ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM

B.E. MARINE ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):
Program educational objectives are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program’s constituencies.

1. Graduates will have the knowledge for the application of scientific principles, Mathematical methods, technical and Innovative skills to perform analysis, application engineering, and system or process development in Marine Industry.

2. Graduates will have the knowledge by engaging in continuous education and will have the ability to function effectively as leaders on professional teams with ability to communicate effectively using speaking, writing and presentation skills.

3. Graduates of the program are to have demonstrated the competent to carry out the Engineering watch at sea and to maintain systems or processes and to direct, supervise, and make important decisions regarding the design and engineering of problems based on engineering fundamentals and modern technological tools.

4. Graduates will demonstrate a respect for professional, ethical and social and environmental issues as well as a commitment to safety, quality and productivity.

5. Graduates will demonstrate disciplined way of working as a part of teams in multidisciplinary projects or shipping companies so as to meet the National and International standards.

PROGRAM OUTCOMES (POs):

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<td>Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
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<td>Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
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<td>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.</td>
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<td>Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</td>
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<td>5</td>
<td>Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.</td>
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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.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs):

In addition to POs, each program should have 3 to 4 PSOs. These statements are the outcomes of a program which should make the students to realize the fact that, the knowledge and techniques learnt in this course has a direct implication for the betterment of society and its sustainability.

1. The ability to have thorough knowledge of Maritime industry in accordance with the STCW-conventions 2010 amendments made time-to-time.

2. Possess an overall and conscious understanding about Marine engineering at the operational and management level.

3. Possess knowledge of National and International rules and regulations concerning Marine engineering.

4. Possess the necessary skill for the technical operation of ships in both off-shore and on-shore.

PEO’s – PO’s & PSO’s MAPPING

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**PRACTICAL**

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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.
### SEMESTER III

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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.
## SEMESTER V

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

## SEMESTER VI

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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 MCII)

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

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*If students undergo “Marine Workshop Practical and Afloat Training”, 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)

# Elective - Management shall be chosen from the elective Management courses

### SEMESTER VIII/VII*

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If students undergo “Marine Workshop Practical and Afloat Training”, in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

**TOTAL CREDITS: 177**
# ELECTIVE – MANAGEMENT

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*Mandatory Courses are offered as Non-Credit courses

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

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<td>Mechanics of Marine Machines</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

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

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

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

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

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)

<table>
<thead>
<tr>
<th>VERTICAL I FINTECH AND BLOCK CHAIN</th>
<th>VERTICAL II ENTREPRENEURSHIP</th>
<th>VERTICAL III PUBLIC ADMINISTRATION</th>
<th>VERTICAL IV BUSINESS DATA ANALYTICS</th>
<th>VERTICAL V ENVIRONMENT AND SUSTAINABILITY</th>
</tr>
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<tr>
<td>Financial Management</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
<td>Statistics for Management</td>
<td>Sustainable infrastructure Development</td>
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<td>Fundamentals of Investment</td>
<td>Team Building &amp; Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining for Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
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<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
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<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management For Business</td>
<td>Administrative Theories</td>
<td>Marketing and Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
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<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurs</td>
<td>Indian Administrative System</td>
<td>Operation and Supply Chain Analytics</td>
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<td>Energy Efficiency for Sustainable Development</td>
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- No courses listed for these verticals.
(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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<tr>
<th>SL. NO.</th>
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<th>TOTAL CONTACT PERIODS</th>
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**VERTICAL 2: ENTREPRENEURSHIP**

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### VERTICAL 4: BUSINESS DATA ANALYTICS

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### VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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

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

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

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

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

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

(i) Physical Activity
This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

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

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

(iv) Literary Activity
Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:
Guide to Induction program from AICTE

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**HS3101** TECHNICAL ENGLISH FOR MARINE ENGINEERS – I

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<th>COURSE OBJECTIVES:</th>
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<td>To improve the communicative competence of learners</td>
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<td>To help learners use language effectively in academic / technical contexts</td>
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<td>To build on students’ English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.</td>
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<td>To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.</td>
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<td>To use language effectively to express their opinions in various media.</td>
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**UNIT I COMMUNICATING**

Listening - Short conversation: Introducing to new classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form (Joining a course or similar) Speaking - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form. Reading - Reading brochures (technical context) ; Reading telephone messages / social media messages relevant to technical context; Reading emails. Writing -
Writing emails / messages; Letters of enquiry
Grammar - Simple Present Tense & Present Progressive; Question forms: Wh-questions; Question Tags; Indirect questions; Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (used in technical context)

UNIT II
NARRATING
Listening - Listening to podcast; Listening to anecdotes / stories / Event narration; Watching documentaries & interviews with celebrities. Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / summarising of documentaries / podcasts/ interviews. Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, Reading travel & technical blogs. Writing - Guided writing; Paragraph writing (biographical/ autobiographical/ narrative), Short report on an event (field trip etc.) Blogging. Grammar – Simple Past tense & Past Progressive tense; Subject-Verb Agreement; Preposition - Vocabulary - Word forms (prefixes& suffixes); Discourse Markers (Connectives & Sequence words); antonyms&synonyms – phrasal verbs.

UNIT III
DESCRIBING
Listening - Listen to a product descriptions; Listen to a process descriptions; Listen to a lecture; Listen/ View an advertisement about a product. Speaking – Picture description; Giving instruction to use the product; Presenting a product; Summarising the lecture. Reading - Reading advertisements; Reading gadget reviews; Reading user manuals. Writing - Writing definitions; Writing instructions; Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; Homophones

UNIT IV
CLASSIFYING
Listening – Listening to TED Talks; Listening to Scientific lectures; watching educational videos. Speaking – Small Talk; Mini presentations on select topics; Giving recommendations for an issue. Reading – Newspaper articles; Journal reports - Domain specific; Tables / Suitable graphical images. Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Use of graphic organizers; Writing recommendations; Transcoding (chart/graph/table to paragraph). Grammar – Articles; Pronouns - Possessive & Relative clauses. Vocabulary - Collocations; Fixed / Semi fixed expressions

UNIT V
EXPRESSING
Listening – Listening to Debates; Listening to /viewing different viewpoints on an issue; Listening to panel discussion. Speaking – Small group discussions; Debates; Expressing opinions through Simulations & Roleplay activities, Reading – Reading editorials; Reading Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content v Function words

COURSE OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

TOTAL : 60 PERIODS

TEXT BOOKS:
2. Learning to Communicate by Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

REFERENCES:
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
### CO-PO & PSO MAPPING

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

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**MA3101 MATHEMATICS FOR MARINE ENGINEERING – I**

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### COURSE OBJECTIVES:

- To provide the required knowledge on fundamentals of geometry integrals and integral calculus for engineering applications.
- To understand the basic concepts of differentiation.
- To apply the concept of partial differentiation for the functions of several variables.
- To understand the basic concepts of integration.
- To apply the integration concepts in double and triple integrations.

### UNIT I

**THREE DIMENSIONAL ANALYTICAL GEOMETRY**


### UNIT II

**DIFFERENTIAL CALCULUS**

Differentiation of algebraic, circular, exponential and logarithmic functions, products, quotient functions of a function and simple implicit functions - Successive differentiation : Introduction and notation - $n^{th}$ order derivatives of standard functions - $n^{th}$ order derivatives using (a) Trigonometric identities and standard functions (b) Partial fractions - Leibnitz’s theorem - Maclaurin’s theorem - Taylor’s theorem - Indeterminate forms and L’Hospital’s rule - Maxima and Minima of one variable functions – Concavity - Curve tracing of cartesian curves.

### UNIT III

**FUNCTIONS OF SEVERAL VARIABLES**


### UNIT IV

**INTEGRAL CALCULUS**

Integration of standard forms by substitution and by parts - Definite integral as the limit of a sum - Application of integration to area under curve - Volume of revolution - First moment of area and the position of a centroid of an area - Work done by variable forces - Mean values, Root mean square values of sin nx and cos nx. Rules of Guldinus -Theorems of parallel and perpendicular axes - Second moments of area and moments of inertia of a rectangular and circular lamina.

### UNIT V

**MULTIPLE INTEGRALS**

Double and triple integrals – Cartesian coordinates - Region of integration and change of order of integration - Spherical polar and cylindrical coordinates - Theorems of parallel and perpendicular axes.
- Second moments of area and moments of inertia of a rectangular and circular laminas - Applications
- Area, Volume, Mass of wire, Lamina and solid - Centre of Gravity of wire, lamina and solid - Moment of inertia using multiple integrals.

**TOTA L: 60 PERIODS**

**COURSE OUTCOMES:**
Upon successful completion of the course, students should be able to:
- Understand the fundamentals of geometry integrals and integral calculus for engineering applications.
- Appreciate for having the basic concepts of differentiation.
- Understand to apply the concept of partial differentiation for the functions of several variables.
- Understand the basic concepts of integration and how to apply the integration concepts in double and triple integrations.
- The basic concepts of analytical geometry and differential and integral calculus learnt by the Students will be applied to marine engineering.

**TEXT BOOKS:**

**REFERENCES:**

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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


UNIT II ELECTROMAGNETIC WAVES

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


UNIT IV BASIC QUANTUM MECHANICS

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

UNIT V APPLIED QUANTUM MECHANICS

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

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

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

TEXT BOOKS:

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

REFERENCES:

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

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

CY3101 CHEMISTRY FOR MARINE ENGINEERING

COURSE OBJECTIVES:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To introduce the basic concepts on the chemistry and mechanism of different types of corrosion of materials.
- To facilitate the understanding of various corrosion control methods.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER TECHNOLOGY
Water: Sources and impurities; Significance and estimation (only mention of methods) of - turbidity, colour, pH, acidity, alkalinity, hardness, solids, chlorides, residual chlorine, sulphates, fluorides, phosphates, iron and manganese, arsenic, DO, BOD, COD, nitrogen, grease, volatile acids. Treatment of water: Zeolites process and ion exchange demineralization; Desalination of water: Reverse osmosis and Electro dialysis; Municipal water treatment: Primary treatment and Disinfection (UV, Ozonation, break-point chlorination).

UNIT II CHEMISTRY OF CORROSION
Introduction: Dry or chemical corrosion, Wet or electrochemical corrosion, Mechanism of wet or electrochemical corrosion- galvanic (or bimetallic) corrosion- concentration cell corrosion- passivity-underground or soil corrosion- pitting corrosion- intergranular corrosion- water line corrosion- stress corrosion- microbiological corrosion- galvanic series- factors influencing corrosion; Uniform and localized corrosion.

UNIT III CORROSION CONTROL METHODS
Corrosion control by: Material selection and design; Electrochemical protection - sacrificial anodic protection and impressed current cathodic protection; Protective coatings: Metallic coatings - hot dipping, metal cladding, anodizing, galvanizing, tinning, electroplating and electroless plating; Non-metallic inorganic coatings; Organic coatings: paints, varnishes, enamels and lacquers.

UNIT IV NANOCHEMISTRY
Basics-distinction between molecules, nanomaterials and bulk materials; size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.
UNIT V  ENERGY SOURCES AND STORAGE DEVICES

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

TOTAL: 45 PERIODS

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

- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To apply the knowledge of corrosion for material selection and fabrication for specific requirements.
- To recommend appropriate corrosion control methods for material and equipments protection.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

REFERENCES:

GE3151  PROBLEM SOLVING AND PYTHON PROGRAMMING  L  T  P  C
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COURSE OBJECTIVES:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I  COMPUTATIONAL THINKING AND PROBLEM SOLVING
UNIT II  DATA TYPES, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

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

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

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

COs- PO’s & PSO’s MAPPING

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

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)


GE3152 HERITAGE OF TAMILS

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, Leather puppetry, 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. தமிழ்நாட்டு இராசத்தல் – மத்திய பழக்கம் – வரலைக் கருத்துக்கோள் (தொகுதியில்: தமிழ்விளக்கம் பலகல் மற்றும் காண்டுபிட்டு கூற்றுக்கள்).
2. காலத்தோடு கீழே – மத்திய பழக்கம். குடியரசு (தொகுதியில் பிளகல்).
3. சிங்கன் – காலத்தோடு கீழே பழக்கம், தமிழ்நாடு நகரம் கோளை குறிப்பிட்டு (தொகுதியில் பலகல் மற்றும் காண்டுபிட்டு).
4. பாரம்பால் – குழுநிலாவுக் குறிப்பிட்டு (தொகுதியில் பலகல் மற்றும் காண்டுபிட்டு).
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.Valarmath) (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...
COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

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

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

TOTAL: 60 PERIODS

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

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

COs- PO's & PSO's MAPPING

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

BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY: (Any Seven Experiments)

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

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

**TOTAL: 30 PERIODS**

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

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

**CO’s-PO’s & PSO’s MAPPING**

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1-Low, 2-Medium, 3-High, "-"-"-"-no correlation

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

**CHEMISTRY LABORATORY:** (Any seven experiments to be conducted)

**COURSE OBJECTIVES:**

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

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

**TOTAL : 30 PERIODS**
COURSE OUTCOMES:
- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK:

CO-PO & PSO MAPPING

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HS3201 TECHNICAL ENGLISH FOR MARINE ENGINEERS - II
L T P C
4 0 0 4

COURSE OBJECTIVES:
- To engage learners in meaningful language activities to improve their LSRW skills
- To enhance learners’ awareness of the general rules of writing for specific audiences
- 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 placement opportunities.

UNIT I COMPARING & CONTRASTING
Listening – Evaluative Listening: Advertisements, Product Descriptions, -Audio / video; Listening and filling a Graphic Organiser (Choosing a product or service by comparison) Speaking – Marketing a product, Persuasive Speech Techniques. Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases, Vocabulary – Etymology (Root words), Vocabulary in Context, comparative adjectives

UNIT II CAUSE & EFFECT
UNIT II PROBLEM SOLVING
12
Listening – Listening / Watching movie scenes/ documentaries depicting technical problem and suggesting solutions. Speaking – Case-based group discussion, Group Discussion (virtual and face to face) - Techniques and Strategies, Ethical dilemmas Reading - Case Studies of the domain, excerpts from literary text, Critical Reading of news reports. Writing – Letter to the Editor, Writing Checklists, Problem solution essay / Argumentative Essay Grammar - Error identification & correction, If conditional clauses Vocabulary - Compound Words, Sentence Completion

UNIT IV REPORTING
12

UNIT V PRESENTING
12
Listening – Listening to TED Talks, Presentations, Formal job interview, (analysis of the interview performance); Speaking – Participating in a Role play, (interview/telephone interview), virtual interviews, Making presentations with visual aids; 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 Vocabulary – Idioms

TOTAL : 60 PERIODS

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

TEXT BOOKS:
2. Learning to Communicate by Dr. V. Chellammal. Allied Publishers, New Delhi, 2003

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AVG. 3.75 3.75 3.75
COURSE OBJECTIVES:
- To provide the required skill to apply the concepts of ordinary differential equations.
- To provide the required skill to apply higher order differential equations in marine applications.
- To provide the required skill to apply vector calculus.
- To provide the required skill to apply complex variables.
- To provide the required skill to apply Laplace transformation in marine engineering problems.

UNIT I ORINARY DIFFERENTIAL EQUATIONS – FIRST ORDER AND APPLICATIONS 12
Definition- Order and degree - Formation of differential equation - Solution of first order, first degree equations in variable separable form, homogeneous equations, other substitutions - Equations reducible to homogeneous and exact differential equations - Equations reducible to exact Integration- Factor - Linear differential equation of first order first degree, reducible to linear - Applications to electrical circuits and orthogonal trajectories

UNIT II ORDINARY DIFFERENTIAL EQUATIONS – HIGHER ORDER AND APPLICATIONS 12

UNIT III VECTOR CALCULUS 12
Gradient - Divergence and curl – Directional derivative – Irrotational and solenoidal vector fields – Vector integration – Green’s theorem in a plane, Gauss divergence theorem and Stokes’ theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelopipeds.

UNIT IV ANALYTIC FUNCTIONS 12
Functions of a complex variable – Analytic functions – Necessary conditions - Cauchy – Riemann equation and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping

UNIT V LAPLACE TRANSFORM 12

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
- Apply the concepts of ordinary differential equations.
- Apply higher order differential equations in marine applications.
- Apply vector calculus.
- Apply complex variables.
- Apply Laplace transformation in marine engineering problems.
- The basic and fundamental knowledge gained by the students in the application of ordinary differential equations vector fields and transformations will be applied by them in the process field related to marine engineering.
TEXT BOOKS:

REFERENCES:

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PH3251 CREDIT HOURS: 3

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

UNIT I CRYSTALLOGRAPHY

UNIT II ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

UNIT III SEMICONDUCTORS AND TRANSPORT PHYSICS
UNIT IV  OPTICAL PROPERTIES OF MATERIALS  

UNIT V  NANOELECTRONIC DEVICES  

TOTAL: 45 PERIODS

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

TEXT BOOKS:  

REFERENCES:  

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

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1-Low,2-Medium,3-High,"-"-no correlation

Note: the average value of this course to be used for program articulation matrix.
COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

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

UNIT II ELECTRICAL MACHINES

UNIT III ANALOG ELECTRONICS

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

UNIT V MEASUREMENTS AND INSTRUMENTATION

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

TEXT BOOKS:
REFERENCES:

Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial

GE3251

ENGINEERING GRAPHICS

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

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

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

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

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)
UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection — isometric scale — Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - combination of two solid objects in simple vertical positions - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

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

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

TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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Low (1) : Medium (2) : High (3)
### NCC CREDIT COURSE LEVEL 1*

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

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**NATIONAL INTEGRATION AND AWARENESS**  

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**PERSONALITY DEVELOPMENT**  

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**LEADERSHIP**  

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**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**  

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**TOTAL: 30 PERIODS**

### NCC Credit Course Level 1*

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

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PERSONALITY DEVELOPMENT 7
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2
PD 2 Communication Skills 3
PD 3 Group Discussion: Stress & Emotions 2

LEADERSHIP 5
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code 3
L 2 Case Studies: Shivaji, Jhasi Ki Rani 2

SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3
SS 4 Protection of Children and Women Safety 1
SS 5 Road / Rail Travel Safety 1
SS 6 New Initiatives 2
SS 7 Cyber and Mobile Security Awareness 1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*
NX3253 (AIR FORCE WING) NCC Credit Course Level - I

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TOTAL : 30 PERIODS
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I  CIVIL ENGINEERING PRACTICES  15
PLUMBING WORK:
   a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
   b) Preparing plumbing line sketches.
   c) Laying pipe connection to the suction side of a pump
   d) Laying pipe connection to the delivery side of a pump.
   e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

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

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

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

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

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

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

TOTAL = 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

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Low (1) ; Medium (2) ; High (3)
COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements.

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

TOTAL: 60 PERIODS

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

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Mapping of COs with POs and PSOs

1 – Slight, 2 – Moderate, 3 – Substantial

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

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

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types- Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV FOURIER TRANSFORMS


UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS


OUTCOMES:

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

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

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVES:
Upon successful completion of the course, students should be able to:
- To impart knowledge on properties of fluid
- To understand fluid kinematics and dynamics
- Learn laminar and turbulent flow of fluid
- To understand the working principles and characteristics of different types of pumps used onboard ship
- Able to classify and understand working of turbines

UNIT I FLUID STATICS

UNIT II FLUID KINEMATICS AND DYNAMICS

UNIT III LAMINAR AND TURBULENT FLOWS

UNIT IV PUMPS
UNIT V  HYDRAULIC TURBINES
Classification of hydraulic turbines – pelton turbines, velocity triangle – efficiencies – non dimensional numbers, working principle of the pelton wheel. francis and kaplan turbines – velocity triangles, - efficiencies of the draft tubes, hydraulic turbine characteristics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: To understand the Fluid properties and effect of various forces acting on different planes, surfaces and Pipes.
CO2: The In-viscid flow and Real Viscous flow and their characteristics.
CO3: To understand the working principles of pumps.
CO4: To understand and apply the theoretical knowledge hydraulic turbines fitted on board ships.
CO5: Apply basic equation of laminar flow and turbulent flows of liquid.

TEXT BOOKS:

REFERENCE BOOKS:

MAPPING OF COS AND POS:

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MV3302  STRENGTH OF MATERIALS FOR MARINE ENGINEERING  L T P C
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COURSE OBJECTIVES:
• To understand the concepts of stress, strain, principal stresses and principal planes.
• To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
• To determine stresses and deformation in circular shafts and helical spring due to torsion.
• To compute slopes and deflections in determinate beams by various methods.
• To study the stresses and deformations induced in thin and thick shells.
UNIT I  STRESS, STRAIN AND DEFORMATION OF SOLIDS  

UNIT II  TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM  

UNIT III  TORSION  
Torsion formulation 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 IV  DEFLECTION OF BEAMS  
Double Integration method – Macaulay’s method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell’s reciprocal theorems.

UNIT V  THIN CYLINDERS, SPHERES AND THICK CYLINDERS  
Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Lame’s theorem.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
CO2: Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
CO3: Apply basic equation of simple torsion in designing of shafts and helical spring
CO4: Calculate the slope and deflection in beams using different methods.
CO5: Analyze and design thin and thick shells for the applied internal and external pressures.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES:

- To impart knowledge on pumps, piping systems and its fittings
- Inculcate knowledge on heat exchanger, evaporators and distillers
- To acquire peripheral knowledge on oil purifier, air compressor and deck machinery.
- To impart knowledge on pollution prevention equipment’s
- To understand the concepts of steering gear system

UNIT I  PUMPS, PIPING SYSTEMS AND FITTINGS

Layout of main and auxiliary machinery in Engine Rooms of different ships, different types of pumps – centrifugal, gear, screw and reciprocating- characteristics performance, applications and maintenance. Piping system- bilge and ballast, fuel oil bunkering and service, lubricating oil, engine central cooling system, steam and condensate system, central priming system, control and service air system, hydrophore system and fire main system. Different types of valves- globe, gate, butterfly, relief valve, Quick closing valve, pressure reducing valve, SDNR valve- principle, working and applications. Principle and working of simplex and duplex filters, Autoclean, back flushing and magnetic filters. Different types of packing materials used on board the ships.

UNIT II  HEAT EXCHANGERS, EVAPORATORS AND DISTILLERS


UNIT III  THEORY OF OIL PURIFIER, AIR COMPRESSOR AND DECK MACHINERY

Construction, operation, maintenance of fuel oil and lubrication oil purifiers- clarifiers together with self de sludge operation. Construction and Operation, maintenance of main air compressor. Theory of air compressor. Emergency air compressor. Uses of compressed air on board the ships. Construction and operation of bow thrusters, cargo winches, windlass and mooring winches.

