reduction and grinding equipment and understand the factors affecting the process
CO4 Identify the gas-liquid and solid-liquid equilibrium concepts and factors influencing equilibrium separation process.
CO5 Differentiate crystallization and distillation processes and identify processing equipment.

COs- PO’s & PSO’s MAPPING

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AI3303 FLUID MECHANICS AND PUMPS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce the students about the properties of the fluids, behaviour of fluids under static, kinematic and dynamic conditions through the control volume approach and expose them to the applications of the conservation laws and to impart basic knowledge of the dimensional analysis and model studies along with flow through pipes.
- The students will be exposed to the basic concepts of open channel flows with significance to steady uniform flows along with flow measurements in open channels.
- To expose the students to the classification of pumps the basic principles of working and to design centrifugal pump.

UNIT I FLUID PROPERTIES AND FLUID STATICS 9

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 9
Classification of flows - Methods of analysis- Continuum hypothesis - System and Control volume approach - Streamline, streak-line and path-lines - Stream function - Velocity potentials - Flow nets - Application of control volume to continuity, energy and momentum - Euler’s equation of motion along a stream line - Bernoulli’s equation - Linear momentum equation – Applications.

UNIT III FLOW THROUGH PIPES AND MODEL STUDIES 9

UNIT IV OPEN CHANNEL FLOWS 9

UNIT V PUMPS 9

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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

**CO1** Demonstrate the properties of fluid and its behaviour in static conditions along with pressure measurements.

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

**CO3** Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel and to understand the concept of application of dimensional analysis in model studies.

**CO4** Describe the basics characteristics of open channel flows and analysis of steady uniform flow with hydraulically efficient channel sections and to measure the flows in artificial/natural channels.

**CO5** Explain the classification, design and working principles of various pumps.

**COs- PO’s & PSO’s MAPPING**

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COURSE OBJECTIVES:

- Applying the basic components of mechanisms, analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism and design cam mechanisms for specified output motions.
- Applying the basic concepts of toothed gearing and kinematics of gear trains.
- Analyzing the effects of friction in machine elements.
- Analyzing the force-motion relationship in components subjected to external forces and analyzing of standard mechanisms.
- Analyzing the undesirable effects of unbalances resulting from prescribed motions in mechanism and the effect of dynamics of undesirable vibrations.

UNIT I   KINEMATICS OF MECHANISMS


UNIT II   GEARS AND GEAR TRAINS


UNIT III   FRICTION IN MACHINE ELEMENTS

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads – Bearings and lubrication – Friction clutches – Belt and rope drives – Friction aspects in brakes – Friction in vehicle propulsion and braking.

UNIT IV   FORCE ANALYSIS


UNIT V   BALANCING AND VIBRATION


TOTAL 45 PERIODS

COURSE OUTCOMES:

On completion of the course, the student is expected to

- CO1 Discuss the basics of mechanism.
- CO2 Solve problems on gears and gear trains.
- CO3 Examine friction in machine elements.
- CO4 Calculate static and dynamic forces of mechanisms.
- CO5 Calculate the balancing masses and their locations of reciprocating and rotating masses. Computing the frequency of free vibration, forced vibration and damping coefficient.

TEXT BOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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

CE3351 SURVEYING AND LEVELLING

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

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING

UNIT II LEVELLING

UNIT III THEODOLITE SURVEYING

UNIT IV CONTROL SURVEYING AND ADJUSTMENT

UNIT V MODERN SURVEYING

TOTAL 45 PERIODS

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

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

TEXTBOOKS:

REFERENCES:

COs- PO’s & PSO’s MAPPING

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| PROGRAM SPECIFIC OUTCOMES(PSO) |
|-----------------------------|----------------|
| PSO1 Knowledge of Civil Engineering discipline | 3   | 3   | 3   | 3   | 3   | 3             |
| PSO2 Critical analysis of Civil Engineering problems and innovation | 3   | 3   | 3   | 3   | 3   | 3             |
| PSO3 Conceptualization and evaluation of engineering solutions to Civil Engineering | 3   | 3   | 3   | 3   | 3   | 3             |
COURSE OBJECTIVES:
- Students should be able to verify the principles studied in theory by performing the experiments in the laboratory

LIST OF EXPERIMENTS
1. Flow Measurement
   - Calibration of Rotameter
   - Flow through Venturimeter
   - Flow through a circular Orifice
   - Determination of mean velocity by Pitot tube
   - Flow through a Triangular Notch
   - Flow through a Rectangular Notch

2. Losses in Pipes
   - Determination of friction coefficient in pipes
   - Determination of losses due to bends, fittings and elbows

3. Pumps
   - Characteristics of Centrifugal pump
   - Characteristics of Submersible pump
   - Characteristics of Reciprocating pump

TOTAL: 60 PERIODS

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Apply Bernoulli equation for calibration of flow measuring devices.
CO2 Measure friction factor in pipes and compare with Moody diagram
CO3 Determine the performance characteristics of rotodynamic pumps.
CO4 Determine the performance characteristics of positive displacement pumps.

COS- PO’s & PSO’s MAPPING

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**AI3312 SOIL SCIENCE LABORATORY**

**COURSE OBJECTIVES:**
- Students should able to verify various quality aspects of soil and water studied in theory by performing experiments in the laboratory.

**LIST OF EXPERIMENTS:**
1. Identification of rocks and minerals
2. Collection and processing of soil samples
3. Determination of soil moisture, EC and pH
4. Field density determination by Core Cutter and Sand Replacement method
5. Specific gravity determination by Pycnometer
6. Textural analysis of soil by International Pipette method
7. Grain size analysis by using Mechanical shaker
8. Determination of Organic carbon
9. Estimation of Gypsum requirements

**REFERENCES:**

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

- **CO1** Explain soil physical properties and compare the properties based on soil and water system
- **CO2** Analyse the soil chemical properties to classify the arable and problem soils to develop different reclamation practices

**COs- PO’s & PSO’s MAPPING**

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**CE3361 SURVEYING AND LEVELLING LABORATORY**

**COURSE OBJECTIVES:**
- At the end of the course the student will possess knowledge about survey field techniques

**LIST OF EXPERIMENTS:**
- **Chain Survey**
  1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
  2. Setting out works – Foundation marking using tapes single Room and Double Room
- **Compass Survey**
  3. Compass Traversing – Measuring Bearings & arriving included angles
- **Levelling - Study of levels and levelling staff**
  4. Fly levelling using Dumpy level & Tilting level
  5. Check levelling
- **Theodolite - Study of Theodolite**
  6. Measurements of horizontal angles by reiteration and repetition and vertical angles
  7. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.
- **Tacheometry – Tangential system – Stadia system**
  8. Determination of Tacheometric Constants
  9. Heights and distances by stadia Tacheometry
  10. Heights and distances by Tangential Tacheometry
- **Total Station - Study of Total Station, Measuring Horizontal and vertical angles**
  11. Traverse using Total station and Area of Traverse
  12. Determination of distance and difference in elevation between two inaccessible points using Total station

**TOTAL: 45 PERIODS**

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

**CO1** Impart knowledge on the usage of basic surveying instruments like chain/tape, compass and
 levelling instruments

CO2 Able to use levelling instrument for surveying operations
CO3 Able to use theodolite for various surveying operations
CO4 Able to carry out necessary surveys for social infrastructures
CO5 Able to prepare planimetric maps

REFERENCES:

COs- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
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<td>PO12</td>
<td>Life Long Learning</td>
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<tr>
<td>PSO1</td>
<td>Knowledge of Civil Engineering discipline</td>
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<tr>
<td>PSO2</td>
<td>Critical analysis of Civil Engineering problems and innovation</td>
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<tr>
<td>PSO3</td>
<td>Conceptualization and evaluation of engineering solutions to Civil Engineering Issues</td>
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</tbody>
</table>

GE3361 PROFESSIONAL DEVELOPMENT

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

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

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

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

**COMMENTS:**
- 30 PERIODS

**COURSE OUTCOMES:**
On successful completion the students will be able to

**CO1** Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements

**CO2** Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
CO3 Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

COURSE OBJECTIVES:
- To introduce the students to the different systems and working principles of tractor, power tiller, makes of tractors and power tillers.

UNIT I TRACTORS
Classification of tractors - Tractor engines – construction of engine blocks, cylinder head and crankcase - features of cylinder, piston, connecting rod and crankshaft – firing order combustion chambers.

UNIT II ENGINE SYSTEMS

UNIT III TRANSMISSION SYSTEMS

UNIT IV HYDRAULIC SYSTEMS
Hydraulic system - working principles, three point linkage - draft control - weight transfer, theory of traction - tractive efficiency – tractor chassis mechanics - stability - longitudinal and lateral. Controls - visibility - operators seat.

UNIT V POWER TILLER, BULLDOZER AND TRACTOR TESTING

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Get an idea on various machinery available for farm mechanization
CO2 Calculate the valve timing of an IC engine and represent by a drawing
CO3 Gain knowledge on the transmission system of a tractor
CO4 Understand the hydraulic system in a tractor and estimate the traction.
CO5 Gain knowledge on power tillers, bulldozers and different tractor testing procedures.

AI3402 SOIL AND WATER CONSERVATION ENGINEERING

COURSE OBJECTIVES:
- Get a sound knowledge in the problems associated with soil erosion.
- Introduce the estimation of soil erosion.
- Impart knowledge in various practices to control erosion.
- Study about the water conservation principles and techniques.

COs- PO's & PSO's MAPPING

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<tr>
<td>PSO1 To bring expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<td>PSO2 To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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</table>
• Get an idea about sedimentation and its control measures.

UNIT I  SOIL EROSION PRINCIPLES

UNIT II  ESTIMATION OF SOIL EROSION

UNIT III  EROSION CONTROL MEASURES

UNIT IV  WATER CONSERVATION MEASURES

UNIT V  SEDIMENTATION

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Gain fundamental knowledge on the concepts of erosion and sedimentation.
CO2 Gain knowledge about evolution of Universal Soil Loss Equation: and its applications.
CO3 Explain and design erosion control measures types and design specifications
CO4 Have sufficient knowledge on soil and water conservation measures.
CO5 Have sufficient knowledge on reservoir sedimentation and sediment control methods.

COs- PO's & PSO's MAPPING

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| PO1 | Knowledge of Engineering Sciences | 2 | 2 | 2 | 3 | 3 | 2 |
| PO2 | Problem Analysis | 2 | 2 | 3 | 3 | 3 | 2 |
| PO3 | Design/ Development of Solutions | 3 | 3 | 3 | 3 | 3 | 3 |
| PO4 | Investigations | 2 | 2 | 2 | 3 | 3 | 2 |
| PO5 | Modern Tool Usage | 2 | 2 | 2 | 2 | 2 | 2 |
| PO6 | Individual and Team work | 2 | 1 | 3 | 1 | 1 | 2 |
| PO7 | Communication | 1 | 3 | 1 | 3 | 1 | 2 |
| PO8 | The Engineer and Society | 2 | 2 | 1 | 1 | 2 | 2 |
| PO9 | Ethics | 1 | 2 | 1 | 1 | 2 | 1 |
| PO10 | Environment and Sustainability | 3 | 3 | 1 | 2 | 3 | 2 |
| PO11 | Project Management and Finance | 2 | 2 | 2 | 2 | 2 | 2 |
| PO12 | Life Long Learning | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO1 | To bring expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO2 | To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 2 | 2 | 2 | 2 | 2 | 2 |
| PSO3 | To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 1 | 1 | 1 | 1 | 1 | 1 |

**AI3403 STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING**

**COURSE OBJECTIVES:**
- To understand the stresses developed in bars, compound bars, beams, shafts, cylinders and spheres.

**UNIT I**

**STRESS, STRAIN AND DEFORMATION OF SOLIDS**


**UNIT II**

**ANALYSIS OF PLANE TRUSSES**

Determinate and indeterminate plane trusses – determination of member forces by method of joints, method of sections and method of tension coefficient.

**UNIT III**

**TRANSVERSE LOADING AND STRESSES IN BEAM**

UNIT IV TORSION
Torsion formula - stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs - carriage springs.

UNIT V DEFLECTION OF BEAMS
Computation of slopes and deflections in determinate beams - Double Integration method – Macaulay”s method – Area moment method – Conjugate beam method.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Find the stress distribution and strains in regular and composite structures subjected to axial loads.
CO2 Evaluate the stresses in plane trusses
CO3 Assess the shear force, bending moment and bending stresses in beams
CO4 Apply torsion equation in design of circular shafts and helical springs
CO5 Evaluate the slope and deflection of beams and buckling loads of columns under different boundary conditions

COs- PO's & PSO's MAPPING

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PSO2  To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.  3 3 3 3 3 3

PSO3  To inculcate entrepreneurial skills through strong Industry-Institution linkage.  1 1 1 1 1 1

AI3404  HYDROLOGY AND WATER RESOURCES ENGINEERING  L T P C 3 0 0 3

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

UNIT I  PRECIPITATION AND ABSTRACTIONS  9

UNIT II  RUNOFF  9
Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange’s table and empirical methods - SCS-CN method – Stage discharge relationship - Flow measurements - Hydrograph – Unit Hydrograph – IUH.

UNIT III  HYDROLOGICAL EXTREMES  9

UNIT IV  RESERVOIRS  9
Classification of reservoirs - Site selection - General principles of design - Spillways -Elevation-Area-Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve.

UNIT V  GROUNDWATER AND MANAGEMENT  9
Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Define the hydrological processes and their integrated behaviour in catchments
CO2 Apply the knowledge of hydrological processes to address basin characteristics, runoff and hydrograph
CO3 Explain the concept of hydrological extremes and its management strategies
CO4 Describe the principles of storage reservoirs
CO5 Understand and apply the concepts of groundwater management

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ME3391 ENGINEERING THERMODYNAMICS

COURSE OBJECTIVES:
- Impart knowledge on the basics and application of zeroth and first law of thermodynamics.
- Impart knowledge on the second law of thermodynamics in analyzing the performance of thermal devices.
- Impart knowledge on availability and applications of second law of thermodynamics.
- Teach the various properties of steam through steam tables and Mollier chart.
- Impart knowledge on the macroscopic properties of ideal and real gases.

UNIT I BASICS, ZEROOTH AND FIRST LAW
Review of Basics – Thermodynamic systems, Properties and processes Thermodynamic Equilibrium - Displacement work - P-V diagram. Thermal equilibrium - Zeroth law – Concept of
temperature and Temperature Scales. First law – application to closed and open systems – steady and unsteady flow processes.

UNIT II  SECOND LAW AND ENTROPY  9

UNIT III  AVAILABILITY AND APPLICATIONS OF II LAW  9
Ideal gases undergoing different processes - principle of increase in entropy. Applications of II Law. High and low grade energy. Availability and Irreversibility for open and closed system processes - I and II law Efficiency

UNIT IV  PROPERTIES OF PURE SUBSTANCES  9
Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT V  GAS MIXTURES AND THERMODYNAMIC RELATIONS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES: At the end of the course the students would be able to
CO1 Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
CO2 Apply the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
CO3 Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart
CO4 Apply the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.
CO5 Apply the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

TEXTBOOKS:

REFERENCES:
GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

COURSE OBJECTIVES:

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

UNIT I ENVIRONMENT AND BIODIVERSITY


UNIT II ENVIRONMENTAL POLLUTION


UNIT III RENEWABLE SOURCES OF ENERGY

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

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

carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

OUTCOMES:

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

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

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

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

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

TEXTBOOKS:

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

REFERENCES:


COs- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>CO</th>
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1-low, 2-medium, 3-high, “-“ no correlation

TOTAL : 30 PERIODS
# NCC Credit Course Level 2*

## NX3451  
**(ARMY WING) NCC Credit Course Level - II**  

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<td>PD 5</td>
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## LEADERSHIP  

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## ENVIRONMENTAL AWARENESS & CONSERVATION  

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<td>Armed Forces, Army, CAPF, Police</td>
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## TOTAL: 45 PERIODS

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# NCC Credit Course Level 2*  

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

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**GENERAL SERVICE KNOWLEDGE**

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<tr>
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<th>Armed Forces &amp; IAF Capsule</th>
<th>Modes of Entry in IAF, Civil Aviation</th>
<th>Aircrafts - Types, Capabilities &amp; Role</th>
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**TOTAL: 45 PERIODS**
COURSE OBJECTIVES:
- To make the students conversant with the anatomy of farm tractor and farm engines
- To make them understand the working principle of IC engines, clutch, gear box, differential and final drive

LIST OF EXPERIMENTS:
1. Identification and study of different components of diesel engine
2. Identification and study of different components of petrol engine
3. Method of working of diesel engine with the help of working models
4. Method of working of diesel engine with the help of working models
5. Dismantling and assembly of diesel engine
6. Dismantling and assembly of petrol engine
7. Study of clutch – components and method of working
8. Study of gear box – components and method of working
9. Study of differential and final drive – components and method of working
10. Study of braking system and steering system – components and method of working
11. Study of hydraulic system and PTO system in a tractor
12. Study of electrical system, instruments in the dash board and controls – components: dynamo, starting motor, battery, lights, horn, odometer, amperemeter, accelerator, brake, differential lock, PTO lever, hydraulic lever, draft and position control lever.

REFERENCES:

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

CO1 Understand the working of tractors, power tillers and their functions.
CO2 Identify and rectify problems in the functioning of tractors and power tillers.
CO3 Summarize the ergonomics of tractors and power tillers.

COs- PO's & PSO's MAPPING

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>Overall correlation of COs with POs</th>
</tr>
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<tbody>
<tr>
<td>PO1 Knowledge of Engineering Sciences</td>
<td>2</td>
<td>3</td>
<td>3</td>
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<tr>
<td>PO2 Problem Analysis</td>
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<td>PO3 Design/ Development of Solutions</td>
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<tr>
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<td>PO12 Life Long Learning</td>
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<tr>
<td>PSO1 To bring expertise in design and engineering</td>
<td>3</td>
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problem solving approach in agriculture with proper knowledge and skill

| PSO2       | To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 3 | 3 | 3 | 3 |
| PSO3       | To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 3 | 3 | 3 | 3 |

### AI3412  
**STRENGTH OF MATERIALS LABORATORY**

**L T P C**  
0 0 4 2

**COURSE OBJECTIVES:**  
- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

**LIST OF EXPERIMENTS**  
1. Tension test on steel rod  
2. Compression test on wood  
3. Double shear test on metal  
4. Torsion test on mild steel rod  
5. Impact test on metal specimen (Izod and Charpy)  
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)  
7. Deflection test on metal beam  
8. Compression test on helical spring  
9. Deflection test on carriage spring  

**REFERENCES:**  

**COURSE OUTCOMES:**

**CO1** Find the stress distribution and strains in regular and composite structures subjected to axial loads.  
**CO2** Assess the shear force, bending moment and bending stresses in beams  
**CO3** Apply torsion equation in design of circular shafts and helical springs

**COs- PO’s & PSO’s MAPPING**

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PSO1  To bring expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill  3  3  3  3
PSO2  To enhance the ability of students to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.  3  3  3  3
PSO3  To inculcate entrepreneurial skills through strong Industry-Institution linkage.  1  1  1  1

AI3501  FARM EQUIPMENT AND MACHINERY  L  T  P  C
3  0  0  3

COURSE OBJECTIVES:
- To introduce the students to the working principles of farm equipments, tillage implements.
- To expose the students to farm mechanization benefits and constraints, identification of components of primary and secondary tillage implements

UNIT I  FARM MECHANIZATION  9

UNIT II  PRIMARY AND SECONDARY TILLAGE IMPLEMENTS  9

UNIT III  SOWING AND FERTILIZING EQUIPMENT  9

UNIT IV  WEEDING AND PLANT PROTECTION EQUIPMENT  9

UNIT V  HARVESTING MACHINERY  9
Principles of cutting crop, types of harvesting machinery, vertical conveyor reaper and binder combine harvesters, balers, threshers, tractor on top combine harvester, combine losses

TOTAL: 45 PERIODS

TEXTBOOKS:
REFERENCES:

COURSE OUTCOME:
CO1 To understand the basics of mechanizing a farm.
CO2 To understand the components of various tillage equipment.
CO3 To study about different sowing and fertilizing attachments and stand-alone units.
CO4 To study about weeder attachments and sprayers.
CO5 To study about combine harvester-thresher for various crops.

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AI3511 FARM MACHINERY LABORATORY

COURSE OBJECTIVE:
- The students will be introduced to the practice of different farm machinery in the field on tillage, sowing, plant protection, harvesting and threshing; care and maintenance; lubrication; fits and tolerances and replacements; adjustments of farm machines; dismantling and reassembling of a disc harrow, seed-cum fertilizer drill and sprayer, engine pumps
LIST OF EXPERIMENTS

- Identification of major systems of a tractor and general guidelines on preliminary check measures before starting a tractor - procedure for starting, running and stopping the tractor.
- Identification of components of power tiller, their maintenance and study on preliminary check measures and safety aspects before starting a power tiller - procedure for starting, running and stopping the power tiller.
- Field operation and adjustments of ploughs
- Field operation and adjustments of harrows
- Field operation and adjustments of cultivators
- Field operation of sowing and planting equipment and their adjustments
- Field operation of plant protection equipment
- Field operation on mowers and reapers
- Field operation of combine and determination of field losses
- Field operation of thresher and their performance evaluation
- Studies on methods of repair, maintenance and off-season storage of farm equipment
- Opening and reassembly of disc harrows, determination and adjustment of tilt and disc angles
- Hitching of agricultural implements and trailers
- Study and operation of bulldozer
- Visit to agro-manufacturers

TOTAL: 60 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES

CO1 To identify major systems in a tractor and general guidelines on preliminary check measures before starting a tractor.

CO2 To have knowledge of the field operations and management of tillage implements.

CO3 To have knowledge of the field operations and management of seeder devices and plant protection equipment.

CO4 To have knowledge of the field operations and management of harvesters, threshers and combines.

CO5 To have knowledge of the field operations and management of heavy earth moving machinery.

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AI3512  
**ICT IN AGRICULTURAL ENGINEERING LABORATORY**  
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**COURSE OBJECTIVES:**
- To gain practical knowledge on various technologies in information and communication for agriculture.

**EXPERIMENTS:**
1. Configuring timers for automatic switching “on and off” of irrigation systems
2. Experience with solenoid valves for pressurized irrigation
3. Using sensors for Agro meteorological measurements
4. Employing Printed Circuit Board (PCB) or Breadboard for controlling or triggering an agricultural system
5. Use of mobile apps for controlling or triggering an agricultural system
6. Construction of crop growth functions (best fit) for crop yields simulations
7. Image processing as tool for biotic and abiotic stress identification
8. Experience with existing open source crop simulation models
9. Exposing cloud resources for agricultural applications
10. Developing automated agro advisory systems

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES**
- **CO1** Knowledge on meteorological measurements
- **CO2** Obtain knowledge on triggering an agricultural system
- **CO3** Knowledge on Image processing as tool for biotic and abiotic stress identification
- **CO4** Ability to conduct Spatial analysis of rainfall data and design water storage reservoirs

**COs- PO’s & PSO’s MAPPING**

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| PSO1    | To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill |
| PSO2    | To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. |
| PSO3    | To inculcate entrepreneurial skills through strong Industry-Institution linkage. |

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**AI3513**

**SUMMER TRAINING**

*(2 WEEKS DURING IV SEMESTER – SUMMER)*

**COURSE OBJECTIVES:**

- To train the students in field work by attaching to any industry / organization so as to have a firsthand knowledge of practical problems in Agricultural Engineering.
- To gain working experience and skills in carrying out engineering tasks related to various fields of agriculture.

The students individually undertake training in reputed engineering companies / Govt organisations / NGOs / Educational Institutions who work in the area of Agricultural Engineering for the specified duration. At the end of the training, a report on the work done will be prepared and presented. The students will be evaluated through a viva-voce examination by a team of internal staff.

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**AI3601**

**POST-HARVEST TECHNOLOGY**

**COURSE OBJECTIVE:**

- The students would be exposed to fundamental knowledge in engineering properties of agricultural materials, different Post Harvest operations and processing methods of harvested crops and storage of crops.