UNIT IV  POLLUTION PREVENTION EQUIPMENTS

Prevention of pollution by oil, garbage, sewage- IMO requirement as per MARPOL act. Operation, construction, maintenance of oily water separator both manual and automatic versions- coalescence- ODMS- Control system – Discharge criteria of waste bilge water. Operation, construction, maintenance of incinerator- sludge burning procedure. Construction and operation of sewage treatment plant on board the ships- comminutor- plant - Discharge criteria of treated sewage water

UNIT V  STEERING SYSTEM

Hydraulic Telemotor system (Transmitter and receiver), Bypass valve—charging system, hydraulic power unit—hunting gear heleshow pump principle, construction and operation pawl and ratchet mechanism, 2-ram and 4-ram steering gear— Electro-hydraulic steering gear-safermatic steering gear Rotary vane steering gear—construction—operation—safety features, relief, isolating and bypass valves, steering system regulations and testing—trouble shooting. Rudder restraining, Automatic system, general arrangement—rudder and pintle, rudder wear down—rudder carrier-swivel bearing

COURSE OUTCOMES:

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

- CO1: Apply the knowledge on Characteristics and application of pumps, different Pipeline systems.
- CO2: Work on modern Fresh water generator, Shell and Plate type heat exchanger and drinking water treatment plant.
CO3: Construct and Operate the Purifiers, Two stage air compressor and different types of deck machinery.
CO4: Adapt and operate Oily water separator, Incinerator and Sewage treatment plant.
CO5: Modern usage of Steering Gear Operation system.

TEXT BOOKS:

REFERENCE BOOKS:
4. “Pumping and Piping Diagram”, IME Publication 1999

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MV3304 \hspace{1cm} SHIP CONSTRUCTION \hspace{1cm} L \hspace{1cm} T \hspace{1cm} P \hspace{1cm} C
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COURSE OBJECTIVE:
- Understand the Ships terms and stresses onboard ships structure.
- Determine the Primary and Secondary girders used onboard ships.
- Distinguish between Fore-end and After-end arrangements onboard ships.
- Understand the free board and Tonnage onboard ships.
- Acquire the knowledge of Off shore Technology and Ship’s Survey.

UNIT I \hspace{1cm} SHIP TERMS
Various terms used in ship construction with reference to ship's parameter e.g. L.B.P. - Moulded Depth - Moulded draught etc. - General classification of ships. Stresses in Ship’s structure: Hogging – Sagging – Racking – Pounding – Panting etc., and Strength members to counteract the same. Sections And Materials Use: Type of sections like angles – Bulb plates flanged beams used in ship construction – Process of welding. Riveting & Welding testing of welds – Fabricated components.
UNIT II  
BOTTOM & SIDE FRAMING  

UNIT III  
FORE & AFT END ARRANGEMENTS  
Fore end arrangement, arrangements to resist pounding bulbous bow – Types of sterns stern frame and rudder – Types of rudder – Supporting of rudder – Locking pintle – Bearing pintle – Pallister, bearing shaft tunnel – Tunnel bearings.

UNIT IV  
FREE BOARD AND TONNAGE  

UNIT V  
OFFSHORE TECHNOLOGY  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
 CO1: Apply the knowledge to identify ships stresses.
 CO2: Design the Primary and Secondary girders used onboard ships.
 CO3: Analyze the Fore-end and After-end arrangements onboard ships.
 CO4: Demonstrate the free board and Tonnage onboard ships
 CO5: Interpretation of data regarding Ship’s Survey

TEXT BOOKS:

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MV3305 SEAMANSHIP, ELEMENTARY NAVIGATION AND SURVIVAL AT SEA

COURSE OBJECTIVES:
- To impart working knowledge on Deck equipment and ship department
- Understand working of navigational system and equipment used.
- Practice on various knots
- To impart on LSA knowledge on life saving appliances.
- To practice survival techniques at sea

UNIT I SEAMAN & THEIR DUTIES
Ship’s Department, General ship knowledge ad nautical terms like poop-deck forecastle, bridge etc. deck equipment: winces, windlass, derricks, cranes, gypsy, capstan, hatches and function. Navigation lights and signals: port and starboard, forward and aft mast lights, colors and location. Look out, precautions and bad weather, flags used on ships, flag etiquette, sound signals.

UNIT II ROPE KNOTS AND MOORINGS
Types of knots. Practice of knot formation, materials of ropes, strength, care and maintenance, use of mooring line, heaving line, rat guards, canvas and its use. Anchors: their use, drooping and weighing anchor, cable stopper.

UNIT III NAVIGATION
General knowledge of principal stars. Sextant, Navigation compasses, echo sounder, GPS, Glonass, log and uses, barometer and weather classification, G.M.T and Zonal time, wireless Navigational Instruments, radar satellite navigation etc.

UNIT IV LIFE BOATS & LIFE RAFTS

UNIT V SURVIVAL AT SEA
Survival difficulties and factors, equipment available, duties of crew members, Initial action on boarding, Maintaining the craft, Practical: Knots, bends and hitches, Ropes splice, donning of life jackets, life boat drills. Lowering & hoisting of life boats (model).

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
- CO1: Operate deck equipment’s and carry out department duties
- CO2: Apply knowledge choose the ropes for different types of requirement
- CO3: Distinguish and select different Navigational equipment for the ship smooth functioning
- CO4: Demonstrate competency skills on life saving appliance
- CO5: Survive at different condition of sea

TOTAL: 45 PERIODS
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MV3311 MARINE HYDRAULICS AND FLUID MACHINERY LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVE:
- To impart knowledge on properties of fluid
- To understand fluid kinematics and dynamics
- Learn laminar and turbulent flow of fluid

LIST OF EXPERIMENTS

(A) FLUID MECHANICS LAB

(B) FLUID MACHINERY LAB
Centrifugal pumps- Performance characteristics of a constant speed pump, specific speed. Performance characteristics of multistage pump. Characteristics of Impulse and Reaction Turbine. Specific speed and unit quantities. Positive displacement pumps. Performance characteristics of a deep well pump, Jet pump

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Understand the flow behavior of fluids
CO2: Calculate the frictional losses and $C_d$ of fluids when it passes through various obstructions
CO3: Calculate the performance characteristics of hydraulic pumps and turbines.
REFERENCES
1. Laboratory Manuals

MV3312 STRENGTH OF MATERIALS AND APPLIED MECHANICS LABORATORY  L T P C
0 0 4 2

OBJECTIVE:
- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion

STRENGTH OF MATERIALS LAB

LIST OF EXPERIMENTS
1. Tension Test on M.S. Rod.
2. Compression test – Bricks, concrete cubes.
3. Deflection Test - Bench type verification of Maxwell theorem.
4. Tension test on thin wire.
5. Hardness test on various machines.
6. Tests on wood - Tension, compression, bending, impact in work testing machine.
7. Tests on springs - Tension, compression.

APPLIED MECHANICS LAB
8. Impact test.
9. Double shear Test in U.T:M.
10. Load measurement using load indicator, load coils.
11. Fatigue test.
12. Strain measurement using Rosette strain gauge.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: To operate the various testing machines.
CO2: To carry out various tests on materials
CO3: To choose the best materials for a particular use, based on the test results

REFERENCES
1. Laboratory Manuals

GE3361 PROFESSIONAL DEVELOPMENT  L T P C
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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:
- Create and format a document
- Working with tables
- Working with Bullets and Lists
- Working with styles, shapes, smart art, charts
- Inserting objects, charts and importing objects from other office tools
- Creating and Using document templates
- Inserting equations, symbols and special characters
- Working with Table of contents and References, citations
- Insert and review comments
- Create bookmarks, hyperlinks, endnotes footnote
- Viewing document in different modes
- Working with document protection and security
- Inspect document for accessibility

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

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS Excel to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
COURSE OBJECTIVES:
- To expose the students to the Electrical equipment’s fitted on boards ships, the concepts of electrical measurements and electrical distribution systems.
- To make the students to understand the concepts of Electricity production,
- To impart knowledge on measurements, cable faults and AC Machines used in Marine Engineering.
- To understand Principles of operation and construction details of synchronous motors, induction machines
- To impart knowledge on Speed control and trouble shooting in induction machines.

UNIT I PRINCIPLES OF D.C. MACHINES AND GENERATORS 9+3

UNIT II TRANSFORMERS 9+3

UNIT III ALTERNATORS 9+3

UNIT IV SYNCHRONOUS MOTORS 9+3

UNIT V INDUCTION MACHINES 9+3

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
- CO1: Operate D.C. Machines
- CO2: Operate and Maintain Transformers
- CO3: Design features of Alternators – their construction and operation.
- CO4: Synchronous the motor
- CO5: Operate and maintain induction machines

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MV3402 MARINE REFRIGERATION AND AIR CONDITIONING L T P C

COURSE OBJECTIVES:
To impart the knowledge of students in
- Reciprocating compressors
- Basic refrigeration and air conditioning
- Marine refrigerating plants
- LMTD and NTU Methods

UNIT I RECIPROCATING COMPRESSORS

UNIT II BASIC REFRIGERATION AND AIR CONDITIONING

UNIT III MARINE REFRIGERATING PLANTS

UNIT IV MARINE AIR CONDITIONING
Principles of air conditioning – Psychrometric properties of air – comfort conditions – control of humidity – airflow and air conditioning capacity – calculation for ships plants.

UNIT V BASIC DESIGN OF HEAT EXCHANGERS
Introduction - types - LMTD and NTU method - double-pipe, shell and tube type, condenser and evaporator – problems

TOTAL: 75 PERIODS
COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Calculate the performance of Reciprocating compressors
CO2: Understand the aspects of Marine refrigeration and air-conditioning
CO3: Operate Marine refrigeration plants
CO4: Apply the knowledge on maintaining air conditioning
CO5: Efficient design of Heat Exchangers for Air conditioning and refrigeration plants.

TEXT BOOKS:

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MV3403
SHIP’S FIRE PREVENTION AND CONTROL

OBJECTIVES:
To impart knowledge in students on:
- Fire protection built in ships.
- Detection and safety systems.
- Firefighting Equipment.
- Fire control.
- Safety measures of firefighting equipment.

UNIT I  FIRE PROTECTION BUILT IN SHIPS
SOLAS convention, requirements in respect of materials of construction and design of ships, (class A, B, type BHDS), fire detection systems, fire test, escape means, electrical installations, ventilation system and venting system for tankers. Statutory requirements for firefighting systems and equipment’s on different vessels, fire doors & fire zones.

UNIT II  DETECTION AND SAFETY SYSTEMS
Fire safety precautions on cargo ships, tankers and passenger ships during working. Types of detectors, selection of fire detectors and alarm systems and their operational limits. Commissioning and periodic testing of sensors and detection system. Description of various systems fitted on ships including micro mist and extinguishing system.
**UNIT III  FIRE FIGHTING EQUIPMENT**
Fire pumps, hydrants and hoses, couplings, nozzles and international shore connection, construction, operation and merits of different types of portable, non-portable and fixed fire extinguishers installations for ships, properties of chemicals used, water-mist fire suppression system. Advantages of various fire extinguishing agents including vaporizing fluids and their suitability for ship’s use. control of class A, C & class D fires, Combustion products & their effects on life safety.

**UNIT IV  FIRE CONTROL**

**UNIT V  SAFETY MEASURES**
Special safety measures for preventing, fighting fire in tankers, chemical carriers, oil rigs, supply vessels, and fire fighting ships - Safe working practice with respect to fire on board ships and first aid for hazards arising from fire in ships.

**OUTCOMES:**
Upon successful completion of the course, students should be able to:
- Fire protection, Detection and Safety systems in ships.
- Construction, Operation and Maintenance of Fixed and portable Fire Extinguishers in ships.
- Fire prevention and control in oil tankers, LPG / LNG carriers, Chemical tankers, oil rigs, supply vessels.
- Operation of Fire fighting ships.
- Extinguish Major Fire and Follow safe working practices.

**TOTAL: 45 PERIODS**

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OBJECTIVES:
- To impart knowledge on various components of marine diesel engines and familiarisation on marine lubricating oils and associated systems.
- To acquire peripheral knowledge on combustion of marine diesel engines, scavenging and turbocharging system.
- To impart knowledge on marine fuels and its properties, exhaust valve function.
- To impart brief knowledge on main engine safeties and associated systems.
- To understand the importance of reduction on marine air pollutant and acquire basic knowledge on modern intelligent engines.

UNIT I  COMPONENTS OF MARINE DIESEL ENGINE AND LUBRICATION SYSTEM  12
Construcional details of Marine diesel engines- Welded construction for bedplates, Foundation bolts, ‘A’ frames, crosshead and guide shoes, main bearings, Crankshaft and its types - Cam shaft, connecting rod, stuffing box- Piston and piston rod, cylinder liners, cylinder heads and its mountings, tie rods, Engine chocks and its types- merits and demerits of chocks.
Auxiliary power transmission- chain and belt – gear transmission etc. Lubricating oils properties and testing of lubricating oils- Types of lubrications - Lubrication system- Main and crosshead bearing lubrication - Rocker arm- Cylinder liner lubrication. lubricating oil contamination- microbial attack-remedies - Alpha lubricator - cylinder oil properties - Cylinder lubricating quills-significance of cylinder lubricating oil.

UNIT II  SCAVENGING&TURBOCHARGING AND COMBUSTION PROCESS  12
Scavenging system in two stroke and four stroke engines- various types of scavenging in two stroke engines- Merits and demerits of various scavenging system- under piston scavenging - scavenge manifolds and scavenge cooler -auxillary blowers and its importance. Turbo charging and supercharging- types of turbocharging system - pulse and constant pressure type – axial and radial flow turbo charging- merits and demerits -significance of Turbo charger – turbo charger seals and arrangements- wet and dry cleaning of turbocharger -expansion allowance in exhaust manifold- turbo charger lubrication system- turbocharger surging, various factors affecting the combustion- two stroke and four stroke engine piston - various types of piston rings – piston ring clearances- types of piston cooling system – merits and demerits of different type of piston cooling systems.

UNIT III  MARINE FUEL OIL, FUEL SYSTEM AND ENGINE RATINGS  12

UNIT IV  MAIN ENGINE SAFETIES AND ASSOCIATED SYSTEM  12
Starting and reversing systems of Marine diesel engines - Maneuvering system - Main Engine auto slowdown and shutdown -Crash maneuvering - Safety interlock system – turning gear arrangement and importance, Crankcase relief valve - crankcase inspection, oil mist detector and its operation, crankshaft deflection. main engine power delivery- Indicator instrument- Power card -simple draw cards and out of phase diagrams - significance of power diagram - power calculations- fault detection.

UNIT V  EMISSION CONTROL AND MODERN INTELLIGENT ENGINES  12
Control of NOx, SOx in exhaust emission -deviation from ideal condition in actual engines, comparative study of slow speed, medium speed and high engines. Construction and Operation of Sulzer, MAN and B&W, Mitsui, Mitsubishi etc. Latest development in marine diesel engines–cam less engines, UMS–Operation, Intelligent engines - RT-flex engines.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
1. Define and identify solution to Marine fuel injection systems.
2. Explain the combustion inside marine engines.
3. Apply and recognize the need for the appropriate techniques to enhance fuel system.
4. Illustrate and assess the maneuverings systems of various marine diesel engines.
5. Select the modern tools to distinguish emission controls.

**TEXTBOOKS:**

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**MV3406 **

**MARINE BOILERS AND STEAM ENGINEERING**

**L T P C**

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**COURSE OBJECTIVES:**
To impart the knowledge to the students on
- Marine boilers and steam engines.
- Operation & Maintenance of Boilers.
- The concept of marine steam plants operations.
- Lubrication for Steam Engines and Turbines.
- Operation and maintenance of turbines.

**UNIT I **

MARINE BOILERS & BOILER MOUNTINGS 9
Gauge glass – Ordinary plate type and remote Indicator; Automatic feed regulator, three element High & Low water level alarms, Main Steam stop valve, Retractable type Soot blower etc.

UNIT II  OPERATION & MAINTENANCE OF BOILERS  9
Pre-commissioning procedures, Hydraulic tests, steam raising and Operating procedures, Action in the event of shortage of water. Regular boiler water tests on board. Blowing down of boiler, Laying up a boiler; general maintenance, External and internal tube cleaning. Tube renewals, etc., maintenance, inspection and survey of boilers. Refractory: Purposes of refractory, types of refractory and reasons for failure. Oil burning: Procedure of Liquid fuel burning in open furnace, Various types of atomizer, Furnace arrangement for oil burning, Boiler Control System i.e. master control, fuel control, air control and viscosity control, Introduction to Automation.

UNIT III  MARINE STEAM PLANTS  9
Steam engines - History of multiple expansion marine reciprocating engines & steam turbines. Description of different types of steam turbines. Layout of plant - General layout of plant & description of a modern geared steam turbine installation including auxiliaries in modern use, open and closed feed system.
Condensers - Types of condensers, constructional details, location & working principles, contraction and expansion allowances, leak test. Effect of change of temperature, circulating water quantity, change of main engine power, condenser surface.

UNIT IV  LUBRICATION FOR STEAM ENGINES AND TURBINES  9
Suitable oils and their properties, lubrication of main bearings, thrust bearings and gears. Gravity and pressure lubrication-oil system and emergency lubrication arrangement.

UNIT V  OPERATION AND MAINTENANCE OF TURBINES  9
Turbine drain system, turbine gland system, warming through a turbine plant, control of speed and power of propulsion, throttle valve control and nozzle control, emergency controls, emergency operation of turbines, vibration in marine steam turbine, steam turbine losses. Breakdown and faultfinding. Selection of materials: Materials used in various components like blades, rotors, casings, sealing glands, gears etc. & their justification.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Define the Waste heat recovery system and boiler mountings.
CO2: Infer the Operation and Watch keeping of boilers.
CO3: Demonstrate the Construction of steam turbines and steam engines.
CO4: Illustrate The Various Method of Lubrication of turbines.
CO5: Define the operation and maintenance of steam turbines.

TEXT BOOKS:

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

OBJECTIVES:

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

UNIT I ENVIRONMENT AND BIODIVERSITY


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


TOTAL : 30 PERIODS
OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
- To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:

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

REFERENCES:


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

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

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

#### ENVIRONMENTAL AWARENESS & CONSERVATION
- **EA 1**  
  Environmental Awareness and Conservation  
  3 periods

#### GENERAL AWARENESS
- **GA 1**  
  General Knowledge  
  4 periods

#### ARMED FORCES
- **AF 1**  
  Armed Forces, Army, CAPF, Police  
  6 periods

#### ADVENTURE
- **AD 1**  
  Introduction to Adventure Activities  
  1 period

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

**TOTAL: 45 PERIODS**

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### NCC Credit Course Level 2*

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

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#### PERSONALITY DEVELOPMENT
- **PD 3**  
  Group Discussion: Change your mindset, Time Management, Social Skills  
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# NCC Credit Course Level 2*

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## PERSONALITY DEVELOPMENT

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

### LEADERSHIP

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

## DISASTER MANAGEMENT

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

## ENVIRONMENTAL AWARENESS & CONSERVATION

EA 1 Environmental Awareness and Conservation

## GENERAL AWARENESS

GA 1 General Knowledge

## GENERAL SERVICE KNOWLEDGE

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

## ADVENTURE

AD 1 Introduction to Adventure Activities

## BORDER & COASTAL AREAS

BCA 1 History, Geography & Topography of Border/Coastal areas
COURSE OBJECTIVE:
To develop skill of the students on
• Welding and Welding techniques
• Usage of hand tools
• Sheet metal work and pipe work

WELDING TECHNIQUES

LIST OF EXPERIMENTS
1. WELDING - Exercises in Electric Arc welding and Gas welding Advanced Techniques.
2. HAND TOOLS - Hand tools, sharpening, Powered hand tools, Measurements etc. Exercise involving above.
3. SHEET METAL WORKING - Simple Exercise.
4. PIPE WORK - Experiments involving thin pipes, Joining, bending, welding and inspection.

LATHE & SPECIAL M/C SHOP

TOTAL: 60 PERIODS

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

CO1: To carry out repair of Ship machinery and components by welding
CO2: To do any kind of sheet metal works
CO3: To make machine components using Lathes and Special machines such as milling, grinding and slotting machine.

REFERENCES:

WELDING WORK SHOP
Name of the Equipment | Qty.
--- | ---
1. Welding Transformer Air Cooled with Fan | 04
2. Maxi – MIG 400A Welding Set | 01
3. AOL make TIG Control Outfit | 01
4. Welding Rectifier Throluxe – 401 MMA | 01
5. Water Cooled Torch 0150102071 400 AMPS | 02
6. Bending Machine Pipe dia ½” to 3” | 01
7. Gas welding and cutting set | 02

FITTING SHOP
Name of the Equipment | Qty.
--- | ---
1. Power Hacksaw | 01
2. Vernier Height Gauge | 02
3. Surface Plate with stand | 02
4. Fitting Bench Vice | 40
5. Hand tools (Different types) | 01
COURSE OBJECTIVE:
To develop skill of the students on
- Demonstration ability to carry out the different tests on heat engines.
- Carrying out the Performance and Characteristics of heat engines.
- Performance tests on boiler feed water, oils, fuels and lubricants based on the test results
- Operation and Maintenance of Refrigeration and Air Conditioning.

HEAT ENGINES LAB

1. Flue gas analysis by Orsat apparatus.
2. Study and performance characteristics of steam turbine.
3. Dryness fraction of steam using calorimeters.
4. Performance characteristics of a constant speed air blower.
5. Verification of fan laws and static efficiency of air blower.
6. Test on Reciprocating compressor.
9. Testing of fuels - calorific value, proximate analysis
10. Testing of fuels - Ultimate analysis, octane number, cetane number.
11. Testing of lubricants - flash point, fire point, pour point.
14. Wind Tunnel - Drag and lift measurements.
15. Performance test on IC Engine as per BIS specifications.

BOILER CHEMISTRY LAB

16. To determine hardness content of the sample of boiler water in P.P.M. in terms of CaCO3.
17. To determine Chloride Content of the sample of water in P.P.M. in terms of CaCO3.
18. To determine Alkalinity due to Phenolphthaline, total Alk. and Caustic Alk. Of the sample of water (in P.P.M).
19. To determine Phosphate Content of the sample of water.
20. To determine dissolved Oxygen content of the sample of water.
21. To determine sulphate content of given sample of water.
22. To determine Ph-value of the given sample of water.
23. Boiler trial.
24. Water Testing - Dissolved oxygen, total-dissolved solids, turbidity.
25. Water Analysis (Fresh and sea water) - Chloride, sulphate, hardness.
26. Sludges and scale deposit - Silica, volatile and non-volatile suspended matter.