**UNIT I  FUNDAMENTALS OF POST HARVESTING**


**UNIT II  PSYCHROMETRY AND DRYING**

UNIT III CLEANING AND GRADING

UNIT IV SHELLING AND HANDLING

UNIT V CROP PROCESSING

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES:
CO1 Understand the importance of post harvest processing and determine moisture content of products
CO2 Perform drying of agricultural products and analyze performance of dryers
CO3 Recognize the working principles of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds, and pulses
CO4 Understand the operation of post harvest equipment like shellers, conveyors
CO5 Different Post Harvest operations and processing methods of harvested crops.

COs- PO's & PSO's MAPPING

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<th>PO/PSO</th>
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TOTAL: 45 PERIODS
PSO2  To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.  

3  3  3  3  3  3

PSO3  To inculcate entrepreneurial skills through strong Industry-Institution linkage.  

1  1  1  1  1  1

AI3602  IRRIGATION AND DRAINAGE ENGINEERING  

L  T  P  C  3  0  0  3

COURSE OBJECTIVES
- Inculcate water resources development and various parameters required for irrigation scheduling and its requirement.
- Understand different kinds of irrigation systems and choose appropriate systems for a given environment.
- Introduce different types of water control and diversion structures for planning the irrigation system.
- Understand canal, tank irrigation and command area development.
- Understand the basic concepts for planning, design, and management of land drainage works in field areas.

UNIT I  WATER RESOURCES AND IRRIGATION REQUIREMENT  

UNIT II  METHODS OF IRRIGATION  
Methods of Irrigation - Surface and Subsurface methods - Drip and Sprinkler - Hydraulics and design - Erodible and non-erodible, Kennedy’s and Lacey’s theories, Materials for lining watercourses and field channels - Water control and diversion structure - Underground pipeline irrigation system.

UNIT III  DIVERSION AND IMPOUNDING STRUCTURES  

UNIT IV  CANAL IRRIGATION AND COMMAND AREA DEVELOPMENT  
Classification of canals - Alignment of canals - Design of irrigation canals - Regime theories - Canal Head works - Canal regulators - Canal drops - Cross drainage works - Canal Outlet, Escapes - Lining and maintenance of canals - Excess irrigation and waterlogging problem - Command area - Concept - Components of CADP - On Farm Development works - Farmer’s committee - its role for water distribution and system operation - rotational irrigation system.

UNIT V  AGRICULTURAL DRAINAGE  
Agricultural drainage - Drainage coefficient; principles of flow through soils - Darcy’s law - Infiltration theory - Surface drainage systems - Subsurface drainage - Design of subsurface
drainage - Pipe materials - mole drains, drainage wells, Leaching requirements - irrigation and drainage water quality - recycling of drainage water for irrigation.

**TOTAL: 45 PERIODS**

**TEXTBOOKS:**

**REFERENCES:**
4. Irrigation water Management, Training Manual No 6, Drainage of Irrigated Lands, Food and Agriculture Organisation, Rome 1996

**COURSE OUTCOMES**

**CO1**  The students will have knowledge and skills on Planning, design, operation and management of Water Resources and Irrigation Requirement.

**CO2**  The student will gain knowledge on different methods of irrigation including canal irrigation.

**CO3**  Obtain knowledge on different types Diversion and Impounding Structures

**CO4**  Understand the concept Canal Irrigation and Command Area Development

**CO5**  Understand the concept recycling of drainage water for irrigation.

**COs- PO’s & PSO’s MAPPING**

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### NCC Credit Course Level 3*

**NX3651**  
(ARMY WING) NCC Credit Course - III  

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TOTAL: 45 PERIODS

### NCC Credit Course Level 3*

**NX3652**  
(NAVAL WING) NCC Credit Course - III  

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TOTAL: 45 PERIODS
NAVIGATION
N 1 Navigation of Ship - Basic Requirements  1
N 2 Chart Work  1

SEAMANSHIP
MH 1 Introduction to Anchor Work  2
MH 2 Rigging Capsule  6
MH 3 Boatwork - Parts of Boat  2
MH 4 Boat Pulling Instructions  2
MH 5 Whaler Sailing Instructions  3

FIRE FIGHTING FLOODING & DAMAGE CONTROL
FFDC 1 Fire Fighting  2
FFDC 2 Damage Control  2

SHIP MODELLING
SM Ship Modelling Capsule  3

TOTAL : 45 PERIODS

AI3611  CAD FOR AGRICULTURE MACHINERY LABORATORY  L  T  P  C
0  0  4  2

COURSE OBJECTIVES:
- To draft the agricultural engineering related machineries and structures manually and also by computer aided methods.
1. Design and Drawing of Underground pipeline system
2. Design and Drawing of Check dam
3. Design and Drawing of Mould board plough
4. Design and Drawing of Disk plough
5. Design and Drawing of Post harvest technology units (threshers and winnowers)
6. Design and Drawing of Biogas plant.
7. Introduction & demonstration on 3D modeling softwares like Pro/E, Creo, Solid works, Solid Edge etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
CO1 Understand the plan and layout of underground pipes, post harvesting units and check dams.
CO2 Design and draw the components using computer aided methods

REFERENCES:

COs- PO’s & PSO’s MAPPING

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**AI3612 POST – HARVEST TECHNOLOGY LABORATORY**

**COURSE OBJECTIVE:**
- After the end of this lab, students will be able to determine various engineering properties of grains, test and evaluate different post harvesting machineries.

**LIST OF EXPERIMENTS:**
- Determination of moisture content of grains by oven method and moisture meter.
- Determination of porosity of grains.
- Determination of coefficient of friction and angle of repose of grains.
- Testing of paddy thresher & paddy winnower.
- Testing of groundnut decorticator & maize sheller
- Evaluation of thin layer drier
- Determining the efficiency of bucket elevator and screw conveyor
- Evaluation of shelling efficiency of rubber roll sheller
- Determining the oil content of oil seeds.
- Visit to modern rice mill
- Visit to pulse milling industry

**TOTAL: 30 PERIODS**

**TEXTBOOKS:**

**REFERENCES:**
COURSE OUTCOMES:
CO1  Determine the different engineering properties of biological materials and their importance
CO2  Determine the efficiency of various post-harvest equipment

COs- PO’s & PSO’s MAPPING

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AI3613 IRRIGATION FIELD LABORATORY

COURSE OBJECTIVE:
- Students should be able to verify the principles studied in theory by performing the experiments in lab.

LIST OF EXPERIMENTS
1. To study various instruments in the Meteorological Laboratory
2. Determination of infiltration rate using double ring and digital infiltrometer
3. Determination of soil moisture wetting pattern for irrigation scheduling
4. Design of Drip irrigation system
5. Design of sprinkler irrigation system
6. Measurement of flow properties in open irrigated channels (flumes, notches)
7. Evaluation of surface irrigation
8. Determination of uniformity coefficient for drip irrigation system
9. Determination of uniformity coefficient for sprinkler system (catch can method)
10. To conduct experiment on disc filter for micro irrigation systems

TOTAL: 30 PERIODS

REFERENCES:
3. Laboratory Manual, Centre for Water Resources, Anna University, Chennai.
COURSE OUTCOMES (COS)
CO1 On the completion of the course the student will have the knowledge on various meteorological instruments and understanding the concept of different irrigational systems in the laboratory tests.
CO2 The student will gain knowledge on infiltrometer
CO3 Obtain knowledge on Drip irrigation system with all accessories
CO4 Obtain knowledge on Sprinkler irrigation system with all accessories

COs- PO’s & PSO’s MAPPING

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AI3701 REMOTE SENSING AND GEOGRAPHICAL INFORMATION SYSTEM

COURSE OBJECTIVES:
- To introduce the principles and basic concepts of Remote Sensing and GIS
- To introduce the remote sensing systems, data products and analysis
- To introduce concepts of GIS 9 Map and their influences
- To introduce the spatial data models, analysis and presentation techniques
- To study the applications of Remote Sensing and GIS in agriculture, soil and water resources

UNIT I CONCEPTS OF REMOTE SENSING AND SATELLITES
Definition- Historical background - Components of remote sensing – Energy source, electromagnetic spectrum, radiation principle, platforms and sensors - Active and passive remote sensing interference - Atmospheric effects on remote sensing – Energy interaction with earth surface feature - Data acquisition - Reflectance, spectral signatures for water, soil and vegetation.- Satellites - Types - Sun synchronous - Geo synchronous remote sensing satellites - LANDSAT,SPOT & IRS - Resolution - Spectral, spatial, radiometric and Temporal resolution - Recent satellites with its applications
UNIT II  DATA PRODUCTS AND IMAGE ANALYSIS

UNIT III  CONCEPTS OF GIS
Definition – Map and their influences – Characteristics of Maps – Elements – Map scale, Projection, Coordinate systems – Sources of spatial data – History and development of GIS – Definition – Components – Hardware and Software.

UNIT IV  DATA INPUT AND ANALYSIS

UNIT V  APPLICATION OF RS AND GIS

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES
CO1 Understand the remote sensing principles and systems.
CO2 Gain sufficient knowledge on satellite data processing and available data products.
CO3 Know the concept of GIS and its tools.
CO4 Have knowledge on data input and analysis techniques.
CO5 Utilize these advanced techniques in addressing the real world problems.

COs- PO’s & PSO’s MAPPING

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PO6 Individual and Team work  1  -  -  -  3  1
PO7 Communication  -  2  -  3  3  2
PO8 The Engineer and Society  1  1  -  1  1  1
PO9 Ethics  1  -  2  -  2  1
PO10 Environment and Sustainability  1  1  2  1  1  1
PO11 Project Management and Finance  2  2  3  2  2  2
PO12 Life Long Learning  3  3  3  2  2  3
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PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.  2  2  2  2  2  2

AI3702 RENEWABLE ENERGY IN AGRICULTURAL ENGINEERING  
L T P C  3 0 0 3

COURSE OBJECTIVES:
- To impart the fundamental knowledge on the importance of Bio resources, Bio energy and reactors.
- To study Slurry handling
- To study Bio reactors/ fermentors
- To study Alcohol and ethanol production and
- To study Energy and Environment

UNIT I BIO RESOURCE – AN INTRODUCTION  9

UNIT II BIO ENERGY  9
Slurry handling- enrichment and utilization – Biogas appliances- Biochemical characteristics of bio resources- Bioenergetics –Biocatalysis –Kinetics of product formation.

UNIT III BIO REACTORS AND FERMENTORS  9

UNIT IV ALCOHOL PRODUCTION  9
UNIT V  ENERGY AND ENVIRONMENT

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCE:
1. Chawla O.P, Advances in Biogas Technology ICAR publication New Delhi 1986

COURSE OUTCOMES
CO1 The students will be able to understand the concepts of bio energy sources and its applications.
CO2 Gain sufficient knowledge on Bioenergy.
CO3 Know the concept of Bioreactors and Fermentors and their working principles.
CO4 Have knowledge on production of alcohol.
CO5 Utilize these advanced techniques in conserving energy and protecting the environment.

COs- PO’s & PSO’s MAPPING

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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

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

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

TOTAL: 30 PERIODS

REFERENCES:
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022
COURSE OUTCOMES
Students will be able to
CO1: Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2: Practice democratic and scientific values in both their personal and professional life.
CO3: Find rational solutions to social problems.
CO4: Behave in an ethical manner in society
CO5: Practice critical thinking and the pursuit of truth.

GE3752 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

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.

TEXT BOOK:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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AI3711 REMOTE SENSING AND GIS LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVES:
• To introduce the principles and basic concepts of Remote Sensing and GIS through hands on training.
1. Measurement of relief displacement using parallax bar
2. Stereoscopic vision test
3. Aerial photo interpretation - visual
4. Satellite images interpretation – visual
5. Introduction to QGIS
6. Geo-referencing of images
7. Image enhancement practice
8. Supervised classification practice
9. Unsupervised classification practice
10. Database Management Systems
11. Spatial data input and editing - Digitising
12. Raster analysis problems – Database query
13. GIS applications in DEM and its analysis
14. GIS application in watershed analysis
15. GIS application in rainfall-runoff modelling
16. GIS application in soil erosion modelling

TOTAL: 60 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES:
CO1 Gain sufficient knowledge on satellite data processing and available data products.
CO2 Know the concept of GIS and its tools.
CO3 Have knowledge on data input and analysis techniques
CO4 Utilize these advanced techniques in addressing problems in various fields of agricultural engineering.

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COURSE OBJECTIVES:
- To gain the practical knowledge on various renewable energy gadgets.
- To know the concept of Automatic weather station.
- To get knowledge on Testing of natural convection solar dryer.

EXPERIMENTS:
2. Determination of caloric value of fuels – solids and gases.
4. Study of UASB biomethanation plant.
5. Purification of biogas – CO$_2$ and H$_2$S removal.
6. Performance evaluation of agro based gasifier.
7. Study on pyrolysis unit – Biochar, Charcoal and Tar making process.
8. Testing of biogas/producer gas engines.
9. Study on briquetting and Stoichiometric calculations.
10. Automatic weather station – Analysis of wind data and prediction.
11. Testing of solar water heater.
13. Study on Solar power and I-V Characteristics.

The lab includes visit to biomass power plant and wind farms.

TOTAL: 30 PERIODS

REFERENCES:

COURSE OUTCOMES:
CO1 Be exposed to renewable energy sources and their applications.
CO2 Aim sufficient knowledge on Purification of biogas – CO$_2$ and H2S removal.
CO3 Know the concept of Automatic weather station.
CO4 Have knowledge on Testing of natural convection solar dryer.
CO5 On completion of the lab course, the students will

COs- PO’s & PSO’s MAPPING

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**PROJECT WORK/INTERNSHIP**

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

Students in a group of 3 or 4 shall work 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 three reviews by the review committee constituted by the Head of the Department. The project work is evaluated based on oral presentation and the final project report jointly by a team of examiners including one external examiner.

**TOTAL: 300 PERIODS**

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

**COs- PO’s & PSO’s MAPPING**
PSO2 | To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 2 | 2 | 2 | 2 | 2

PSO3 | To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 2 | 2 | 2 | 2 | 2

### PROFESSIONAL ELECTIVE COURSES : VERTICALS

#### VERTICAL 1: FOOD PROCESSING

**AI3001**

**REFRIGERATION AND COLD STORAGE**

**L T P C**

3 0 0 3

**COURSE OBJECTIVES**

- To interpret principles of operation of different Refrigeration & Air conditioning systems
- To understand the types of compressors and expansion devices and their applications
- To combine the parameters involved in design of the various air conditioning and cold storage systems

**UNIT I**

**REFRIGERATION PRINCIPLES AND COMPONENTS**

Refrigeration principles - refrigeration effect coefficient of performance -units of refrigeration - Refrigeration components -compressor-classification-principle and working- condensers-types- construction, principle and working. Evaporators - types-principle and working. Expansion device types construction, principle and working. Refrigerants properties classification comparison and advantages chloroflouro carbon (CFC) refrigerants - effect on environmental pollution - alternate refrigerants

**UNIT II**

**VAPOUR COMPRESSION AND VAPOUR ABSORPTION CYCLE**

Simple vapour compression cycle - T-S diagram - p-h chart- vapour compression system-different types-vapour absorption cycle simple and practical vapour absorption system- advantages- ideal vapour absorption system- Electrolux refrigerator Lithium bromide refrigeration-construction and principles.

**UNIT III**

**APPLIED PSYCHROMETRY**

Principle and properties of psychrometry, Representation of various psychometric processes on psychometric chart and their analysis, by-pass factor, sensible heat factor, room sensible heat factor, equipment sensible heat factor, grand sensible heat factor, apparatus dew point, ventilation and infiltration, energy efficiency ratio. Use of psychometric charts. Cooling and heating load calculations

**UNIT IV**

**AIR CONDITIONING SYSTEM**

Air conditioning systems-equipment used-classification-comfort and Industrial air conditioning system- winter, summer and year-round air conditioning system- unitary and central air conditioning system- application of refrigeration and air conditioning-domestic refrigerator and freezer- ice manufacture.
UNIT V  APPLICATIONS OF REFRIGERATION IN FOOD PROCESSING AND PRESERVATION

Cooling and heating load estimation, cold storage design, types of cooling plants for cold storage. Insulation properties and types of insulation material. Cold storage for milk, meat, fruits, vegetables, poultry and marine products. Refrigerated Transport, Handling and Distribution, Cold chain, refrigerated product handling, order picking, refrigerated vans, refrigerated display. Sensors for cold storage management.

FOR FURTHER READING
Design of cold storage system- IoT in cold storage management

REFERENCE(s)
2. Langley and C. Billy, Refrigeration and Air conditioning, Ed. 3, Engle wood Cliffs (NJ), Prentice Hall of India, New Delhi, 2009

COURSE OUTCOMES
CO1 Select appropriate components of the refrigeration unit and analyze the effect of different refrigerants on environment
CO2 Differentiate various refrigeration cycles and its applicability
CO3 Apply knowledge of psychrometry for air conditioning & various food processing operations
CO4 Apply the knowledge of refrigeration and air conditioning in persevering foods using domestic and industrial refrigeration systems
CO5 Choose and design appropriate cold storage system for ensuring the product quality

COs- PO's & PSO's MAPPING

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PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.  

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AI3002 FOOD AND DAIRY ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:
- To acquire better understanding of the food concentration and thermal processing of foods
- To know the physical and thermal properties of milk and different methods of milk processing and milk products
- To gain knowledge on the theory, methods, and equipment for the various unit operations of dairy industry

UNIT I BASIC PROPERTIES AND THERMAL PROCESSING OF FOODS MATERIALS 9

UNIT II DRYING AND DEHYDRATION 9
Food spoilage - causes for spoilage -Moisture content - free moisture - bound and unbound moisture - equilibrium moisture content - Water activity - sorption behaviour of foods - types of dryers - drum, spray, Freeze drying, dryers-advantages and disadvantages - dehydration - methods of dehydration osmotic dehydration

UNIT III MILK PROCESSING 8
Physical, chemical, thermal and rheological properties of milk - storage tanks. Receiving handling and testing of milk - storage. Pasteurization - application- equipment - Low Temperature Long Time - High Temperature Short Time - Ultra High Temperature pasteurization, filling and packaging of milk and milk products

UNIT IV DAIRY EQUIPMENT AND PRODUCTS 10

UNIT V ADVANCED TECHNOLOGIES IN FOOD PROCESSING 9
Non-thermal and other alternate thermal processing in Food processing - Nanotechnology: History- fundamental concepts - tools and techniques Nanomaterials - applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology.
FOR FURTHER READING
Waste utilisation and energy conservation in dairy industry - Utilisation of whey for energy generation through biomethanation, energy conservation opportunities in dairy industry and packaging of dry products.

Total: 45 PERIODS

REFERENCES

COURSE OUTCOMES
CO1 Explain physio-chemical properties of food material and select suitable thermal processing method for food products based on their properties
CO2 Compare food drying systems and assess their limitations in applying different food products
CO3 Explain physical, chemical and thermal properties of milk and compare milk processing techniques
CO4 Apply various milk processing equipment for processing and producing milk products and evaluate their performance
CO5 Assess the application and limitations of advanced food processing techniques

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COURSE OBJECTIVES:
- Implement specific post harvest handling technique for storage and transport of fruits and vegetables
- Apply preservation techniques to produce value added fruits and vegetable products
- Learn the industrial scale processing and preservation methods to extend the shelf life of fruit and vegetable commodities

UNIT I  HARVESTING, HANDLING AND STORAGE OF FRUITS AND VEGETABLES  9
Fruits and vegetables: classification, nutritional profile - Harvesting of fruits and vegetables - maturity indices - post harvest physiology - handling - pre-cooling and storage - Storage under ambient condition, low temperature storage - chilling, frozen storage- chilling injury, freeze burn. Controlled atmosphere storage, Modified atmosphere storage - concepts and methods - gas composition - Changes during storage

UNIT II  PRESERVATION OF FRUITS AND VEGETABLES BY VALUE ADDITION  9
Methods of fruit and vegetable preservation - Processing using sugar- Preparation of jam, jelly, marmalade, squash, RTS, crush, nectar, cordial, fruit bar, preserves, candies and carbonated, fruit beverages. Processing using salt - Brining - Preparation of pickles, chutney and sauces, ketchup. Machinery involved in processing of fruits and vegetables products

UNIT III  PRESERVATION BY DRYING AND DEHYDRATION  9

UNIT IV  MINIMAL PROCESSING AND FERMENTATION  9
Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables, Minimal Processing of Fruits and Vegetables. Preservation by fermentation - wine, vinegar, cider and sauerkraut.

UNIT V  CANNING AND BOTTLING  9
Canning - principles, types of cans - preparation of canned products - packing of canned products - spoilage of canned foods. Bottling of fruit and vegetable. Precautions in canning operations. General considerations in establishing a commercial fruit and vegetable cannery, machineries involved in canning and bottling unit.

FOR FURTHER READING
Toping of sugar/salt, Hybrid drier, safe level of irradiation, solid state fermentation, layout of fruit/vegetable canning unit

Total: 45 PERIODS

TEXT BOOKS

REFERENCES
COURSE OUTCOMES

CO1 Implement low temperature, modified atmosphere and controlled atmospheric storage methods for storage of fruits and vegetables

CO2 Produce value added products from fruits and vegetables by using suitable preservation method (sugar, salt or dehydration)

CO3 Produce dehydrated fruits and vegetables

CO4 Apply minimal processing and fermentation methods to produce value added products from fruits and vegetables

CO5 Plan to produce canned and bottled fruits and vegetables

COs- PO's & PSO's MAPPING

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AI3004 STORAGE AND PACKAGING TECHNOLOGY L T P C 3 0 0 3

COURSE OBJECTIVES:
- To study about the different storage structures
- To learn about the different packaging materials and various methods of packaging to improve the shelf life of the products
- To understand the concepts of Controlled Atmosphere Storage and Modified Atmosphere Packaging

UNIT I STORAGE ENVIRONMENT AND STORAGE STRUCTURES 9
Storage losses in agricultural commodities. Physical properties of grain affecting storability- Factors of spoilage- fungi and mycotoxins- Treatments for enhancing shelf life- Fumigation

UNIT II INTRODUCTION TO PACKAGING
Introduction Protection of Food products major role and functions of food packaging Effect of environmental factors, mechanical forces and biological factors on food quality and shelf life. Estimating the shelf life requirement accelerated storage studies. Tests on packaging materials Mechanical strength (Tension, notch and tearing strengths), Gas and water vapour transmission rates.

UNIT III CONTROLLED ATMOSPHERE STORAGE AND MODIFIED ATMOSPHERE PACKAGING

UNIT IV CANNING
Metal Cans and Glass Bottles as Packaging. Types of Metallic cans. Basics of Canning operations, Can closures. Glass jars and Bottles in food packaging, Design features and applications, Sterilization of bottles, advantages and problems, Bottle and jar closures, different types of caps and liners used. Plastics used and their Specific applications - Polyethylene (LDPE and HDPE), Cellulose, Polypropylene (PP), Polyester, Polyvinylidene Chloride (PVDC Diocan, Ixan and Saran), Polyvinyl chloride, Copolymers their applications. Closing and sealing of Rigid plastic containers Seal types.

UNIT V FLEXIBLE FILMS PACKAGING

TEXT BOOKS

REFERENCES
4. Gordon L. Robertson, Food Packaging- Principles and Practice Marcel Dekker Inc, USA, 1993
5. Donald Downing, Complete Course in Canning (3 Volumes) CTI Publications Inc, USA, 1996
COURSE OUTCOMES
CO1 Possess the knowledge on Storage environment and storage structures
CO2 The students will have a clear understanding of various methods of storage and different packaging techniques for food.
CO3 Determine the principles of Controlled Atmosphere Storage and Modified Atmosphere Packaging
CO4 Differentiate various canning systems and their application in food industry
CO5 Apply the knowledge to choose suitable flexible packaging film and the sealing technique for processed foods.

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AI3005 FOOD PROCESS EQUIPMENT AND DESIGN

COURSE OBJECTIVES:
- Impart knowledge on basic principles of designing equipment for food processing
- Become familiar with design and manufacture of storage tanks, pulpers, heat exchangers, driers etc.
- Provide an idea about devising cold storage units, freezers etc.