REFRIGERATION LABORATORY

27. Watch keeping: Parameters to be monitored during running of refrigeration unit.
28. Various cut-outs, viz, pressure, temperature
29. Determination of actual COP, theoretical COP and Carnot COP.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
- CO1: To Perform various tests on the heat engines
- CO2: To Analyze the results to understand the performance characteristics of Engines
- CO3: To Perform Boiler water tests, Sea water and fresh water tests
- CO4: To Choose the best water, oils, fuels and lubricants based on the test results.
REFERENCES:
1. Laboratory Manuals

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

UNIT I    BASICS SHIP PROPULSION SYSTEM AND EQUIPMENTS
         law of floatation - Basics principle of propulsion - Earlier methods of propulsion - ship propulsion machinery- boiler, Marine steam engine, diesel engine, ship power transmission system, ship dynamic structure, Marine propulsion equipment - shaft tunnel, Intermediate shaft and bearing, stern tube, stern tube sealing etc. degree of freedom, Modern propelling methods- water jet propulsion, screw propulsion.

UNIT II    SHIPS MOVEMENTS AND SHIP STABILIZATION
         Thrust augmented devices, Ship hull, modern ship propulsion design, bow thruster – Advantages, various methods to stabilize the ship- passive and active stabilizer, fin stabilizer, bilge keel - stabilizing and securing ship in port- effect of tides on ship – effect of river water and sea water sailing vessel, Load line and load line of marking- draught markings.

UNIT III    SHIPS SPEED AND ITS PERFORMANCE
         Ship propulsion factors, factors affecting ships speed, various velocities of ship, hull drag, effects of fouling on ships hull, ship wake, relation between powers, Fuel consumption of ship, cavitations - effects of cavitation’s, ship turning radius.

UNIT IV      BASICS OF PROPELLER
UNIT V          BASICS OF RUDDER
Rudder dimension, Area of rudder and its design, Rudder arrangements, Rudder fittings - Rudder pintle - Rudder types- Balanced rudder, semi balanced rudder, Spade rudder, merits and demerits of various types of rudders, Propeller and rudder interaction, Rudder stopper, movement of rudders, Basic construction of Rudder

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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MV3511          ELECTRICAL ENGINEERING, ELECTRONICS AND MICROPROCESSOR LABORATORY

COURSE OBJECTIVES:
- To impart Practical knowledge in
- Operation and maintenance of Electrical Machines
- Operation and maintenance of electronic equipment’s
- Operation and maintenance of Microprocessor

ELECTRICAL ENGG. LABORATORY

LIST OF EXPERIMENTS
1. Load Test on D.C. Shunt Motor
2. Load Test on D.C.Series Motor
4. Parallel operation of D.C.Shunt Generator
5. Speed control of D.C.Shunt Motor.
7. Parallel operation of single-phase transformers.
8. To connect similar single-phase transformers in the following ways.
10. Load Test on Squirrel cage induction motor
11. Load Test on Slip ring induction motor
12. Pole changing motor for various speeds.
14. Trouble shooting in Electric Motors and Transformers.
15. Exercises in Power Wiring and earthing.

ELECTRONICS / MICROPROCESSOR LABORATORY
1. To study the volt-ampere characteristics of a high current semiconductor diode.
2. To study the volt-ampere characteristics of a diode and Zener diode.
3. To study the half wave and full wave rectification circuit without and with filter circuit.
4. To study the volt-ampere characteristics of a Transistor.
5. To study the volt-ampere characteristics of Field Effect Transistor.
6. To study the characteristics of Silicon Control Rectifier.
7. To study the Transistor Feed Back Amplifier.
8. To study the Integrated Circuit operational amplifier.
9. To study the logic training board.
10. To study the speed control of D.C. motor using Thyristor.
11. Arithmetic operations using 8085
12. Logical operations using 8085
13. Array operations using 8085
14. Speed & Direction Control of Stepper motor using 8085.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
CO1: Conducting all types of tests on the Shunt and Series Motors,
CO2: Load tests on the Transformers, parallel operation of single phase Transformers Synchronizing three phase Alternators
CO3: Understanding the volt-ampere characteristics of Semiconductors, Diodes, Transistors, Field Effect transistor, Amplifier, Thyristor and 8085 Microprocessor.

MV3512 MARINE MACHINERY DRAWING L T P C 0 0 4 2

COURSE OBJECTIVES:
To make the students understand and practice on
- Sketching and dimensioning
- Basic system of Limits, fits tolerance, Rivets and welding joint
- Marine Machinery Parts and components

UNIT I EXPLANATION AND SKETCHING 3+12
Dimensioning conventions of shafts, arcs, angles, holes, tapers, welded joints, threads and pipes conventional representation of metals and materials. sectioning conventions, removed sections and revolved sections, parts not usually sectioned, conventions of gears

UNIT II LIMITS, FITS AND TOLERANCES 3+12
Limits and tolerances, Surface Finish, Type of fits – description, hole basis system and shaft basis system, calculations involving minimum and maximum clearances for given combination of tolerance grades- simple problems, geometric tolerances

UNIT III RIVETS AND JOINT 3+12
Sketching screw-threads, screwed fastenings, rivets and riveted joints keep. cotter joints & pin joints.

UNIT IV MARINE MACHINERY PARTS 3+12
Drawing of machine components in assembly - details like couplings, glands, non-return valves, cocks & plugs, cylinder, connecting rod & bearings. boiler mountings – full bore safety valve, gauge glass, main stop valve.
UNIT V MARINE COMPONENT
3+12
Assembly drawings of simple marine components - bilge strainer boxes, control valves, cylinder relief valves, boiler blow down cock.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Understand and explain the Limits, Fits and Tolerances, arcs etc., with respect to the Marine Machinery.
CO2: Apply the knowledge to Sketch Valves, Cocks and Plugs.
CO3: Draw Various parts of Marine Machinery and the general Marine components

TEXT BOOKS:

REFERENCES

MV3601 STABILITY OF SHIPS

OBJECTIVES:
- To impart the Knowledge on the Basic Hydrostatics and Stability Calculations of Ship.
- To understand and apply the law of the Archimedes principle, floatation and displacement.
- To understand and calculate the Centre of gravity & effect of addition of mass.
- To determine the Meta centric Height, free surface effect and Carry out the Inclining experiment.
- To derive the loss of stability due to grounding.

UNIT I HYDROSTATICS
Density, relative density, pressure exerted by a liquid on an immersed plane, center of pressure, load on immersed plane, load diagram, shearing forces on bulk head stiffeners– problems.

UNIT II GEOMETRY AND SHIP FORM CALCULATION
Archimedes principle, Laws of floatation, displacement, tonne per cm immersion. Coefficients of form, wetted surface area, similar figures, shearing force and bending moment – problems.

UNIT III CALCULATION OF AREA, VOLUME, FIRST AND SECOND MOMENTS
Simpsons first rule and second rule, application to area and volume, use of intermediate ordinate rule, trapezoidal rule, mean and mid – ordinate rule, application of 5,8, – 1 Rule for area, application of simpson rule to first and second moments of area – Centre of gravity, effect of addition of mass, effect of movement of mass, effect of suspended mass – problems.
UNIT IV  TRANSVERSE STABILITY AND HEEL
Static stability at small angles of heel, calculation of BM and meta centric height, meta centric diagram, inclining experiment, free surface effect, stability at large angles of heel, curves of static stability, dynamic stability, angle of loll, stability of a wall sided ship – inclining experiment, problems. IMO recommendations concerning ship stability.

UNIT V  LONGITUDINAL STABILITY
Longitudinal BM – MCT1 cm – Change of trim, change of LCB with change of trim, alteration of trim by adding or removing weights, mean draft, change in mean and end draft due to density and bilging – flooding calculation – floodable length – factor of sub division – loss of stability due to grounding – problems- Knowledge of Trim and stress tables and equipment's.

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
- CO1: Apply Knowledge to Calculate the Basic Hydrostatics and Stability Calculations of Ship.
- CO2: Define the law of the Archimedes principle, floatation and displacement.
- CO3: Able to interpret the stability data.
- CO4: Use of Modern tools to calculate the Meta centric Height, free surface effect.
- CO5: Determine the loss of stability due to grounding.

TOTAL: 60 PERIODS

TEXT BOOKS:

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### NCC Credit Course Level 3*

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

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<td><strong>ARMED FORCES</strong></td>
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<td>AF 2 Modes of Entry to Army, CAPF, Police</td>
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<td><strong>COMMUNICATION</strong></td>
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<td>C 1 Introduction to Communication &amp; Latest Trends</td>
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### NCC Credit Course Level 3*

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

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**TOTAL : 45 PERIODS**
COURSE OBJECTIVE:
- To impart Practical knowledge of fire fighting
- To understand and practice hydraulic and pneumatic control systems on board ship
- To train the students in simulator for the operation of Marine Machinery fitted on board ship

LIST OF EXPERIMENTS
1. Fire hazard aboard ships – inflammability, fire extinguishing use. Control of class A, B & C fires.
2. Fire protection built in ships, extinction systems, and escape means.
3. System for tankers, statutory requirements for fire fighting systems and equipment’s on different vessels.
4. Fire fighting equipment: fire pumps, hydrants and hoses, couplings, nozzles and International shore connection, Construction, Operation and merits of different types of portable extinguishers.
5. Non-portable and fixed fire extinguishers, installation for ships. Properties of chemical used, bulk carbon-di-oxide, and inert gas systems.
6. Firemen outfit its use and care, maintenance, testing and recharging of appliances, preparation, and fire appliance survey.
7. Fire Control: Action required and practical techniques adopted for extinguishing fires in accommodation, machinery spaces, boiler rooms, Cargo holds, galley etc.,
8. Fire fighting in port and dry dock. Procedure for re-entry after putting off fire, rescue operations from affected compartments.
10. Fire drill.

COURSE OUTCOMES:
Upon Completion of the course, the students will be able to:
- CO1: Prevent, detect, and extinguish different types of fire onboard ship and provide first aid.
- CO2: Operate Hydraulic and Pneumatic control equipment, systems and components.
- CO3: Start, Operate of Marine Machinery and Watch keeping onboard ship.

REFERENCES:
1. Laboratory Manual

PNEUMATIC AND HYDRAULIC CONTROL LABORATORY
1. Symbols of Hydraulics
2. Hydraulic Power Pack
3. Double acting Cylinder Operation 4/3 Direct Control valve
4. Pilot operated check valve.
5. Speed control of cylinder with throttle valve.
6. To study the cracking pressure pilot operated check valve.
8. Meter - Out-Circuit
9. Bleed of Circuit
10. Direct operated relief valve.
11. Hydraulic motor operation.
12. Speed variation of hydraulic motor.
13. Sequence Circuit.
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<td>16.</td>
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<td>Time Delay circuit.</td>
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<td>Impulse operation of single acting cylinder</td>
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<td>Impulse operation of double acting cylinder</td>
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<td>Parallel connection of electro pneumatic Contacts</td>
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</table>

**REFERENCES:**
1. Laboratory manual
2. Shanmuga Sundram, “Hydraulics and Pneumatics Controls”, S. Chand group, 2010

**SIMULATOR LAB. EXPERIMENTS**
1. Description of basic engine functions and their simulation.
3. Engine operation from Remote stations – i.e. engine control room and Navigation Bridge.
5. Electronic logic circuits in remote control stations.
7. Study and adjustments of Logic circuits for remote control operation of main engine

**REFERENCES:**
1. Laboratory Manual
2. Original Equipment (Simulator) Manufacturers manual

**TOTAL: 60 PERIODS**

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**MV3612 MEASUREMENT AND INSTRUMENTATION LABORATORY**

**COURSE OBJECTIVE:**
- To impart knowledge on the use of Measuring Techniques
- To practice on measuring equipment and instruments
- To study the use of strain gauge (LVDT), accelerometer and vibro meter.

**MEASUREMENT LABORATORY**

**LIST OF EXPERIMENTS**
1. Use of precision measuring instruments like micrometer, vernier, height and depth gauges, surface plate, etc.
2. Checking dimensions of a part using slip gauge.
3. Use of sine bar for measuring angles and tapers.
5. Calibration of dial gauge.
6. Taper and bore measurement-using spheres.
7. Fundamental dimension of a gear using contour projector.
8. Testing squareness of a try square using slip gauges.
10. Measurement of angles between centre lines of holes drilled radially on a shaft.
12. Use of pneumatic comparator and mechanical comparator.

**INSTRUMENTATION LABORATORY**

1. Pressure measuring devices—pressure and vacuum gauge calibration.
2. Temperature measuring devices like Platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
3. Flow measuring devices like orifice meter, rotameter, etc.
4. Speed measuring devices like tachometer, stroboscope, etc.
5. Force measuring devices, load cells and proving rings.
6. Torque measuring devices
7. Power measurement using rope, prony brake, mechanical, hydraulic and electrical dynamometers.
8. Displacement devices—strain gauge indicator, LVDT.
9. Velocity and acceleration—accelerometer.

**TOTAL: 60 PERIODS**

**COURSE OUTCOMES:**
Upon Completion of the course, the students will be able to:

- CO1: Demonstrate the measuring techniques on marine equipment
- CO2: Measure the parameters on board ship devices
- CO3: Display the concept of measuring displacement vibration acceleration

**MV3701 SHIP OPERATIONAL MANAGEMENT AND IMO REQUIREMENTS**

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**COURSE OBJECTIVE:**

- To impart knowledge on shipping company structure and registration procedure of ship
- To understand commercial shipping practices
- To familiarize marine insurance principles
- To understand on statutory regulation
- To understand and remember STCW convention for seafarer

**UNIT I STRUCTURE OF A SHIPPING COMPANY**

Structure of a shipping company and functioning of its various departments, ownership of vessels, registration of ships, flags of convenience, IMO identification number. Maritime Declarations of Health and the requirements of the International Health Regulations.

**UNIT II COMMERCIAL SHIPPING PRACTICE**

Planning sailing schedules and voyage estimates, liner and tramp shipping services, conference systems, chartering and charter parties, ship’s papers for arrival and departure, port procedures, role of agents, theory of freight rates, bills of lading, cargo surveys and note of protests, International labour organization (ILO) and Maritime Labour Convention,2006, COLREG 1972

**UNIT III MARINE INSURANCE**

Underwriting and loss adjusting principles applied to Marine cargo insurance, hull / machinery policy, particular average, general average, P & I Clubs – making claims.

**UNIT IV STATUTORY REGULATIONS**

Responsibilities under International Instruments Affecting the Safety of the Ships, Passengers, Crew or Cargo, Ballast Water Management, Classification Societies and Survey of Ship.

UNIT V STCW
International convention on STCW for seafarers 1978 with 1995 amendments, an overview of all sections, manning of ships, engagement and discharge of ship’s crew, ship’s articles, Merchant shipping act, Role of Maritime administration(DGS) and its functions: DGS Rules and MS Notices Port state control, PSC mandatory certificate check list, grounds for PSC inspection criteria for detention. Emergency Preparedness, drills and exercises, ERM(engine room resource management)

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Explain about shipping company structure.
CO2: Plan voyage schedule and estimate the cost
CO3: Apply knowledge on marine insurance
CO4: To practices on statutory regulation
CO5: Apply international convention while carrying out watch keeping on board

TEXT BOOKS:

REFERENCES
2. SOLAS – 1974 - International Maritime Organisation Publications
4. STCW -1978/95 - International Maritime Organisation Publications

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COURSE OBJECTIVE:
- To impart the knowledge to students on
- Various resistance applied on ship at sea
- Propeller Theory
- Rudder types experiments and trails.
- Theory of Waves
- Ship Vibration & Noise

UNIT I  RESISTANCE  9
Types of resistance, frictional, residuary - wave making, eddy and form resistances and total resistance, air, appendage, model testing, propeller tests in open water, admiralty coefficient, fuel coefficient and consumption, sea trials – Problems.

UNIT II  PROPELLER THEORY  9
Types and theory of propellers, apparent slip, real slip, wake, thrust, relation between powers and speed, measurement of pitch, cavitations, built and solid propellers, interaction between the ship and propeller, hull efficiency over all propulsive efficiency – problems. Bow Thruster and its usage

UNIT III  RUDDER THEORY  9
Types of rudders, model experiments and manouvering trials, area and shape of rudder, position of rudder, bow rudders vs stern rudder, forces on rudder, torque on stock, angle of heel, due to force on rudder and angle of heel when turning – problems.

UNIT IV  WAVE THEORY  9
Theory of waves, trochoidal waves, relationship between line of orbit centres and the undisturbed surface, sinusoidal wave, Irregular wave pattern, wave spectra, wave amplitudes, rolling in unresisting media, rolling in resisting media, practical aspects of rolling, Anti rolling devices, forces caused by rolling, pitching, heaving and yawing.

UNIT V  SHIP VIBRATION & NOISE  9
Hull vibration, Engine vibration, vibration of shafting system, engine noise reduction.

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Determine the Ship’s Resistance while sailing.
CO2: Distinguish between the Ship’s Propeller and its types.
CO3: Distinguish between the Ship’s Rudder and its types.
CO4: Understand the students about Wave theory.
CO5: Acquire the knowledge about ship vibration & noise.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
1. R. Battacharjee, "Dynamics of Marine vehicles “SNAME Publication, year
2. Srikant Bhave, “Mechanical Vibrations”, Pearson, 2010
## MAPPING OF COS AND POS:

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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 R

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

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

TOTAL: 30 PERIODS

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.
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

MV3711      PROJECT WORK      L T P C
0 0 6 3

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.

TOTAL: 90 PERIODS

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

COURSE OUTCOMES:
On Completion of the project work students will be able to:
CO1: Analyze engineering the complex problems
CO2: Demonstrate Marine engineering competency skills

MV3811      MARINE WORKSHOP PRACTICAL AND AFLOAT TRAINING      L T P C
0 0 48* 18

OBJECTIVE:
To impart knowledge, skill and to train the students to be able to perform as Engineer officer on board ships.

*The students are required to undergo Marine Workshop Training in DG Shipping approved Marine Engineering Workshop for a duration of 6 months. The training should be as per the Merchant Shipping (Standard of Training Certification and Watch keeping for Seafarers) Rule 1998.

Competency on - use of hand tools used for marine equipment’s for dismantling, maintenance, repair and reassembly of shipboard equipment’s.
Competency on - use of hand tools used for electrical and electronic equipment's, measuring and test equipment's for locating and repairing faults and malfunctions.

100 hrs.

Competency on - Operation of Main and Auxiliary machinery and associated control systems.

100 hrs.

Competency on - Operating pumping systems & associated control systems.

90 hrs.

Competency on - Operating alternators, generators & control systems.

100 hrs.

Competency on - Maintaining alternators, generators and Control systems.

20 hrs.

Competency on - Maintaining Marine Engineering system including control systems (overhauling and maintenance of Marine Diesel Engines, air compressors, heat exchangers, oil separators etc.,)

700 hrs.

Competency on - Controlling and fighting fire onboard.

6 hrs.

Competency on - Operation of life saving appliances.

6 hrs.

Total hrs. of Training: 1152 hrs.

The competency of the students are evaluated by the Marine Engineering Workshop and a report is sent to the college. During the training the students have to maintain a work dairy. After completion of this training the students will be examined as follows:

a) Assessment on work diary (Internal)

200 Marks.

b) *(i) Written test for 1 hour. 10 questions

10 X 10 = 100 Marks

(ii) Viva voce

200 Marks

Total 500 Marks

* Valuation by both Internal and External Examiners.

COURSE OUTCOMES:

On completion of the work shop training the students are expected to have acquired the sufficient knowledge

CO1: In operation, maintenance, repair and refit of Marine machines viz. main engine, auxiliary engines,

CO2: In operation, maintenance, repair and refit of Auxiliaries such as Compressors, Pumps, Steering gear, distillation plant, incinerator, sewage treatment plant etc.,

CO3: In using hand tools, electrical and electronic equipment's,

CO4: In using Measuring and Testing Equipment’s for locating faults, malfunctions

CO5: In repairing faults and malfunctions

CO6: In operation, maintenance, repair and refit of Marine Electrical machines such as Alternators, Generators, Motors, Stabilizers

CO7: Overhauling and maintenance of heat exchangers, oil separators, filters etc.

CO8: Of Firefighting and Lifesaving Methods

CO9: On maintenance of systems and controls

REFERENCES:

1. Original Equipment Manufacturers Manuals for On Board Equipments

MV3001 SHIP LOGISTICS AND MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:
To impart knowledge to the students on:
- International trade logistics and supply chain management
- Block chain Technology
- Role of logistics service provider’s role of logistics service providers supply chain design and strategy
- Supply chain design and strategy
- Warehousing

UNIT I INTERNATIONAL TRADE LOGISTICS AND SUPPLY CHAIN MANAGEMENT
Definition of trade, logistics and supply chain management, supply chain partners in international trade - role of supply chain partners in international trade, types of international trade, cost composition of product in terms of materials and taxes based on Indian environment.

UNIT II BLOCKCHAIN TECHNOLOGY
Emerging models for Block Chain Technology, how Block chain technology affects supply chain – supply chain finance - Application Programming Interface (APIs) for trade finance, Managing Accounts Receivable and Accounts Payable with Block chain
UNIT III  ROLE OF LOGISTICS SERVICE PROVIDERS  
International Lsp types air and sea - role identification – process of lsp offers- negotiation – importance of statutory regulation like service tax etc., on - transportation, warehousing and packaging types and process – related statutory regulations.

UNIT IV  SUPPLY CHAIN DESIGN AND STRATEGY  
How drivers of supply chain interfaced in imports and exports – demand forecasting and budgeting process - pricing of product and services - performance measurement - bull whip effect - outsourcing - role of outsourcing in international supply chain. Co-ordination in a international supply chain: how JIT, VMI and other inventory control operation in ISCM, - reverse logistics in international supply chain - commercial payment process - risk management - commercial and cargo risk

UNIT V  WAREHOUSING  
Definition-nature and importance-role of warehousing in logistic system-types-basic components-functions-warehousing layout and design-warehousing decisions & operations-warehouse productivity. Packaging-importance-advantages objectives and principles-types of packaging materials used-bar coding.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Identify the nature of international trade logistics & supply chain management
CO2: Explain the need and role for block chain technology
CO3: Examine the different Logistics Service Providers
CO4: Discuss the importance of supply chain design and strategy
CO5: Apprise the relevance of warehouse with respect to supply chain management

TEXT BOOKS:
1. Text Book of Logistics and Supply Chain Management, D.K.Agrawal

REFERENCES:
1. Elements of Shipping – Alan E. Branch - Routledge- Special Indian Edition

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MV3002  ENGLISH FOR COMPETITIVE EXAMINATION  

COURSE OBJECTIVES:
To Impart Knowledge to the students on
- Language components essential to face competitive examinations
- Specific patterns in Language Testing
- Respective skills to Tackle verbal reasoning
- Respective skills to Tackle verbal ability tests.
- Language-learning usage accuracy of grammar and coherence in writing.
UNIT I

UNIT II

UNIT III
Reading - Specific information and detail – Identifying main and supporting ideas – Speed reading techniques – Improving global reading skills – Linking ideas – Summarizing – Understanding argument – Identifying opinion/attitude and making inferences - Critical reading

UNIT IV

UNIT V

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Expand their vocabulary knowledge skill sets.
CO2: Gain practical techniques to read and comprehend a wide range of texts with the emphasis required
CO3: Identify errors with precision.
CO4: Write with clarity and coherence
CO5: understand the importance of task fulfillment and the usage of task-appropriate vocabulary

TEXT BOOKS:

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TOTAL: 60 PERIODS
UNIT I  GLOBAL MANAGEMENT -THEORY AND PRACTICE  9

UNIT II  PLANNING AND DECISION MAKING  9

UNIT III  ORGANIZING AND STAFFING  9

UNIT IV  LEADERSHIP AND MOTIVATION  9

UNIT V  CONTROLLING AND CONTROL TECHNIQUES  9
Controlling function- Basic control process- Critical control points-standards- Control as a feedback system- Control of overall performance- Profit & Loss Control-Control through ROI-Management Audits-Balanced score card-effective control. Control techniques: Budget as a control Device-Time-event Network analysis and analytics in Managing-Use of computers in handling information- Digital economy, ecommerce and m-Commerce-Tools to improve productivity and TQM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Function as successful managers.
CO2: Plan and make appropriate decision.
CO3: Organize resources
CO4: Demonstrate Leadership qualities.
CO5: Apply control techniques

TEXT BOOKS:
REFERENCES:


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MV3004 HUMAN RESOURCE MANAGEMENT

COURSE OBJECTIVES:
To impart knowledge to the students on:

- Perspectives in human Resource Management
- Human Resource Planning and Recruitment
- Training and Development
- Employee Engagement
- Performance Evaluation and Control

UNIT I  PERSPECTIVES IN HUMAN RESOURCE MANAGEMENT

UNIT II  HUMAN RESOURCE PLANNING AND RECRUITMENT

UNIT III TRAINING AND DEVELOPMENT

UNIT IV EMPLOYEE ENGAGEMENT

UNIT V PERFORMANCE EVALUATION AND CONTROL

COURSE OUTCOMES:
On completion of course the students will be able to:
CO1: Gain knowledge on the various aspects of HRM.
CO2: Understand the knowledge needed for human resources professional.
CO3: Develop the skills needed for a successful HR Manager
CO4: To apply the concepts learned in the workplace.
CO5: Be aware of the emerging concepts in the field of HRM

REFERENCES:

MV3005 SAFETY PRECAUTIONS AND WATCH KEEPING

COURSE OBJECTIVE:
To impart knowledge to the student’s in
• Safe watch keeping
• Trouble shooting in auxiliary machineries
• Trouble shooting in Main engine
• maintenance of engine components
• Watch-keeping of Engine Room in various types of ships and to prepare for Class IV MOT Examination

UNIT I SAFE WATCH KEEPING
Definition of watch, operating principles, requirements of watch keeping, requirements of certification, duties of engineer officers – operation of engine room in general, log book writing – watch keeping under way – watch keeping at port – at unsheltered anchorage, fitness for duty, preparation of Diesel Engines for a long voyage – bad weather precautions, safe working practices – during overhauling at port, and during bad weather, change over from diesel oil to heavy oil and vice versa. Trouble shooting during watch keeping: Emergency measures taken in case of –flooding of engine room, engine room bilge fire, general fire, In case of any system failure or breakage of pipe lines, etc.

UNIT II TROUBLE SHOOTING IN AUXILIARY MACHINERIES
Malfunctioning, partial or total failure of auxiliary machineries – such as, auxiliary engines, purifiers, heat exchangers, air compressors, reefer and air conditioning compressors and systems, boilers and accessories, fresh water generators, hydrophore tanks and systems, all pumps & systems. Repairs and maintenance of propeller, rudder, dry-docking methods, dry-docking inspection and repair
UNIT III        TROUBLE SHOOTING IN MAIN ENGINE

Trouble shooting related to various types of marine diesel engines and condition monitoring – causes, effects, remedies and prevention of engine not turning on Air and Fuel, knocking at TDC and BDC, black smoke in funnel, poor compression and combustion, early or advanced injection, turbocharger surging, scavenge fire, Air starting line explosion, crank case explosion, exhaust uptake fire, failure of bottom end bolts.

UNIT IV        MAINTENANCE OF ENGINE COMPONENTS

Checking of holding down bolts, resin chocking – Tie-rods tensioning, checking and tightening of 2-stroke and 4-stroke bottom end bolts.
Inspection and maintenance of crankshaft and cam shaft, dismantle inspection and reassemble of main bearings, cross head bearings & bottom end bearings, connecting rod, piston and piston assembly, stuffing box, cylinder head and all mountings, governor and over speed trip – checking of all clearances, adjustments, effect of improper clearances, prevention and rectification.
Cylinder liner and cylinder lubrication, thrust bearing, running gears inspection, engine alignment, chains drive adjustment and tensioning.

UNIT V       TROUBLE SHOOTING AND MAINTENANCE OF ELECTRICAL MACHINERIES

Circuit testing, shore supply arrangement, maintenance of circuit breakers, transformers, electrical motors, navigational lights, batteries, starters, electrical equipments, maintenance of switchboard.
Maintenance of electrical equipments in oil tankers, LNG / LPG carriers.

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Carry out safe Watch-keeping in various ships.
CO2: Understand STCW standards of training, requirements of officers and ratings.
CO3: Identify Trouble shooting in auxiliary machineries
CO4: Maintain and repair Electrical machineries.
CO5: Prevention, rectification and maintenance with respect electrical machineries to trouble shooting of machineries.

TEXT BOOKS:

REFERENCES
1.IME Manuals and Ship’s Marine Manuals.
4.Manual De Maintenance & operation MAN type K.270 120E DMR.

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**MV3006**  
**SHIP SAFETY AND ENVIRONMENTAL PROTECTION**  

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**OBJECTIVE:**

- Learn precautions required for oil tanker operations.
- Learn about MARPOL 73/78 requirements and Safe Working Practices.
- Learn and Understand Life Saving and Survival at Sea techniques.
- Learn about IMO, its conventions and statutory certificates of ships.
- To understand Personnel Management, Training and Emergency drills of ships.

**UNIT I**  
**OIL POLLUTION PREVENTION**

Pollution of the Marine environment while bunkering, loading/discharging oil cargo – tank cleaning – pumping out bilges etc., - knowledge of construction and operation of oil pollution prevention equipment in engine room and on tankers.

**UNIT II**  
**LEGISLATIONS**

MARPOL 73/78 and other country legislations like OPA-90 MARPOL equipment – Knowledge of Codes of Safety Working practices as published – Knowledge of type of information issued by D.G. Shipping with regard to safety at sea & safe working practices.

**UNIT III**  
**SURVIVAL TECHNIQUES AND LIFE SAVING APPLIANCES ON SHIP**


**UNIT IV**  
**RULES & REGULATIONS**

Knowledge of the appropriate statutes of concern to marine engineer officers: The administrative duties of a Chief Engineer – the organisation and training of staff for both normal and emergency duties. The various statutory certificates and documents to be carried onboard ships by all ships: Dangerous goods codes– Carrying more than 2000 tonnes of oil – Chemical tankers and Gas carriers.

**UNIT V**  
**PERSONNEL MANAGEMENT**

9
Organisation of Staff: Manning arrangements – Analysis of work – Allocation of staff – Organisation of safety and emergencies, staff duties, maintenances, Ship's records, communication on the ship, meeting techniques.

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OUTCOMES:
Upon Completion of the Course the students will be able to:
- Take precautions required for oil tanker operations.
- Follow MARPOL 73/78 requirements and Safe Working Practices.
- Handle Life Saving and Survival at Sea techniques.
- Adhere to IMO and its conventions and statutory certificates of ships.
- Carry out understand Personnel Management, Training and Emergency drills of ships

TEXT BOOK:
1. STCW – 1995 Hand Book

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COURSE OBJECTIVE:
To impart knowledge to the students in:
- Complex heat engine plants
- Combustion and flame stabilization
- Turbo blowers and turbo compressors
- Heat exchanger
- Recent trends in Marine Machinery

UNIT I  COMPLEX HEAT ENGINE PLANTS

UNIT II  COMBUSTION AND FLAME STABILISATION

UNIT III  TURBO BLOWERS AND TURBO COMPRESSORS
UNIT IV  HEAT EXCHANGER  
Types – construction – design – applications.

UNIT V  RECENT TRENDS  
Diesel Engines using LNG vapour, cam less intelligent Engines, CRDI, NOx and SOx control by various types – Exhaust gas recirculation – water injection selective cat Reduction – Emission variable injection timing.

TOTAL :45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Understand the Complex of heat engine plants
CO2: Identify the troubles of Combustion and flame stabilization
CO3: Understand the characteristics and performance of Turbo blowers and turbo compressors
CO4: Maintain and repair Heat exchanger
CO5: Understand the recent trends in Marine Machinery

TEXT BOOKS:
2. Gorla, “ Turbomachinery” 1st Ed. Taylor & Francis, First Indian reprint 2011(Yesdee Publishing)

REFERENCES

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MV3008  MARINE ENGINEERING THERMODYNAMICS  L T P C  3 0 0 3

COURSE OBJECTIVE:
To impart knowledge to the students on.
- Basic concepts and first law of thermodynamics
- Basic concepts of second law of thermodynamics
- Fluid cycles
- Gas power cycles
- Thermodynamic relations and combustion of fuel

UNIT I  BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS  9
Thermodynamic systems, concepts of continuum, thermodynamic properties, equilibrium, processes, cycle, work, heat, temperature, Zeroth law of thermodynamics. First law of thermodynamics – applications to closed and open systems, internal energy, specific heats, enthalpy, – applications to steady and unsteady flow conditions.

UNIT II  BASIC CONCEPTS OF SECOND LAW OF THERMODYNAMICS  9
Thermodynamic systems, second law of thermodynamics, Reversibility, causes of irreversibility, Carnot cycle, reversed Carnot cycle, heat engines, refrigerators, and heat pumps. Clausius inequality, entropy, principles of increase in entropy, Carnot theorem, available energy, availability.

**UNIT III          FLUID CYCLES**
Thermodynamic properties of pure substances, property diagram, PVT surface of water and other substances, calculation of properties, first law and second law analysis using tables and charts.

**UNIT IV         GAS POWER CYCLES**

**UNIT V          THERMODYNAMIC RELATIONS AND COMBUSTION OF FUEL**
Exact differentials, T-D diagrams, Maxwell relations, Clasius Claperon Equations, Joule Thomson coefficients. Heat value of fuels, Combustion equations, Theoretical and excess air, Air fuel ratio and Exhaust gas analysis

**COURSE OUTCOMES:**
On completion of the course the students will be able to:
- CO1: Knowledge on the basic concepts and first law of thermodynamics
- CO2: Understand the concepts of second law of thermodynamics
- CO3: Calculate the properties of substances.
- CO4: Calculate the properties of ideal and real gases.
- CO5: Knowledge on fuel used in IC Engines and Combustion of Fuels

**TEXT BOOKS:**

**REFERENCES:**

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TOTAL:45 PERIODS
COURSE OBJECTIVE:
To impart knowledge to the students on.
- Mechanisms
- Theory of gearing
- Control mechanisms
- Balancing
- Vibration

UNIT I MECHANISMS
Introduction – science of mechanisms – terms and definitions kinematic inversion – slider crank chain inversions – four bar chain inversions – Grashoff’s law – Determination of velocities and acceleration in mechanisms – relative motion method (graphical) for mechanisms having turning, sliding and rolling pair – Coriolis acceleration

UNIT II THEORY OF GEARING
Classification of gears, law of gearing, nomenclature – involutes as a gear tooth profile – lay out of an involute gear, producing gear tooth – interference and undercutting – minimum number of teeth to avoid interference, contact ratio, internal gears – cycloid tooth profiles – comparison of involutes and cycloidal tooth forms, Backlash of Marine Gearing. Self-Shift Synchronous Gears.

UNIT III CONTROL MECHANISMS
Governors – gravity controlled and spring controlled – governor characteristics – governor effort and power - Gyroscopes – gyroscopic forces and couple – forces on bearing due to gyroscopic action – gyroscopic effects on the movement of air planes and ships, stability of two wheel drive and four wheel drive

UNIT IV BALANCING

UNIT V VIBRATION
Periodic motion – non harmonic periodic motion – undamped free vibration – linear and torsion solution – natural frequency of single degree freedom system — Free vibrations with viscous damping of single degree freedom system and solution – logarithmic decrement.
Forced vibration of single degree freedom system with damping – reciprocating and rotating unbalance – vibration isolation and transmissibility System with two degrees of freedom – shaft with two rotors, system with many degrees of freedom – three rotor system – geared system- torsional vibration of major components in Ships - problems.

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Analysis the various forces
CO2: Classify the gears and identify various parameters of gears and gear trains
CO3: Evaluate Governors and gyroscopic forces & couple
CO4: Explain the Concept of Static and dynamic balancing
CO5: Problem analysis due to vibration.

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MV3010 MARINE MANUFACTURING TECHNOLOGY

L T P C
3 0 0 3

COURSE OBJECTIVE:
To impart knowledge to the students on.

- Metal joining processes
- Casting processes
- Surface finishing processes
- Metal forming processes
- Machining processes

UNIT I METAL JOINING PROCESSES

UNIT II CASTING PROCESSES

UNIT III SURFACE FINISHING PROCESSES

UNIT IV METAL FORMING PROCESSES

UNIT V MACHINING PROCESSES
Lathe: working principle, classification, specification accessories, lathe and tool holders, different operations on a lathe, methods of taper turning machining time and power required for cutting, Drilling and boring - classification, specification, cutters speed feed, machining time parts and description of parts parts-boring machines- jig borer –description, types and hole location procedures – milling - classification, principle, parts- specification milling cutters indexing, selection of milling /c fundament also finches processes, milling processes and operations – CNC machines.

TOTAL :45 PERIODS
OUTCOMES:
On completion of the course the students will be able to:
- Carry out Metal joining processes
- Understand Casting processes
- Evaluate Surface finishing processes
- Design Metal forming processes
- Classify Machining processes

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MV3011 MARINE ENGINEERING MATERIALS

COURSE OBJECTIVES:
To Impart Knowledge to the Students on
- Fundamentals of metallurgy
- Heat treatment
- Mechanical properties and testing
- Material processing
- Testing of joints

UNIT I  FUNDAMENTALS OF METALLURGY  9

UNIT II  HEAT TREATMENT  9
carburizing, nitriding, cyaniding, carbonitriding, flame and induction hardening – precipitation hardening.

UNIT III  MECHANICAL PROPERTIES AND TESTING  9
Mechanism of plastic deformation, slip and twinning – Types of fracture – Failure modes - Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Impact test - Izod and Charpy, Fatigue and creep tests, fracture toughness tests.

UNIT IV  MATERIAL PROCESSING  9
Properties and applications of materials used in machinery on board ships. Engineering processes used in construction and repair. Design characteristics and selection of materials in construction of equipment – Welding, Gas cutting methods.

UNIT V  TESTING OF JOINTS  9
Materials under load, self-secured joints, permanent joints, bonding plastics, adhesives and bonding. Vibration tests. Destructive and non-destructive testing of materials – different methods

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Distinguish the Properties of metals & non-metals and uses
CO2: Demonstrate the various heat treatment processes
CO3: Demonstrate Metal Processing methods
CO4: Conduct destructive and non-destructive tests on materials.

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COURSE OBJECTIVES:
To impart knowledge to the students on
- Sacrificial and Cathodic protection
- Hull plate preparation
- Modern paint types
- Corrosion in boiler
- Corrosion and its prevention

UNIT I  INTRODUCTION  9

UNIT II  HULL PLATE PREPARATION  9

UNIT III  MODERN PAINT TYPES  9

UNIT IV  CORROSION IN BOILER  9

UNIT V  CORROSION AND ITS PREVENTION  9

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Identify the Causes of Hull corrosion
CO2: Apply correct Method of prevention during operation.
CO3: Select Anti-corrosive paints
CO4: Detect Corrosion in BOILERS and IC ENGINES
CO5: Design and develop mechanism of corrosion.

TOTAL: 45 PERIODS

TEXT BOOKS:
1. Lavery, H.I., “Shipboard operations” Institute of Marine Engineers Publication, 1990

REFERENCES
COURSE OBJECTIVE:
To impart knowledge to the students on
- Sliding and Rolling Contact bearings
- Spur, Helical Bevel and Worm Gears
- IC Engine Parts
- Valves & Lifting Devices
- Design criteria for Marine systems

UNIT I SLIDING AND ROLLING CONTACT BEARINGS

UNIT II SPUR, HELICAL BEVEL AND WORM GEARS
Basic design principles of spur gears, helical gears, dynamic tooth loads, design for strength and wear. Lewis and Buckingham equations. Basic design principles of bevel gears and worm gears, Lewis formula, thermal rating of worm gears.

UNIT III IC ENGINE PARTS
Piston, connecting rod with bearings, crankshaft, flywheel and rocker arms

UNIT IV VALVES & LIFTING DEVICES
Valves, safety valves and reducing valves - crane hooks, lifting chains, chain blocks, E.O.T. Crane.

UNIT V DESIGN CRITERIA FOR MARINE SYSTEMS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Identify suitable types of Bearings.
CO2: Design of IC Engine parts and gears.
CO3: Design of Marine Machinery systems.
CO4: Conduct tests on valves
CO5: Understand the design criteria for marine systems.
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MV3014 SPECIAL DUTY VESSELS AND TYPE OF OPERATION L T P C 3 0 0 3

COURSE OBJECTIVE:
To impart knowledge to the students on
- Operation of Bulk Carriers
- Oil Tanker Cargo Operations
- Oil Tankers Routine Operations
- Intrinsically Dangerous Cargos
- Rules and Regulations

UNIT I INTRODUCTION 9
Need for special duty vessels with reference to development of trade and necessities of the trade. Operation of Bulk carriers – Bulk Grain and ore etc., Banana carriers – Coal Carriers – Forest Products carriers – Timber carriers – Container vessels.

UNIT II OIL TANKER CARGO OPERATIONS 9

UNIT III OIL TANKERS ROUTINE OPERATIONS 9
Inert Gas system – principle – components of system, plant and distribution system – uses of inert gas during tanker operating cycle. Tank washing: Procedure – portable and fixed machines – tank washing with water – washing atmospheres – crude oil washing (COW) – advantages and
disadvantages of COW – operating and safety procedures – gas freeing – pressure vacuum values – “Load on Top” system (LOT) regulations and operation – Segregated Ballast Tanks (SBT).

UNIT IV INTRINSICALLY DANGEROUS CARGOS

UNIT V RULES AND REGULATIONS
Classification societies for hull, equipment and machineries of Cargo ships and oil tankers – requirements of various types of surveys and certification of Merchant Ships.

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Create the need for special duty vessels
CO2: Familiarized with Operation of Bulk Carriers
CO3: Familiarized with Oil Chemical tankers, LPG / LNG vessels Cargo Operations
CO4: Conduct Oil Tankers Routine maintenance
CO5: Classify Intrinsically Dangerous Cargos

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MV3015 MARINE VEHICLES

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UNIT I  MARINE VEHICLES  6
Types – general – by function – commercial marine vehicles- submersibles types – applications

UNIT II  SUBMERSIBLES  9
Manned and unmanned submersibles – towed vehicles – gliders – crawler – Design and construction

UNIT III  REMOTELY OPERABLE VEHICLE (ROV)  9

UNIT IV  AUTONOMOUS UNDERWATER VEHICLE (AUV)  9

UNIT V  MANNED SUBMERSIBLE  12
Introduction – Design and operational consideration – pressure hulls and exostructures – ballasting and trim – maneuvering and control – Life support and habitability – emergency devices and equipment’s – certification and classification

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Distinguish the different types of marine vehicle
CO2: Familiarize with Submersibles vehicle
CO3: Understand the operation of Remotely Operable vehicle (ROV)
CO4: Understand the operation of Autonomous underwater vehicle (AUV)
CO5: Design operation of Manned submersible vehicle

TEXT BOOKS:
1. Jonathan M. Ross, human factors for naval marine vehicle design and operation
4. R. Frank Busby, Manned Submersibles, Office of the oceanographer of the Navy, 1976
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COURSE OBJECTIVES:
To impart knowledge to the students on:

- Performance characteristics of fuel cell power plant and its components.
- Performance and design characteristics and operating issues for various fuel cells.
- Design philosophy and challenges to make this power plant economically feasible.
- Design and analysis emphasis will be on the thermodynamics and electrochemistry.
- Working in a fuel cell industry R&D organization.

UNIT I INTRODUCTION AND OVERVIEW OF FUEL CELLS TECHNOLOGY

UNIT II FUEL CELL THERMODYNAMICS.
Gibbs free energy; reversible and irreversible loss - Nernst Equation; effect of temperature and pressure concentration on Nernst potential – Concept of Electrode potential and Electrochemical Potential.

UNIT III HYDROGEN FUEL AND FUEL CELL
Properties of hydrogen as fuel, Hydrogen pathways introduction-current uses, general introduction to infrastructure requirement for hydrogen production, storage, dispensing and utilization, and hydrogen production plants. low and high temperature fuel cells - Effect of Green House Gas (GHG) emission - Basic fuel cell operations -Fuel cell and Hydrogen economy - Basic electrochemistry for all fuel cells

UNIT IV APPLICATIONS OF FUEL CELLS
Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space, economic and environmental analysis on usage of hydrogen and fuel cell. Future trends in fuel cells, portable fuel cells, laptops, mobiles, submarines.

UNIT V HYDROGEN PRODUCTION AND STORAGE.
Thermal-Steam reformation, thermochemical water splitting, gasification-pyrolysis, nuclear thermal catalytic and partial oxidation methods. Electrochemical-Electrolysis, photo electro chemical, Biological-Anaerobic digestion, fermentation micro-organism, PM based electrolyser- Physical and chemical properties, general storage methods, compressed storage-composite cylinders, glass micro sphere storage, zeolites, metal hydride storage, chemical hydride storage and cryogenic storage, carbon based materials for hydrogen storage.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:

CO1: Apply know-how of thermodynamics, electrochemistry, heat transfer, and fluid mechanics principles to design and analysis of this emerging technology.