UNIT I PROCESS EQUIPMENT DESIGN
Introduction on process equipment design, principles and selection of food processing equipment
Application of design engineering for processing equipment.
UNIT II DESIGN PROCEDURE
Design parameters and general design procedure, Material specification, Types of material for process equipment, Design codes, Pressure vessel design, Design of cleaners

UNIT III HEAT EXCHANGER
Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger
Problems on tubular heat exchanger, shell and tube type heat exchanger and plate heat exchanger

UNIT IV CONVEYING SYSTEM
Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers. Design of milling equipment.

UNIT V CAD
Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design

FOR FURTHER READING
Factor of safety, Poisson's ratio, Food grade stainless steel, hygienic design of equipment, hygienic practices during maintenance operation

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES
CO1 Analyse the various process equipment design.
CO2 Understand the design procedure the development of vessels and cleaners.
CO3 Analyse the different types heat exchanger methods
CO4 Apply the different methods of conveying system
CO5 Optimize the variables using CAD for the process equipment design.

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**AI3006 FOOD PLANT DESIGN AND MANAGEMENT**  

**L T P C**  

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**COURSE OBJECTIVES:**
- State the different specifications and processes involved in the design and development of food processing plant
- Define the processes involved in layout design
- Evaluate the projects and cost estimation of designing food plant
- Outline the product cost and plant overheads
- Perform profitability analysis in food processing industry.

**UNIT I PLANT LAYOUT-INTRODUCTION**  
Design considerations of processing agricultural and food products. Plant design concepts and general design considerations: Plant layout, plant location, location factors and their interaction with plant location, location theory models, and computer aided selection of the location. Human factors in design, selection of materials of construction and standard component, design standards and testing standards.

**UNIT II PROCESS ECONOMICS OF PLANT LAYOUT**  
Feasibility analysis and preparation of feasibility report: plant size, factors affecting plant size and their interactions, estimation of break-even and economic plant size; Product and process design, process selection, process flow charts, Plant utilities, electricity, water, steam, air, raw material requirements and computer aided development of flow charts.

**UNIT III DEVELOPMENT AND PRESENTATION OF LAYOUT**  
Hygienic design aspects and worker’s safety, functional design of plant building and selection of building materials, estimation of capital investment, analysis of plant costs and profitability’s, management techniques in plant design including applications of network analysis, preparation of project report and its appraisal.

**UNIT IV FOOD PROCESSING PLANT & EQUIPMENT LAYOUT**  
Plant layout and design of bakery and biscuit industries; fruits and vegetables processing industries including beverages; milk and milk products; meat, poultry and fish processing industries. Equipment layout in Food Industries: Basic understanding of equipment layout and. Preparation of flow sheets for material movement and utility consumption in food plants.
UNIT V                   PROJECT EVALUATION AND COST ESTIMATION
Preparation of flow sheets for material movement and utility consumption in food plants; Application of Program Evaluation and Review Technique (PERT) and Critical Path Method (CPM) in project planning and monitoring; Cost estimation for a Food Plant; Scale-up. Case Study: Preparation of plant layout and cost estimation for a food processing plant
Total: 45 PERIODS

REFERENCES

COURSE OUTCOMES
CO1 Design and construct the well-equipped food processing plant for effective processing
CO2 List the start – to – end facilities, infrastructure, utilities, investments along with the government regulations and specifications for plant layout
CO3 Evaluate and estimate the capital investments and methods of cost estimation of designing food plants
CO4 Assess the overall production cost, profitability and factors involved in the cost estimation of products manufactured
CO5 Analyze the problems involved in deciding the level of manufacture of a food product

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COURSE OBJECTIVES:
- Understand and apply the different emerging technologies in processing of foods
- Familiarize about the equipment used for the processing of foods by novel technologies
- Compare the application of alternate thermal and non-thermal processing techniques on foods

UNIT I    HIGH PRESSURE PROCESSING
Principles - Mechanism and applications of high pressure processing to food systems - High pressure processing of salads, meats and sea foods, fruits and fruit products - Effect of high pressure on microorganisms, enzymes, textural and nutritional quality of foods - Other applications of high pressure processing - High Pressure Freezing: principles and equipment, types of high pressure freezing process, microbiological and enzymatic inactivation after high pressure freezing.

UNIT II   PULSED ELECTRIC FIELDS PROCESSING
Principles - Mechanism - PEF treatment systems - Main processing parameters PEF technology - Equipment - Applications - Mechanisms of microbial and enzyme inactivation. PEF processing of solid foods, liquid foods and beverages. Food safety aspects of pulsed electric fields.

UNIT III  FOOD IRRADIATION
Introduction - Fundamentals of food Irradiation - Type and sources of radiation, dosimetry, mode of action of ionizing radiation - Direct and indirect effect, radiation effect on food constituents, Dose requirement for different products and regulations.

UNIT IV   ALTERNATIVE NON THERMAL PROCESSING TECHNIQUES
High intensity pulsed light technology:- principles of PLT technology - Technological aspects of PLT - Effects of PLT technology on microorganisms and food quality. Ultrasound Processing: Principle of ultrasound - Fundamentals - Ultrasound as a processing and food preservation tool - Effect of ultrasound on properties of foods - Applications of ultrasound in microbial inactivation, assisted drying, extraction, osmotic dehydration, detection of foreign bodies, filtration and freezing - challenges in ultrasound processing. Radio frequency electric fields: equipment, applications for heating and drying, effect of radio frequency electrical field on inactivation of microorganisms.

UNIT V    ALTERNATIVE THERMAL PROCESSING TECHNIQUES
Hurtle technology- Microwave heating and microwave drying: Microwaves - dielectric heating, dielectric properties of foods - thermal properties of foods - Recent developments in microwave heating - combined microwave-vacuum drying, microwave freeze-drying - applications. Case Study – development of a nonthermal processing technique for food and beverages.

FURTHER READING
Ohmic heating, UV: Equipment- processing- effect of UV on microorganisms and enzyme-application of UV in food processing. Safety and standards regulations of novel processing on food.

REFERENCE(s)
COURSE OUTCOMES
CO1 Understand the effect of high pressure processing on microbial inactivation of foods
CO2 Apply the principle of pulsed electric field and analyse the impact of pulsed electric field processing for both solid and liquid foods
CO3 Apply and assess the irradiation dosage requirement for foods
CO4 Apply non thermal technologies for inactivation of microorganisms and improve the food quality
CO5 Apply advanced thermal treatments for food processing and preservation

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VERTICAL 2- FARM MACHINERY AND ENERGY

AI3008 FARM POWER AND MACHINERY MANAGEMENT LT P C 3 0 0 3

COURSE OBJECTIVE:

- To expose the student with the mechanization status in the country and management techniques for future requirements.

UNIT I FARM MECHANIZATION

The role of farm mechanization and its relationship to productivity, employment, social and Technological change.- Farm Power availability- Mechanization status in India–performance index of power source and farm machinery -Scheduling of farm operations
UNIT II  COST ANALYSIS  
Farm records and inventory control - cost analysis of machinery: fixed cost and variable costs, effect of inflation on cost; Cost economics of tractor and farm machinery – land preparation, planting, intercultural, plant protection and harvesting machinery cost calculation

UNIT III  MACHINERY SELECTION  
Selection of tractor and farm machinery – Matching implements for different hp - computation of hp requirement - optimum machinery and Replacement criteria; Break-even analysis, reliability and cash flow problems;

UNIT IV  FARM MACHINERY OPERATION AND MANAGEMENT  

UNIT V  CUSTOM HIRING MODELS  
Establishment of CHC-operationalization – Custom hiring models – case studies of custom hiring – Custom hiring project formulation – ownership vs custom hiring services- Economic viability of custom hiring service units – Replacement of farm machinery

TOTAL: 45 PERIODS

TEXT BOOKS
1. Donnell Hunt , Farm Power and Machinery Management

REFERENCES

COURSE OUTCOMES:
At the completion of the course the student will:

CO1 have knowledge about the present status of farm mechanization
CO2 be able to optimally select machinery for varying uses.
CO3 be able to plan for mechanization of the farm.
CO4 be able to estimate the cost of machinery.
CO5 be able to create custom hiring centres

COs- PO's & PSO's MAPPING

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Overall correlation of COs with POs
PSO1 To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill

PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.

PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.

AI3009 TESTING AND EVALUATION OF FARM MACHINERY AND EQUIPMENT LT P C 3 0 0 3

COURSE OBJECTIVES:
- Learn out testing of tractors and all other agricultural equipment and machinery

UNIT I TESTING OF AGRICULTURAL TRACTORS
Testing and evaluation system in India - Agricultural machinery situation - Mechanization policy - future prospects - standardization efforts - type of testing systems – General regulations - terminology - basic measurements, speed, fuel consumption, smoke density and power measurement - test items, specifications checking - PTO performance test - engine test, drawbar performance test - field test procedures - interpretation of results

UNIT II TESTING OF TILLAGE AND SOWING EQUIPMENT
Testing of tillage machinery - laboratory test (hardness testing, chemical analysis) - field test (rate of work, quality of work, draft measurement, fuel consumption) - seed drill - laboratory test (seed drill calibration) - field checking and field tests

UNIT III TESTING OF INTERCULTURAL EQUIPMENT
Testing and evaluation of weeders - types of tests for weeder - types of pesticide application equipment - terminology - types of tests for sprayers - testing methods - types of test for duster - testing methods

UNIT IV TESTING OF COMBINE HARVESTER
Types of grain combines - combine systems - test items - procedure for laboratory testing - materials for field test - observations during field tests - sample analysis - data analysis - summary of performance parameters - analysis of field test data

UNIT V SAFETY TESTING OF AGRICULTURAL MACHINERY
Types of agricultural machinery accidents - causes of agricultural machinery accidents - technical measurements for ensuring safety - methods of safety testing - ROPS and FOPS - safety precautions

TOTAL: 45 PERIODS

TEXT BOOKS
2. Indian Standards Test Codes related to tractors, power tillers and agricultural implements
REFERENCES
2. Nebraska Tractor Test Codes for Testing Tractors, Nebraska, USA.

COURSE OUTCOMES:
CO1 Understand the basics of testing procedures and standards of tractor testing
CO2 Understand the testing procedures and standards of tillage, sowing equipment
CO3 Understand the testing procedures and standards of intercultural equipment
CO4 Understand the testing procedures and standards of harvesting equipment
CO5 Understand the safety standards and testing procedures

COs- PO's & PSO's MAPPING

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CAI331 BIOCHEMICAL AND THERMOCHEMICAL CONVERSION OF BIOMASS LT P C
3 0 0 3

COURSE OBJECTIVES:
- To expose the students with different bio and thermal conversion of biomass.

UNIT I BIOMASS CHARACTERIZATION 9
UNIT II BIOCHEMICAL CONVERSION

UNIT III THERMO CHEMICAL CONVERSION BY COMBUSTION

UNIT IV THERMOCHEMICAL CONVERSION BY GASIFICATION AND PYROLYSIS

UNIT V COGENERATION AND WASTE HEAT RECOVERY

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

COURSE OUTCOMES:
CO1 Biomass identification and classes
CO2 Biomass characters and biochemical conversion.
CO3 Thermo chemical conversion techniques and cogeneration from waste
CO4 To know about application of biomass conversion
CO5 Analyse the energy generated from waste

COS- PO’s & PSO’s MAPPING

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**AI3010 WASTE AND BY PRODUCT UTILIZATION**

**COURSE OBJECTIVES:**
- To expose the students with different byproducts of food industry and waste water management of any industry.

**UNIT I INTRODUCTION TO WASTE WATER TREATMENT**
9
Types and formation of by-products and waste; magnitude of Waste generation in different food processing industries; concept scope and maintenance of waste management and effluent treatment.

**UNIT II CHEMICAL PROPERTIES**
9
Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of phosphorous and sulphur in waste waters, microbigy of waste, other ingredients like insecticide, pesticides and fungicides residues.

**UNIT III BY-PRODUCTS UTILIZATION**
9
Waste utilization in various industries, furnaces and boilers run on agricultural wastes and by-products, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermi-composting.

**UNIT IV PROCESSING TECHNIQUES**
9
Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, Tertiary treatments.

**UNIT V ADVANCED WASTE WATER TREATMENT PROCESSES**
9
Sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation.

**TOTAL : 45 PERIODS**

**TEXT BOOK:**
REFERENCES
2. USDA: Agricultural Waste Management Field Hand Book, New York, USA.

COURSE OUTCOMES:
CO1 Types of waste and influences
CO2 Waste water management from any food industry.
CO3 By product utilization from processing plants of cereals, pulses
CO4 Hands on training in wastewater treatment process
CO5 Advance procession techniques for waste water treatment

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AI3011 HUMAN ENGINEERING AND SAFETY IN FARM MACHINERY OPERATIONS

COURSE OBJECTIVE:
- To impart the fundamental knowledge to the student on the importance of human engineering and safety in the field of agriculture machinery.

UNIT I ERGONOMICS
Ergonomics- introduction- Role of ergonomics in Agriculture - Human metabolism- energy liberation in human body- Types of human metabolism- energy requirements at work - acceptable work load.
UNIT II  PHYSIOLOGICAL FUNCTIONS   9
Human Skeletal system – muscle, structure and function - Physiological stress - Efficiency of work
-Physical functions - Age and individual differences in physical functions- Physiological and
operational criteria of physical activity.

UNIT III  ENERGY EXPENDITURE   9
Energy expenditure of activities-keeping energy expenditure within bounds- Energy expenditure of
Spraying-Weeding operations - Movements of body members- Strength and endurance of
movements - Movement of body members related to Agricultural activities - Speed and accuracy
of movements - Time and distance of movements - Reaction time

UNIT IV  ANTHROPOMETRY   9
Anthropometry – introduction- Types of data- Principles of applied anthrophometry - concept of
percentile – Normal distribution – Estimating the range – Minimum and Maximum dimensions-
Cost benefit analysis - applications of anthropometric data. Anthropometric consideration in tool /
equipment design.

UNIT V  HUMAN SAFETY   9
Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety
gadgets for spraying, threshing, Chaff cutting and tractor & trailer operation etc.

TOTAL : 45 PERIODS

TEXT BOOKS
Co., New York.
John Wiley and sons, New York.
London.

REFERENCES
ndbook/media/Chap17_1200.pdf
3. http://www.derby.ac.uk/online/course/ergonomics
4. http://www.online.colostate.edu/certificates/ergonomics/

COURSE OUTCOMES:
CO1 Understand the importance of human factors and their application in system development.
CO2 Know the effect of visual, auditory and factual displays in human performance.
CO3 Understand the importance of optimum work-rest cycles in endurance.
CO4 Be able to ideally design the work space in accordance to anthropometry.
CO5 Have the general understanding safety features and regulation acts in farm machinery.

COs- PO’s & PSO’s MAPPING

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| PSO1 | To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill | 1 | 1 | 1 | 1 | 1 |
| PSO2 | To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 1 | 1 | 1 | 1 | 1 |
| PSO3 | To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 1 | 1 | 1 | 1 | 1 |

AI3012 PRECISION FARMING EQUIPMENT

COURSE OBJECTIVES:

- To learn about the fundamentals of precision farming principles and application of precision farming equipment

UNIT I ROLE OF ELECTRONICS IN AGRICULTURAL ENGINEERING


UNIT II SENSORS, MICROCONTROLLER AND ACTUATOR FOR PRECISION AGRICULTURE

Types of sensor- principle and concept of different sensor like ultrasonic, proximity, PIR, IR, radar, pressure, gas, temperature, moisture, strain /weight, colour sensor etc. used in agriculture. Microcontroller: Arduino, Raspberry Pi and PLC Actuator : DC Motor, Pump, linear Actuator etc. - Basic input circuits and signal conditioning systems – amplifiers and filters.

UNIT III PRECISION FARMING CONCEPTS AND PRECISION FARMING MACHINERY

Precision farming concepts- Map based system- Real time system – Combination Map and real time system -components of PF – Site specific management- Constraints of PF- Precision tillage, planting, intercultural, plant protection and harvesting equipment, laser guided leveller, power sprayer, straw chopper cum spreader, straw bailer, combine harvester etc.

UNIT IV SITE-SPECIFIC MANAGEMENT SYSTEM

Site-specific nutrient management- weeds management- Agro-chemicals and fertilizer management, data sources and decision making for site-specific management. Grain quality and yield. Yield monitoring and mapping, soil sampling and analysis.

UNIT V UNMANNED VEHICLES AND IOT IN AGRICULTURE


TOTAL : 45 PERIODS
TEXT BOOKS

COURSE OUTCOMES:
CO1 Understand the role of electronics in precision farming
CO2 Analyse the principles and applications of sensors, micro controllers and actuators in precision farming equipment
CO3 Understand the precision farming concepts and machinery
CO4 Understand about site specific management system and unmanned vehicles & IoT applications
CO5 Analyse the application of sensors and electronics in farm machinery

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
- To learn about the fundamental aspects of solar energy availability, solar energy conversion technologies
- To understand about the fundamental aspects of wind energy availability and wind power generators
- To acquire the knowledge on the alternate sources of energy such as geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and energy storage

UNIT I  SOLAR ENERGY RADIATION AND SOLAR THERMAL COLLECTORS  9

UNIT II  SOLAR CONCENTRATING COLLECTORS AND PV TECHNOLOGY  9
Optically concentrating collectors - types reflectors - solar thermal power stations principle and applications - solar stills - types - solar pond performance - characteristics applications. Photovoltaics types characteristic - load estimation batteries invertors operation system controls. PV system installations standalone systems - PV powered water pumping system sizing and optimization hybrid system solar technologies in green buildings.

UNIT III  WIND MAPPING ANALYSIS AND CHARACTERISTICS OF WIND  9
Nature of wind - wind structure and measurement - wind power laws - velocity and power duration curves - aero foil - tip speed ratio - torque and power characteristics power coefficients - Betz coefficient

UNIT IV  WIND MILL DESIGN AND APPLICATIONS  9
Turbines - Wind mill - classification - power curve. Upwind and downwind systems - transmission rotors - pumps - generators - standalone system - grid system - batteries. Wind energy storage - wind farms - wheeling and banking - testing and certification procedures.

UNIT V  ALTERNATE ENERGY SOURCES  9

TEXT BOOKS

REFERENCES
5.
COURSE OUTCOMES:
CO1 Understand the basics of solar energy and solar thermal energy conversion technologies and compare direct mode and indirect mode solar dryers
CO2 Analyse the principles and applications of solar thermal power stations, solar pond, and solar stills
CO3 Understand the wind power laws and calculate the torque and power characteristics of wind energy
CO4 Design wind mills and test the units for certification
CO5 Understand the principles of geothermal energy, wave energy, tidal energy, OTEC energy, fuel cells and analyse their applications

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VERTICAL 3- WATER MANAGEMENT AND PROTECTED CULTIVATION

AI3013 WATERSHED PLANNING AND MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
- To provide the technical know-how of analysing the degradation of soil and water resources and implementation of the measures for soil and water conservation.
- To provide a comprehensive treatise on the engineering practices of watershed management for realizing the higher benefits of watershed management.
UNIT- I  INTRODUCTION  9
Watershed – Definition - concept - Objectives – Land capability classification - Watershed Based
Land Use Planning-Watershed Characteristics: Classification and Measurement- priority
watersheds - land resource regions in India- Importance of Watershed Properties for Watershed
Management.

UNIT- II  WATERSHED PLANNING  9
Importance of Watershed Planning - Utility of Hydrologic Data in Watershed Planning -Watershed
Delineation - Planning principles – collection of data – present land use - Preparation of watershed
development plan - Estimation of costs and benefits - Financial plan – selection of implementation
agency - Monitoring and evaluation system

UNIT- III  WATERSHED MANAGEMENT  9
Participatory watershed Management - run off management - Factors affecting runoff - Temporary
& Permanent gully control measures - Water conservation practices in irrigated lands - Soil and
moisture conservation practices in dry lands

UNIT- IV  WATER CONSERVATION PRACTICES  9
In-situ & Ex-situ moisture conservation principle and practices - Afforestation principle - Micro
catchment water harvesting - Ground water recharge – percolation ponds -Water harvesting
Design of Water Harvesting Structures - Farm pond - Supplemental irrigation - Evaporation
suppression - Seepage reduction

UNIT- V  WATERSHED DEVELOPMENT PROGRAMME  9
River Valley Project (RVP) - Hill Area Development Programme (HADP) - National Watershed
Development Programme for Rainfed Agriculture (NWDPRA) - Other similar projects operated in
India – Govt. of India guidelines on watershed development programme - Watershed based rural
development – infrastructure development - Use of Aerial photography and Remote sensing in
watershed management - Role of NGOs in watershed development.

TOTAL: 45 PERIODS

TEXT BOOKS :
Distributors, New Delhi.

REFERENCES:
publishing Co. New Delhi.
New Delhi
Delhi
4. Murthy, V.V.N. 2005, Land and water management, Kalyani publishing, New Delhi

COURSE OUTCOMES (COS)
CO1 The students will able to describe the watershed management concepts
CO2 The students will able to describe the components involved in watershed planning
CO3 The students will able to describe the methods of water harvesting structures
CO4 The students will able to design and construct the soil conservation structures
CO5 The students will able to prioritize and execute the watershed development programme

COs- PO’s & PSO’s MAPPING

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| PSO3| To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 2 | 2 | 2 | 2 | 2 | 2 |

CAI333  GROUNDWATER AND WELL ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES
- To acquaint and equip the students with the techniques of groundwater development and management

UNIT I  GROUND WATER OCCURRENCE  9
Occurrence of groundwater, temporal and spatial variability of groundwater, methods for groundwater exploration, determination of aquifer parameters, pumping tests, assessment of groundwater potential

UNIT II  WELL CONSTRUCTION  9
Groundwater structures, groundwater development and utilization, types of water wells, design and construction of water wells, drilling methods, well development, well maintenance and rehabilitation, groundwater monitoring, monitoring wells, design and construction of monitoring wells

UNIT III  GROUNDWATER POLLUTION  9
Groundwater development and quality considerations, groundwater contamination, sources and causes of groundwater pollution, contaminated systems and their rehabilitation, groundwater bioremediation, management of salt water ingress in inland and coastal aquifers.

UNIT IV  GROUNDWATER MANAGEMENT  9
Management of declining and rising water table, Natural and artificial groundwater recharge, Groundwater recharge basins and injection wells. Groundwater management in irrigation command, conjunctive water use, water lifting, different types of pumps, selection of pumps, pump characteristics curve, cost of groundwater pumping, comparative economics of surface and groundwater use for irrigation
UNIT V  GROUNDWATER DEVELOPMENT POLICIES

Major issues related to groundwater development and management in India, Legal aspects of groundwater exploitation, Diagnostic survey of sick wells/tube wells and their rehabilitation.

TOTAL:45 PERIODS

TEXT BOOKS:

REFERENCES

COURSE OUTCOMES
CO1 The students will be able to describe the concepts of aquifer parameters
CO2 The students will be able to describe the components involved in Groundwater structures
CO3 The students will be able to describe the Groundwater development and quality considerations
CO4 The students will be able to describe the Management of declining and rising water table
CO5 The students will be able to prioritize and execute the Groundwater development programme

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COURSE OBJECTIVES:
- To understand the basic concepts, tools, and skills used to deliver water efficiently and effectively on both a field and garden scale efficiency
- To learn about the role of irrigation water in agriculture, and the environmental factors that influence the type, frequency, and duration of irrigation
- To learn about the resources and essential skills needed to determine the proper timing and volume of irrigation, using both qualitative and quantitative methods

UNIT I MICRO IRRIGATION CONCEPT AND APPLICATIONS 9

UNIT II DRIP IRRIGATION DESIGN 9
Drip irrigation - Components - Dripper - types and equations governing flow through drippers - Wetting pattern - Chemigation application - Pump capacity - Installation - Operation and maintenance of Drip irrigation system. - Design of surface and sub-surface drip irrigation.