CO2: Have thorough understanding of performance behavior, operational issues and challenges for all major types of fuel cells.

CO3: Identify, formulate, and solve problems related to fuel cell technology keeping in mind economic viability.

CO4: Use the techniques, skills, and modern engineering tools necessary for design and analysis of innovative fuel cell systems.

CO5: Understand the impact of this technology in a global and societal context.

CO6: Develop enough skills to design systems or components of fuel cells.

CO7: Be ready to begin a career as an engineer in companies developing fuel cell components and systems.

TEXT BOOKS:
REFERENCES:
5. K. Hemmes, G. Lindbergh, J. R. Selman, D. A. Shores, and I. Uchida, Carbonate Fuel Cell Technology, PV 99-20, Honolulu, Hawaii, Fall 1999, Published by The Electrochemical Society, Inc., 10 South Main Street, Pennington, NJ, 08534; Tel: 609-7371902; website: www.electrochem.org

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COURSE OBJECTIVES:
- To impart knowledge on the following topics;
- Testing of power apparatus and insulation coordination
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Measurement of over voltages.
- Generation of over voltages in laboratories.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS
Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages, Corona and its effects—Bewley lattice Diagram—Protection against over voltages.

UNIT II DIELECTRIC BREAKDOWN
Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown impure and commercial liquids, Maintenance of oil Quality—Breakdown mechanisms in solid and composite Dielectrics-Applications of insulating materials in electrical equipment's.

UNIT III GENERATION OF HIGH VOLTAGES AND HIGH CURRENTS
UNIT IV  MEASUREMENT OF HIGH VOLTAGES AND HIGH CURRENTS  9

UNIT V  HIGH VOLTAGE TESTING & INSULATION COORDINATION  9
High voltage testing of electrical power apparatus as per International and Indian standards–Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers –Insulation Coordination & testing of capabilities.

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Have thorough understanding of Transients in power system.
CO2: Identify, formulate, and solve problems related to Generation and measurement of high voltage.
CO3: Explain High voltage testing.
CO4: Understand various types of over voltages in power system.
CO5: Measure over voltages.

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MV3018  MARINE CONTROL ENGINEERING AND AUTOMATION  L T P C
3 0 0 3

COURSE OBJECTIVE:
To provide knowledge to the students on
• Control system
• Graphical representation of signals
• Process control systems
• Transmission
• Application of controls on ships
UNIT I  CONTROL SYSTEM
Introduction to control terms, Block diagrams for control systems, open loop and closed feedback control, comparison of closed and open loop, feed forward control. Feed forward modification. ON-OFF control, sequential control, Proportional plus integral plus derivative controls. Use of various control modes, Mathematical Model: Developing Mathematical Models for Mechanical, Hydraulic, Pneumatic, Thermal, Electrical and Electro Mechanical Systems

UNIT II  GRAPHICAL REPRESENTATION OF SIGNALS
Inputs of step, Ramp, Sinusoid, Pulse and Impulse, Exponential Function etc Error Detector, Controller output elements. Dynamics of a simple servomechanism for Angular Position Control: Torque Proportional to error, Different responses of servomechanism.

UNIT III  PROCESS CONTROL SYSTEMS

UNIT IV  TRANSMISSION

UNIT V  APPLICATION OF CONTROLS ON SHIPS
Marine Boiler - Automatic Combustion control, Air - Fuel ratio control, feed water control single, two and three-element type, steam pressure control, fuel oil temperature control, Control in Main Machinery units for temperature of lubricating oil, jacket cooling water, fuel valve cooling water, piston cooling water and scavenge air, fuel oil viscosity control. Bridge control of main machinery, Instruments for UMS classification.

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Classify basics of Control systems.
CO2: Create Graphical representation of signals.
CO3: Choose Electrical, Electronics, Pneumatic and Hydraulic control systems.
CO4: Understand Pneumatic and electric transmission
CO5: Design control systems for on board ships.

TOTAL: 45 PERIODS

TEXT BOOKS:

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MV3019  MARINE ELECTRONICS  L T P C
3 0 0 3

COURSE OBJECTIVE:
To impart knowledge to the students on
- Operation Amplifier Theory
- Digital Circuits
- Converters (a-d and d-a)
- Industrial Electronics
- Microprocessors

UNIT I  OPERATION AMPLIFIER THEORY  9
Concept of Differential Amplifiers – its use in DP AMPS, Linear OP amp circuits.

UNIT II  DIGITAL CIRCUITS  11

UNIT III  CONVERTERS; (A-D AND D-A):  10

UNIT IV  INDUSTRIAL ELECTRONICS  8
Power rectification – silicon control rectifier power Control-Filters, RPS –Photoelectric devices – invertors. Satellite communication as applicable to GMDSS, GPS, Inmarsat. Introduction to ECDIS

UNIT V  MICROPROCESSORS  7
8085 Architecture – Programming – interfacing and Control of motors – Temperature/Speed control – Basics and Control mechanism of PLC.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Understand the concepts of Amplifier Theory, Digital Circuits, Logic systems and Gates.
CO2: Identify Analog and Digital Converters and their applications
CO3: Select Electronic Instruments and Micro Processors suitable for Marine operations.
CO4: Examine the Satellite communication as applicable to GMDSS, GPS, Inmarsat
CO5: Design the programming of microprocessors.

TEXT BOOKS:
New Delhi, 1995.

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MV3020 MARINE ROBOTICS

COURSE OBJECTIVES:
To impart knowledge to the students on:
- Marine Robots
- Robotic Sailing
- Submersibles
- Autonomous Underwater Vehicle (auv)
- Underwater Vehicle Guidance and Control

UNIT I MARINE ROBOTS
Types and classification of marine robots – robotic sailing – submersibles, applications of sailing robots and submersibles, Limitations in marine autonomy

UNIT II ROBOTIC SAILING
History and recent developments in robotic sailing – miniature sailing robot platform (MOOP) – autonomous sailing vessel – design, development and deployment

UNIT III SUBMERSIBLES

UNIT IV AUTONOMOUS UNDERWATER VEHICLE (AUV)

UNIT V UNDERWATER VEHICLE GUIDANCE AND CONTROL

TOTAL: 45 PERIODS
COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Display the knowledge in various types of marine robots.
CO2: Understand the basic concepts of designing robots.
CO3: Develop and deploy marine robots in the field
CO4: Design AUV
CO5: Familiarized with stability and control of underwater vehicles

TEXT BOOKS:
4. 4 Thor I Fossen, "Guidance and control of ocean vehicles", John wiley and Sons, 1999

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MV3021 CYBER PHYSICAL SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To learn about the principles of cyber-physical systems
- To familiarize with the basic requirements of CPS.
- To know about CPS models
- To facilitate the students to understand the CPS foundations
- To make the students explore the applications and platforms.

UNIT I INTRODUCTION TO CYBER-PHYSICAL SYSTEMS

UNIT II CPS - REQUIREMENTS

UNIT III CPS MODELS
UNIT IV CPS FOUNDATIONS
Symbolic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Scheduling for CPS

UNIT V APPLICATIONS AND PLATFORMS
Medical CPS- CPS Built on Wireless Sensor Networks- CyberSim User Interface- iCleboKobuki - iRobot Create- myRIO- Cybersim- Matlab toolboxes - Simulink

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Explain the core principles behind CPS
CO2: Discuss the requirements of CPS.
CO3: Explain the various models of CPS.
CO4: Describe the foundations of CPS.
CO5: Use the various platforms to implement the CPS

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MV3022 AUTONOMOUS SHIPS

COURSE OBJECTIVES:
To impart knowledge to the students on
- Remote Controlled Ship Operation
- Marine Situational Awareness and Autonomous Navigation
- Legal Implications of Remote and Autonomous Shipping
- Safety and Security in autonomous shipping
- Innovations to Markets, Redefining Shipping

UNIT I INTRODUCTION
Background-AAWA Initiative-Vision of remote controlled ship Operation-Voyage planning and initiation Unmooring and maneuvering out of Harbor-Operation modes at open Sea-Port approach and docking Applicability for different ship types
UNIT II  TECHNOLOGIES FOR MARINE SITUATIONAL AWARENESS AND AUTONOMOUS NAVIGATION  
Autonomous navigation of the Vessel-Situational awareness (SA) for autonomous ships-Off-ship communication

UNIT III  LEGAL IMPLICATIONS OF REMOTE AND AUTONOMOUS SHIPPING  

UNIT IV  SAFETY AND SECURITY IN AUTONOMOUS SHIPPING – CHALLENGES FOR RESEARCH AND DEVELOPMENT  
Introducing of autonomous merchant ships for maritime Operation-Are ‘unmanned ships’ safe? Preconditions of safety and Security-Focal areas of risk – some selected examples Managing shipping safety and security in short and long Term-Building risk understanding for the future Recommendations

UNIT V  INNOVATIONS TO MARKETS – REDEFINING SHIPPING  
Redefining shipping – a transition to autonomous Shipping-Autonomous shipping – an issue of business relationships and Networks-Autonomous shipping – a renewed set of roles between the key Factors-Transition drivers to autonomous Shipping-Transition roadmap

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course the students will be able to:
CO1: Understand the remote Controlled Ship Operation
CO2: Gain Situational Awareness and Autonomous Navigation
CO3: Familiarized with Legal Implications of Remote and Autonomous Shipping
CO4: Create Safety and Security for autonomous shipping
CO5: Design Innovations to Markets.

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COURSE OBJECTIVES:
To impart knowledge to the students on:
- Marine Resources
- Underwater Exploration
- Subsea Pipeline and Risers
- Introduction to Underwater Vehicles
- Underwater Navigation & Sensing Systems

UNIT I  MARINE RESOURCES  9
Introduction, Challenges in deep sea, Seafloor characteristics, Physical properties of sea water. Effects of density, salinity and temperature on sound speed, Ocean resources, classification, potential uses of sea, Mineral and hydrocarbon resources

UNIT II  UNDERWATER EXPLORATION  9
Exploration, development, Underwater Sound Channels, Underwater instruments for positioning, signal transfer and mapping, production of hydrocarbons, deep sea mining – national developments

UNIT III  SUBSEA PIPELINE AND RISERS  9
Introduction subsea pipeline, Pipeline Elements, Piping material selection, Pipeline survey and mapping, Pipeline route; Pipeline Installation Methods. Riser – different types of risers

UNIT IV  INTRODUCTION TO UNDERWATER VEHICLES  9
Introduction, unmanned marine vehicles – Applications, Unmanned surface vehicles, unmanned underwater vehicles – Remotely Operated Vehicles (ROVs) and Autonomous Underwater Vehicles (AUVs), Classification, Types of ROV services, Operations, Type of propulsions, Design theory – Vehicle design and stability

UNIT V  UNDERWATER NAVIGATION & SENSING SYSTEMS  9
Vehicle sensors; Function of sensors, Types of sensors, Sensor Categories Vehicle navigation sensors, Flux gate compass, Tether turn counter, Pressure-sensitive depth gauge, Obstacle avoidance sonar, Altimeter, Inclinometer, Vehicle lighting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of the course, the students will be able to:
1. List the various challenges involved in the underwater exploration
2. Explain the importance of ocean resources
3. Make use of the national developments in underwater exploration of resources
4. Inspect the different pipeline methods and their installation with respect to subsea applications
5. Develop the various sensors and navigation systems used for underwater Application

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MV3024 OFFSHORE TECHNOLOGY

COURSE OBJECTIVES:
To impart knowledge to the students on:
- Offshore Structures
- Ocean Environments
- Loads and Responses
- Fixed Offshore Platform Design factors
- Floating Offshore Platform Design Factors

UNIT I INTRODUCTION OF OFFSHORE STRUCTURES
9

UNIT II OCEAN ENVIRONMENTS
9

UNIT III LOADS AND RESPONSES
9

UNIT IV FIXED OFFSHORE PLATFORM DESIGN FACTORS
9

UNIT V FLOATING OFFSHORE PLATFORM DESIGN FACTORS
9

TOTAL: 45 PERIODS
COURSE OUTCOME:
On completion of the course the students will be able to:
CO1: Definition of Offshore Structures.
CO2: Understand Ocean Environments
CO3: Classify the Loads applied on Offshore structures.
CO4: Apply Design factors for Fixed Offshore Platform
CO5: Functional requirements for Floating Offshore Platform.

TEXT BOOKS:

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GE3751 PRINCIPLES OF MANAGEMENT

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

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING 9

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

TOTAL : 45 PERIODS

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

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GE3752 TOTAL QUALITY MANAGEMENT L T P C
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COURSE OBJECTIVES:
- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.
UNIT I  
INTRODUCTION  
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM– Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II  
TQM PRINCIPLES  

UNIT III  
TQM TOOLS & TECHNIQUES I  

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

UNIT V  
QUALITY MANAGEMENT SYSTEM  

TOTAL: 45 PERIODS

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

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TEXT BOOK:
GE3753          ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING

COURSE OBJECTIVES:

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

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

UNIT II      PRODUCTION AND COST ANALYSIS

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

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

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

COURSE OUTCOMES: Students able to

CO1: Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions

CO2: Evaluate the economic theories, cost concepts and pricing policies

CO3: Understand the market structures and integration concepts

CO4: Understand the measures of national income, the functions of banks and concepts of globalization

CO5: Apply the concepts of financial management for project appraisal

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

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GE3754 HUMAN RESOURCE MANAGEMENT

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

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

UNIT II HUMAN RESOURCE PLANNING

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

UNIT IV EMPLOYEE COMPENSATION

UNIT V PERFORMANCE EVALUATION AND CONTROL

TOTAL: 45 PERIODS

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

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GE3755 KNOWLEDGE MANAGEMENT

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

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

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING

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

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

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

**TOTAL : 45 PERIODS**

**COURSE OUTCOMES:**
Upon completion of the course, the student should be able to:

- **CO1:** Understand the process of acquiring knowledge from experts.
- **CO2:** Understand the learning organization.
- **CO3:** Use the knowledge management tools.
- **CO4:** Develop knowledge management applications.
- **CO5:** Design and develop enterprise applications.

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**TEXT BOOK:**

**REFERENCE:**

**GE3792 INDUSTRIAL MANAGEMENT**

**COURSE OBJECTIVES**
1. To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
2. To study the planning; organizing and staffing functions of management in professional organization.
3. To study the leading; controlling and decision making functions of management in professional organization.
4. To study the organizational theory in professional organization.
5. To learn the principles of productivity and modern concepts in management in professional organization.

**UNIT – I INTRODUCTION TO MANAGEMENT**
9
Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg’s Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

**UNIT – II FUNCTIONS OF MANAGEMENT – I**
9
Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.
UNIT – III  FUNCTIONS OF MANAGEMENT – II  9
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT – IV  ORGANIZATION THEORY  9
Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow’s hierarchy of needs theory; Herzberg’s motivation-hygiene theory; McClelland’s three needs motivation theory; Vroom’s valence-expectancy theory – Change Management: Concept of Change; Lewin’s Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT – V  PRODUCTIVITY AND MODERN TOPICS  9
Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students would be able to
CO1 Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.
CO2 Discuss the planning; organizing and staffing functions of management in professional organization.
CO3 Apply the leading; controlling and decision making functions of management in professional organization.
CO4 Discuss the organizational theory in professional organization.
CO5 Apply principles of productivity and modern concepts in management in professional organization.

TEXT BOOKS:

REFERENCES:

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MANDATORY COURSES I

MX3081 INTRODUCTION TO WOMEN AND GENDER STUDIES

COURSE OUTLINE

UNIT I CONCEPTS
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN’S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL
Rise of Feminism in Europe and America.
Women’s Movement in India.

UNIT IV GENDER AND LANGUAGE
Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION
Advertising and popular visual media.
Gender and Representation in Alternative Media. Gender and social media.

TOTAL : 45 PERIODS

MX3082 ELEMENTS OF LITERATURE

OBJECTIVE:
- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. COURSE CONTENTS
Introduction to Elements of Literature

1. Relevance of literature
   a) Enhances Reading, thinking, discussing and writing skills.
   b) Develops finer sensibility for better human relationship.
   c) Increases understanding of the problem of humanity without bias.
   d) Providing space to reconcile and get a cathartic effect.

2. Elements of fiction
   a) Fiction, fact and literary truth.
   b) Fictional modes and patterns.
   c) Plot character and perspective.

3. Elements of poetry
   a) Emotions and imaginations.
   b) Figurative language.
c) (Simile, metaphor, conceit, symbol, pun and irony).
d) Personification and animation.
e) Rhetoric and trend.

4. **Elements of drama**
a) Drama as representational art.
b) Content mode and elements.
c) Theatrical performance.
d) Drama as narration, mediation and persuasion.
e) Features of tragedy, comedy and satire.

3. **READINGS:**
3.1 Textbook:
3.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

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

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

**TOTAL : 45 PERIODS**

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

**MX3083 FILM APPRECIATION**

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

**Theme - A: The Component of Films**
A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making... structure of a film

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

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

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

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

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

**MX3084 DISASTER RISK REDUCTION AND MANAGEMENT**

**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

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MANDATORY COURSES II
MX3085 WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA
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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 - Sadvrittta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocsm and Microcosm theory - Pancheekaran 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:
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
2. Simple lifestyle modifications to maintain health
https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-
health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to %20cook.
3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html
5. Benefits of healthy eating https://www.cdc.gov/nutrition/resources-
publications/benefits-of-healthy-eating.html
6. Food additives
7. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/
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://yogamedicine.com/guide-types-yoga-styles/
Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-
ayurveda
10. CAM : https://www.hindawi.com/journals/ecam/2013/376327/
11. Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSE OUTCOMES:
After completing the course, the students will be able to:
- Learn the importance of different components of health
- Gain confidence to lead a healthy life
- Learn new techniques to prevent lifestyle health disorders
- Understand the importance of diet and workouts in maintaining health

MX3086 HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA
L T P C
3 0 0 0

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

UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA
Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT-III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA
Technology in pre-historic period
Beginning of agriculture and its impact on technology
Science and Technology during Vedic and Later Vedic times Science and technology from 1st century AD to C-1200.

UNIT-IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA
Legacy of technology in Medieval India, Interactions with Arabs
Development in medical knowledge, interaction between Unani and Ayurveda and alchemy
Astronomy and Mathematics: interaction with Arabic Sciences
Science and Technology on the eve of British conquest
UNIT-V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA
Science and the Empire
Indian response to Western Science
Growth of techno-scientific institutions

UNIT-VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA
Science, Technology and Development discourse
Shaping of the Science and Technology Policy
Developments in the field of Science and Technology Science and technology in globalizing India
Social implications of new technologies like the Information Technology and Biotechnology

TOTAL : 45 PERIODS

MX3087 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY 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. (5 lectures)
(Refs: Marx, Lenin, Mao, M N Roy)
Welfare state. Relation with human desires. Empowered human beings, satisfaction. (3 lectures)
Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one’s lives. Relationship with nature. (6 lectures)
(Refs: M K Gandhi, Schumacher, Kumarappa)
Essential elements of Indian civilization. (3 lectures)
(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)
Technology as driver of society, Role of education in shaping of society. Future directions. (4 lectures) (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)
Conclusion (2 lectures)
Total lectures: 39
Preferred Textbooks: See Reference Books

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

GRADING:

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TOTAL : 45 PERIODS

OUTCOME:
• The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

MX3088 STATE, NATION BUILDING AND POLITICS IN INDIA  L T P C  3 0 0 0

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.


1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies.

Constitution making and the Constitution of India.

Goals, objective and philosophy. Why a federal system?

National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari)

New social movements.

The changing nature of Indian Political System, the future scenario.

What can we do?

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:
It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct
perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

SUGGESTED READING:


MX3089 INDUSTRIAL SAFETY L T P C
3 0 0 0

OBJECTIVES
• To Understand the Introduction and basic Terminologies safety.
• To enable the students to learn about the Important Statutory Regulations and standards.
• To enable students to Conduct and participate the various Safety activities in the Industry.
• To have knowledge about Workplace Exposures and Hazards.
• To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES
Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures- Lead indicators- lag Indicators- Flammability- Toxicity Time-weighted Average (TWA) - Threshold Limit Value (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry- Personnel Protective Equipment- Health and Safety Policy- Material Safety Data Sheet- MSDS

UNIT II STANDARDS AND REGULATIONS

UNIT III SAFETY ACTIVITIES

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

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

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

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

REFERENCES
5. Society of Safety Engineers, USA

ONLINE RESOURCES

CO’s – PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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<tr>
<td>CO1</td>
<td>Understand the basic concept of safety.</td>
<td>PO1 3 PO2 3 PO3 3 PO4 1 PO5 1 PO6 3 PO7 2 PO8 3 PO9 1 PO10 3 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<td>CO2</td>
<td>Obtain knowledge of Statutory Regulations and standards.</td>
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<tr>
<td>CO3</td>
<td>Know about the safety Activities of the Working Place.</td>
<td>PO1 2 PO2 2 PO3 1 PO4 2 PO5 2 PO6 3 PO7 2 PO8 1 PO9 2 PO10 3 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<td>CO4</td>
<td>Analyze on the impact of Occupational Exposures and their Remedies</td>
<td>PO1 3 PO2 3 PO3 2 PO4 2 PO5 3 PO6 2 PO7 3 PO8 2 PO9 1 PO10 3 PO11 3 PO12 3 PSO1 3 PSO2 3 PSO3 3</td>
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<tr>
<td>CO5</td>
<td>Obtain knowledge of Risk Assessment Techniques.</td>
<td>PO1 3 PO2 3 PO3 2 PO4 3 PO5 2 PO6 3 PO7 2 PO8 3 PO9 2 PO10 3 PO11 3 PSO1 3 PSO2 3 PSO3 3</td>
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Industrial safety | PO1 3 PO2 3 PO3 2 PO4 3 PO5 2 PO6 3 PO7 2 PO8 3 PO9 2 PO10 3 PO11 3 PSO1 3 PSO2 3 PSO3 3 |
OBJECTIVES:
The main objectives of this course are to:
1. Understand the importance, principles, and search methods of AI
2. Provide knowledge on predicate logic and Prolog.
3. Introduce machine learning fundamentals
4. Study of supervised learning algorithms.
5. Study about unsupervised learning algorithms.

UNIT I  INTELLIGENT AGENT AND UNINFORMED SEARCH  6

UNIT II  PROBLEM SOLVING WITH SEARCH TECHNIQUES  6
Informed Search - Greedy Best First - A* algorithm - Adversarial Game and Search - Game theory - Optimal decisions in game - Min Max Search algorithm - Alpha-beta pruning - Constraint Satisfaction Problems (CSP) - Examples - Map Coloring - Job Scheduling - Backtracking Search for CSP

UNIT III  LEARNING  6
Machine Learning: Definitions – Classification - Regression - approaches of machine learning models - Types of learning - Probability - Basics - Linear Algebra – Hypothesis space and inductive bias, Evaluation. Training and test sets, cross validation, Concept of over fitting, under fitting, Bias and Variance - Regression: Linear Regression - Logistic Regression

UNIT IV  SUPERVISED LEARNING  6

UNIT V  UNSUPERVISED LEARNING  6
Unsupervised Learning – Principle Component Analysis - Neural Network: Fixed Weight Competitive Nets - Kohonen Self-Organizing Feature Maps – Clustering: Definition - Types of Clustering – Hierarchical clustering algorithms – k-means algorithm

TOTAL : 30 PERIODS

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

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

Unsupervised learning
9. Implementing neural network using self-organizing maps
10. Implementing k-Means algorithm to cluster a set of data.
11. Implementing hierarchical clustering algorithm.
Note:
- 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.

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

TOTAL: 60 PERIODS

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

REFERENCES

OCS352 IOT CONCEPTS AND APPLICATIONS L T P C 2 0 2 3

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

UNIT I INTRODUCTION TO INTERNET OF THINGS 5

UNIT II COMPONENTS IN INTERNET OF THINGS 5
- Functional Blocks of an IoT Ecosystem – Sensors, Actuators, and Smart Objects – Control Units - Communication modules (Bluetooth, Zigbee,Wifi, GPS, GSM Modules)

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 6

UNIT IV OPEN PLATFORMS AND PROGRAMMING 7
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

PRACTICAL EXERCISES: 30 PERIODS
1. Introduction to Arduino platform and programming
2. Interfacing Arduino to Zigbee module
3. Interfacing Arduino to GSM module
4. Interfacing Arduino to Bluetooth Module
5. Introduction to Raspberry PI platform and python programming
6. Interfacing sensors to Raspberry PI
7. Communicate between Arduino and Raspberry PI using any wireless medium
8. Setup a cloud platform to log the data
9. Log Data using Raspberry PI and upload to the cloud platform
10. Design an IOT based system

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

TOTAL: 60 PERIODS

TEXTBOOKS

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

OCS353 DATA SCIENCE FUNDAMENTALS

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:

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

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

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

TOTAL:60 PERIODS
TEXT BOOKS

REFERENCES

CCS333 AUGMENTED REALITY/VIRTUAL REALITY L T P C
2 0 2 3

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

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

TOTAL: 60 PERIODS

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

OPEN ELCTIVE III

OHS351 ENGLISH FOR COMPETITIVE EXAMINATIONS

L T P C
3 0 0 3

COURSE DESCRIPTION:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

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

UNIT I

UNIT II
UNIT III

UNIT IV

UNIT V

TOTAL: 45 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- Expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
- Identify errors with precision and write with clarity and coherence
- Understand the importance of task fulfilment and the usage of task-appropriate vocabulary
- Communicate effectively in group discussions, presentations and interviews
- Write topic based essays with precision and accuracy

CO-PO & PSO MAPPING

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

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

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

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

TEXTBOOKS:
OMG352  
NGOS AND SUSTAINABLE DEVELOPMENT  

L T P C  
3 0 0 3

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

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
CO 3 Present strategies for NGOs in attaining sustainable development
CO 4 recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment
CO 5 understand the environmental legislations

REFERENCE BOOKS

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

COURSE OBJECTIVES
1. To know the Indian and global energy scenario
2. To learn the various solar energy technologies and its applications.
3. To educate the various wind energy technologies.
4. To explore the various bio-energy technologies.
5. To study the ocean and geothermal technologies.
UNIT – I  ENERGY SCENARIO
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status - Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT – II  SOLAR ENERGY

UNIT – III  WIND ENERGY

UNIT – IV  BIO-ENERGY

UNIT – V  OCEAN AND GEOTHERMAL ENERGY

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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Low (1) ;     Medium (2) ;       High (3)
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:
- Define & test various hypotheses to mitigate the inherent risks in product innovations.
- Design the solution concept based on the proposed value by exploring alternate solutions to achieve value-price fit.
- Develop skills in empathizing, critical thinking, analyzing, storytelling & pitching
- Apply system thinking in a real-world scenario

TEXT BOOKS
1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.

REFERENCES
1. https://www.ideou.com/pages/design-thinking#process
4. https://blog.forgefor ward.in/evaluating-product-innovations-e8178e58b86e
5. https://blog.forgefor ward.in/user-guide-for-product-innovation-rubric-857181b253dd
6. https://blog.forgefor ward.in/star tup-failure-is-like-true-9b85
COURSE OBJECTIVES:
- The main learning objective of this course is to prepare students for:
  - Applying the fundamental concepts and principles of reverse engineering in product design and development.
  - Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
  - Applying the concept and principles of material identification and process verification in reverse engineering of product design and development.
  - Analysing the various legal aspect and applications of reverse engineering in product design and development.
  - Understand about 3D scanning hardware & software operations and procedure to generate 3D model.

UNIT I  INTRODUCTION & GEOMETRIC FORM  

UNIT II  MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION  

UNIT III  DATA PROCESSING  

UNIT IV  3D SCANNING AND MODELLING  

UNIT V  INDUSTRIAL APPLICATIONS  

TOTAL : 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

AU3791 ELECTRIC AND HYBRID VEHICLES

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

UNIT I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES

UNIT II ENERGY SOURCES

UNIT III MOTORS AND DRIVES
Types of Motors- DC motors- AC motors, PMSM motors, BLDC motors, Switched reluctance motors working principle, construction and characteristics.

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the student will be able to
1. Understand the operation and architecture of electric and hybrid vehicles
2. Identify various energy source options like battery and fuel cell
3. Select suitable electric motor for applications in hybrid and electric vehicles.
4. Explain the role of power electronics in hybrid and electric vehicles
5. Analyze the energy and design requirement for hybrid and electric vehicles.
TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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OPR351 SUSTAINABLE MANUFACTURING

COURSE OBJECTIVES:
- To be acquainted with sustainability in manufacturing and its evaluation.
- To provide knowledge in environment and social sustainability.
- To provide the student with the knowledge of strategy to achieve sustainability.
- To familiarize with trends in sustainable operations.
- To create awareness in current sustainable practices in manufacturing industry.

UNIT – I ECONOMIC SUSTAINABILITY

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

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

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

UNIT – V TRENDS IN SUSTAINABLE OPERATIONS


TOTAL: 45 PERIODS

COURSE OUTCOMES

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

TEXT BOOKS:


REFERENCES:


Mapping of COs with POs and PSOs

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OAS352 SPACE ENGINEERING

OBJECTIVES:

- Use the standard atmosphere tables and equations.
- Find lift and drag coefficient data from NACA plots.
- Apply the concept of static stability to flight vehicles.
- Describe the concepts of stress, strain, Young’s modulus, Poisson’s ratio, yield strength.
- Demonstrate a basic knowledge of dynamics relevant to orbital mechanics.
UNIT I  STANDARD ATMOSPHERE  
History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II  AERODYNAMICS  
Aerodynamic forces – Lift generation Viscosity and its implications - Shear stress in a velocity profile - Lagrangian and Eulerian flow field - Concept of a streamline – Aircraft terminology and geometry - Aircraft types - Lift and drag coefficients using NACA data.

UNIT III  PERFORMANCE AND PROPULSION  
Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations -thrust/power available and thrust/power required.

UNIT IV  AIRCRAFT STABILITY AND STRUCTURAL THEORY  

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

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

TEXT BOOKS:  

REFERENCE:  

UNIT III  ORGANIZATIONAL BEHAVIOUR  9

UNIT IV  GROUP DYNAMICS  9

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

COURSE OUTCOMES:
CO1: Understand the basic concepts of industrial management
CO2: Identify the group conflicts and its causes.
CO3: Perform swot analysis
CO4: Analyze the learning curves
CO5: Understand the placement and performance appraisal

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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  9
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.

COURSE OUTCOMES:
Students will be able to:
CO1: Control the quality of processes using control charts for variables in manufacturing industries.
CO2: Control the occurrence of defective product and the defects in manufacturing companies.
CO3: Control the occurrence of defects in services.
CO4: Analyzing and understanding the process capability study.
CO5: Developing the acceptance sampling procedures for incoming raw material.

CO’s- PO’s & PSO’s MAPPING

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OSF351                    FIRE SAFETY ENGINEERING
L T P C
3 0 0 3

COURSE OBJECTIVES
1: To enable the students to acquire knowledge of Fire and Safety Studies
2: To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance
3: To learn about fire area, fire stopped areas and different types of fire-resistant doors
4: To learn about the method of fire protection of structural members and their repair due to fire damage.
5: To develop safety professionals for both technical and management through 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  9
Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements-standard heating condition, Indian standard test method, performance criteria.

UNIT III  WORKING CONDITIONS  9
Fire separation between building- principle of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors;

UNIT IV  FIRE SEVERITY AND REPAIR TECHNIQUES  9
Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC.. Reparability of fire damaged structures-Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques-repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V  WORKING AT HEIGHTS  9

TOTAL : 45 PERIODS

COURSE OUTCOMES
On completion of the course the student will be able to

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

TEXT BOOKS

REFERENCES:
OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING

L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application.

UNIT I INTRODUCTION TO NDT & VISUAL TESTING
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
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.

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

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OMR351 MECHATRONICS L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Selecting sensors to develop mechatronics systems.
2. Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
3. Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
4. Applying PLC as a controller in mechatronics system.
5. Designing and develop the apt mechatronics system for an application.

UNIT – I INTRODUCTION AND SENSORS
UNIT – II    8085 MICROPROCESSOR

UNIT – III PROGRAMMABLE PERIPHERAL INTERFACE

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

UNIT – V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

TOTAL: 45 PERIODS

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

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

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

UNIT – I  FUNDAMENTALS OF ROBOT

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

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

UNIT – IV  SENSORS IN ROBOTICS
Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT – V  PROGRAMMING AND APPLICATIONS OF ROBOT
Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL : 45 PERIODS

COURSE OUTCOMES
At the end of the course, students will be able to:
CO1: Interpret the features of robots and technology involved in the control.
CO2: Apply the basic engineering knowledge and laws for the design of robotics.
CO3: Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.
CO4: Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.
CO5: Demonstrate the image processing and image analysis techniques by machine vision system.
Mapping of COs with POs and PSOs

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<thead>
<tr>
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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:

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

UNIT IV BASICS OF AIRCRAFT STRUCTURES
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.

TOTAL : 45 PERIODS

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

TEXT BOOKS
   Wiley, NJ, 2021

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

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

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

UNIT I  REMOTE SENSING AND ELECTROMAGNETIC RADIATION
Definition – components of RS – History of Remote Sensing – Merits and demerits of data
collation between conventional and remote sensing methods - Electromagnetic Spectrum –
Radiation principles - Wave theory, Planck’s law, Wien’s Displacement Law, Stefan’s Boltzmann
law, Kirchoff’s law – Radiation sources: active & passive - Radiation Quantities

UNIT II  EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of
radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy
balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance –
Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation,
soil and water – solid surface scattering in microwave region.

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

UNIT IV  SENSING TECHNIQUES
Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal
resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal
sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR, UAV –
Orbital and sensor characteristics of live Indian earth observation satellites
UNIT V  DATA PRODUCTS AND INTERPRETATION
Photographic and digital products – Types, levels and open source satellite data products — selection and procurement of data– Visual interpretation: basic elements and interpretation keys -Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

TOTAL:45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO 1 Understand the concepts and laws related to remote sensing
CO 2 Understand the interaction of electromagnetic radiation with atmosphere and earth material
CO 3 Acquire knowledge about satellite orbits and different types of satellites
CO 4 Understand the different types of remote sensors
CO 5 Gain knowledge about the concepts of interpretation of satellite imagery

TEXTBOOKS:

REFERENCES:

CO-PO MAPPING

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<thead>
<tr>
<th>PO</th>
<th>Graduate Attribute</th>
<th>Course Outcome</th>
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<td>Problem Analysis</td>
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<td>PO3</td>
<td>Design/Development of Solutions</td>
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<td>Conduct Investigations of Complex Problems</td>
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<td>PO9</td>
<td>Individual and Team Work</td>
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<td>PO10</td>
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<td>Project Management and Finance</td>
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<td>Knowledge of Geoinformatics discipline</td>
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<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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OBJECTIVES:
- To introduce the students the principles of agricultural crop production and the production practices of crops in modern ways.
- To delineate the role of agricultural engineers in relation to various crop production practices.

UNIT I INTRODUCTION
Benefits of urban agriculture - economic benefits, environmental benefits, social and cultural benefits, educational, skill-building and job training benefits, health, nutrition and food accessibility benefits.

UNIT II VERTICAL FARMING

UNIT III SOIL LESS CULTIVATION
Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyard gardens - tactical gardens - street landscaping - forest gardening, greenhouses, urban beekeeping

UNIT IV MODERN CONCEPTS
Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops

UNIT V WASTE MANAGEMENT
Concept, scope and maintenance of waste management: recycle of organic waste, garden wastes - solid waste management-scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
CO-PO MAPPING

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<tr>
<th>PO/PSO</th>
<th>CO1</th>
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<td>PO4 Conduct Investigations of Complex Problems</td>
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<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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OEN351 DRINKING WATER SUPPLY AND TREATMENT  

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

UNIT I SOURCES OF WATER  

UNIT II CONVEYANCE FROM THE SOURCE  

UNIT III WATER TREATMENT  
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – sand filters – Disinfection – Construction, Operation and Maintenance aspects.
UNIT IV  ADVANCED WATER TREATMENT


UNIT V  WATER DISTRIBUTION AND SUPPLY


OUTCOMES

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

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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

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

OEE352  ELECTRIC VEHICLE TECHNOLOGY

L T P C  3 0 0 3

COURSE OBJECTIVES

- To provide knowledge about electric machines and special machine
- To understand the basics of power converters
- To know the concepts of controlling DC and AC drive systems
- To understand the architecture and power train components.
- To impart knowledge on vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)
UNIT I  ROTATING POWER CONVERTERS  9
Magnetic circuits - DC machine and AC machine  – Working principle of Generator and Motor DC and AC - Voltage and torque equations – Characteristics and applications. Working principle of special machines like: Brushless DC motor, Switched reluctance motor and PMSM.

UNIT II  STATIC POWER CONVERTERS  9
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  9
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  9

UNIT V  MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES  9
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.

REFERENCE:
INTRODUCTION TO PLC PROGRAMMING

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

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

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

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

UNIT IV  COMMUNICATION OF PLC AND SCADA
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

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

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/etc)
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Communication Network Used for PLC/SCADA.

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

TEXT BOOKS:
1. Frank Petruzzula, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication
REFERENCES:
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles andApplications, Pearson publication

List of Open Source Software/ Learning website:
1. https://nptel.ac.in/courses/108105063

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

<table>
<thead>
<tr>
<th>PO, PSO, CO</th>
<th>PO 01</th>
<th>PO 02</th>
<th>PO 03</th>
<th>PO 04</th>
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OCH351 NANO TECHNOLOGY L T P C 3 0 0 3

UNIT I INTRODUCTION 8
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 8
Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel
technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron
sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III NANO COMPOSITES 10
Definition- importance of nanocomposites- nano composite materials-classification of composites-
metal/metal oxides, metal-polymer- thermoplastic based, thermoset based and elastomer based-
influence of size, shape and role of interface in composites applications.

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES 10
Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional
nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice- clusters
of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods,
thermal analysis method, BET analysis method.

UNIT V APPLICATIONS OF NANO MATERIALS 9
Overview of nanomaterials properties and their applications, nano painting, nano coating,
nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots-
Biological Applications. Emerging technologies for environmental applications- Practice of
nanoparticles for environmental remediation and water treatment.

TOTAL: 45 PERIODS
OUTCOMES:
CO1 Understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications.
CO2 Able to acquire knowledge about the different types of nano material synthesis
CO3 Describes about the shape, size,structure of composite nano materials and their interference
CO4 Understand the different characterization techniques for nanomaterials
CO5 Develop a deeper knowledge in the application of nanomaterials in different fields.

TEXT BOOKS

REFERENCES

COURSE ARTICATION MATRIX

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OBJECTIVE:

- The course emphasis on the molecular safe assembly and materials for polymer electronics.

UNIT I  INTRODUCTION  9

UNIT II  MOLECULAR SELF ASSEMBLY  9

UNIT III  BIO-INSPired MATERIALS  9

UNIT IV  SMART OR INTELLIGENT MATERIALS  9
Criteria for Smartness, Significance of Smart Materials, Representative Examples like Smart Gels and Polymers, Electro/Magneto Rheological Fluids, Smart Electroceramics, Technical Limitations and Challenges, Functional Nanocomposites, Polymer-carbon nanotube composites.

UNIT V  MATERIALS FOR POLYMER ELECTRONICS  9
Polymers for Electronics, Organic Light Emitting Diodes, Working Principle of OLEDs, Illustrated Examples, Organic Field-Effect Transistors Operating Principle, Design Considerations, Polymer FETs vs Inorganic FETs, Liquid Crystal Displays, Engineering Aspects of Flat Panel Displays, Intelligent Polymers for Data Storage, Polymer-based Data Storage-Principle, Magnetic Vs. Polymer-based Data Storage.

TOTAL: 45 PERIODS

OUTCOME:

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

TEXT BOOK:


REFERENCE:

UNIT II TRADITIONAL METHODS OF FOOD PROCESSING

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

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

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE
Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, seaweeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

UNIT II METHODS OF FOOD HANDLING AND STORAGE
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT III LARGE-SCALE FOOD PROCESSING
Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying. Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing.
with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

UNIT IV  FOOD WASTES IN VARIOUS PROCESSES  6
Waste disposal-solid and liquid waste; rodent and insect control; use of pesticides; ETP; selecting and installing necessary equipment.

UNIT V  FOOD HYGIENE  9
Food related hazards – Biological hazards – physical hazards – microbiological considerations in foods. Food adulteration – definition, common food adulterants, contamination with toxic metals, pesticides and insecticides; Safety in food procurement, storage handling and preparation; Relationship of microbes to sanitation, Public health hazards due to contaminated water and food; Personnel hygiene; Training & Education for safe methods of handling and processing food; sterilization and disinfection of manufacturing plant; use of sanitizers, detergents, heat, chemicals, Cleaning of equipment and premises.

COURSE 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

UNIT V  INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Basic Principles of patent law – Basics principles and acquisition of IPR. Ramakrishna T. CIPRA, NLSIU, Bangalore, 2005

COURSE OUTCOME
The student will be able to
C1 Understand and differentiate the categories of intellectual property rights.
C2 Describe about patents and procedure for obtaining patents.
C3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
C4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.
C5 Provide different organizations role and responsibilities in the protection of IPR in the international level.
C6 Understand the interrelationships between different Intellectual Property Rights on International Society

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

UNIT I   RESIN FINISHING

UNIT II   FLAME PROOF & WATERPROOF
Concept of Flame proof & flame retardancy. Flame retardant finishes for cotton, Concept of waterproof and water repellent Finishes, Durable & Semi-durable and Temporary finishes, Concept of Antimicrobial finish.

UNIT III  SOIL RELEASE AND ANTISTATIC FINISHES

UNIT IV   MECHANICAL FINISHES

UNIT V   STIFFENING AND SOFTENING
Concept of stiffening and softening of textile materials. Mechanism in the weight reduction of PET. Concept of Micro encapsulation techniques in finishing process, Nano finish, Plasma Treatment and Bio finishing.

OUTCOMES:
Upon completion of the course, the students will be able to Understand the
- CO: 2 Concept of Flame proof & flame retardancy, waterproof and water repellent, Antimicrobial finishes.
- CO: 3 Concept of Soil Release, Anti Pilling, UV Protection and Antistatic finishes.
- CO: 4 Concept of Mechanical finishing.
- CO: 5 Basics of Micro encapsulation techniques, Nano finish, Plasma Treatment.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

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
Scope of industrial engineering in apparel industry, role of industrial engineers.
Productivity: Definition - Productivity, Productivity measures .Reduction of work content due to the product and process, Reduction of ineffective time due to the management, due to the worker. Causes for low productivity in apparel industry and measures for improvement.

UNIT II  WORK STUDY
Definition, Purpose, Basic procedure and techniques of work-study.
Work environment – Lighting, Ventilation, Climatic condition on productivity. Temperature control, humidity control, noise control measures. Safety and ergonomics on work station and work environment
Material Handling – Objectives, Classification and characteristics of material handling equipments, Specialized material handling equipments.

UNIT III  METHOD STUDY
Definition, Objectives, Procedure, Process charts and symbols. Various charts – Charts indicating process sequence: Outline process chart, flow process chart (man type, material type and equipment type); Charts using time scale – multiple activity chart. Diagrams indicating movement – flow diagram, string diagram, cycle graph, chrono cycle graph, travel chart
MOTION STUDY: Principle of motion economy, Two handed process chart, micro motion analysis – therbligs, SIMO chart.

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

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

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

TOTAL: 45 PERIODS

TEXTBOOKS:

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

## OTT353 BASICS OF TEXTILE MANUFACTURE

**L T P C**

3 0 0 3

**OBJECTIVES:**

To enable the students to learn about the basics of fibre forming, yarn production, fabric formation, coloration of fabrics and garment manufacturing.

**UNIT I** NATURAL FIBRES

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

**UNIT II** REGENERATED AND SYNTHETIC FIBRES

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

**UNIT III** BASICS OF SPINNING

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

**UNIT IV** BASICS OF WEAVING

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

**UNIT V** BASICS OF KNITTING AND NONWOVEN


**TOTAL : 45 PERIODS**
OUTCOMES:
On completion of this course, the students shall have the basic knowledge on
CO1: Classification of fibres and production of natural fibres
CO2: Regenerated and synthetic fibres
CO3: Yarn spinning
CO4: Weaving
CO5: Knitting and nonwoven

TEXTBOOKS

REFERENCES:

COURSE ARTICULATION MATRIX:

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVE:
The course is aimed to

- Gain knowledge about petroleum refining process and production of petrochemical products.