UNIT III SPRINKLER IRRIGATION DESIGN 9
Sprinkler irrigation - Components and accessories - Hydraulic design - Sprinkler selection and spacing - Capacity of sprinkler system - types - Sprinkler performance - Sprinkler discharge - Water distribution pattern - Droplet size, filtering unit, fertigation - System maintenance

UNIT IV ECONOMIC ANALYSIS 9

UNIT V AUTOMATION IN MICRO IRRIGATION 9
Automation, Need for Automation of Irrigation, Merits and Demerits of Automation, Semiautomatic and Fully Automatic Systems of Automation, Components of Automation System, Types of Controls and Automation in Micro Irrigation

FOR FURTHER READING
Project preparations: Design and draw the layout of a drip/sprinkler irrigation system for 10 acres, preparation of project proposal for the installation and commissioning of irrigation systems

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES
CO1 Categorize the different types of pumps and water lifting devices based on the principle, components, and working efficiency
CO2 Explain the working principle of centrifugal pump as well as its characteristics with efficiencies and design the centrifugal pump including impeller design, casing and other parts of pumps.
CO3 Estimate water budgets and hydraulics used to develop irrigation schedules through micro irrigation based on crop geometry

CO4 Design drip and sprinkler irrigation system including, main line, sub main and laterals designs by consider pump capacity

CO5 Design green house irrigation system and advanced types of irrigation including lift irrigation and automation

COs- PO’s & PSO’s MAPPING

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AI3015 PROTECTED CULTIVATION

COURSE OBJECTIVES:

- To impart knowledge on the protected cultivation of vegetables, fruits and flower crops.
- To sensitize the students on hi-tech production technology of fruits and vegetables and flower crops.
- To learn and practices the various production practices of flower and other high value crops

UNIT I PROTECTED CULTIVATION AND ITS TYPES

Importance and methods of protected culture in horticultural crops. Importance and scope of protected cultivation, different growing structures of protected culture viz., green house, poly house, net house, poly tunnels, screen house, protected nursery house. Study of environmental
factors influencing green house production, cladding / glazing / covering material, ventilation systems, cultivation systems including nutrient film technique / hydroponics / aeroponic culture, growing media and nutrients, canopy management, micro irrigation and fertigation systems.

UNIT II PROTECTED CULTIVATION OF VEGETABLE CROPS
Protected cultivation technology for vegetable crops: Hi-tech protected cultivation techniques for tomato, capsicum nursery, cucumber, gherkins strawberry and melons, integrated pest and disease management, post harvest handling.

UNIT III PROTECTED CULTIVATION OF FLOWER CROPS
Protected cultivation technology for flower crops: Hi-tech protected cultivation of cut roses, cut chrysanthemum, carnation, gerbera, asiatic lilies, anthurium, orchids, cut foliages and fillers, integrated pest and disease management, postharvest handling.

UNIT IV PRECISION FARMING TECHNIQUES
Concept and introduction of precision Farming: importance, definition, principles and concepts. Role of GIS and GPS. Mobile mapping system and its application in precision farming. Design, layout and installation of drip and fertigation in horticultural crops, role of commuters in developing comprehensive systems needed in site specific management (SSM), georeferencing and photometric correction. Sensors for information gathering, geostatistics, robotics in horticulture, postharvest process management (PPM), remote sensing, information and data management and crop growth models, GIS based modeling, VRT, robotics and drones in agriculture

UNIT V PRECISION FARMING FOR HORTICULTURAL CROPS
Precision farming techniques for horticultural crops: Precision farming techniques for tomato, chilli, bhendi, bitter gourd, bottle gourd, caulifower, cabbage, grapes, banana, rose, jasmine, chrysanthemum, marigold, tuberose, china aster, turmeric, coriander, coleus and gloriosa.

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES
2. David Reed, Water, media and nutrition for green house crops. Ball publishing USA, 1996

COURSE OUTCOMES
CO1 The students will be able to describe the different methods of protected cultivation practices available for vegetable crops and flowers
CO2 The students will be able to assess the technology available for vegetable crops
CO3 The students will be able to assess the technology available for flower crops
CO4 The students will be able to assess precision farming techniques using sensors and Geographic information systems for the crops
CO5 The students will be able to assess the technology available for horticulture crops

COs- PO's & PSO's MAPPING

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| PSO1| To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill | 1 | 1 | 2 | 1 | 2 | 1 |
| PSO2| To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 1 | 1 | 2 | 1 | 2 | 1 |
| PSO3| To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 1 | 1 | 2 | 1 | 2 | 1 |

**AI3016 ON-FARM WATER MANAGEMENT**

**L T P C**

3 0 0 3

**COURSE OBJECTIVES:**

- Understand the fundamental design of irrigation channels and diversion structures.
- Study about command area development.
- Know about availability and utilization of water resources.
- Impart knowledge on water use efficiency.
- Get an idea about automation of irrigation systems and water policies.

**UNIT I DESIGN OF IRRIGATION CHANNELS**

9

Design of Erodible (earthen), Non-Erodible (lined) & Alluvial channels (pre-fabricated) - Kennedy's and Lacey's Theories; Materials for Lining watercourses and field channel; Water control and Diversion structure - Design - Land grading - Land Levelling methods.

**UNIT II COMMAND AREA**

9

Command area - Concept - CADA Programmes in Tamil Nadu; Duty of water expression - relationship between duty and delta; Warabandhi - water distribution and Rotational Irrigation System - Participatory irrigation management.

**UNIT III CONJUNCTIVE USE OF SURFACE AND GROUNDWATER**

9

Availability of water - rainfall, canal supply and groundwater - conjunctive use - crop calendar - Irrigation demand - water requirement and utilization - Prediction of over and under utilization of water - Dependable rainfall - Rainfall analysis by Markov chain method - Probability matrix.

**UNIT IV WATER BALANCE**

9

Groundwater balance model - Weekly water balance - Performance indicators Appropriateness, Adequacy, Dependability, Equity, Reliability, Timeliness and efficiency - conjunctive use plan by optimization; Agricultural productivity indicators - Water use efficiency.

**UNIT V DESIGN OF FARM DRAINAGE SYSTEM**

9

Agricultural drainage – types and Concept - Issues; Principles of flow through soils - Darcy's law - drainage coefficient -Infiltration theory; Surface drainage - methods - design - Random drainage - Herringbone - Grid iron types -Design of Open Drains. Steady State flow - Dupit'sForchimer
assumptions - Hooghoudt’s equation; Methods & Design - Mole drains - Drainage wells - Pipe materials - Problem soils - Leaching Requirements; Land reclamation - methods of Reclamation.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

COURSE OUTCOMES (COS)
CO1 The students will be able to design irrigation channels and diversion structures.
CO2 The students will be able to organize the different CADA programme and involved farmers to participate
CO3 The students will be able to inspect the conjunctive use of water resources by farmers
CO4 The students will be able to identify water balance between productivity and water use efficiency in agricultural land
CO5 The students will be able to design the surface and subsurface drainage systems.

COs- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
- To know the basics concepts of irrigation water quality
- To impart knowledge on water quality for irrigation purposes, besides relevant environmental problems and recycle and reuse concepts.
- To understand the importance of water quality for irrigation and major uses of water and the role environmental issues.

UNIT I WATER QUALITY

UNIT II IRRIGATION WATER QUALITY
Water quality for irrigation – Salinity and permeability problem – Root zone salinity – Irrigation practices for poor quality water – Saline water irrigation – Future strategies

UNIT III WATER POLLUTION
Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland

UNIT IV RECYCLING AND REUSE OF WATER
Multiple uses of water – Reuse of water in agriculture – Low cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation

UNIT V WATER QUALITY MANAGEMENT

TEXT BOOKS:

COURSE OUTCOMES
CO1 The students will be able to describe the parameters of water quality
CO2 The students will be able to describe the concepts of water quality for irrigation
CO3 The students will be able to describe the water pollution and quality considerations
CO4 The students will be able to describe the recycling and reuse of water
CO5 The students will be able to describe the management of water quality
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CAI332 CLIMATE CHANGE AND ADAPTATION

COURSE OBJECTIVES:
- To know the basics, importance of global warming
- To know the concept of mitigation measures against global warming
- To learn about the global warming and climate change

UNIT I EARTHS CLIMATE SYSTEM
Role of ozone in environment ozone layer ozone depleting gases Green House Effect, Radiative effects of Greenhouses Gases Hydrological Cycle Green House Gases and Global Warming Carbon Cycle

UNIT II ATMOSPHERE AND ITS COMPONENTS
UNIT III IMPACTS OF CLIMATE CHANGE

Causes of Climate change: Change of Temperature in the environment Melting of ice Pole-sea level rise - Impacts of Climate Change on various sectors Agriculture, Forestry and Ecosystem Water Resources Human Health Industry, Settlement and Society Methods and Scenarios Projected Impacts for Different Regions Uncertainties in the Projected Impacts of Climate Change Risk of Irreversible Changes.

UNIT IV CLIMATE CHANGES AND ITS CAUSES

Climate change and Carbon credits - CDM - Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change - Climate Sensitivity and Feedbacks - The Montreal Protocol - UNFCCCIPCC - Evidences of Changes in Climate and Environment - on a Global Scale and in India.

UNIT V CLIMATE CHANGE AND MITIGATION MEASURES


FOR FURTHER READINGS
Sequestration of carbon through renewable energy technologies

 COURSE OUTCOMES

CO1 Demonstrate an understanding of how the threats and opportunities of predicted climate changes will influence specific sectors at global and regional scale
CO2 Identify the relationship between atmosphere and its components
CO3 Analyze the impacts of climate change on environment parameters
CO4 Evaluate the scientific insights underlying the assessment reports of the IPCC, with a focus on impacts, adaptation and mitigation
CO5 Critically evaluate the relative opportunities and needs for mitigation and adaptation (including vulnerability assessments) in a variety of sectoral contexts

TOTAL: 45 PERIODS

TEXTBOOKS
2. Intergovernmental Panel on Climate Change: https://www.ipcc.ch/

REFERENCES

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VERTICAL 4- IT AND AGRICULTURAL BUSINESS MANAGEMENT

AI3017 INTEGRATED FARMING SYSTEM L T P C 3 0 0 3

COURSE OBJECTIVES

- This course will improve the student skills in the area of farming system research and optimization methodology to design individual integrated farming system in scientific manner.

UNIT I INTRODUCTION OF FARMING SYSTEM 9

UNIT II INTEGRATED FARMING SYSTEM 9

UNIT III LIVESTOCK PRODUCTION IN IFS 9
IFS With Goats and Sheep – housing and feeding management – deworming – Young stock management - Dairy Farming in IFS - Fodder production in IFS - IFS With poultry rearing - Duck farming – Rabbit farming – Piggery

UNIT IV IFS COMPONENTS 9
UNIT V RESOURCE RECYCLING IN IFS

Resource recycling in wetland IFS - Resource flow in crop + dairy + biogas + spawn + silviculture
In IFS - Biogas production through IFS – Resource recycling in crop + goat IFS - Uses and features of biogas - Structure and function of Dheenabandhu Gas plant - Vermicompost - Preparation of vermicompost from farm residue – Mushroom production in IFS.

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES

COURSE OUTCOMES
1. Understand practical knowledge on specialized in different farming system.
2. Apply the farm wastes with recycle use of different IFS components.
3. Analysis of comparative benefits of the different IFS components
4. Design a farming system model for wetland, garden land and dry land
5. Evaluate the extent of wetland, garden land and dry land Integrated Farming System

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COURSE OBJECTIVES:
- To introduce the importance of Agri-business management, its characteristics and principles
- To impart knowledge on the functional areas of Agri-business like Marketing management, Product pricing methods and Market potential assessment.

UNIT I   CONCEPTS OF AGRICULTURAL BUSINESS
Agri-business - scope, characteristics, types. Management - importance, definition, management and administration, management thoughts, Small business - characteristics and stages of growth - Management functions - planning, organizing, leading.

UNIT II   AGRI – BUSINESS ORGANIZATION

UNIT III   AGRICULTURAL MARKETING
Functional areas of Agri-business - Production and Operations management - functions, planning physical facilities and managing quality. Agro-inputs and products inventory management - raw material procurement, inventory types, and costs. Marketing management- Marketing environment, marketing mix - Agricultural input marketing firms.

UNIT IV   AGRICULTURAL BUSINESS FINANCE

UNIT V   MARKET PROMOTION AND HUMAN RESOURCES

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES
CO1 Understand the concepts and fundamentals of management with reference to agribusiness.
CO2 Gain knowledge about organization and functioning of different institutions involved in agriculture marketing.
CO3 Understand the different concepts of inventory management of agricultural inputs.
CO4 Expose students to various concepts of financing Agri Business
CO5 Have the knowledge of marketing agricultural products and the techniques involved

COs- PO’s & PSO’s MAPPING

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AI3019 SUSTAINABLE AGRICULTURE AND FOOD SECURITY

COURSE OBJECTIVES:
- To study the importance of sustainable agriculture for the growing population, various resources required and their sustainability.
- Importance of science, food security and ecological balance.

UNIT I SUSTAINABILITY OF NATURAL RESOURCES
Land Resources of India, Population and land, Land utilization, Net Area Sown, changes in cropping pattern, land degradation. Rainfall forecasting - Adequacy of Rainfall for crop growth - Rainfall, Drought and production instability – Irrigation potential – Available, created and utilized – River basins; Watersheds and Utilizable surface water – Utilizable water in future (Ground water & Surface water)

UNIT II SUSTAINABLE AGRICULTURE
Sustainable agriculture-definition. Agro-ecosystems - Impact of climate change on Agriculture, Effect on crop yield, effect on Soil fertility – Food grain production at State Level – Indicators of Sustainable food availability – Indicators of food production sustenance.
UNIT III  ORGANIC FARMING

UNIT IV  SUSTAINABLE FOOD PRODUCTION FOR FOOD SECURITY

UNIT V  POLICIES AND PROGRAMMES FOR SUSTAINABLE AGRICULTURE AND FOOD SECURITY

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES:
CO1 Understand methods to sustain land resources.
CO2 Cognize approaches to sustain water resources and its utilization for agriculture and allied activities.
CO3 Design and develop new, improved and sustainable systems of agriculture and allied activities.
CO4 Understand new technologies for improving food security.
CO5 Comprehend policies to achieve sustainable farming and food security.

COs- PO’s & PSO’s MAPPING

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PSO3  To inculcate entrepreneurial skills through strong Industry-Institution linkage.  1 1 2 2 3 2

AI3020  SYSTEMS ANALYSIS IN AGRICULTURAL ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES
- To introduce the students to the application of systems concept to irrigation planning and management.
- Optimization technique for modeling water resources systems, irrigation management and advanced optimization techniques to cover the socio-technical aspects will be taught.

UNIT I  SYSTEM CONCEPTS  9
Definition, classification, and characteristics of systems – Scope and steps in systems engineering – Need for systems approach to water resources and irrigation.

UNIT II  LINEAR PROGRAMMING  9
Introduction to operations research – Linear programming, problem formulation, graphical solution, solution by simplex method – Sensitivity analysis, application to design and operation of reservoir, single and multipurpose development plans – Irrigation water allocation- Cropping pattern optimization.

UNIT III  SIMULATION  9

UNIT IV  DYNAMIC PROGRAMMING  9
Bellman’s optimality criteria, problem formulation and solutions – Application to design and operation of reservoirs, Single and multipurpose reservoir development plans – Applications in Irrigation management.

UNIT V  OPTIMIZATION TECHNIQUES  9
Integer and parametric linear programming – Applications to Irrigation water management- Goal programming models with applications.

TOTAL: 45 PERIODS
TEXTBOOKS

REFERENCES

COURSE OUTCOMES
CO1 Understand practical knowledge on specialized in different water resources and irrigation system.
CO2 Apply the Linear programming for crop planning and scheduling.
CO3 Apply the Dynamic Programming for reservoir release for irrigation management.
CO4 Design a reservoir irrigation system simulation model for efficient water management.
CO5 To evaluate the application of optimization techniques used to address the socio-technical aspects irrigation water management.

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COURSE OBJECTIVES:

- To introduce the students to areas of agricultural systems in which IT and computers play a major role.
- To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.

UNIT I  PRECISION FARMING  9
Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II  ENVIRONMENT CONTROL SYSTEMS  9
Artificial light systems, management of crop growth in greenhouses, simulation of CO₂ consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

UNIT III  AGRICULTURAL SYSTEMS MANAGEMENT  9
Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation of crop growth and field operations, Optimizing the use of resources, Linear programming, Project scheduling, Artificial intelligence and decision support systems.

UNIT IV  WEATHER PREDICTION MODELS  9
Importance of climate variability and seasonal forecasting, Understanding and predicting world’s climate system, Global climatic models and their potential for seasonal climate forecasting, General systems approach to applying seasonal climate forecasts.

UNIT V  E-GOVERNANCE IN AGRICULTURAL SYSTEMS  9
Expert systems, decision support systems, Agricultural and biological databases, e-commerce, e-business systems & applications, Technology enhanced learning systems and solutions, e-learning, Rural development and information society.

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOMES:

CO1 The students shall be able to understand the applications of IT in remote sensing applications such as Drones etc.

CO2 The students will be able to get a clear understanding of how a greenhouse can be automated and its advantages.

CO3 The students will be able to apply IT principles and concepts for management of field operations.

CO4 The students will get an understanding about weather models, their inputs and applications.

CO5 The students will get an understanding of how IT can be used for e-governance in agriculture.
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### AI3022 AUTOMATION IN AGRICULTURE

**L T P C**

3 0 0 3

### COURSE OBJECTIVES:

- To know the operation of various electronic circuits and its applications.
- To get adequate knowledge about various sensors and robots used in agricultural processes.
- To learn automation techniques in agricultural system.

### UNIT I INTRODUCTION


### UNIT II PRECISION FARMING

Precision farming -Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modelling.
UNIT III  ROBOTICS IN AGRICULTURE  9

UNIT IV  AUTOMATION USING IoT  9
Use of different sensors - Temperature and humidity sensor - Soil Moisture Sensor - Water Level Depth Detector, Raspberry Pi Arduino UNO

UNIT V  AUTOMATION OF AGRICULTURE OPERATION  9

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES

COURSE OUTCOMES
CO1 Exemplify the working operations of electronic devices and processors
CO2 Interpret the necessity of sensor requirements for precision farming practices
CO3 Understand the basics of robotics and their applications in agriculture
CO4 Apply the IOT concepts in cropping practices
CO5 Interpolate the concept of automation in governing the agricultural systems

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engineering problem solving approach in agriculture with proper knowledge and skill

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AI3023 LANDSCAPE ARCHITECTURE

COURSE OBJECTIVES::

- To understand the paradigms in landscape architecture in the post-industrial revolution era and to understand the multifaceted dimensions of landscape architecture such as ecology, environment and sustainability.
- To study the contemporary landscape and the manifestation in the western and Indian contexts.

UNIT I BASICS OF LANDSCAPE ARCHITECTURE

Site analysis, synthesis, suitability, landscape zoning and planning with landscape land uses for medium to large scale projects. Evolving an open space structure for the site and suggesting a suitable landscape treatment with respect to ecological, functional, cultural and visual contexts.

UNIT II LANDSCAPE FORMULATIONS

Process for landscape project formulation and landscape design development based on synthesis. Examining how humans occupy exterior space and combines this information with the principles of design to create garden scale models.

UNIT III SITE MOBILIZATION

Site mobilization; Sequence of site activity, site protection measures, site implementation checklist. Design and detailing of hard landscapes: Roads, paving, barriers, edge conditions - functions, types, criteria for selection, design aspects, details.

UNIT IV ILLUMINATION


UNIT V IRRIGATION FEATURES

Water features and Irrigation systems: Design of water features such as swimming pools, cascades, fountains etc., and their technical requirements. Consideration for design and detail of water bodies and natural ponds. Design of irrigation system – landscape area types, Course Overviews and design, water needs and sources, application, methods of installation. Control systems, scheduling and maintenance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 To equip the students to do landscape working drawings and preparation of bill of quantities and estimation.
CO2 To understand the design solutions for larger sites and express the same using models.
CO3 To understand the different concepts of landscape formulations.
CO4 To acquire the knowledge of illumination and lighting.
CO5 To obtain the knowledge on design of water bodies and irrigation systems.

**TEXT BOOKS**

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<td>PO6 The Engineer and Society</td>
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<td>PO7 Environment and sustainability</td>
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<td>PO8 Ethics</td>
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<td>PO9 Individual and team work:</td>
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<td>PO10 Communication</td>
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<td>PO11 Project management and finance</td>
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<td>PO12 Life-long learning:</td>
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<tr>
<td>PSO1 To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<td>PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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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, binarism, 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:
3.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual
   student so as to enable him or her to write the term paper.

4. OTHER SESSION:
   4.1*Tutorials:
   4.2*Laboratory:
   4.3*Project: The students will write a term paper to show their understanding of a particular
   piece of literature

5. ASSESSMENT:
   5.1 HA:
   5.2 Quizzes-HA:
   5.3 Periodical Examination: one
   5.4 Project/Lab: one (under the guidance of the teachers the students will take a volume of
   poetry, fiction or drama and write a term paper to show their understanding of it in a given
   context; sociological, psychological, historical, autobiographical etc.
   5.5 Final Exam:

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:
- Students will be able to understand the relevance of literature in human life and appreciate
  its aspects in developing finer sensibilities.

MX3083 FILM APPRECIATION L T P C
3 0 0 0

In this course on film appreciation, the students will be introduced broadly to the development of
film as an art and entertainment form. It will also discuss the language of cinema as it evolved over
a century. The students will be taught as to how to read a film and appreciate the various nuances
of a film as a text. The students will be guided to study film joyfully.
Theme - A: The Component of Films
   A-1: The material and equipment
   A-2: The story, screenplay and script
   A-3: The actors, crew members, and the director
   A-4: The process of film making… structure of a film

Theme - B: Evolution of Film Language
   B-1: Film language, form, movement etc.
   B-2: Early cinema… silent film (Particularly French)
   B-3: The emergence of feature films: Birth of a Nation
   B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation
   C-1: Realist theory; Auteurists
   C-2: Psychoanalytic, Ideological, Feminists
   C-3: How to read films?
   C-4: Film Criticism / Appreciation

Theme – D: Development of Films
   D-1: Representative Soviet films
   D-2: Representative Japanese films
   D-3: Representative Italian films
   D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films
   E-1: The early era
   E-2: The important films made by the directors
   E-3: The regional films
   E-4: The documentaries in India

READING:
A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

MX3084 DISASTER RISK REDUCTION AND MANAGEMENT  L T P C
3 0 0 0

COURSE OBJECTIVE
   • To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
   • To acquaint with the skills for planning and organizing disaster response

UNIT I HAZARDS, VULNERABILITY AND DISASTER RISKS
Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals

UNIT II DISASTER RISK REDUCTION (DRR)
Sendai Framework for Disaster Risk Reduction, Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.
UNIT III DISASTER MANAGEMENT

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT


UNIT V DISASTER MANAGEMENT: CASE STUDIES

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill - TOTAL : 45 PERIODS

TEXT BOOKS:
1 Taimpo (2016), Disaster Management and Preparedness, CRC Publications

REFERENCES

COURSE OUTCOME:
CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)
CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
CO3: To develop disaster response skills by adopting relevant tools and technology
CO4: Enhance awareness of institutional processes for Disaster response in the country and
CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

COs- PO’s & PSO’s MAPPING

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<th>CO’s</th>
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COURSE OBJECTIVES:

- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I  HEALTH AND ITS IMPORTANCE  2+4

Health: Definition - Importance of maintaining health - More importance on prevention than treatment

Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional health.


Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken

UNIT II  DIET  4+6

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.


Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet
Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes
Different cooking methods, merits and demerits of each method
UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / (Five Element Theory) 96 fundamental Principles - Uyir Thathukkal (Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine
Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS 3+4

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life - Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.