UNIT I
ORIGIN, FORMATION AND REFINING OF CRUDE OIL

UNIT II
CRACKING
Cracking, Thermal Cracking, Vis-breaking, Catalytic Cracking (FCC), Hydro Cracking, Coking and Air Blowing of Bitumen

UNIT III
REFORMING AND HYDROTREATING

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

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

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
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

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

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:
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
Compressional moulding – Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties, moulding materials, process variables and process cycle, Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements. Preforms and preheating- Techniques of preheating. Machines used-Types of compression mould-positive, semi-positive and flash. Common moulding faults and their correction- Finishing of mouldings. Transfer moulding: working principle, equipment, Press capacity-Integral moulds and auxiliary ram moulds, moulding cycle, moulding tolerances, pot transfer, plunger transfer and screw transfer moulding techniques, advantages over compression moulding

UNIT V  BLOW MOLDING, THERMOFORMING AND CASTING  9

TOTAL 45 PERIODS
COURSE OUTCOMES

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

REFERENCES


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

COURSE OBJECTIVES:

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

UNIT I  CLASSIFICATION OF SIGNALS AND SYSTEMS  9


UNIT II  ANALYSIS OF CONTINUOUS TIME SIGNALS  9


UNIT III  LINEAR TIME INVARINT CONTINUOUS TIME SYSTEMS  9

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

UNIT V  LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

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

TEXT BOOKS:

REFERENCES:

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OEC352  FUNDAMENTALS Of ELECTRONIC DEVICES AND CIRCUITS  L T P C
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COURSE OBJECTIVES :
- To give a comprehensive exposure to all types of devices and circuits constructed with discrete components. This helps to develop a strong basis for building linear and digital integrated circuits
- To analyze the frequency response of small signal amplifiers
- To design and analyze single stage and multistage amplifier circuits
- To study about feedback amplifiers and oscillators principles
- To understand the analysis and design of multi vibrators

UNIT I  SEMICONDUCTOR DEVICES
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator
UNIT II AMPLIFIERS
Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – Analysis of CS and Source follower – Gain and frequency response - High frequency analysis.

UNIT III MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – Tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS

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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OBJECTIVES:
• To understand the global trends and development methodologies of various types of products and services
• To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
• To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them into design specification
• To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
• To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I  BASICS OF PRODUCT DEVELOPMENT

UNIT II  REQUIREMENTS AND SYSTEM DESIGN

UNIT III  DESIGN AND TESTING

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

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY

TOTAL: 45 PERIODS

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

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

REFERENCES:

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CBM333 ASSISTIVE TECHNOLOGY L T P C
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OBJECTIVES:
The student should be made to:
• To know the hardware requirement various assistive devices
• To understand the prosthetic and orthotic devices
• To know the developments in assistive technology

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

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

TEXT BOOKS

REFERENCES
4. Cardiac Assist Devices, Daniel Goldstein (Editor), Mehmet Oz (Editor), Wiley-Blackwell April 2000 ISBN: 978-0-879-93449-1

CO’s- PO’s & PSO’s MAPPING

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OMA352 OPERATIONS RESEARCH

OBJECTIVES:
This course will help the students to
- Determine the optimum solution for Linear programming problems.
- Study the Transportation and assignment models and various techniques to solve them.
- Acquire the knowledge of optimality, formulation and computation of integer programming problems.
- Acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
- Determine the optimum solution for non-linear programming problems.
UNIT I  LINEAR PROGRAMMING  

UNIT II  TRANSPORTATION AND ASSIGNMENT PROBLEMS  

UNIT III  INTEGER PROGRAMMING  

UNIT IV  DYNAMIC PROGRAMMING PROBLEMS  

UNIT V  NON-LINEAR PROGRAMMING PROBLEMS  

TOTAL:45 PERIODS

OUTCOMES:
At the end of the course, students will be able to
- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- Analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.
- Solve the integer programming problems using various methods.
- Conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- Determine the optimum solution for non-linear programming problems.

TEXT BOOKS:

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

UNIT I  GROUPS AND RINGS
9
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem.
Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism.

UNIT II  FINITE FIELDS AND POLYNOMIALS
9
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

UNIT III  DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS
9
Division algorithm- Base-b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

UNIT IV  DIOPHANTINE EQUATIONS AND CONGRUENCES
9
Linear Diophantine equations – Congruence’s – Linear Congruence’s - Applications : Divisibility tests - Modular exponentiation - Chinese remainder theorem – 2x2 linear systems.

UNIT V  CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS
9
Wilson’s theorem – Fermat’s Little theorem – Euler’s theorem – Euler’s Phi functions – Tau and Sigma functions.

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

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### OMA354 LINEAR ALGEBRA

**L T P C**

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### COURSE OBJECTIVES:

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

### UNIT I - MATRICES AND SYSTEM OF LINEAR EQUATIONS


### UNIT II - VECTOR SPACES

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

### UNIT III - LINEAR TRANSFORMATION

- Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem– Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation – Diagonalization.

### UNIT IV - INNER PRODUCT SPACES

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

### UNIT V - EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION


**TOTAL : 45 PERIODS**

### COURSE OUTCOMES:

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

1. Test the consistency and solve system of linear equations.
2. Find the basis and dimension of vector space.
3. Obtain the matrix of linear transformation and its eigenvalues and eigenvectors.
4. Find orthonormal basis of inner product space and find least square approximation.
5. Find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

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OBT352        BASICS OF MICROBIAL TECHNOLOGY        L T P C
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COURSE OBJECTIVE:
• Enable the Non-biological student’s to understand about the basics of life science and their pro and cons for living organisms.

UNIT I       BASICS OF MICROBES AND ITS TYPES    9
Introduction to microbes, existence of microbes, inventions of great scientist and history, types of microorganisms – Bacteria, Virus, Fungi.

UNIT II      MICROBIAL TECHNIQUES              9
Sterilization – types – physical and chemical sterilization, Decontamination, Preservation methods, fermentation, Cultivation and growth of microbes, Diagnostic methods.

UNIT III     PATHOGENIC MICROBES            9
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengue, 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, Vermi compost, Pharmaceutical products - Antibiotics, Vaccines

TOTAL: 45 PERIODS

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

**TEXT BOOKS**

**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 & 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**

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

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

UNIT-I INTRODUCTION TO CELL
Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution, Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria, mycoplasma and prions.

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

UNIT III BIO-MEMBRANE TRANSPORT

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

UNIT V CENTRAL DOGMA

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

REFERENCES:

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  

OUTCOMES
By the end of the course, learners will be able to
• Write effective project reports.
• Use statistical tools with confidence.

TOTAL:45 PERIODS
• Explain the purpose and intension of the proposed project coherently and with clarity.
• Create writing texts to suit achieve the intended purpose.
• Master the art of writing winning proposals and projects.

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

**REFERENCES:**

**OMA355** ADVANCED NUMERICAL METHODS

**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


**TEXT BOOKS:**

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OMA356 RANDOM PROCESSES L T P C
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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 9

UNIT II RANDOM PROCESSES 9

UNIT III SPECIAL RANDOM PROCESSES 9

UNIT IV CORRELATION AND SPECTRAL DENSITIES 9

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 9
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.

TOTAL: 45 PERIODS
OUTCOMES
Upon successful completion of the course, students should be able to:

- Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
- Apply the concept random processes in engineering disciplines.
- Understand and apply the concept of correlation and spectral densities.
- Get an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable.
- Analyze the response of random inputs to linear time invariant systems.

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OMA357 QUEUEING AND RELIABILITY MODELLING

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
Classification – Stationary process – Markov process - Poisson process – Discrete parameter

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

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

UNIT IV  SYSTEM RELIABILITY
Reliability and hazard functions- Exponential, Normal, Weibull and Gamma failure distribution –

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

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

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

TEXT BOOKS
   Delhi,2010.

REFERENCES
   2003.
   2016.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science
   Delhi,1983.

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

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT 9
Functions of Production Management - Relationship between production and other functions – Production management and operations management, Characteristics of modern production and operation management, organisation of production function, recent trends in production/operations management - production as an organisational function, decision making in production Operations research

UNIT II PRODUCTION & OPERATION SYSTEMS 9
Production Systems- principles – Models - CAD and CAM- Automation in Production - Functions and significance- Capacity and Facility Planning: Importance of capacity planning- Capacity measurement – Capacity Requirement Planning (CRP) process for manufacturing and service industry

UNIT III PRODUCTION & OPERATIONS PLANNING 9
Facility Planning – Location of facilities – Location flexibility – Facility design process and techniques – Location break even analysis-Production Process Planning: Characteristic of production process systems – Steps for production process- Production Planning Control Functions – Planning phase- Action phase- Control phase - Aggregate production planning

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS 9

UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT 9

TOTAL 45 : PERIODS

COURSE OUTCOMES
Upon completion of this course the learners will be able:
CO1: To understand the basics and functions of Production and Operation Management for business owners.
CO2: To learn about the Production & Operation Systems.
CO4: To known about the Production & Operations Management Processes in organisations.
CO5: To comprehend the techniques of controlling, Production and Operations in industries.

REFERENCES
OCE354 BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT  L T P C
3 0 0 3

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

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).
OMG355  MULTIVARIATE DATA ANALYSIS

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

OUTCOMES:
- Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.
- Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
- Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
- Make better business decisions by using advanced techniques in data analytics.

REFERENCES:
OBJECTIVE:

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

UNIT I INTRODUCTION
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
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
Concepts in lean thinking - Principles of lean construction - Variability and its impact - Traditional construction and lean construction - Traditional project delivery - Lean construction and workflow reliability - Work structuring - Production control.

UNIT IV LEAN TOOLS AND TECHNIQUES

UNIT V LEAN IMPLEMENTATION IN CONSTRUCTION INDUSTRY
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

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

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

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

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

CO4 Apply lean techniques to achieve sustainability in construction projects.

CO5 Apply lean construction techniques in design and modeling.

REFERENCES:
COURSE OBJECTIVES:
To introduce the development, capabilities, applications, of Additive Manufacturing (AM), and its business opportunities.
To be acquainted with vat polymerization and material extrusion processes
To be familiar with powder bed fusion and binder jetting processes.
To gain knowledge on applications of direct energy deposition, and material jetting processes.
To impart knowledge on sheet lamination and direct write technologies.

UNIT I INTRODUCTION

UNIT II VAT POLYMERIZATION AND MATERIAL EXTRUSION

UNIT III POWDER BED FUSION AND BINDER JETTING

UNIT IV MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION

UNIT V SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY
Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

COURSE OUTCOMES:
At the end of this course students shall be able to:
CO1: Recognize the development of AM technology and how AM technology propagated into various businesses and developing opportunities.
CO2: Acquire knowledge on process vat polymerization and material extrusion processes and its applications.
CO3: Elaborate the process and applications of powder bed fusion and binder jetting.
CO4: Evaluate the advantages, limitations, applications of material jetting and directed energy deposition processes.
CO5: Acquire knowledge on sheet lamination and direct write technology.

TEXT BOOKS:
REFERENCES:

CME343 NEW PRODUCT DEVELOPMENT

COURSE OBJECTIVES

1. To introduce the fundamental concepts of the new product development
2. To develop material specifications, analysis, and process.
3. To Learn the Feasibility Studies & reporting of new product development.
4. To study the New product qualification and Market Survey on similar products of new product development
   To learn Reverse Engineering. Cloud points generation, converting cloud data to 3D model

UNIT – I FUNDAMENTALS OF NPD

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.
Detailed study on PPAP with 18 elements reporting, APQP and its 5 Sections, APQP vs PPAP, Importance of SOP (Standard Operating Procedure) – Purpose & documents, deployment in shop floor. Prototyping & RPT - Concepts, Application and its advantages, 3D Printing – resin models, Sand cores for foundries; Reverse Engineering. Cloud points generation, converting cloud data to 3D model – Advantages & Limitation of RE, CE (Concurrent Engineering) – Basics, Application and its advantages in NPD (to reduce development lead time, time to Market, Improve productivity and product cost.)

TOTAL :45 PERIODS

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

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

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

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OME355  INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES  L T P C

3 0 0 3

OBJECTIVES:
The course aims to
- Outline Fundamental concepts in UI & UX
- Introduce the principles of Design and Building an mobile app
- Illustrate the use of CAD in product design
- Outline the choice and use of prototyping tools
- Understanding design of electronic circuits and fabrication of electronic devices

UNIT I  UI/UX
UNIT II  APP DEVELOPMENT
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
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
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
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:
- Create quick UI/UX prototypes for customer needs
- Develop web application to test product traction / product feature
- Develop 3D models for prototyping various product ideas
- Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

MF3010  MICRO AND PRECISION ENGINEERING  LT P C
3 0 0 3

COURSE OBJECTIVES:
At the end of this course the student should be able to
- Learn about the precision machine tools
- Learn about the macro and micro components.
- Understand handling and operating of the precision machine tools.
- Learn to work with miniature models of existing machine tools/robots and other instruments.
- Learn metrology for micro system

UNIT I  INTRODUCTION TO MICROSYSTEMS
Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical, electrical
properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems.

UNIT II FABRICATION PROCESSES FOR MICRO-SYSTEMS 9
Additive, subtractive, forming process, microsystems-Micro-pumps, micro- turbines, micro engines, micro-robot, and miniature biomedical devices

UNIT III INTRODUCTION TO PRECISION ENGINEERING 9
Machine tools, holding and handling devices, positioning fixtures for fabrication/assembly of microsystems. Precision drives: inch worm motors, ultrasonic motors, stick-slip mechanism and other piezo-based devices.

UNIT IV PRECISION MACHINING PROCESSES 9
Precision machining processes for macro components - Diamond turning, fixed and free abrasive processes, finishing processes.

UNIT V METROLOGY FOR MICRO SYSTEMS 9
Metrology for micro systems - Surface integrity and its characterization.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
- Select suitable precision machine tools and operate
- Apply the macro and micro components for fabrication of micro systems.
- Apply suitable machining process
- Able to work with miniature models of existing machine tools/robots and other instruments.
- Apply metrology for micro system

TEXT BOOKS:

REFERENCES:

AU3002 BATTERIES AND MANAGEMENT SYSTEM L T P C
3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to make the students
- To understand the working and characteristics of different types of batteries and their management.
UNIT I  ADVANCED BATTERIES  9
Li-ion Batteries-different formats, chemistry, safe operating area, efficiency, aging. Characteristics- SOC,DOD, SOH. Balancing-Passive Balancing Vs Active Balancing. Other Batteries-NCM and NCA Batteries. NCR18650B specifications.

UNIT II  BATTERY PACK  9
Battery Pack- design, sizing, calculations, flow chart, real and simulation Model.Peak power – definition, testing methods-relationships with Power, Temperature and ohmic Internal Resistance. Cloud based and Local Smart charging.

UNIT III  BATTERY MODELLING  9
Battery Modelling Methods-Equivalent Circuit Models, Electrochemical Model, Neural Network Model. ECM Comparisons- Rint model, Thevenin model, PNGV model. State space Models- Introduction. Battery Modelling software/simulation frameworks

UNIT IV  BATTERY STATE ESTIMATION  9

UNIT V  BMS ARCHITECTURE AND REAL TIME COMPONENTS  9
Battery Management System- need, operation, classification. BMS ASIC-bq76PL536A-Q1 Battery Monitor IC- CC2662R-Q1 Wireless BMS MCU. Communication Modules- CAN Open-Flex Ray- CANedge1 package.ARBIN Battery Tester. BMS Development with Modeling software and Model-Based Design.

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of this course, students will be able to
1. Acquire knowledge of different Li-ion Batteries performance.
2. Design a Battery Pack and make related calculations.
3. Demonstrate a Battery Model or Simulation.
5. Approach different BMS architectures during real world usage.

TEXT BOOKS

REFERENCE BOOKS
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet
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

Sensors: Functions, Classifications, Main technical requirement and trends, Units and standards, Calibration methods, Classification of errors, Error analysis, Limiting error, Probable error, Propagation of error, Odds and uncertainty, principle of transduction, Classification. Static characteristics, mathematical model of transducers, Zero, First and Second order transducers, Dynamic characteristics of first and second order transducers, for standard test inputs.

UNIT II  VARIABLE RESISTANCE AND INDUCTION SENSORS

Principle of operation, Construction details, Characteristics and applications of resistive potentiometer, Strain gauges, Resistive thermometers, Thermistors, Piezoresistive sensors, Inductive potentiometer, Variable reluctance transducers, EI pick up and LVDT.

UNIT III  VARIABLE AND OTHER SPECIAL SENSORS

Variable air gap type, variable area type and variable permittivity type capacitor microphone, Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor, digital transducers, Humidity sensor, Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV  AUTOMOTIVE ACTUATORS


UNIT V  AUTOMATIC TEMPERATURE CONTROL ACTUATORS

Different types of actuators used in automatic temperature control, Fixed and variable displacement temperature control, Semi Automatic Controller design for Fixed and variable displacement type air conditioning system.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

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

TEXT BOOKS:


REFERENCES:

COURSE OBJECTIVES:
Summarize the costing concepts and their role in decision making
Infer the project management concepts and their various aspects in selection
Interpret costing concepts with project execution
Develop knowledge of costing techniques in service sector and various budgetary control techniques
Illustrate with quantitative techniques in cost management

UNIT – I \ INTRODUCTION TO COSTING CONCEPTS
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT – II \ INTRODUCTION TO PROJECT MANAGEMENT
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts

UNIT – III \ PROJECT EXECUTION AND COSTING CONCEPTS
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

UNIT – IV \ COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL

UNIT – V \ QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand the costing concepts and their role in decision making.
CO2: Understand the project management concepts and their various aspects in selection.
CO3: Interpret costing concepts with project execution.
CO4: Gain knowledge of costing techniques in service sector and various budgetary control techniques.
CO5: Become familiar with quantitative techniques in cost management.

TEXT BOOKS:
REFERENCES:

OAS353 SPACE VEHICLES

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

UNIT V NOSE CONE CONFIGURATION
Aerodynamic aspects on the selection of nose shape of a launch vehicle - design factors in the finalization of nose configuration with respect to payload - nose cone thermal protection system - separation of fairings - payload injection mechanism.

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
- Apply knowledge in selecting the appropriate rocket propulsion systems.
- Interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
- Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
- Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.
COURSE OBJECTIVES:
Of this course are
- To introduce fundamental concepts of management and organization to students.
- To impart knowledge to students on various aspects of marketing, quality control and marketing strategies.
- To make students familiarize with the concepts of human resources management.
- To acquaint students with the concepts of project management and cost analysis.
- To make students familiarize with the concepts of planning process and business strategies.

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANISATION  9

UNIT II  OPERATIONS AND MARKETING MANAGEMENT  9

UNIT III  HUMAN RESOURCES MANAGEMENT  9
Concepts of HRM, HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR, Basic functions of HR Manager:Manpower planning, Recruitment, Selection, Training and Development, Wage and Salary Administration, Promotion,Transfer,Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating –Capability Maturity Model (CMM)Levels.

UNIT IV  PROJECT MANAGEMENT  9
Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), identifying critical path, Probability of Completing the project within given time, Project Cost Analysis,Project Crashing (simple problems).

UNITV  STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, Students will be able to
CO1: Plan an organizational structure for a given context in the organization to carryout production operations through Work-study.
CO2: Survey the markets, customers and competition better and price the given products appropriately
CO3: Ensure quality for a given product or service.
CO4: Plan, schedule and control projects through PERT and CPM.
CO5: Evaluate strategy for a business or service organisation.
OIM353 PRODUCTION PLANNING AND CONTROL L T P C 3 0 0 3

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 9
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 9
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.
UNIT III PRODUCT PLANNING AND PROCESS PLANNING

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING


UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder procedure-Introduction to computer integrated production planning systems- elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

COURSE OUTCOMES:

Upon completion of this course,
CO1:The students can able to prepare production planning and control act work study,
CO2:The students can able to prepare product planning,
CO3:The students can able to prepare production scheduling,
CO4:The students can able to prepare Inventory Control.
CO5:They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

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COURSE OBJECTIVE:

- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
- Relate the interdependence of the operations function with the other key functional areas of a firm.
- Teach analytical skills and problem-solving tools to the analysis of the operations problems.
- Apply scheduling and Lean Concepts for improving System Performance.

UNIT I  INTRODUCTION TO OPERATIONS MANAGEMENT  9
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy - Strategic fit, framework; Supply Chain Management

UNIT II  FORECASTING, CAPACITY AND FACILITY DESIGN  9

UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS  9

UNIT IV  MATERIALS MANAGEMENT  9

UNIT V  SCHEDULING AND PROJECT MANAGEMENT  9
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

2. Norman Gaither and Gregory Frazier, Operations Management, South Western

REFERENCES

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OSF352 INDUSTRIAL HYGIENE

COURSE OBJECTIVES:
1. Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
2. Compare and contrast the roles of environmental and biological monitoring in work health and safety.
3. Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.
4. Discuss how personal protective equipment can be used to reduce risks associated with workplace exposures.
5. 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
Occupational Health and Environment Safety Management System, ILO and EPA Standards Industrial Hygiene: Definition of Industrial Hygiene, Industrial Hygiene: Control Methods, Substitution, Changing the process, Local Exhaust Ventilation, Isolation, Wet method, Personal hygiene, housekeeping and maintenance, waste disposal, special control measures.

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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COURSE OBJECTIVES

- Teach the principles of safety applicable to the design, and operation of chemical process plants.
- Ensure that potential hazards are identified and mitigation measures are in place to prevent unwanted release of energy.
- Learn about the hazardous chemicals into locations that could expose employees and others to serious harm.
- Focuses on preventing incidents and accidents during large scale manufacturing of chemicals and pharmaceuticals.
- Ensure that the general design of the plant is capable of complying with the dose limits in force and with the radioactive releases.

UNIT I   SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES   9
Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief - relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation - pipe line transport - safety in chemical laboratories.

UNIT II   CHEMICAL REACTION HAZARDS   9
Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testing strategies, Self-heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening,

UNIT III   SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS   9
Design principles -Process design development -types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation, factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during startup and shutdown - non destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.

UNIT IV   SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS   9
Properties of chemicals - Material Safety Data Sheets - the various properties and formats used - methods available for property determination. Operational activities and hazards - standards operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures-condition monitoring - control valves - safety valves - pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

UNIT V   SAFETY AND ANALYSIS   9
Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to

CO1 Differentiate between inherent safety and engineered safety and recognize the importance of safety in the design of chemical process plants.

CO2 Develop thorough knowledge about safety in the operation of chemical plants.

CO3 Apply the principles of safety in the storage and handling of gases.

CO4 Identify the conditions that lead to reaction hazards and adopt measures to prevent them.

CO5 Develop thorough knowledge about
REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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OML352 ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the importance of various materials used in electrical, electronics and magnetic applications
- Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
- Gaining knowledge on the selection of suitable materials for the given application
- Knowing the fundamental concepts in Semiconducting materials
- Getting equipped with the materials used in optical and optoelectronic applications.