Sleep - Sleep and its importance for mental wellness - Sleep and digestion.
Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA 2+12

Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL : 45 PERIODS

TEXT BOOKS:
1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body, by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:
1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001
1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
2. Simple lifestyle modifications to maintain health https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,have%20time%20to%20cook
3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html


7. BMI [https://www.hsph.harvard.edu/nutritionsource/healthy-weight/](https://www.hsph.harvard.edu/nutritionsource/healthy-weight/)
   [https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations](https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations)

8. Yoga [https://www.healthifyme.com/blog/types-of-yoga/](https://www.healthifyme.com/blog/types-of-yoga/)
   [https://yogamedicine.com/guide-types-yoga-styles/](https://yogamedicine.com/guide-types-yoga-styles/)
   Ayurveda: [https://vikaspedia.in/health/ayush/ayurveda/1/concept-of-healthy-living-in-ayurveda](https://vikaspedia.in/health/ayush/ayurveda/1/concept-of-healthy-living-in-ayurveda)


10. CAM: [https://www.hindawi.com/journals/ecam/2013/376327/](https://www.hindawi.com/journals/ecam/2013/376327/)

11. Preventive herbs: [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/](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**

**UNIT-I CONCEPTS AND PERSPECTIVES**

Meaning of History
Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation versus evidence, concept of historical inevitability, Historical Positivism.
Science and Technology: Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

**UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA**

Introduction to the works of D.D. Kosambi, 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 L T P C
3 0 0 0
Pre-Requisite: None. (Desirable: Universal Human Values 1, Universal Human Values 2)

OBJECTIVES:
- This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

COURSE TOPICS:
Considerations for humane society, holistic thought, human being’s desires, harmony in self, harmony in relationships, society, and nature, societal systems. (9 lectures, 1 hour each)
(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. (5 lectures)
(Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. (2 lectures)

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.
(Refs: Marx, Lenin, Mao, M N Roy) (5 lectures)

Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one’s lives. Relationship with nature. (6 lectures)
(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. (3 lectures)
(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. (4 lectures) (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

Conclusion (2 lectures)

Total lectures: 39

Preferred Textbooks: See Reference Books
Reference Books: Authors mentioned along with topics above. Detailed reading list will be provided.
GRADING:

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<td>Term paper</td>
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<td><strong>TOTAL</strong></td>
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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.
- 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:


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

UNIT II STANDARDS AND REGULATIONS


UNIT III SAFETY ACTIVITIES


UNIT IV WORKPLACE HEALTH AND SAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety-Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL : 45 PERIODS
COURSE OUTCOMES
on completion of this course the student will be able:
- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES
5. Society of Safety Engineers, USA

ONLINE RESOURCES

COs- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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<tr>
<td>CO1</td>
<td>Understand the basic concept of safety.</td>
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<tr>
<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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<tr>
<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 | 3 3 3 2 1 3 2 2 3 3 2 1 3 3 3 3 |
COURSE OBJECTIVES:
The main objectives of this course are to:
1. Understand the importance, principles, and search methods of AI
2. Provide knowledge on predicate logic and Prolog.
3. Introduce machine learning fundamentals
4. Study of supervised learning algorithms.
5. Study about unsupervised learning algorithms.

UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH

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
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

UNIT V UNSUPERVISED LEARNING
Unsupervised Learning – Principle Component Analysis - Neural Network: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – Clustering: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

PRACTICAL EXERCISES: 30 PERIODS
Programs for Problem solving with Search
1. Implement breadth first search
2. Implement depth first search
3. Analysis of breadth first and depth first search in terms of time and space
4. Implement and compare Greedy and A* algorithms.

Supervised learning
5. Implement the non-parametric locally weighted regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs
6. Write a program to demonstrate the working of the decision tree based algorithm.
7. Build an artificial neural network by implementing the back propagation algorithm and test the same using appropriate data sets.
8. Write a program to implement the naïve Bayesian classifier.
Unsupervised learning
9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.

Note:
- Installation of gnu-prolog, Study of Prolog (gnu-prolog).
- The programs can be implemented in using C++/JAVA/ Python or appropriate tools can be used by designing good user interface
- Data sets can be taken from standard repositories (https://archive.ics.uci.edu/ml/datasets.html) or constructed by the students.

COURSE OUTCOMES:
- CO1: Understand the foundations of AI and the structure of Intelligent Agents
- CO2: Use appropriate search algorithms for any AI problem
- CO3: Study of learning methods
- CO4: Solving problem using Supervised learning
- CO5: Solving problem using Unsupervised learning

TOTAL PERIODS: 60

TEXT BOOK
2. S.N.Sivanandam and S.N.Deepa, Principles of soft computing-Wiley India.3 rd ed

REFERENCES

OCS352 IOT CONCEPTS AND APPLICATIONS

COURSE OBJECTIVES:
- To apprise students with basic knowledge of IoT that paves a platform to understand physical and logical design of IoT
- To teach a student how to analyse requirements of various communication models and protocols for cost-effective design of IoT applications on different IoT platforms.
- To introduce the technologies behind Internet of Things(IoT).
- To explain the students how to code for an IoT application using Arduino/Raspberry Pi open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I INTRODUCTION TO INTERNET OF THINGS

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
UNIT IV OPEN PLATFORMS AND PROGRAMMING


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 platform and Raspberry Pi using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry Pi and upload to the cloud platform
10. Design an IOT based system

COURSE OUTCOMES:

CO1: Explain the concept of IoT.
CO2: Understand the communication models and various protocols for IoT.
CO3: Design portable IoT using Arduino/Raspberry Pi /open platform
CO4: Apply data analytics and use cloud offerings related to IoT.
CO5: Analyze applications of IoT in real time scenario.

TOTAL PERIODS: 60

TEXTBOOKS


REFERENCES

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

OCS353 DATA SCIENCE FUNDAMENTALS

COURSE OBJECTIVES:

- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.
UNIT I  INTRODUCTION
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

UNIT II  DATA MANIPULATION

UNIT III  MACHINE LEARNING
The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

UNIT IV  DATA VISUALIZATION

UNIT V  HANDLING LARGE DATA
Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

PRACTICAL EXERCISES:
1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
   a) Frequency distributions
   b) Mean, Mode, Standard Deviation
   c) Variability
   d) Normal curves
   e) Correlation and scatter plots
   f) Correlation coefficient
   g) Regression
6. Use the standard benchmark data set for performing the following:
   a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b) Bivariate Analysis: Linear and logistic regression modelling.
7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

Note: Example data sets like: UCI, Iris, Pima Indians Diabetes etc.

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Gain knowledge on data science process.
CO2: Perform data manipulation functions using Numpy and Pandas.
CO3: Understand different types of machine learning approaches.
CO4: Perform data visualization using tools.
CO5: Handle large volumes of data in practical scenarios.

TOTAL :60 PERIODS

TEXT BOOKS

REFERENCES

CCS333 AUGMENTED REALITY/VIRTUAL REALITY

COURSE OBJECTIVES:
- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION

UNIT II VR MODELING

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

UNIT IV APPLICATIONS

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

30 PERIODS
PRACTICAL EXERCISES:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
10. Develop simple MR enabled gaming applications.

TOTAL PERIODS: 60

COURSE OUTCOMES:

On completion of the course, the students will be able to:

CO1: Understand the basic concepts of AR and VR
CO2: Understand the tools and technologies related to AR/VR
CO3: Know the working principle of AR/VR related Sensor devices
CO4: Design of various models using modeling techniques
CO5: Develop AR/VR applications in different domains

TEXTBOOKS:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018

COs- PO’s & PSO’s MAPPING

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OPEN ELECTIVE 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.

COURSE OBJECTIVES:
- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students’ confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS
Learning Outcomes:
At the end of the course, learners will be able
CO1 expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
CO2 identify errors with precision and write with clarity and coherence
CO3 understand the importance of task fulfilment and the usage of task-appropriate vocabulary
CO4 communicate effectively in group discussions, presentations and interviews
CO5 write topic based essays with precision and accuracy

Teaching Methods:
Instructional methods will involve discussions, taking mock tests on various question papers – Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion – Using multimedia.

Evaluative Pattern:
Internal Tests – 50%
End Semester Exam - 50%

TEXTBOOKS:

REFERENCE BOOKS:

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

COs- PO’s & PSO’s MAPPING

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

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

OMG352 NGOS AND SUSTAINABLE DEVELOPMENT

COURSE OBJECTIVES
- To understand the importance of sustainable development
- To acquire a reasonable knowledge on the legal frameworks pertaining to pollution control and environmental management
- To comprehend the role of NGOs in attaining sustainable development
UNIT I  ENVIRONMENTAL CONCERNS
Introduction to sustainable development goals, Global responsibility of environmental concern, Importance of environmental preservation, Environmental threats, Pollution and its types, Effects of Pollution, Pollution control, Treatment of wastes

UNIT II  ROLE OF NGOS
Role of NGO’s in national development, NGO’s and participatory management, Challenges and limitations of NGO’s, Community Development programmes, Role of NGO’s in Community Development programmes, Participation of NGO’s in environment management, Corporate Social responsibility, NGO’s and corporate social responsibility

UNIT III  SUSTAINABLE DEVELOPMENT
Issues and Challenges of Sustainable Development, Bioenergy, Sustainable Livelihoods and Rural Poor in Sustainable Development, Protecting ecosystem services for sustainable development, Non-renewable sources of energy and its effect, Renewable sources of energy for sustainability, Nuclear resources and Legal Regulation of Hazardous Substances, Sustainable Development: Programme and Policies, Sustainability assessment and Indicators

UNIT IV  NGO’S FOR SUSTAINABILITY
Civil Society Initiatives in Environment Management, Civil Society Initiatives for Sustainable Development, Global Initiatives in Protecting Global Environment, World Summit on Sustainable Development (Johannesburg Summit 2002), Ecological economics, Environmental sustainability, Social inclusion, Health for all, education for all, Food security and Water security, NGOs and Sustainable Development strategies

UNIT V  LEGAL FRAMEWORKS
Need for a Legal framework and its enforcement, Legal measures to control pollution, Environmental Legislations in India, Mechanism to implement Environmental Laws in India, Legal Protection of Forests Act 1927, Legal Protection of Wild Life, Role of NGO’s in implementing environmental laws, Challenges in the implementation of environmental legislation

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student will:

CO1 Have a thorough grounding on the issues and challenges being faced in attaining sustainable development

CO2 Have a knowledge on the role of NGOs towards sustainable development

CO3 Present strategies for NGOs in attaining sustainable development

CO4 Recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment

CO5 Understand the environmental legislations

REFERENCES
OMG353 DEMOCRACY AND GOOD GOVERNANCE 

UNIT I 
Structure and Process of Governance: Indian Model of Democracy, Parliament, Party Politics and Electoral Behaviour, Federalism, the Supreme Court and Judicial Activism, Units of Local Governance 

UNIT II 
Regulatory Institutions – SEBI, TRAI, Competition Commission of India, 

UNIT III 
Lobbying Institutions: Chambers of Commerce and Industries, Trade Unions, Farmers Associations, etc. 

UNIT IV 
Contemporary Political Economy of Development in India: Policy Debates over Models of Development in India, Recent trends of Liberalisation of Indian Economy in different sectors, E-governance 

UNIT V 
Dynamics of Civil Society: New Social Movements, Role of NGO’s, Understanding the political significance of Media and Popular Culture. 

REFERENCES: 
4. Saima Saeed: Screening the Public Sphere: Media and Democracy in India,2013 

CME365 RENEWABLE ENERGY TECHNOLOGIES 

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

COURSE OUTCOMES:
At the end of the course the students would be able to
CO1 Discuss the Indian and global energy scenario.
CO2 Describe the various solar energy technologies and its applications.
CO3 Explain the various wind energy technologies.
CO4 Explore the various bio-energy technologies.
CO5 Discuss the ocean and geothermal technologies.

TEXT BOOKS:

REFERENCES:

COs- PO's & PSO's MAPPING

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Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:
The course aims to
- Introduce tools & techniques of design thinking for innovative product development
- Illustrate customer-centric product innovation using on simple use cases
- Demonstrate development of Minimum usable Prototypes
- Outline principles of solution concepts & their evaluation
- Describe system thinking principles as applied to complex systems

UNIT I DESIGN THINKING PRINCIPLES
Exploring Human-centered Design - Understanding the Innovation process, discovering areas of opportunity, Interviewing & empathy-building techniques, Mitigate validation risk with FIR [Forge Innovation rubric] - Case studies

UNIT II ENDUSER-CENTRIC INNOVATION
Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit

UNIT III APPLIED DESIGN THINKING TOOLS
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
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
System Thinking, Understanding Systems, Examples and Understandings, Complex Systems

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1 Define & test various hypotheses to mitigate the inherent risks in product innovations.
CO2 Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
CO3 Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching
CO4 Apply system thinking in a real-world scenario

Text Books
1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
3. Proposition Design: How to Create Products and Services Customers Want, Wiley
REFERENCES
1. https://www.ideou.com/pages/design-thinking#process
4. https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e
6. https://blog.forgeforward.in/star-up-failure-is-like-true-lie-7812cdfe9b85

MF3003 REVERSE ENGINEERING LT P C
3 0 0 3

COURSE OBJECTIVES:
- The main learning objective of this course is to prepare students for:
- Applying the fundamental concepts and principles of reverse engineering in product design and development.
- Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Applying the concept and principles of material identification and process verification in reverse engineering of product design and development.
- Analysing the various legal aspect and applications of reverse engineering in product design and development.
- Understand about 3D scanning hardware & software operations and procedure to generate 3D model

UNIT I INTRODUCTION & GEOMETRIC FORM 9

UNIT II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION 9

UNIT III DATA PROCESSING 9

UNIT IV 3D SCANNING AND MODELLING 9

UNIT V INDUSTRIAL APPLICATIONS 9

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1 Apply the fundamental concepts and principles of reverse engineering in product design and development.
CO2 Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
CO3 Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
CO4 Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.
CO5 Analyze the various legal aspect
CO6 Applications of reverse engineering in product design and development.

TEXT BOOKS:

REFERENCES:

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

UNIT II SOCIAL AND ENVIRONMENTAL SUSTAINABILITY
Social sustainability – Introduction-Work management -Human rights - Societal commitment - Customers -Business practices -Modelling and assessing social sustainability. Environmental issues pertaining to the manufacturing sector: Pollution - Use of resources -Pressure to reduce costs - Environmental management: Processes that minimize negative environmental impacts - environmental legislation and energy costs - need to reduce the carbon footprint of manufacturing Operations-Modelling and assessing environmental sustainability

UNIT III SUSTAINABILITY PRACTICES
Sustainability awareness - Measuring Industry Awareness-Drivers and barriers -Availability of sustainability indicators -Analysis of sustainability practicing -Modeling and assessment of sustainable practicing -Sustainability awareness -Sustainability drivers and barriers - Availability of
sustainability indicators - Designing questionnaires - Optimizing Sustainability Indexes - Elements – Cost and time model.

UNIT IV MANUFACTURING STRATEGY FOR SUSTAINABILITY
Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme - Manufacturing strategy in business success strategy formulation and formulation - Structured strategy formulation - Sustainable manufacturing system design options - Approaches to strategy formulation - Realization of new strategies/system designs.

UNIT V TRENDS IN SUSTAINABLE OPERATIONS

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Discuss the importance of economic sustainability.
CO2: Describe the importance of sustainable practices.
CO3: Identify drivers and barriers for the given conditions.
CO4: Formulate strategy in sustainable manufacturing.
CO5: Plan for sustainable operation of industry with environmental, cost consciousness.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES:

- The objective of this course is to prepare the students to know about the general aspects of Electric and Hybrid Vehicles (EHV), including architectures, modelling, sizing, and subsystem design and hybrid vehicle control.

UNIT I   DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES


UNIT II  ENERGY SOURCES


UNIT III  MOTORS AND DRIVES

Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

UNIT IV  POWER CONVERTERS AND CONTROLLERS

Solid state Switching elements and characteristics – BJT, MOSFET, IGBT, SCR and TRIAC - Power Converters – rectifiers, inverters and converters - Motor Drives - DC, AC motor, PMSM motors, BLDC motors, Switched reluctance motors – four quadrant operations –operating modes

UNIT V    HYBRID AND ELECTRIC VEHICLES

Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of this course, the student will be able to

CO1 Understand the operation and architecture of electric and hybrid vehicles
CO2 Identify various energy source options like battery and fuel cell
CO3 Select suitable electric motor for applications in hybrid and electric vehicles.
CO4 Explain the role of power electronics in hybrid and electric vehicles
CO5 Analyze the energy and design requirement for hybrid and electric vehicles.

TEXT BOOKS:

REFERENCES:
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OAS352                      SPACE ENGINEERING                      L T P C  
COURSEOBJECTIVES:  
- 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

COURSE OUTCOMES:
- CO1 Illustrate the history of aviation & developments over the years  
- CO2 Ability to identify the types & classifications of components and control systems  
- CO3 Explain the basic concepts of flight & Physical properties of Atmosphere  
- CO4 Identify the types of fuselage and constructions.  
- CO5 Distinguish the types of Engines and explain the principles of Rocket

TEXT BOOKS:

REFERENCE:  
OIM351  INDUSTRIAL MANAGEMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To introduce fundamental concepts of industrial management
- To understand the approaches to the study of Management
- To learn about Decision Making, Organizing and leadership
- To analyze the Managerial Role and functions
- To know about the Supply Chain Management'

UNIT I  INTRODUCTION  9

UNIT II  FUNCTIONS OF MANAGEMENT  9

UNIT III  ORGANIZATIONAL BEHAVIOUR  9

UNIT IV  GROUPDYNAMICS  9

UNIT V  MODERN CONCEPTS  9
Management by Objectives (MBO) - Management by Exception (MBE),Strategic Management - Planning for Future direction - SWOT Analysis -Evolving development strategies, information technology in management Decisions support system-Management Games Business Process Re-engineering(BPR) –Enterprises Resource Planning (ERP) - Supply Chain Management (SCM) - Activity Based Management (AM) - Global Perspective - Principles and Steps Advantages and disadvantage

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

REFERENCES:
COs- PO’s & PSO’s MAPPING

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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 - 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.
COs- PO’s & PSO’s MAPPING

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OSF351                      FIRE SAFETY ENGINEERING                       L T P C
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COURSE OBJECTIVES

- To enable the students to acquire knowledge of Fire and Safety Studies
- To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance
- To learn about fire area, fire stopped areas and different types of fire-resistant doors
- To learn about the method of fire protection of structural members and their repair due to fire damage.
- To develop safety professionals for both technical and management through systematic and quality-based study programmes

UNIT I                  INHERENT SAFETY CONCEPTS
Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behavior of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials.

UNIT II                PLANT LOCATIONS
Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements-standard heating condition, Indian standard test method, performance criteria.

UNIT III              WORKING CONDITIONS
Fire separation between building- principle of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors;

UNIT IV            FIRE SEVERITY AND REPAIR TECHNIQUES
Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures- Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V                 WORKING AT HEIGHTS

TOTAL : 45 PERIODS

185
COURSE OUTCOMES
On completion of the course the student will be able to
CO1: Understand the effect of fire on materials used for construction
CO2: Understand the method of test for non-combustibility and fire resistance; and will be able to select different structural elements and their dimensions for a particular fire resistance rating of a building.
CO3: To understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.
CO4: To decide the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.
CO5: Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

TEXT BOOKS

REFERENCES:

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OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application.
UNIT I  INTRODUCTION TO NDT & VISUAL TESTING  9
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  9
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  9
Eddy Current Testing: Generation of eddy currents– properties– eddy current sensing elements,
probes, Instrumentation, Types of arrangement, applications, advantages, limitations – Factors
affecting sensing elements and coil impedance, calibration, Interpretation/Evaluation.
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  9
Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes,
EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of
scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique,
Thickness determination by ultrasonic method, Study of A, B and C scan presentations,
calibration.
Acoustic Emission Technique – Introduction, Types of AE signal, AE wave propagation, Source
location, Kaiser effect, AE transducers, Principle, AE parameters, AE instrumentation, Advantages
& Limitations, Interpretation of Results, Applications.

UNIT V  RADIOGRAPHY TESTING  9
Sources-X-rays and Gamma rays and their characteristics-absorption, scattering. Filters and
screens, Imaging modalities-film radiography and digital radiography (Computed, Direct, Real
Time, CT scan). Problems in shadow formation, exposure factors, inverse square law, exposure
charts, Penetrameters, safety in radiography.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Realize the importance of NDT in various engineering fields.
CO2 Have a basic knowledge of surface NDE techniques which enables to carry out various
inspection in accordance with the established procedures.
CO3 Calibrate the instrument and inspect for in-service damage in the components by means of
Eddy current testing as well as Thermography testing.
CO4 Differentiate various techniques of UT and AET and select appropriate NDT methods for
better evaluation.
CO5 Interpret the results of Radiography testing and also have the ability to analyse the influence
of various parameters on the testing.

TEXT BOOKS:
1. Baldev Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha
2. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata
REFERENCES:

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OMR351 MECHATRONICS

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

UNIT I INTRODUCTION AND SENSORS

UNIT II 8085 MICROPROCESSOR

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE

UNIT IV PROGRAMMABLE LOGIC CONTROLLER
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

TOTAL: 45 PERIODS
COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Select sensors to develop mechatronics systems.
CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor.
CO4: Apply PLC as a controller in mechatronics system.
CO5: Design and develop the apt mechatronics system for an application.

TEXT BOOKS

REFERENCES

COS - PO's & PSO's MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

ORA351 FOUNDATION OF ROBOTICS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Vision application in robots.
- To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

UNIT I FUNDAMENTALS OF ROBOT 9
UNIT II ROBOT KINEMATICS
Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse
Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of
freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices,
translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors,
Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These
Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers,
Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design
considerations of a gripper.

UNIT IV SENSORS IN ROBOTICS
Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety
considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance
mechanism. Machine vision system - camera, frame 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: Demonstrate the concept of kinematics, degeneracy, dexterity and trajectory planning.
CO5: Demonstrate the image processing and image analysis techniques by machine vision
system.

TEXT BOOKS:

REFERENCES:
1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence",
2010.
COs- PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

OAE352 FUNDAMENTALS OF AERONAUTICAL ENGINEERING

L T P C
3 0 0 3

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
- 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
- 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
- Physical Properties and structures of the Atmosphere, Temperature, pressure and altitude
  relationships, Newton’s Law of Motions applied to Aeronautics-Evolution of lift, drag and moment.
  Aerofoils, Mach number, Maneuvers.

UNIT IV BASICS OF AIRCRAFT STRUCTURES
- General types of construction, Monocoque, semi-monocoque and geodesic constructions, typical
  wing and fuselage structure. Metalic and non-metallic materials. Use of Aluminium alloy, titanium,
  stainless steel and composite materials. Stresses and strains-Hooke’s law-stress-strain diagrams-
  elastic constants-Factor of Safety.

UNIT V BASICS OF PROPULSION
- 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.

COURSE OUTCOMES:
CO1 Illustrate the history of aircraft & developments over the years
CO2 Ability to identify the types & classifications of components and control systems
CO3 Explain the basic concepts of flight & Physical properties of Atmosphere
CO4 Identify the types of fuselage and constructions.
CO5 Distinguish the types of Engines and explain the principles of Rocket

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCE
1. SADHU SINGH, “INTERNAL COMBUSTION ENGINES AND GAS TURBINE”-, SS Kataraia & sons, 2015

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

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

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 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
  CO1 Understand the concepts and laws related to remote sensing
  CO2 Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO3 Acquire knowledge about satellite orbits and different types of satellites
CO4 Understand the different types of remote sensors
CO5 Gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS:

REFERENCES:

COs- PO's & PSO's MAPPING

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OCE353 LEAN CONCEPTS, TOOLS AND PRACTICES L T P C
3 0 0 3

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

UNIT I INTRODUCTION
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.

TOTAL : 45 PERIODS

COURSE 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:

OEN351  DRINKING WATER SUPPLY AND TREATMENT  L T P C
3 0 0 3

COURSE OBJECTIVE:
- To equip the students with the principles and design of water treatment units and distribution system.

UNIT I  SOURCES OF WATER  9
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
Requirements of water distribution – Components – Selection of pipe material – Service reservoirs - Functions – Network design – Economics - Computer applications – Appurtenances – Leak detection - Principles of design of water supply in buildings – House service connection – Fixtures and fittings, systems of plumbing and types of plumbing. TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: an understanding of water quality criteria and standards, and their relation to public health
CO2: the ability to design the water conveyance system
CO3: the knowledge in various unit operations and processes in water treatment
CO4: an ability to understand the various systems for advanced water treatment
CO5: an insight into the structure of drinking water distribution system

TEXTBOOKS:

REFERENCES:

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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 provide knowledge about electric machines and special machine
- To understand the basics of power converters
- To know the concepts of controlling DC and AC drive systems
- To understand the architecture and power train components.
- To impart knowledge on vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)

UNIT I   ROTATING POWER CONVERTERS

UNIT II   STATIC POWER CONVERTERS
Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.

UNIT III CONTROL OF DC AND AC MOTOR DRIVES
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives

UNIT IV HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS

UNIT V MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power split mode - parallel mode - engine brake mode - regeneration mode - series parallel mode

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Able to understand the principles of conventional and special electrical machines.
CO2: Acquired the concepts of power devices and power converters
CO3: Able to understand the control for DC and AC drive systems.
CO4: Learned the electric vehicle architecture and power train components.
CO5: Acquired the knowledge of mechanics of electric vehicles and control of electric vehicles.

REFERENCES:

**COs- PO’s & PSO’s MAPPING**

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**OEI353 INTRODUCTION TO PLC PROGRAMMING**

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<tr>
<td>Understand basic PLC terminologies digital principles, PLC architecture and operation.</td>
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<td>Familiarize different programming language of PLC.</td>
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<td>Develop PLC logic for simple applications using ladder logic.</td>
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<td>Understand the hardware and software behind PLC and SCADA.</td>
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<td>Exposures about communication architecture of PLC/SCADA.</td>
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**UNIT I**

**INTRODUCTION TO PLC**

Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, , PLC Special I/O, PLC Types.

**UNIT II**

**PLC INSTRUCTIONS**

PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters, Examples.

**UNIT III**

**PLC PROGRAMMING**

Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions

**UNIT IV**

**COMMUNICATION OF PLC AND SCADA**

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

**UNIT V**

**CASE STUDIES**

Stepper Motor Control- Elevator Control-CNC Machine Control- conveyor control-Interlocking Problems

**TOTAL: 45 PERIODS**
SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)

1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Communication Network Used for PLC/SCADA.

COURSE OUTCOMES:
CO1 Know the basic requirement of a PLC input/output devices and architecture. (L1)
CO2 Ability to apply Basics Instruction Sets used for ladder Logic and Function Block Programming.(L2)
CO3 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO4 Able to develop a PLC logic for a specific application on real world problem. (L5)
CO5 Ability to Understand the Concepts of Communication used for PLC/SCADA.(L1)

TEXT BOOKS:
1. Frank Petruzulla, 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

CoS- PO’s & PSO’s MAPPING

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OCH351 NANO TECHNOLOGY

UNIT I INTRODUCTION
General definition and size effects—important nano structured materials and nano particles—importance of nano materials- Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials- surface area - band gap energy and applications. Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials- Nano catalysis.
UNIT II SYNTHESIS OF NANOMATERIALS
Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III NANO COMPOSITES
Definition- importance of nanocomposites- nano composite materials-classification of composites-metal/metal oxides, metal-polymer- thermoplastic based, thermostet based and elastomer based-influence of size, shape and role of interface in composites applications.

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES
Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice-clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.

UNIT V APPLICATIONS OF NANO MATERIALS
Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots-Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

CO1 understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications.

CO2 able to acquire knowledge about the different types of nano material synthesis

CO3 describes about the shape, size,structure of composite nano materials and their interference

CO4 understand the different characterization techniques for nanomaterials

CO5 develop a deeper knowledge in the application of nanomaterials in different fields.

TEXT BOOKS

REFERENCES

COs- PO's & PSO's MAPPING

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**COURSE 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

COURSE OUTCOME:
- Students will be able to differentiate among various functional properties and select appropriate material for certain functional applications, analyze the nature and potential of functional material.

TEXT BOOK:

REFERENCE:

OFD352     TRADITIONAL INDIAN FOODS
L T P C
3 0 0 3

COURSE OBJECTIVE:
- To help students acquire a sound knowledge on diversities of foods, food habits and patterns in India with focus on traditional foods.

UNIT I     HISTORICAL AND CULTURAL PERSPECTIVES
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

UNIT II     TRADITIONAL METHODS OF FOOD PROCESSING

UNIT III    TRADITIONAL FOOD PATTERNS
Typical breakfast, meal and snack foods of different regions of India. Regional foods that have gone Pan Indian / Global. Popular regional foods; Traditional fermented foods, pickles and preserves, beverages, snacks, desserts and sweets, street foods; IPR issues in traditional foods.

UNIT IV     COMMERCIAL PRODUCTION OF TRADITIONAL FOODS
Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut.
water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

UNIT V HEALTH ASPECTS OF TRADITIONAL FOODS 9
Comparison of traditional foods with typical fast foods / junk foods – cost, food safety, nutrient composition, bioactive components; energy and environmental costs of traditional foods; traditional foods used for specific ailments / illnesses.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 To understand the historical and traditional perspective of foods and food habits
CO2 To understand the wide diversity and common features of traditional Indian foods and meal patterns.

TEXT BOOKS:

OFD353 INTRODUCTION TO FOOD PROCESSING
L T P C 3 0 0 3

COURSE OBJECTIVE:
• The course aims to introduce the students to the area of Food Processing. This is necessary for effective understanding of a detailed study of food processing and technology subjects. This course will enable students to appreciate the importance of food processing with respect to the producer, manufacturer and consumer.

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students are expected to
CO1 Be aware of the different methods applied to processing foods.
CO2 Be able to understand the significance of food processing and the role of 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
CO1 Understand and differentiate the categories of intellectual property rights.
CO2 Describe about patents and procedure for obtaining patents.
CO3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
CO4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.
CO5 Provide different organizations role and responsibilities in the protection of IPR in the international level.
CO6 Understand the interrelationships between different Intellectual Property Rights on International Society

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OTT351 BASICS OF TEXTILE FINISHING

COURSE OBJECTIVE:
- To enable the students to understand the basics and different types of finishes required for textile materials and machines used for finishing.

UNIT I RESIN FINISHING

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  9

UNIT IV  MECHANICAL FINISHES  9

UNIT V  STIFFENING AND SOFTENING  9
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.

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO1 Basics of Resin Finishing Process.  
CO2 Concept of Flame proof & flame retardancy, waterproof and water repellent, Antimicrobial finishes.  
CO3 Concept of Soil Release, Anti Pilling, UV Protection and Antistatic finishes.  
CO4 Concept of Mechanical finishing.  
CO5 Basics of Micro encapsulation techniques, Nano finish, Plasma Treatment.

TEXT BOOKS:

REFERENCES:
1. Microencapsulation in finishing, Review of progress of Colouration, SDC, 2001 62  

OTT352  INDUSTRIAL ENGINEERING FOR GARMENT INDUSTRY  L T P C 3 0 0 3

COURSE 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
Definition, Objectives, Procedure, Process charts and symbols. Various charts – Charts indicating process sequence: Outline process chart, flow process chart (man type, material type and equipment type); Charts using time scale – multiple activity chart. Diagrams indicating movement – flow diagram, string diagram, cycle graph, chrono cycle graph, travel chart

MOTION STUDY: Principle of motion economy, Two handed process chart, micro motion analysis – therbligs, SIMO chart.

UNIT IV  WORK MEASUREMENT
Definition, purpose, procedure, equipments, techniques. Time study - Definition, basics of time study- equipments. Time study forms, Stop watch procedure. Predetermined motion time standards (PMTS). Time Study rating, calculation of standard time, Performance rating – relaxation and other allowances. Calculation of SAM for different garments, GSD.

UNIT V  WORK STUDY APPLICATION
Application of work study techniques in cutting, stitching and packing in garment industry. Workaids in sewing, Pitch diagram, Line balancing, Capacity planning, scientific method of training.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of the course the student shall be able to understand

CO1: Fundamental concepts of industrial Engineering and productivity
CO2: Method study
CO3: Motion analysis
CO4: Work measurement and SAM
CO5: Ergonomics and its application to garment industry

TEXTBOOKS:

REFERENCES

COs- PO’s & PSO’s MAPPING

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### OTT353  
**BASICS OF TEXTILE MANUFACTURE**  
**L T P C**  
3 0 0 3

**COURSE OBJECTIVES:**
- To enable the students to learn about the basics of fibre forming, yarn production, fabric formation, coloration of fabrics and garment manufacturing

**UNIT I  
NATURAL FIBRES**

Introduction: Definition of staple fibre, filament; Classification of natural and man-made fibres, essential and desirable properties of fibres. Production and cultivation of Natural Fibres: Cultivation of cotton, production of silk (sericulture), wool and jute – physical and chemical structure of these fibres.

**UNIT II  
REGENERATED AND SYNTHETIC FIBRES**

Production sequence of regenerated and modified cellulosic fibres: viscose rayon, Acetate Rayon, high wet modulus and high tenacity fibres; synthetic fibres – chemical structure, fibre forming polymers, production principles.

**UNIT III  
BASICS OF SPINNING**

Spinning – principle of yarn formation, sequence of machines for yarn production with short staple fibres and blends, principles of opening and cleaning machines; yarn numbering - calculations

**UNIT IV  
BASICS OF WEAVING**

Woven fabric – warp, weft, weaving, path of warp; looms – classification, handloom and its parts, powerloom, automatic looms, shuttleless looms, special type of looms; preparatory machines for weaving process and their objectives; basic weaving mechanism - primary, secondary and auxiliary mechanisms

**UNIT V  
BASICS OF KNITTING AND NONWOVEN**


**COURSE OUTCOMES:**

On completion of this course, the students shall have the basic knowledge on
**CO1:** Classification of fibres and production of natural fibres  
**CO2:** Regenerated and synthetic fibres  
**CO3:** Yarn spinning  
**CO4:** Weaving  
**CO5:** Knitting and nonwoven

**TOTAL : 45 PERIODS**

**TEXTBOOKS**


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

OPE351 INTRODUCTION TO PETROLEUM REFINING AND PETROCHEMICALS L T P C 3 0 0 3

COURSE OBJECTIVE:
The course is aimed to
- Gain knowledge about petroleum refining process and production of petrochemical products.

UNIT I ORIGIN, FORMATION AND REFINING OF CRUDE OIL 9
UNIT II CRACKING 9
Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen

UNIT III REFORMING AND HYDROTREATING 9

UNIT IV INTRODUCTION TO PETROCHEMICALS 9
Petrochemicals - Cracking of Naphtha and Feed stock gas for the production of Ethylene, Propylene, Isobutylene and Butadiene. Production of Acetylene from Methane, and Extraction of Aromatics.

UNIT V PRODUCTION OF PETROCHEMICALS 9
Production of Petrochemicals like Dimethyl Terephthalate (DMT), Ethylene Glycol, Synthetic glycerine, Linear Alkyl Benzene (LAB), Acrylonitrile, Methyl Methacrylate (MMA), Vinyl Acetate Monomer, Phthalic Anhydride, Maleic Anhydride, Phenol, Acetone, Methanol, Formaldehyde, Acetaldehyde, Pentaerythritol and production of Carbon Black.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On the completion of the course students are expected to

CO1: Understand the classification, composition and testing methods of crude petroleum and its products. Learn the mechanism of refining process.

CO2: Understand the insights of primary treatment processes to produce the precursors.

CO3: Study the secondary treatment processes cracking, vis-breaking and coking to produce more petroleum products.

CO4: Appreciate the need of treatment techniques for the removal of sulphur and other impurities from petroleum products.

CO5: Understand the societal impact of petrochemicals and learn their manufacturing processes.

CO6: Learn the importance of optimization of process parameters for the high yield of petroleum products.

TEXT BOOKS

REFERENCES

CPE334 ENERGY CONSERVATION AND MANAGEMENT

COURSE OBJECTIVES:
At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I INTRODUCTION 9
UNIT II ELECTRICAL SYSTEMS

UNIT III THERMAL SYSTEMS

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students can able to analyze the energy data of industries.

CO1: Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.

CO2: Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.

CO3: Skills on combustion thermodynamics and kinetics.

CO4: Apply calculation and design tube still heaters.

CO5: Studied different heat treatment furnace.

CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

REFERENCES:

OPT351 BASICS OF PLASTICS PROCESSING

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
CO1 Ability to find out the correlation between various processing techniques with product properties.
CO2 Understand the major plastics processing techniques used in moulding (injection, blow, compression, and transfer), extrusion, thermoforming, and casting.
CO3 Acquire knowledge on additives for plastic compounding and methods employed for the same
CO4 Familiarize with the machinery and ancillary equipment associated with various plastic processing techniques.
CO5 Select an appropriate processing technique for the production of a plastic product

REFERENCES

OEC351 SIGNALS AND SYSTEMS

COURSE OBJECTIVES:
- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS
- Standard signals: Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids
- Classification of signals: Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals

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

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS
- Impulse response: convolution integrals
- Differential Equation: Fourier and Laplace transforms in Analysis of CT systems
- Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS
- Baseband signal Sampling
- Fourier Transform of discrete time signals (DTFT)
- Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS
- Impulse response: Difference equations
- Convolution sum: Discrete Fourier Transform and Z Transform
- Analysis of Recursive & Non-Recursive systems
- DT systems connected in series and parallel.

COURSE OUTCOMES:
At the end of the course, the student will be able to:
- CO1: determine if a given system is linear/causal/stable
- CO2: determine the frequency components present in a deterministic signal
- CO3: characterize continuous LTI systems in the time domain and frequency domain
- CO4: characterize discrete LTI systems in the time domain and frequency domain
- CO5: compute the output of an LTI system in the time and frequency domains

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES :

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OEC352  FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS L T P C
3 0 0 3

COURSE OBJECTIVES:
- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT I SEMICONDUCTOR DEVICES 9
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator

UNIT II AMPLIFIERS 9
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 9
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – Tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS 9
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 :


REFERENCES:


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CBM348 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

COURSE OBJECTIVES:

• To understand the global trends and development methodologies of various types of products and services
• To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
• To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
• To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
• To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
UNIT I  BASICS OF PRODUCT DEVELOPMENT  9
Global Trends Analysis and Product decision - Social Trends - Technical Trends-
Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product
Development Methodologies and Management - Overview of Products and Services - Types
of Product Development - Overview of Product Development methodologies - Product Life
Cycle – Product Development Planning and Management.

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  9
Requirement Engineering - Types of Requirements - Requirement Engineering - traceability
Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction
to System Modeling - System Optimization - System Specification - Sub-System Design -
Interface 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, S/W Testing- Hardware Schematic, Component design,
Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid
Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV  SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT  9
Introduction to Product verification processes and stages - Introduction to Product Validation
processes and stages - Product Testing Standards and Certification - Product
Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL -
Obsolescence Management – Configuration Management - EoL Disposal.

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9
The Industry - Engineering Services Industry - Product Development in Industry versus
Academia –The IPD Essentials - Introduction to Vertical Specific Product Development
processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical,
Embedded and Software Systems – Product Development Trade-offs - Intellectual Property

COURSE OUTCOMES:
Upon completion of the course, the students will be able to:
CO1 Define, formulate, and analyze a problem
CO2 Solve specific problems independently or as part of a team
CO3 Gain knowledge of the Innovation & Product Development process in the Business
Context
CO4 Work independently as well as in teams
CO5 Manage a project from start to finish

TEXT BOOKS:
1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata

REFERENCES:
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier],

TOTAL: 45 PERIODS

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CBM333 ASSISTIVE TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:
The student should be made to:
- To know the hardware requirement various assistive devices
- To understand the prosthetic and orthotic devices
- To know the developments in assistive technology

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

UNIT II HEMODIALYSERS 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 9
Transcutaneous electrical nerve stimulator, bio-feedback, assistive devices in drug delivery

TOTAL : 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Interpret the various mechanical techniques that will help in assisting the heart functions.
CO2: Describe the underlying principles of hemodialyzer machine.
CO3: Indicate the methodologies to assess the hearing loss.
CO4: Evaluate the types of assistive devices for mobilization.
CO5: Explain about TENS and biofeedback system.
TEXT BOOKS

REFERENCES

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OMA352 OPERATIONS RESEARCH

COURSE OBJECTIVES:
This course will help the students to

- determine the optimum solution for Linear programming problems.
- study the Transportation and assignment models and various techniques to solve them.
- acquire the knowledge of optimality, formulation and computation of integer programming problems.
- acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
- determine the optimum solution for non-linear programming problems.

UNIT I LINEAR PROGRAMMING

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEMS

UNIT III INTEGER PROGRAMMING
UNIT IV       DYNAMIC PROGRAMMING PROBLEMS

UNIT V       NON - LINEAR PROGRAMMING PROBLEMS

TOTAL:45 PERIODS

COURSE OUTCOMES :
At the end of the course, students will be able to
CO1 Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
CO2 analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.
CO3 solve the integer programming problems using various methods.
CO4 conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
CO5 determine the optimum solution for non linear programming problems.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES:
- To introduce the basic notions of groups, rings, fields which will then be used to solve related problems.
- To examine the key questions in the Theory of Numbers.
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I GROUPS AND RINGS
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange’s theorem.
Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT II FINITE FIELDS AND POLYNOMIALS
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS
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
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
Wilson’s theorem – Fermat’s Little theorem – Euler’s theorem – Euler’s Phi functions – Tau and Sigma functions.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
CO2 Demonstrate accurate and efficient use of advanced algebraic techniques.
CO3 The students should be able to demonstrate their mastery by solving non-trivial problems related to the concepts, and by proving simple theorems about the, statements proven by the text

TEXT BOOKS:

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OMA354                     LINEAR ALGEBRA                     L T P C
3 0 0 3

COURSE OBJECTIVES:
- To test the consistency and solve system of linear equations.
- To find the basis and dimension of vector space.
- To obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
- To find orthonormal basis of inner product space and find least square approximation.
- To find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9

UNIT II VECTOR SPACES 9
- Vector spaces over Real and Complex fields - Subspace – Linear space - Linear independence and dependence - Basis and dimension.

UNIT III LINEAR TRANSFORMATION 9
- Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem – Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation – Diagonalization.

UNIT IV INNER PRODUCT SPACES 9
- Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process - Least square approximation.

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
- After the completion of the course the student will be able to
  CO1 Test the consistency and solve system of linear equations.
  CO2 Find the basis and dimension of vector space.
  CO3 Obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
  CO4 Find orthonormal basis of inner product space and find least square approximation.
  CO5 Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

TEXT BOOKS
REFERENCES

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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

TOTAL: 45 PERIODS

221
COURSE OUTCOME:
At the end of the course the students will be able to
CO1 Microbes and their types
CO2 Cultivation of microbes
CO3 Pathogens and control measures for safety
CO4 Microbes in different industry for economy.

TEXT BOOKS

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

COURSE OBJECTIVES:
- The objective is to offer basic concepts of biochemistry to students with diverse background in life sciences including but not limited to the structure and function of various biomolecules and their metabolism.

UNIT I CARBOHYDRATES
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
Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipids, sphingolipid and glycerolipid. Biological function of lipid. Fatty acid, Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.

UNIT III AMINO ACIDS AND PROTEIN.

UNIT IV NUCLEIC ACIDS
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & 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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Students will learn about various kinds of biomolecules and their physiological role.
CO2 Students will gain knowledge about various metabolic disorders and will help them to know the importance of various biomolecules in terms of disease correlation.
TEXT BOOKS

REFERENCES

OBT354 FUNDAMENTALS OF CELL AND MOLECULAR BIOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:
- To provide knowledge on the fundamentals of cell biology.
- To understand the signalling mechanisms.
- Understand basic principles of molecular biology at intracellular level to regulate growth, division and development.

UNIT I INTRODUCTION TO CELL 9
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 9
Molecular organisation, biogenesis and function Mitochondria, endoplasmic reticulum, golgi apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.

UNIT III BIO-MEMBRANE TRANSPORT 9

UNIT IV CELL CYCLE 9
Cell cycle- Cell division by mitosis and meosis, Comparison of meosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signaling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.

UNIT V CENTRAL DOGMA 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1 Understanding of cell at structural and functional level.
CO2 Understand the central dogma of life and its significance.
CO3 Comprehend the basic mechanisms of cell division.

TEXTBOOKS:

REFERENCES:

OPEN ELECTIVE IV
OHS352 PROJECT REPORT WRITING L T P C
3 0 0 3

COURSE OBJECTIVE
The Course will enable Learners to,
- Understand the essentials of project writing.
- Perceive the difference between general writing and technical writing
- Assimilate the fundamental features of report writing.
- Understand the essential differences that exist between general and technical writing.
- Learn the structure of a technical and project report.

UNIT 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
COURSE OUTCOMES
By the end of the course, learners will be able to
CO1 Write effective project reports.
CO2 Use statistical tools with confidence.
CO3 Explain the purpose and intention of the proposed project coherently and with clarity.
CO4 Create writing texts to suit achieve the intended purpose.
CO5 Master the art of writing winning proposals and projects.

REFERENCES

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

OMA355 ADVANCED NUMERICAL METHODS

COURSE OBJECTIVE:

- To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology. This will also serve as a precursor for future research.

UNIT I ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM

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  

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

CO1: demonstrate the understandings of common numerical methods for nonlinear equations, system of linear equations and eigenvalue problems;

CO2: understand the interpolation theory;

CO3: understand the concepts of numerical methods for ordinary differential equations;

CO4: demonstrate the understandings of common numerical methods for elliptic equations;

CO5: understand the concepts of numerical methods for time dependent partial differential equations

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES:
- To introduce the basic concepts of probability, one and two dimensional random variables with applications to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in communication networks.
- To acquaint with specialized random processes which are apt for modelling the real time scenario.
- To understand the concept of correlation and spectral densities.
- To understand the significance of linear systems with random inputs.

UNIT I RANDOM VARIABLES

UNIT II RANDOM PROCESSES

UNIT III SPECIAL RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1 Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
CO2 Apply the concept random processes in engineering disciplines.
CO3 Understand and apply the concept of correlation and spectral densities.
CO4 Get an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
CO5 Analyze the response of random inputs to linear time invariant systems.

TEXT BOOKS

REFERENCES


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**OMA357** QUEUEING AND RELIABILITY MODELLING

**COURSE OBJECTIVES:**
- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the concept of queueing models and apply in engineering.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.
- To study the system reliability and hazard function for series and parallel systems.
- To implement Markovian Techniques for availability and maintainability which opens up new avenues for research.

**UNIT I RANDOM PROCESSES**

**UNIT II MARKOVIAN QUEUEING MODELS**
Markovian queues – Birth and death processes – Single and multiple server queueing models – Little’s formula - Queues with finite waiting rooms.

**UNIT III ADVANCED QUEUEING MODELS**
M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E_k/1 as special cases – Series queues – Open Jackson networks.

**UNIT IV SYSTEM RELIABILITY**

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**
Upon successful completion of the course, students should be able to:
- **CO1** Enable the students to apply the concept of random processes in engineering disciplines.
- **CO2** Students acquire skills in analyzing various queueing models.
CO3 Students can understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.

CO4 Students can analyze reliability of the systems for various probability distributions.

CO5 Students can be able to formulate problems using the maintainability and availability analyses by using theoretical approach.

**TEXT BOOKS**

**REFERENCES**

**CO’s- PO’s & PSO’s MAPPING**

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OMG354 PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS

**COURSE OBJECTIVES:**
- To know the basic concept and function of Production and Operation Management for entrepreneurship.
- To understand the Production process and planning.
- To understand the Production and Operations Management Control for business owners.

**UNIT I** INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT

Functions of Production Management - Relationship between production and other functions – Production management and operations management, Characteristics of modern production and operation management, organisation of production function, recent trends in production /operations management - production as an organisational function, decision making in production Operations research

**UNIT II** PRODUCTION & OPERATION SYSTEMS

Production Systems- principles – Models - CAD and CAM- Automation in Production - Functions and significance- Capacity and Facility Planning: Importance of capacity planning- Capacity measurement – Capacity Requirement Planning (CRP) process for manufacturing and service industry
UNIT III PRODUCTION & OPERATIONS PLANNING 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

UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT 9

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

OMG355 MULTIVARIATE DATA ANALYSIS  L T P C
COURSE OBJECTIVE:
- To know various multivariate data analysis techniques for business research.

UNIT I INTRODUCTION 9
Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation.
UNIT II PREPARING FOR MULTIVARIATE ANALYSIS 9
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 9
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 9
Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES 9
Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.
CO2 Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
CO3 Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
CO4 Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
CO5 Make better business decisions by using advanced techniques in data analytics.