UNIT I DIELECTRIC MATERIALS
Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS
Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials. Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS
Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.
UNIT IV  MATERIALS FOR ELECTRICAL APPLICATIONS  9
Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V  OPTICAL AND OPTOELECTRONIC MATERIALS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
- Understand various types of dielectric materials, their properties in various conditions.
- Evaluate magnetic materials and their behavior.
- Evaluate semiconductor materials and technologies.
- Select suitable materials for electrical engineering applications.
- Identify right material for optical and optoelectronic applications

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OML353  NANOMATERIALS AND APPLICATIONS  L T P C
3 0 0 3

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

UNIT I  NANOMATERIALS  9
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II  THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS  9
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III  PROCESSING  9
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV  STRUCTURAL CHARACTERISTICS  9
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis.

UNIT V  APPLICATIONS  9
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
1. Evaluate nanomaterials and understand the different types of nanomaterials
2. Recognise the effects of dimensionality of materials on the properties
3. Process different nanomaterials and use them in engineering applications
4. Use appropriate techniques for characterising nanomaterials
5. Identify and use different nanomaterials for applications in different engineering fields.

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COURSE OBJECTIVES:
1. To knowledge on fluid power principles and working of hydraulic pumps
2. To obtain the knowledge in hydraulic actuators and control components
3. To understand the basics in hydraulic circuits and systems
4. To obtain the knowledge in pneumatic and electro pneumatic systems
5. To apply the concepts to solve the trouble shooting

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS

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

UNIT V TROUBLE SHOOTING AND APPLICATIONS

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO 1: Analyze the methods in fluid power principles and working of hydraulic pumps
CO 2: Recognize the concepts in hydraulic actuators and control components
CO 3: Obtain the knowledge in basics of hydraulic circuits and systems
CO 4: Know about the basics concept in pneumatic and electro pneumatic systems
CO 5: Apply the concepts to solve the trouble shooting hydraulic and pneumatics
### TABLE 1: Mapping of COs with POs and PSOs

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### TEXT BOOKS

### REFERENCES

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

### UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES

### UNIT II DISPLACEMENT, PROXIMITY AND RANGING SENSORS
UNIT III  FORCE, MAGNETIC AND HEADING SENSORS


UNIT IV  OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS


UNIT V  SIGNAL CONDITIONING


TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors. They can also analyze the sensor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.

CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.

CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

Mapping of COs with POs and PSOs

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TEXT BOOKS


REFERENCES:

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

UNIT – I INTRODUCTION TO MOBILE ROBOTICS

UNIT – II KINEMATICS

UNIT – III PERCEPTION

UNIT – IV LOCALIZATION

UNIT – V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Evaluate the appropriate mobile robots for the desired application.
CO2: Create the kinematics for given wheeled and legged robot.
CO3: Analyse the sensors for the intelligence of mobile robotics.
CO4: Create the localization strategies and mapping technique for mobile robot.
CO5: Create the collaborative mobile robotics for planning, navigation and intelligence for desired applications.

TEXT BOOKS

REFERENCES:
CRA332 DRONE TECHNOLOGIES

**COURSE OBJECTIVES:**
1. To understand the basics of drone concepts
2. To learn and understand the fundamentals of design, fabrication and programming of drone
3. To impart the knowledge of an flying and operation of drone
4. To know about the various applications of drone
5. To understand the safety risks and guidelines of fly safely

**UNIT I INTRODUCTION TO DRONE TECHNOLOGY**
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

**UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING**
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts - Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program -Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

**UNIT III DRONE FLYING AND OPERATION**
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications

**UNIT IV DRONE COMMERCIAL APPLICATIONS**
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

**UNIT V FUTURE DRONES AND SAFETY**
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

**COURSE OUTCOMES**
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO4: Createthe programs for various drones

**CO-PO MAPPING:**

<table>
<thead>
<tr>
<th>COs/POs&amp;P Sos</th>
<th>POs</th>
<th>PSOs</th>
</tr>
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<tr>
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<td>CO1</td>
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<tr>
<td>CO/PO &amp; PSO Average</td>
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</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TOTAL: 45 PERIODS
### TEXT BOOKS

### REFERENCES

### OGI352 GEOGRAPHICAL INFORMATION SYSTEM L T P C 3 0 0 3

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

### UNIT I  FUNDAMENTALS OF GIS 9

### UNIT II  SPATIAL DATA MODELS 9

### UNIT III  DATA INPUT AND TOPOLOGY 9

### UNIT IV  DATA QUALITY AND STANDARDS 9
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards – Interoperability - OGC - Spatial Data Infrastructure

### UNIT V  DATA MANAGEMENT AND OUTPUT 9
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.

**TOTAL:45 PERIODS**

### COURSE OUTCOMES:
On completion of the course, the student is expected to
- **CO1** Have basic idea about the fundamentals of GIS.
- **CO2** Understand the types of data models.
- **CO3** Get knowledge about data input and topology
- **CO4** Gain knowledge on data quality and standards
- **CO5** Understand data management functions and data output
TEXT BOOKS:

REFERENCES:

CO – PO – PSO MAPPING: GEOGRAPHIC INFORMATION SYSTEM

<table>
<thead>
<tr>
<th>PO</th>
<th>Graduate Attribute</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
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<tr>
<td>PO3</td>
<td>Design/Development of Solutions</td>
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<tr>
<td>PO4</td>
<td>Conduct Investigations of Complex Problems</td>
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<td>PO5</td>
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<tr>
<td>PO6</td>
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<tr>
<td>PO7</td>
<td>Environment and Sustainability</td>
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<td>PO8</td>
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<td>PO9</td>
<td>Individual and Team Work</td>
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<td>PO12</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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</tbody>
</table>

OAI352 AGRICULTURE ENTREPRENEURSHIP DEVELOPMENT L T P C 3 0 0 3

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

UNIT I ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT
Entrepreneur Development(ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics- Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.

UNIT II AGRIPRNEURSHIP IN GLOBAL ARENA: LEGAL PERSPECTIVE
Importance of agribusiness in Indian economy - International trade-WTO agreements- Provisions related to agreements in agricultural and food commodities - Agreements on
Agriculture (AOA)- Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS).

UNIT III ENTREPRENEURSHIP MANAGEMENT: FINANCIAL PERSPECTIVE 9

UNIT IV ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE 9
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country - Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.

UNIT V ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT 9
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis- Government schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) - overview of agricultural engineering industry, characteristics of Indian farm machinery industry.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
CO-PO MAPPING

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
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<th>CO4</th>
<th>CO5</th>
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<td>PO3</td>
<td>Design/ Development of Solutions</td>
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<td>Modern Tool Usage</td>
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<tr>
<td>PO6</td>
<td>The Engineer and Society</td>
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<td>PO8</td>
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<tr>
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<tr>
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<td>2</td>
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</tbody>
</table>

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.

OEN352 BIODIVERSITY CONSERVATION L T P C 3 0 0 3

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

UNIT I INTRODUCTION 9
Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY 9
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III MICROBIAL DIVERSITY 9
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis.
UNIT IV MEGA DIVERSITY
Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio-economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNIT V CONSERVATIONS OF BIODIVERSITY
In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

OUTCOMES:
Upon successful completion of this course, students will:
CO1: An insight into the structure and function of diversity for ecosystem stability.
CO2: Understand the concept of animal diversity and taxonomy
CO3: Understand socio-economic issues pertaining to biodiversity
CO4: An understanding of biodiversity in community resource management.
CO5: Student can apply fundamental knowledge of biodiversity conservation to solve problems associated with infrastructure development.

CO’s- PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>CO’s</th>
<th>PO’s</th>
<th>PSO’s</th>
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<tr>
<td>Avg.</td>
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</tbody>
</table>

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

OBJECTIVES
- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems.
- To analyze the stability of linear systems in frequency domain and time domain.
- To develop linear models mainly state variable model and transfer function model.
UNIT I  MATHEMATICAL MODELS OF PHYSICAL SYSTEMS  
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

UNIT II  TIME RESPONSE ANALYSIS & ROOTLOCUS TECHNIQUE  

UNIT III  FREQUENCY RESPONSE ANALYSIS  
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV  STABILITY CONCEPTS & ANALYSIS  

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

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

UNIT I INTRODUCTION

UNIT II AUTOMATION COMPONENTS
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)
5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1 Design a signal conditioning circuits for various application (L3).
CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block. (L3)
CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)
TEXT BOOKS:

REFERENCES:

List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063

| CO’s- PO’s & PSO’s MAPPING |
| CO1 | 3 | 2 | 2 | 2 | 1 | 1 | - | 1 | - | 1 | 1 | - | 1 |
| CO2 | 3 | 1 | - | 1 | - | 1 | - | 1 | - | 1 | - | 1 |
| CO3 | 3 | - | 1 | - | 1 | - | 1 | - | 1 | - | 1 | - |
| CO4 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| CO5 | 3 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| AVg. | 3 | 2.25 | 2 | 2.6 | 1 | 1 | - | 1 | - | 1 | - | 1 |

OCH353 ENERGY TECHNOLOGY L T P C

UNIT I INTRODUCTION 8
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II CONVENTIONAL ENERGY 8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY 10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.
UNIT IV       BIOMASS ENERGY
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V       ENERGY CONSERVATION
Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

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.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES

Course articulation matrix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>CO1</td>
<td>Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.</td>
</tr>
<tr>
<td>CO2</td>
<td>Students will excel as professionals in the various fields of energy engineering</td>
</tr>
<tr>
<td>CO3</td>
<td>Compare different renewable energy technologies and choose the most appropriate based on local conditions.</td>
</tr>
</tbody>
</table>
Explain the technological basis for harnessing renewable energy sources.

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.

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

OCH354 SURFACE SCIENCE

OBJECTIVE:
- To enable the students to analyze properties of a surfaces and correlate them to structure, chemistry, and physics and surface modification technique.

UNIT I SURFACE STRUCTURE AND EXPERIMENTAL PROBES
Relevance of surface science to Chemical and Electrochemical Engineering, Heterogeneous Catalysis and Nanoscience; Surface structure and reconstructions, absorbate structure, Band and Vibrational structure, Importance of UHV techniques, Electronic probes and molecular beams, Scanning probes and diffraction, Qualitative introduction to electronic and vibrational spectroscopy

UNIT II ADSORPTION, DYNAMICS, THERMODYNAMICS AND KINETICS AT SURFACES
Interactions at the surface, Physisorption, Chemisorption, Diffusion, dynamics and reactions of atoms/molecules on surfaces, Generic reaction mechanism on surfaces, Adsorption isotherms, Kinetics of adsorption, Use of temperature desorption methods

UNIT III LIQUID INTERFACES
Structure and Thermodynamics of liquid-solid interface, Self-assembled monolayers, Electrified interfaces, Charge transfer at the liquid-solid interfaces, Photoelectrochemical processes, Gratzel cells

UNIT IV HETEROGENEOUS CATALYSIS
Characterization of heterogeneous catalytic processes, Microscopic kinetics to catalysis, Overview of important heterogeneous catalytic processes: Haber-Bosch, Fishcher-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS
OUTCOME:
• Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena

TEXT BOOK:

REFERENCE:

OFD354 FUNDAMENTALS OF FOOD ENGINEERING

OBJECTIVES:
The course aims to
• Acquaint and equip the students with different techniques of measurement of engineering properties.
• Make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger’s, Kick’s and Bond’s equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT V
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine. Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment: plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids. Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-
filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electro-dialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.

**COURSE OUTCOMES:**
At the end of the course the students will be able to
CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.

**TEXT BOOKS:**

**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, Biosecurity 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

NUTRACEUTICALS

OBJECTIVES:
- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods: importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from 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 (United Kingdom), 2006

REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE OUTCOME - NUTRACEUTICALS

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

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<th>COURSE OUTCOME</th>
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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

OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO1: Basics of grey fabric
CO2: Basics of pre treatment
CO3: Concept of Dyeing
CO4: Concept of Printing
CO5: Machinery in processing industry

TEXT BOOKS:

REFERENCES:
2. Dr. N N Mahapatra., “Textile dyeing”, Wood head publishing India, 2018
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series
COURSE ARTICULATION MATRIX:

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

<table>
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<th>Course Outcomes</th>
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<td>Classification of fibres and production of natural fibres</td>
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FT 3201 FIBRE SCIENCE L T P C 3 0 0 3

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

UNIT I INTRODUCTION TO TEXTILE FIBRES
Definition of various forms of textile fibres - staple fibre, filament, bicomponent fibres. Classification of Natural and Man-made fibres, essential and desirable properties of Fibres. Production and cultivation of Natural Fibers: Cotton, Silk, Wool - Physical and chemical structure of the above fibres.

UNIT II REGENERATED FIBRES
Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel ,Tencel

UNIT III SYNTHEITC FIBRES
Production Sequence of Synthetic Fibers: polymer-Polyester, Nylon, Acrylic and polypropylene. Mineral fibres: fibre glass ,carbon .Introduction to spin finishes and texturization

UNIT IV SPECIALITY FIBRES
Properties and end uses of high tenacity and high modulus fibres, high temperature and flame retardant fibres, Chemical resistant fibres
UNIT V  FUNCTIONAL SPECIALITY FIBRES  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
- Understand the process sequence of various fibres
- Understand the properties of various fibres

TEXT BOOKS:

REFERENCES:

OTT355  GARMENT MANUFACTURING TECHNOLOGY  L T P C 3 0 0 3

OBJECTIVE:
- To enable the students to understand the basics of pattern making, cutting and sewing.
- To expose the students to various problems & remedies during garment manufacturing

UNIT I  PATTERN MAKING, MARKER PLANNING, CUTTING  9
Anthropometry, specification sheet, pattern making – principles, basic pattern set drafting, grading, marker planning, spreading & cutting

UNIT II  TYPES OF SEAMS, STITCHES AND FUNCTIONS OF NEEDLES  9
Different types of seams and stitches; single needle lock stitch machine – mechanism and accessories; needle – functions, special needles, needlepoint

UNIT III  COMPONENTS AND TRIMS USED IN GARMENT  9
Sewing thread-construction, material, thread size, packages, accessories – labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons

UNIT IV  GARMENT INSPECTION AND DIMENSIONAL CHANGES  9
Raw material, in process and final inspection; needle cutting; sewability of fabrics; strength properties of apparel; dimensional changes in apparel due to laundering, dry-cleaning, steaming and pressing.
UNIT V  GARMENT PRESSING, PACKING AND CARE LABELING
Garment pressing – categories and equipment, packing; care 234abelling of apparels

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to Understand
CO1: Pattern making, marker planning, cutting
CO2: Types of seams, stitches and functions of needles
CO3: Components and trims used in garment
CO4: Garment inspection and dimensional changes
CO5: Garment pressing, packing and care 234abelling

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

REFERENCES:

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OPE353 INDUSTRIAL SAFETY
L T P C
3 0 0 3

OBJECTIVES:
• To educate about the health hazards and the safety measures to be followed in the industrial environment.
• Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
• Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards

UNIT I INTRODUCTION
Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.
UNIT II  OCCUPATIONAL HEALTH AND HYGIENE  

UNIT III  WORKPLACE SAFETY AND SAFETY SYSTEMS

UNIT IV  HAZARDS AND RISK MANAGEMENT

UNIT V  ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
After completion of this course, the student is expected to be able to:
- Describe, with example, the common work-related diseases and accidents in occupational setting
- Name essential members of the Occupational Health team
- What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354  UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES  L T P C

OBJECTIVES:
- To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I  FLUID MECHANICS CONCEPTS
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton’s Law of viscosity. Fluid statics-Pascal’s law, Hydrostatic equilibrium, Barometric equation and pressure measurement(problems),Basic equations of fluid flow - Continuity equation, Euler’s equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numerials.

UNIT II  FLOW MEASUREMENTS & MECHANICAL OPERATIONS
Different types of flow measuring devices (Orifice meter, Venturimeter, Rotameter) with derivations, flow measurements –. Pumps – types of pumps (Centrifugal & Reciprocating pumps), Energy calculations and characteristics of pumps. Size reduction–characteristics of comminute products, sieve analysis, Properties and handling of particulate solids – characterization of solid particles, average particle size, screen analysis- Conceptual numerical of differential and

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV BASICS OF MASS TRANSFER

UNIT V MASS TRANSFER OPERATIONS
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction). Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method. Drying- drying operations, batch and continuous drying. Conceptual numerical.

COURSE OUTCOMES:

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

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

TEXTBOOKS:

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

REFERENCE BOOKS

2. Unit Operations of Chemical Engineering, Vol I &II Chattopadhyaya Khanna Publishers, Delhi-6 1996

COURSE OBJECTIVES

- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
- Understand the basics as well as the advanced applications of various plastic materials in the industry
- To understand the preparation methods of thermosetting materials
- Select suitable specialty plastics for different end applications
UNIT I  INTRODUCTION TO PLASTIC MATERIALS

Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)

UNIT II  ENGINEERING THERMOPLASTICS AND APPLICATIONS

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:

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

REFERENCES

COURSE OBJECTIVES

- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
- To study about the environmental effects and prevent polymer degradation.

UNIT I  INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS  9

UNIT II  MECHANICAL PROPERTIES  9
Mechanical properties: Tensile, compression, flexural, shear, tear strength, hardness, impact strength, resilience, abrasion resistance, creep and stress relaxation, compression set, dynamic fatigue, ageing properties, Basic concepts of stress and strain, short term tests: Viscoelastic behavior (simple models: Kelvin model for creep and stress relaxation, Maxwell-Voigt model, strain recovery and dynamic response), Effect of structure and composition on mechanical properties, Behavior of reinforced polymers

UNIT III  THERMAL RHEOLOGICAL PROPERTIES  9
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

UNIT IV  ELECTRICAL AND OPTICAL PROPERTIES  9
Electrical properties: Volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

UNIT V  ENVIRONMENTAL AND CHEMICAL RESISTANCE  9

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

REFERENCES:
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

OUTCOMES:

Upon successful completion of the course the student will be able to

CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.

TEXT BOOKS:

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CBM370 WEARABLE DEVICES L T P C

OBJECTIVES:
The student should be made to:
- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT I INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS

UNIT IV SMART TEXTILE
UNIT V APPLICATIONS OF WEARABLE SYSTEMS

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

OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Compare the various wearable devices in healthcare system

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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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  9
Introduction - conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT IV  COMPUTER ASSISTED MEDICAL DECISION-MAKING  9
Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer--assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis inclclinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V  RECENT TRENDS IN MEDICAL INFORMATICS  9
Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health-Medical education and healthcare information, computer assisted instruction in medicine.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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OBT355  BIOTECHNOLOGY FOR WASTE MANAGEMENT  L T P C
UNIT I  BIOLOGICAL TREATMENT PROCESS  9

UNIT II  WASTE BIOMASS AND ITS VALUE ADDITION  9
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

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

OBT356  LIFESTYLE DISEASES  L T P C
UNIT I  INTRODUCTION  9
Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II  CANCER  9
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment
UNIT III  CARDIOVASCULAR DISEASES
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

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

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

TEXT BOOKS:

REFERENCES:

OBT357  BIOTECHNOLOGY IN HEALTH CARE

COURSE OBJECTIVES
The aim of this course is to
1. Create higher standard of knowledge on healthcare system and services
2. Prioritize advanced technologies for the diagnosis and treatment of various diseases

UNIT I  PUBLIC HEALTH

UNIT II  CLINICAL DISEASES
Communicable diseases: Chickenpox / Shingles, COVID-19, Tuberculosis, Hepatitis B, Hepatitis C, HIV / AIDS, Influenza, Swine flu. Non Communicable diseases: Diabetes mellitus, atherosclerosis, fatty liver, Obesity, Cancer

UNIT III  VACCINOLOGY
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment.

UNIT IV  OUTPATIENT & IN PATIENT SERVICES
Radiotherapy, Nuclear medicine, surgical units, OT Medical units, G & Obs. units Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation, Neurology, Gastroenterology, Endoscopy, Pulmonology, Cardiology.

UNIT V  BASICS OF IMAGING MODALITIES

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCE BOOKS:

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

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

UNIT I INTRODUCTION TO FINANCIAL MANAGEMENT 9
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization - Time Value of money - Risk and return concepts.

UNIT II SOURCES OF FINANCE 9
Long term sources of Finance - Equity Shares – Debentures – Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III INVESTMENT DECISIONS 9
Cost of Capital - Cost of Specific Sources of Capital - Equity - Preferred Stock - Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION 9

UNIT V WORKING CAPITAL DECISION 9

TOTAL : 45 PERIODS
CMG332  FUNDAMENTALS OF INVESTMENT  LT P C 3 0 0 3

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

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

UNIT II  FIXED INCOME SECURITIES
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT III  APPROACHES TO EQUITY ANALYSIS
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

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

UNIT V  INVESTOR PROTECTION
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism

TOTAL: 45 PERIODS

REFERENCES:
OBJECTIVES

- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM

Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector – RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS


UNIT III DEVELOPMENT IN BANKING TECHNOLOGY


UNIT IV FINANCIAL SERVICES


UNIT V INSURANCE


REFERENCES:


CMG334 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS

UNIT I INTRODUCTION TO BLOCKCHAIN

Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.
UNIT II  INTRODUCTION TO CRYPTOCURRENCY

UNIT III  ETHEREUM
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV  WEB3 AND HYPERLEDGE

UNIT V  EMERGING TRENDS

TOTAL: 45 PERIODS

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

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

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 IV  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

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

TEXT BOOKS:

REFERENCES:
7) Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship
High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III  INTRODUCTION TO LEADERSHIP
Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment

UNIT IV  LEADERSHIP IN ORGANISATIONS

UNIT V  LEADERSHIP EFFECTIVENESS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO 1 Learn the basics of managing teams for business.
CO 2 Understand developing effective teams for business management.
CO 3 Understand the fundamentals of leadership for running a business.
CO 4 Learn about the importance of leadership for business development.
CO 5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs.

REFERENCES:

CMG339  CREATIVITY & INNOVATION IN ENTREPRENEURSHIP  L T P C
3 0 0 3

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  9
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  9
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  9
Innovation: Definition - Levels of Innovation - Incremental Vs Radical Innovation -
Product Innovation and Process - Technological, Organizational Innovation - Indicators - Characteristics
of Innovation in Different Sectors. Theories in Innovation and Creativity - Design Thinking and
Innovation - Innovation as Collective Change - Innovation as a system.

UNIT IV  INNOVATION AND ENTREPRENEURSHIP  9
Innovation and Entrepreneurship: Entrepreneurial Mindset, Motivations and Behaviours -
Opportunity Analysis and Decision Making - Industry Understanding - Entrepreneurial
Opportunities - Entrepreneurial Strategies - Technology Pull/Market Push - Product - Market fit

UNIT V  INNOVATIVE BUSINESS MODELS  9
Innovative Business Models: Customer Discovery - Customer Segments - Prospect Theory and
Developing Value Propositions - Developing Business Models: Elements of Business Models -
Innovative Business Models: Elements, Designing