REFERENCES:

OME352 ADDITIVE MANUFACTURING  L T P C
3 0 0 3

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  9

UNIT II  VAT POLYMERIZATION AND MATERIAL EXTRUSION  9

UNIT III  POWDER BED FUSION AND BINDER JETTING  9

UNIT IV  MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION  9

UNIT V  SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY  9
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:

CME343 NEW PRODUCT DEVELOPMENT LT P C

3 0 0 3

COURSE OBJECTIVES

• To introduce the fundamental concepts of the new product development
• To develop material specifications, analysis and process.
• To Learn the Feasibility Studies & reporting of new product development.
• To study the New product qualification and Market Survey on similar products of new product development
• To learn Reverse Engineering. Cloud points generation, converting cloud data to 3D model

UNIT I FUNDAMENTALS OF NPD


UNIT II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS

Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT III ESSENTIALS OF NPD


UNIT IV CRITERIONS OF NPD

New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

UNIT V REPORTING & FORWARD-THINKING OF NPD

Detailed study on PPAP with 18 elements reporting, APQP and its 5 Sections, APQP vs PPAP, Importance of SOP (Standard Operating Procedure) – Purpose & documents, deployment in shop
floor. Prototyping & RPT - Concepts, Application and its advantages, 3D Printing – resin models, Sand cores for foundries; Reverse Engineering. Cloud points generation, converting cloud data to 3D model – Advantages & Limitation of RE, CE (Concurrent Engineering) – Basics, Application and its advantages in NPD (to reduce development lead time, time to Market, Improve productivity and product cost.)

TOTAL :45 PERIODS

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

CO1 Discuss fundamental concepts and customer specific requirements of the New Product development

CO2 Discuss the Material specification standards, analysis and fabrication, manufacturing process Develop Feasibility Studies & reporting of New Product development

CO3 Analyzing the New product qualification and Market Survey on similar products of new product development

CO4 Develop Reverse Engineering. Cloud points generation, converting cloud data to 3D model

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

REFERENCES:
Revolutionizing Product Development – Steven C Wheelwright & Kim B. Clark
Change by Design
Toyota Product Development System – James Morgan & Jeffrey K. Liker
Winning at New Products – Robert Brands 3rd Edition
Product Design & Value Engineering – Dr. M.A. Bulsara &Dr. H.R. Thakkar

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OME355 INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES L T P C

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

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1 Create quick UI/UX prototypes for customer needs
CO2 Develop web application to test product traction / product feature
CO3 Develop 3D models for prototyping various product ideas
CO4 Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

MF3010 MICRO AND PRECISION ENGINEERING LT P C 3 0 0 3

COURSE OBJECTIVES:
At the end of this course the student should be able to
- Learn about the precision machine tools
- Learn about the macro and micro components.
- Understand handling and operating of the precision machine tools.
- Learn to work with miniature models of existing machine tools/robots and other instruments.
- Learn metrology for micro system
UNIT I    INTRODUCTION TO MICROSYSTEMS  9
Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical, electrical properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems.

UNIT II    FABRICATION PROCESSES FOR MICRO-SYSTEMS:  9
Additive, subtractive, forming process, microsystems-Micro-pumps, micro- turbines, micro engines, micro-robot, and miniature biomedical devices

UNIT III    INTRODUCTION TO PRECISION ENGINEERING  9
Machine tools, holding and handling devices, positioning fixtures for fabrication/ assembly of microsystems. Precision drives: inch worm motors, ultrasonic motors, stick- slip mechanism and other piezo-based devices.

UNIT IV    PRECISION MACHINING PROCESSES  9
Precision machining processes for macro components - Diamond turning, fixed and free abrasive processes, finishing processes.

UNIT V    METROLOGY FOR MICRO SYSTEMS  9
Metrology for micro systems - Surface integrity and its characterization.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Select suitable precision machine tools and operate
CO2 Apply the macro and micro components for fabrication of micro systems.
CO3 Apply suitable machining process
CO4 Able to work with miniature models of existing machine tools/robots and other instruments.
CO5 Apply metrology for micro system

TEXT BOOKS:

REFERENCES:

OMF354    COST MANAGEMENT OF ENGINEERING PROJECTS    LT P C
3 0 0 3

COURSE OBJECTIVES:
Summarize the costing concepts and their role in decision making
Infer the project management concepts and their various aspects in selection
Interpret costing concepts with project execution
Develop knowledge of costing techniques in service sector and various budgetary control techniques
Illustrate with quantitative techniques in cost management
UNIT I    INTRODUCTION TO COSTING CONCEPTS  9
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential
cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.'

UNIT II    INTRODUCTION TO PROJECT MANAGEMENT  9
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project
execution: conception to commissioning. Project execution as conglomeration of technical and
nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and
documents, Project team: Role of each member, Importance Project site: Data required with
significance, Project contracts

UNIT III    PROJECT EXECUTION AND COSTING CONCEPTS  9
Project execution Project cost control, Bar charts and Network diagram, Project commissioning:
mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between
Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis,
Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle
Costing

UNIT IV    COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  9
Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity
Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis,
Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V    QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning
Curve Theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand the costing concepts and their role in decision making.
CO2: Understand the project management concepts and their various aspects in selection.
CO3: Interpret costing concepts with project execution.
CO4: Gain knowledge of costing techniques in service sector and various budgetary control
techniques.
CO5: Become familiar with quantitative techniques in cost management.

TEXT BOOKS:
1. John M. Nicholas, Herman Steyn Project Management for Engineering, Business and
2. Albert Lester ,Project Management, Planning and Control, Elsevier/Butterworth-

REFERENCES:
3. Charles T. Horngren et al Cost Accounting a Managerial Emphasis, Prentice Hall of India,
New Delhi, 2011.
5. Vohra N.D., Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd,
2007.
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
CO1  Acquire knowledge of different Li-ion Batteries performance.
CO2  Design a Battery Pack and make related calculations.
CO3  Demonstrate a Battery Model or Simulation.
CO4  Estimate State-of-Charges in a Battery Pack.
CO5  Approach different BMS architectures during real world usage

TEXT BOOKS

REFERENCES
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet
COURSE OBJECTIVES:
- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS

UNIT II VARIABLE RESISTANCE AND INDUCTANCE 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, Magnetostriective, 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.

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1 List common types of sensor and actuators used in vehicles.
CO2 Design measuring equipment’s for the measurement of pressure force, temperature and flow.
CO3 Generate new ideas in designing the sensors and actuators for automotive application
CO4 Understand the operation of the sensors, actuators and electronic control.
CO5 Design temperature control actuators for vehicles.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- To interpret the missile space stations, space vs earth environment.
- To explain the life support systems, mission logistics and planning.
- To deploy the skills effectively in the understanding of space vehicle configuration design.
- To explain Engine system and support of space vehicle
- To interpret nose cone configuration of space vehicle

UNIT I  FUNDAMENTAL ASPECTS
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II  SELECTION OF ROCKET PROPULSION SYSTEMS
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III  ENGINE SYSTEMS, CONTROLS, AND INTEGRATION

UNIT IV  THRUST VECTOR CONTROL
TVC Mechanisms with a Single Nozzle – TVC with Multiple Thrust Chambers or Nozzles – Testing – Integration with Vehicle – SITVC method – other jet control methods - exhaust plume problems in space environment

UNIT V  NOSE CONE CONFIGURATION
Aerodynamic aspects on the selection of nose shape of a launch vehicle - design factors in the finalization of nose configuration with respect to payload - nose cone thermal protection system - separation of fairings - payload injection mechanism

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1 Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
CO2 Apply knowledge in selecting the appropriate rocket propulsion systems.
CO3 Interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
CO4 Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
CO5 Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.

TOTAL: 45 PERIODS

COURSE OBJECTIVES:
- 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
Concepts of Management and organization- nature, importance and Functions of Management,
Systems Approach to Management - Taylor's Scientific Management Theory- Fayal's Principles of
responsibilities of Management, Designing Organisational Structures: Basic concepts related to
Organisation -Departmentation and Decentralisation.

UNIT II  OPERATIONS AND MARKETING MANAGEMENT  9
Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass
Production),Work Study - Basic procedure involved in Method Study and Work Measurement - BusinessProcessReengineering(BPR)-
StatisticalQualityControl:controlchartsforVariablesandAttributes (simple Problems) and Acceptance
Sampling, Objectives of Inventory control, EOQ,ABC Analysis, Purchase Procedure, Stores
Management and Store Records - JIT System,Supply Chain Management, Functions of Marketing,
Marketing Mix, and Marketing Strategies based on ProductLifeCycle.

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,
TrainingandDevelopment,WageandSalaryAdministration,Promotion,Transfer,PerformanceApprais
al, 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
Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning
Process, Environmental Scanning, Value Chain Analysis, SWOT Analysis, Steps in Strategy
Formulation and Implementation, Generic Strategy alternatives. Bench Marking and Balanced
Score Cardas Contemporary Business Strategies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, Students will be able to
CO1:Plan an organizational structure for a given context in the organization to carryout production
operations through Work-study.
CO2:Survey the markets,customers and competition better and price the given products
appropriately
CO3:Ensure quality for a given product or service.
CO4:Plan, schedule and control projects through PERTandCPM.
CO5:Evaluate strategyforabusiness orserviceorganisation.

TEXTBOOKS:
3. ThomasN.Duening & John M.Ivancevich Management Principles and Guidelines, Biztantra,
    2007.

REFERENCES:

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OIM353 PRODUCTION PLANNING AND CONTROL

COURSE OBJECTIVES:
- To understand the concept of production planning and control act work study,
- To apply the concept of product planning,
- To analyze the production scheduling,
- To apply the Inventory Control concepts.
- To prepare the manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC
Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course,
CO1: The students can able to prepare production planning and control act work study,
CO2: The students can able to prepare product planning,
CO3: The students can able to prepare production scheduling,
CO4: The students can able to prepare Inventory Control.
CO5: They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

REFERENCES
7. Samson Eilon, “Elements of Production Planning and Control", Universal Book Corp.1984

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OIE353 OPERATIONS MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVE:
- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
- Relate the interdependence of the operations function with the other key functional areas of a firm.
- Teach analytical skills and problem-solving tools to the analysis of the operations problems.
- Apply scheduling and Lean Concepts for improving System Performance.
UNIT I  INTRODUCTION TO OPERATIONS MANAGEMENT
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy - Strategic fit, framework; Supply Chain Management

UNIT II  FORECASTING, CAPACITY AND FACILITY DESIGN

UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS

UNIT IV  MATERIALS MANAGEMENT

UNIT V  SCHEDULING AND PROJECT MANAGEMENT
Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.

CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.

CO3: The students will be able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.

CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.

CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

TEXT BOOKS

REFERENCES

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OSF352 INDUSTRIAL HYGIENE

COURSE OBJECTIVES:
- Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
- Compare and contrast the roles of environmental and biological monitoring in work health and safety.
- Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.
- Discuss how personal protective equipment can be used to reduce risks associated with workplace exposures.
- Provide high-level advice on managing and controlling noise and noise-related hazards.

UNIT I: INTRODUCTION AND SCOPE

UNIT II: MONITORING FOR SAFETY, HEALTH & ENVIRONMENT

UNIT III: OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY EDUCATION

UNIT IV: OCCUPATIONAL SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT
UNIT V INDUSTRIAL HAZARDS


TOTAL: 45 PERIODS

COURSE OUTCOMES:

Students able to

CO1: Explain and apply human factors engineering concepts in both evaluation of existing systems and design of new systems

CO2: Specify designs that avoid occupation related injuries

CO3: Define and apply the principles of work design, motion economy, and work environment design.

CO4: Identify the basic human sensory, cognitive, and physical capabilities and limitations with respect to human-machine system performance.

CO5: Acknowledge the impact of workplace design and environment on productivity

TEXT BOOKS:

REFERENCES:
2. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2,

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OSF353 CHEMICAL PROCESS SAFETY

COURSE OBJECTIVES

- Teach the principles of safety applicable to the design, and operation of chemical process plants.
- Ensure that potential hazards are identified and mitigation measures are in place to prevent unwanted release of energy.
- Learn about the hazardous chemicals into locations that could expose employees and others to serious harm.
Focuses on preventing incidents and accidents during large scale manufacturing of chemicals and pharmaceuticals.

Ensure that the general design of the plant is capable of complying with the dose limits in force and with the radioactive releases.

UNIT I  SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES  9
Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief - relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation - pipe line transport - safety in chemical laboratories.

UNIT II  CHEMICAL REACTION HAZARDS  9
Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self- heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening,

UNIT III  SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS  9
Design principles - Process design development - types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during startup and shutdown - non destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.

UNIT IV  SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS  9
Properties of chemicals - Material Safety Data Sheets - the various properties and formats used - methods available for property determination. Operational activities and hazards - standards operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures- condition monitoring - control valves - safety valves - pressure reducing valves, drains, bypass valves, inert gases, Chemical splashes, eye irritation and automatic showers.

UNIT V  SAFETY AND ANALYSIS  9
Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1 Differentiate between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.
CO2 Develop thorough knowledge about safety in the operation of chemical plants.
CO3 Apply the principles of safety in the storage and handling of gases.
CO4 Identify the conditions that lead to reaction hazards and adopt measures to prevent them.
CO5 Develop thorough knowledge about

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OML352          ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS          L T P C
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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, bimetallic fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

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UNIT V  OPTICAL AND OPTOELECTRONIC MATERIALS


TOTAL: 45 PERIODS

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

CO1 Understand various types of dielectric materials, their properties in various conditions.
CO2 Evaluate magnetic materials and their behavior.
CO3 Evaluate semiconductor materials and technologies.
CO4 Select suitable materials for electrical engineering applications.
CO5 Identify right material for optical and optoelectronic applications

TEXT BOOKS:

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OML353  NANOMATERIALS AND APPLICATIONS

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- Gaining knowledge on dimensionality effects on different properties of nanomaterials
- Getting acquainted with the different processing techniques employed for fabricating nanomaterials
- Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
- Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.
UNIT I  NANOMATERIALS
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II  THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III  PROCESSING
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV  STRUCTURAL CHARACTERISTICS
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis.

UNIT V  APPLICATIONS
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Evaluate nanomaterials and understand the different types of nanomaterials
CO2 Recognise the effects of dimensionality of materials on the properties
CO3 Process different nanomaterials and use them in engineering applications
CO4 Use appropriate techniques for characterising nanomaterials
CO5 Identify and use different nanomaterials for applications in different engineering fields

TEXT BOOKS:

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COURSE OBJECTIVES:
- To knowledge on fluid power principles and working of hydraulic pumps
- To obtain the knowledge in hydraulic actuators and control components
- To understand the basics in hydraulic circuits and systems
- To obtain the knowledge in pneumatic and electro pneumatic systems
- To apply the concepts to solve the trouble shooting

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS
Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids
- Properties of fluids and selection – Basics of Hydraulics – Pascal’s Law – Principles of flow
- Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS
Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning –
Hydraulic motors - Control Components : Direction Control, Flow control and pressure control
valves – Types, Construction and Operation – Servo and Proportional valves – Applications –

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS
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
Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air
control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit –
Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems,
Introduction to fluidics and pneumatic logic circuits

UNIT V TROUBLE SHOOTING AND APPLICATIONS
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic
systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and
Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling
in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Analyze the methods in fluid power principles and working of hydraulic pumps
CO2: Recognize the concepts in hydraulic actuators and control components
CO3: Obtain the knowledge in basics of hydraulic circuits and systems
CO4: Know about the basics concept in pneumatic and electro pneumatic systems
CO5: Apply the concepts to solve the trouble shooting hydraulic and pneumatics

TEXT BOOKS
REFERENCES

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OMR353 SENSORS L T P C
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COURSE OBJECTIVES:
- To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
- To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
- To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
- To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
- To familiarize students with different signal conditioning circuits design and data acquisition system.

UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES 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.

TEXT BOOKS

REFERENCES

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COURSE OBJECTIVES

- To introduce mobile robotic technology and its types in detail.
- To learn the kinematics of wheeled and legged robot.
- To familiarize the intelligence into the mobile robots using various sensors.
- To acquaint the localization strategies and mapping technique for mobile robot.
- To aware the collaborative mobile robotics in task planning, navigation and intelligence.

UNIT I INTRODUCTION TO MOBILE ROBOTICS


UNIT II KINEMATICS


UNIT III PERCEPTION


UNIT IV LOCALIZATION


UNIT V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS


TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Evaluate the appropriate mobile robots for the desired application.
CO2: Create the kinematics for given wheeled and legged robot.
CO3: Analyse the sensors for the intelligence of mobile robotics.
CO4: Create the localization strategies and mapping technique for mobile robot.
CO5: Create the collaborative mobile robotics for planning, navigation and intelligence for desired applications.

TEXTBOOK


REFERENCES:


MV3501 MARINE PROPULSION

COURSE OBJECTIVES:
- To impart knowledge on basics of propulsion system and ship dynamic movements
- To educate them on basic layout and propulsion equipment’s
- To impart basic knowledge on performance of the ship
- To impart basic knowledge on Ship propeller and its types
- To impart knowledge on ship rudder and its types

UNIT I BASICS SHIP PROPULSION SYSTEM AND EQUIPMENTS 9
- 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 9
- 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 9
- 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 9
- Propeller dimension, Propeller and its types – fixed propeller, control pitch propeller, kort nozzle, ducted propeller, voith schneider, Parts of propeller, 3 blade - 5 blade - 6 blade propellers and its advantages, propeller boss hub, crown nut, propeller skew, pitch of propeller - Thrust creation by propeller. Propeller Material – Propeller balancing- static and dynamic.

UNIT V BASICS OF RUDDER 9
- Rudder dimension, Area of rudder and its design, Rudder arrangements, Rudder fittings- Rudder pintle - Rudder types- Balanced rudder, semi balanced rudder, Spade rudder, merits and demerits of various types of rudders, Propeller and rudder interaction, Rudder stopper, movement of rudders, Basic construction of Rudder

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Explain the basics of propulsion system and ship dynamic movements
CO2: Familiarize with various components assisting ship stabilization.
CO3: Demonstrate the performance of the ship.
CO4: Classify the Propeller and its types, Materials etc.
CO5: Categories the Rudder and its types, design criteria of rudder.
TEXT BOOKS:
1. GP. Ghose, “Basic Ship propulsion”, 2015

REFERENCES:

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OMV351 MARINE MERCHANT VESSELS LT P C
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COURSE OBJECTIVES:
At the end of the course, students are expected to acquire
- Knowledge on basics of Hydrostatics
- Familiarization on types of merchant ships
- Knowledge on Shipbuilding Materials
- Knowledge on marine propeller and rudder
- Awareness on governing bodies in shipping industry

UNIT I INTRODUCTION to HYDROSTATICS 9

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 Gas carriers - 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**

**COURSE OUTCOMES:**

Upon completion of this course, students would

- CO1 Acquire Knowledge on floatation of ships
- CO2 Acquire Knowledge on features of various ships
- CO3 Acquire Knowledge of Shipbuilding Materials
- CO4 Acquire Knowledge to identify the different types of marine propeller and rudder
- CO5 Understand the Roles and responsibilities of governing bodies

**TEXT BOOKS:**

2. Dr.DA Taylor, “Merchant Ship Naval Architecture” I. Mar EST publications, 2006

**REFERENCES:**

2. MARPOL Consolidated Edition, Bhandakar Publications, 2018

**OMV352 ELEMENTS OF MARINE ENGINEERING**

**COURSE OBJECTIVES:**

At the end of the course, students are expected to

- Understand the role of Marine machinery systems
- Be familiar with Marine propulsion machinery system
- Acquaint with Marine Auxiliary machinery system
- Have acquired basics of Marine Auxiliary boiler system
- Be aware of ship propellers and steering system

**UNIT I ELEMENTARY KNOWLEDGE ON MARINE MACHINERY SYSTEMS**

Marine Engineering Terminologies, Parts of Ship, Introduction to Machinery systems on board ships – Propulsion Machinery system, Electricity Generator system, Steering gear system, Air compressors & Air reservoirs, Fuel oil and Lubricating Oil Purifiers, Marine Boiler systems

**UNIT II MARINE PROPULSION MACHINERY SYSTEM**

Two stroke Large Marine slow speed Diesel Engine – General Construction, Basic knowledge of Air starting and reversing mechanism, Cylinder lubrication oil system, Main lubricating oil system and cooling water system

**UNIT III MARINE AUXILIARY MACHINERY SYSTEM**

Four stroke medium speed Diesel engine – General Construction, Inline, V-type arrangement of engine, Difference between slow speed and medium speed engines – advantages, limitations and applications

**UNIT IV MARINE BOILER SYSTEM**

Types of Boiler – Difference between Water tube boiler and Fire tube boiler, Need for boiler on board ships, Uses of steam, Advantages of using steam as working medium, Boiler mountings and accessories – importance of mountings, need for accessories
UNIT V  SHIP PROPELLERS AND STEERING MECHANISM  
Importance of 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

COURSE OUTCOMES:
At the end of the course, students should able to,
CO1  Distinguish the role of various marine machinery systems
CO2  Relate the components of marine propulsion machinery system
CO3  Explain the importance of marine auxiliary machinery system
CO4  Acquire knowledge of marine boiler system
CO5  Understand the importance of ship propellors and steering system

TEXT BOOKS:

REFERENCES:
1. Alan L.Rowen, “Introduction to Practical Marine Engineering, Volume 1&2, The Institute of Marine Engineers (India), Mumbai, 2006
2. A.S.Tambwekar, “Naval Architecture and Ship Construction”, The Institute of Marine Engineers (India), Mumbai, 2015

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

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Create the programs for various drones

TEXT BOOKS

REFERENCES

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OGI352  GEOGRAPHICAL INFORMATION SYSTEM  L T P C 3 0 0 3

COURSE 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

UNIT III DATA INPUT AND TOPOLOGY

UNIT IV DATA QUALITY AND STANDARDS
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
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS-distributed GIS.

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Have basic idea about the fundamentals of GIS.
CO2 Understand the types of data models.
CO3 Get knowledge about data input and topology
CO4 Gain knowledge on data input and topology
CO5 Understand data management functions and data output

TEXTBOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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<th>PO</th>
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<td>Problem Analysis</td>
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<td>Design/Development of Solutions</td>
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<td>Conduct Investigations of Complex Problems</td>
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<td>Knowledge of Geoinformatics discipline</td>
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<td>PSO2</td>
<td>Critical analysis of Geoinformatics Engineering problems and innovations</td>
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<td>PSO3</td>
<td>Conceptualization and evaluation of Design solutions</td>
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OCE354     BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT  

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

UNIT I     OVERVIEW OF IWRM

UNIT II     WATER USE SECTORS: IMPACTS AND SOLUTION
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
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
River basin management - Ecosystem Regeneration – 5 Rs - WASH - Sustainable livelihood - Water management in the context of climate change.

UNIT V     IMPLEMENTATION OF IWRM
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

COURSE 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).

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:

COURSE OUTCOMES
Upon successful completion of this course, students will:
CO1: An insight into the structure and function of diversity for ecosystem stability.
CO2: Understand the concept of animal diversity and taxonomy
CO3: Understand socio-economic issues pertaining to biodiversity
CO4: An understanding of biodiversity in community resource management.
CO5: Student can apply fundamental knowledge of biodiversity conservation to solve problems associated with infrastructure development.

CO’s- PO’s & PSO’s MAPPING

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

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

OEE353        INTRODUCTION TO CONTROL SYSTEMS        L T P C
                          3 0 0 3

COURSE OBJECTIVES
- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems
- To analyze the stability of linear systems in frequency domain and time domain
- To develop linear models mainly state variable model and transfer function model

UNIT I  MATHEMATICAL MODELS OF PHYSICAL SYSTEMS  9
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction—Signal flow graphs.

UNIT II  TIME RESPONSE ANALYSIS & ROOTLOCUSTECHNIQUE  9

UNIT III  FREQUENCY RESPONSE ANALYSIS  9
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV  STABILITY CONCEPTS & ANALYSIS  9
UNIT V  STATE VARIABLE ANALYSIS

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Ability to
CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.
CO5: Assess the state models for linear and continuous Systems.

TEXTBOOKS

REFERENCES
2. Control System Dynamics” by Robert Clark, Cambridge University Press, 1996 USA.

CO’s- PO’s & PSO’s MAPPING

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OEI354  INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS  LT P C

3 0 03

COURSE OBJECTIVES:
• To educate on design of signal conditioning circuits for various applications.
• To Introduce signal transmission techniques and their design.
• Study of components used in data acquisition systems interface techniques
• To educate on the components used in distributed control systems
• To introduce the communication buses used in automation industries.

UNIT I  INTRODUCTION

UNIT II AUTOMATION COMPONENTS 9
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 9
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 9
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 9
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) 5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1 Design a signal conditioning circuits for various application (L3).
CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:

REFERENCES:
List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108/105/108105063

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

OCH353 ENERGY TECHNOLOGY

UNIT I INTRODUCTION 8
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources.

UNIT II CONVENTIONAL ENERGY 8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY 10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY 10
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V ENERGY CONSERVATION 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

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COURSE OUTCOMES:
On completion of the course, the students will be able to
CO1: Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
CO2: Students will excel as professionals in the various fields of energy engineering
CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.
CO4: Explain the technological basis for harnessing renewable energy sources.
CO5: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

| Course Outcomes | Statements | Program Outcomes | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|-----------------|------------|------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| CO1             | Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels. | 2    | 3    | 2    | 3    | 3    | -    | -    | -    | 1    | 1    | -     | 3     | 1     | 1     | 3     |
| CO2             | Students will excel as professionals in the various fields of energy engineering | 2    | 3    | 1    | 3    | 3    | -    | -    | -    | 1    | 1    | -     | 3     | 2     | 1     | 3     |
| CO3             | Compare different renewable energy technologies and choose the most appropriate based on local conditions. | 2    | 2    | 2    | 3    | 3    | 1    | 1    | -    | 1    | 1    | -     | 3     | 2     | 1     | 3     |
| CO4             | Explain the technological basis for harnessing renewable energy sources. | 2    | 2    | 1    | 3    | 3    | 1    | 1    | 1    | 1    | -    | 1     | 3     | 1     | 1     | 3     |
| CO5             | Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding | 2    | 2    | 1    | 3    | 3    | 1    | 1    | 1    | 1    | -    | 1     | 3     | 2     | 1     | 3     |

267
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
Relevance of surface science to Chemical and Electrochemical Engineering, Heterogeneous Catalysis and Nanoscience; Surface structure and reconstructions, absorbate structure, Band and Vibrational structure, Importance of UHV techniques, Electronic probes and molecular beams, Scanning probes and diffraction, Qualitative introduction to electronic and vibrational spectroscopy

UNIT II ADSORPTION, DYNAMICS, THERMODYNAMICS AND KINETICS AT SURFACES
Interactions at the surface, Physisorption, Chemisorption, Diffusion, dynamics and reactions of atoms/molecules on surfaces, Generic reaction mechanism on surfaces, Adsorption isotherms, Kinetics of adsorption, Use of temperature desorption methods

UNIT III LIQUID INTERFACES
Structure and Thermodynamics of liquid-solid interface, Self-assembled monolayers, Electrified interfaces, Charge transfer at the liquid-solid interfaces, Photoelectrochemical processes, Gratzel cells

UNIT IV HETEROGENEOUS CATALYSIS
Characterization of heterogeneous catalytic processes, Microscopic kinetics to catalysis, Overview of important heterogeneous catalytic processes: Haber-Bosch, Fischer-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS

COURSE OUTCOME:
- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena

TEXT BOOK:

REFERENCE:
COURSE OBJECTIVES
The course aims to
- acquaint and equip the students with different techniques of measurement of engineering properties.
- make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger's, Kick's and Bond's equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for lo.w- 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.

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.

TEXTBOOKS:
OFD355 FOOD SAFETY AND QUALITY REGULATIONS

COURSE OBJECTIVES:
• To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
• To help become skilled in systems for food safety surveillance
• To be aware of the regulatory and statutory bodies in India and the world
• To ensure processed food meets global standards

UNIT I
Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

UNIT II
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

UNIT III
Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT IV
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V
Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
CO2 Awareness on regulatory and statutory bodies in India and the world
REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
4. Microbiological safety of Food by Hobbs BC, 1973

OPY353 NUTRACEUTICALS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrotopological 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 (UnitedKingdom), 2006
REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE OUTCOMES
CO1 acquire knowledge about the Nutraceuticals and functional foods, their classification and benefits.
CO2 acquire knowledge of phytochemicals, zoochemicals and microbes in food, plants, animals and microbes
CO3 attain the knowledge of the manufacturing practices of selected nutraceutical components and formulation considerations of functional foods.
CO4 distinguish the various In vitro and In vivo assessment of Antioxidant activity of compounds from plant sources.
CO5 gain information about the health benefits of various functional foods and nutraceuticals in the prevention and treatment of various lifestyle diseases.
CO6 Attain the knowledge of the regulatory and safety issues of nutraceuticals at national and international level.

CO’s- PO’s & PSO’s MAPPING

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OTT354 BASICS OF DYEING AND PRINTING

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

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

UNIT II PRE TREATMENT
UNIT III DYEING

UNIT IV PRINTING
Definition of printing – Difference between printing and dying - Classification thickeners – Requirements to be good thickener, printing paste Preparation - different styles of printing.

UNIT V MACHINERIES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO1: Basics of grey fabric
CO2: Basics of pre treatment
CO3: Concept of Dyeing
CO4: Concept of Printing
CO5: Machinery in processing industry

TEXT BOOKS:

REFERENCES:
2. Dr. N N Mahapatra., “Textile dyeing”, Wood head publishing India, 2018
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series

<table>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
COURSE OBJECTIVE

- 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

COURSE OUTCOMES

Upon completion of this course, the student would be able to

CO1 Understand the process sequence of various fibres

CO2 Understand the properties of various fibres

TEXT BOOKS:


REFERENCES:

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, 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 labeling of apparels

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand
CO1: Pattern making, marker planning, cutting
CO2: Types of seams, stitches and functions of needles
CO3: Components and trims used in garment
CO4: Garment inspection and dimensional changes
CO5: Garment pressing, packing and care labeling

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

REFERENCES:
COURSE OBJECTIVES:

- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
- Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards

UNIT I INTRODUCTION
Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS

UNIT IV HAZARDS AND RISK MANAGEMENT

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

TOTAL: 45 PERIODS

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

CO1 Describe, with example, the common work-related diseases and accidents in occupational setting
CO2 Name essential members of the Occupational Health team

CO3 What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES  L T P C

3 0 0 3

COURSE OBJECTIVES:

• To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I FLUID MECHANICS CONCEPTS 9
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton’s Law of viscosity. Fluid statics-Pascal’s law, Hydrostatic equilibrium, Barometric equation and pressure measurement(problems). Basic equations of fluid flow - Continuity equation, Euler’s equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numericals.

UNIT II FLOW MEASUREMENTS & MECHANICAL OPERATIONS 9

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER 9
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders: Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV BASICS OF MASS TRANSFER 9

UNIT V MASS TRANSFER OPERATIONS 9
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction). Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method. Drying- drying operations, batch and continuous drying. Conceptual numerical.

TOTAL: 45 PERIODS

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

CO1 State and describe the nature and properties of the fluids.

CO2 Study the different flow measuring instruments, the principles of various size reductions, conveying equipment’s, sedimentation and mixing tanks.

CO3 Comprehend the laws governing the heat and mass transfer operations to solve the problems.

CO4 Design the heat transfer equipment suitable for specific requirement.
TEXTBOOKS
2. Fluid Mechanics K L Kumar S Chand & Company Ltd 2008

REFERENCES
2. Unit Operations of Chemical Engineering, Vol I &II Chattopadhyaya Khanna Publishers, Delhi-6 1996

COURSE OBJECTIVES
- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
- Understand the basics as well as the advanced applications of various plastic materials in the industry
- To understand the preparation methods of thermosetting materials
- Select suitable specialty plastics for different end applications

UNIT I   INTRODUCTION TO PLASTIC MATERIALS
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
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
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
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

Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 To study the importance, advantages and classification of plastic materials
CO2 Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
CO3 To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
CO4 Know the manufacture, properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU
CO5 To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES

OPT353  PROPERTIES AND TESTING OF PLASTICS  L T P C
3 0 0 3

COURSE OBJECTIVES
- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
- To study about the environmental effects and prevent polymer degradation.

UNIT I  INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS


UNIT II  MECHANICAL PROPERTIES

Mechanical properties: Tensile, compression, flexural, shear, tear strength, hardness, impact strength, resilience, abrasion resistance, creep and stress relaxation, compression set, dynamic fatigue, ageing properties, Basic concepts of stress and strain, short term tests: Viscoelastic behavior (simple models: Kelvin model for creep and stress relaxation, Maxwell-Voigt model, strain recovery and dynamic response), Effect of structure and composition on mechanical properties, Behavior of reinforced polymers
UNIT III THERMAL RHEOLOGICAL PROPERTIES
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

UNIT IV ELECTRICAL AND OPTICAL PROPERTIES
Electrical properties: Volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

UNIT V ENVIRONMENTAL AND CHEMICAL RESISTANCE

COURSE OUTCOMES
CO1 Understand the relevance of standards and specifications.
CO2 Summarize the various test methods for evaluating the mechanical properties of the polymers.
CO3 To know the thermal, electrical & optical properties of polymers.
CO4 Identify various techniques used for characterizing polymers.
CO5 Distinguish the processability tests used for thermoplastics, thermosets and elastomers.

REFERENCES

OEC353 VLSI DESIGN

COURSE OBJECTIVES:
- Understand the fundamentals of IC technology components and their characteristics.
- Understand combinational logic circuits and design principles.
- Understand sequential logic circuits and clocking strategies.
- Understand Interconnects and Memory Architecture.
- Understand the design of arithmetic building blocks.

UNIT I MOS TRANSISTOR PRINCIPLES
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor DC transfer Characteristics, small signal analysis of MOSFET.

UNIT II COMBINATIONAL LOGIC CIRCUITS
UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE
Interconnect Parameters – Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS
Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course the student will be able to
CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combinational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.

TEXTBOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM370 WEARABLE DEVICES

COURSE OBJECTIVES:
The student should be made to:
- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine
UNIT I  INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS


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.

TOTAL :45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Compare the various wearable devices in healthcare system

TEXT BOOKS


REFERENCES

CBM356 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
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
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 in clinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS
Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health-Medical education and healthcare information, computer assisted instruction in medicine.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1 Explain the structure and functional capabilities of Hospital Information System.
CO2 Describe the need of computers in medical imaging and automated clinical laboratory.
CO3 Articulate the functioning of information storage and retrieval in computerized patient record system.
CO4 Apply the suitable decision support system for automated clinical diagnosis.
CO5 Discuss the application of virtual reality and telehealth technology in medical industry.
TEXT BOOKS:

REFERENCE:

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Biotechnology for Waste Management

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

COURSE OUTCOMES
After completion of this course, the students should be able
CO1 To learn the various methods biological treatment
CO2 To know the details of waste biomass and its value addition
CO3 To develop the bioconversion processes to convert wastes to energy
CO4 To synthesize the chemicals and enzyme from wastes
CO5 To produce the biocompost from wastes
CO6 To apply the theoretical knowledge for the development of value added products

TEXT BOOKS

REFERENCES

OBT356 LIFESTYLE DISEASES 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 9
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesphagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES 9
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY 9
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES 9
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
OBT357 BIOTECHNOLOGY IN HEALTH CARE L T P C 3 0 0 3

COURSE OBJECTIVES
The aim of this course is to
- Create higher standard of knowledge on healthcare system and services
- Prioritize advanced technologies for the diagnosis and treatment of various diseases

UNIT I PUBLIC HEALTH 9

UNIT II CLINICAL DISEASES 9
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 9
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 9
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 9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CMG331 FINANCIAL MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVES
- To acquire the knowledge of the decision areas in finance.
- To learn the various sources of Finance
- To describe about capital budgeting and cost of capital.
- To discuss on how to construct a robust capital structure and dividend policy
- To develop an understanding of tools on Working Capital Management.
UNIT I  INTRODUCTION TO FINANCIAL MANAGEMENT  9
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit
Maximization and Wealth Maximization- Time Value of money - Risk and return concepts.

UNIT II  SOURCES OF FINANCE  9
Long term sources of Finance - Equity Shares – Debentures - Preferred Stock – Features – Merits
and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers,
Certificate of Deposits, Money market mutual funds etc

UNIT III  INVESTMENT DECISIONS:  9
Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital
Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves -
Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV  FINANCING AND DIVIDEND DECISION  9
Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants
of Capital structure- Designing an Optimum capital structure .
Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - -
Determinants of Dividend Policy

UNIT V  WORKING CAPITAL DECISION  9
Working Capital Management: Working Capital Management - concepts - importance -
Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and
Strategies of Cash Management. Receivables Management: Objectives - Credit policies.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
2. Prasanna Chandra, Financial Management,

CMG332  FUNDAMENTALS OF INVESTMENT  LT P C
3 0 0 3

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

UNIT I  THE INVESTMENT ENVIRONMENT  9
The investment decision process, Types of Investments – Commodities, Real Estate and
Financial Assets, the Indian securities market, the market participants and trading of securities,
security market indices, sources of financial information, Concept of return and risk, Impact of
Taxes and Inflation on return.

UNIT II  FIXED INCOME SECURITIES  9
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks,
default risk and credit-rating.
UNIT III APPROACHES TO EQUITY ANALYSIS
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

CMG333 BANKING, FINANCIAL SERVICES AND INSURANCE

COURSE OBJECTIVES
- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM
Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector – RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY

UNIT IV FINANCIAL SERVICES
UNIT V  INSURANCE


TOTAL : 45 PERIODS

REFERENCES :
UNIT I  CURRENCY EXCHANGE AND PAYMENT

UNIT II  DIGITAL FINANCE AND ALTERNATIVE FINANCE
A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity, Introduction to the concept of Initial Coin Offering

UNIT III  INSURTECH
InsurTech Introduction , Business model disruption, AI/ML in InsurTech, IoT and InsurTech, Risk Modeling, Fraud Detection Processing claims and Underwriting Innovations in Insurance Services

UNIT IV PEER TO PEER LENDING
P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding Crowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models, SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations

UNIT V REGULATORY ISSUES

TOTAL : 45 PERIODS

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

CMG336  INTRODUCTION TO FINTECH
COURSE OBJECTIVES:
- To learn about history, importance and evolution of Fintech
- To acquire the knowledge of Fintech in payment industry
- To acquire the knowledge of Fintech in insurance industry
- To learn the Fintech developments around the world
- To know about the future of Fintech
UNIT I INTRODUCTION
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.

TOTAL : 45 PERIODS

REFERENCES
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

VERTICAL 2: ENTREPRENEURSHIP

CMG337 FOUNDATIONS OF 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 - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy - Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -- Success Stories of Technopreneurs - Case Studies

UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP

TOTAL 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO1 Learn the basics of Entrepreneurship
CO2 Understand the business ownership patterns and environment
CO3 Understand the Job opportunities in Industries relating to Technopreneurship
CO4 Learn about applications of technopreneurship and successful technopreneurs
CO5 Acquaint with the recent and emerging trends in entrepreneurship

TEXT BOOKS:
2) Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning,

REFERENCES:
7) Basics of Technopreneurship: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship
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

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO1 Learn the basics of managing teams for business.
CO2 Understand developing effective teams for business management.
CO3 Understand the fundamentals of leadership for running a business.
CO4 Learn about the importance of leadership for business development.
CO5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs.”

REFERENCES:
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:

CO1 Learn the basics of creativity for developing Entrepreneurship
CO2 Understand the importance of creative intelligence for business growth
CO3 Understand the advances through Innovation in Industries
CO4 Learn about applications of innovation in building successful ventures
CO5 Acquaint with developing innovative business models to run the business efficiently and effectively

Suggested Readings:
Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.
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 DISTRIBUTION MANAGEMENT


UNIT V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT


COURSE OUTCOMES:

After completion of this course, the students will be able to:

CO1 Have the awareness of marketing management process
CO2 Understand the marketing environment
CO3 Acquaint about product and pricing strategies
CO4 Knowledge of promotion and distribution in marketing management.
CO5 Comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCES:

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION TO HRM

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:

CO1 To understand the Evolution of HRM and Challenges faced by HR Managers

CO2 To learn about the HR Planning Methods and practices.

CO3 To acquaint about the Recruitment and Selection Techniques followed in Industries.

CO4 To known about the methods of Training and Employee Development.

CO5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES
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


COURSE OUTCOMES:

Upon completion of this course, the students should be able to:

- CO1 Learn the basics of starting a new business venture.
- CO2 Understand the basics of venture financing.
- CO3 Understand the sources of debt financing.
- CO4 Understand the sources of equity financing.
- CO5 Acquaint with the methods of fund raising for new business ventures.

REFERENCES:

1) Principles of Corporate Finance by Brealey and Myers et al.,12TH ed, McGraw Hill Education (India) Private Limited, 2018

VERTICAL 3: PUBLIC ADMINISTRATION

CMG343 PRINCIPLES OF PUBLIC ADMINISTRATION L T P C 3 0 0 3

UNIT I
1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration

UNIT II
1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT III
1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT IV
1. Bureaucratic Approach: Max Weber
2. Human Relations Approach : Elton Mayo
3. Ecological Approach : Riggs

UNIT V
1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers

TOTAL: 45 PERIODS

REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

CMG344 CONSTITUTION OF INDIA L T P C 3 0 0 3

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
REFERENCES:
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S: Personnel Management & Industrial Relations

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. Crozier M : The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis : Organization Theory (MAC)

TOTAL: 45 PERIODS

CMG347 INDIAN ADMINISTRATIVE SYSTEM L T P C 3 0 0 3

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  
L T P C  
3 0 0 3  

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.  

REFERENCES:  
4. Pradeep Saxena : Public Policy Administration and Development  

TOTAL: 45 PERIODS  

COURSE 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

COURSE OUTCOMES:
CO1 To facilitate objective solutions in business decision making.
CO2 understand and solve business problems
CO3 To apply statistical techniques to data sets, and correctly interpret the results.
CO4 To develop skill-set that is in demand in both the research and business environments
CO5 To enable the students to apply the statistical techniques in a work setting.

REFERENCES:
UNIT I INTRODUCTION
Data mining, Text mining, Web mining, Data ware house.

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

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

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

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

COURSE OUTCOMES:
CO1 Learn to apply various data mining techniques into various areas of different domains.
CO2 Be able to interact competently on the topic of data mining for business intelligence.
CO3 Apply various prediction techniques.
CO4 Learn about supervised and unsupervised learning technique.
CO5 Develop and implement machine learning algorithms

REFERENCES:
1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
7. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011

CMG351 HUMAN RESOURCE ANALYTICS

COURSE OBJECTIVE:
- 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  9
People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II  HR ANALYTICS I: RECRUITMENT  9
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  9
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  9
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  9
Workforce Diversity and Development Metrics : Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

COURSE OUTCOMES:
CO1 The learners will be conversant about HR metrics and ready to apply at work settings.
CO2 The learners will be able to resolve HR issues using people analytics.

REFERENCES:

CMG352  MARKETING AND SOCIAL MEDIA WEB ANALYTICS  L T P C  3 0 0 3

COURSE 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.

COURSE OUTCOME:
- The Learners will understand social media, web and social media analytics and their potential impact.

REFERENCES:
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004

CMG353 OPERATION AND SUPPLY CHAIN ANALYTICS L T P C
3 0 0 3

COURSE OBJECTIVE:
- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I INTRODUCTION 9
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

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
COURSE OUTCOME:
CO1  To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:

CMG354      FINANCIAL ANALYTICS  L T P C
            3 0 0 3

COURSE 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.

TOTAL: 45 PERIODS

COURSE OUTCOME
CO1 The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:
VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

CES331 SUSTAINABLE INFRASTRUCTURE DEVELOPMENT

COURSE OBJECTIVE:
- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES

UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS
Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES:**
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", Springer 2005

**CO’s- PO’s & PSO’s MAPPING**

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**CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT L T P C 3 0 0 3**

**COURSE OBJECTIVES:**
• To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.
UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS
Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT
Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT
Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT
Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS
Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

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

CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture
CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources
CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

REFERENCES:
1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
CO’s- PO’s & PSO’s MAPPING

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CES333  SUSTAINABLE BIOMATERIALS  L T P C

3 0 0 3

COURSE OBJECTIVES
- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT I  INTRODUCTION TO BIOMATERIALS

UNIT II  BIO POLYMERS
Molecular structure of polymers -Molecular weight - Types of polymerization techniques–Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Poly(methylmethacrylate) (PMMA-Polyactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III  BIO CERAMICS AND BIOCOMPOSITES
General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites-Polymer Matrix Composite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)–glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV  METALS AS BIOMATERIALS
Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys- Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals
UNIT V  NANOBIOMATERIALS

TOTAL : 45 PERIODS

COURSE OUTCOMES
CO1 Students will gain familiarity with Biomaterials and they will understand their importance.
CO2 Students will get an overview of different biopolymers and their properties
CO3 Students gain knowledge on some of the important Bioceramics and Biocomposite materials
CO4 Students gain knowledge on metals as biomaterials
CO5 Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES
6. VasifHasirci, NesrinHasirici “Fundamentals of Biomaterials” Springer, 2018

CES334 MATERIALS FOR ENERGY SUSTAINABILITY L T P C 3 0 0 3

COURSE OBJECTIVES
- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I SUSTAINABLE ENERGY SOURCES 9
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery
(Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO$_2$, LiFePO$_4$, LiMn$_2$O$_4$) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III  FUEL CELLS
9

UNIT IV  PHOTOVOLTAICS
9

UNIT V  SUPERCAPACITORS
9
Supercapacitor – types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - Design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non-Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonnitrides, and nitrides.

TOTAL : 45 PERIODS

OUTCOMES
CO1 Students will acquire knowledge about energy sustainability.
CO1 Students understand the principles of different electrochemical devices.
CO1 Students learn about the working of fuel cells and their application.
CO1 Students will learn about various Photovoltaic applications and the materials used.
CO1 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

COURSE OBJECTIVES:
• 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

UNIT V GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5 To understand advanced technology in green synthesis

TEXT BOOKS

REFERENCE
1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017
COURSE OBJECTIVES:
- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I: ENVIRONMENTAL MONITORING AND STANDARDS  9

UNIT II: MONITORING OF ENVIRONMENTAL PARAMETERS  9

UNIT III: ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING  9
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) & RISK ASSESSMENT  9

UNIT V: AUTOMATED DATA ACQUISITION AND PROCESSING  9
Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks - Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students will know
CO1 Basic concepts of environmental standards and monitoring.
CO2 the ambient air quality and water quality standards;
CO3 the various instrumental methods and their principles for environmental monitoring
CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 The various ways of raising environmental awareness among the people.
CO6 Know the standard research methods that are used worldwide for monitoring the environment.

TEXTBOOKS
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc
REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

CO’s- PO’s & PSO’s MAPPING

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CES337 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

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

UNIT I ENERGY SCENARIO
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

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1 Understand the world and Indian energy scenario
CO2 Analyse energy projects, its impact on environment and suggest control strategies
CO3 Recognise the need of Sustainable development and its impact on human resource development
CO4 Apply renewable energy technologies for sustainable development
CO5 Fathom Energy policies and planning for sustainable development.

REFERENCES:
7. https://www.niti.gov.in/verticals/energy

CES338 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
- To create awareness on energy audit and its impacts
- To acquaint the techniques adopted for performance evaluation of thermal utilities
- To familiarise on the procedures adopted for performance evaluation of electrical utilities
- To learn the concept of sustainable development and the implication of energy usage

UNIT I ENERGY AND ENVIRONMENT 9
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING 9
Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVATION IN ELECTRICAL UTILITIES 9
Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers
UNIT V  SUSTAINABLE DEVELOPMENT


TOTAL: 45 PERIODS

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

CO1 Understand the prevailing energy scenario
CO2 Familiarise on energy audits and its relevance
CO3 Apply the concept of energy audit on thermal utilities
CO4 Employ relevant techniques for energy improvement in electrical utilities
CO5 Understand Sustainable development and its impact on human resource development

REFERENCES: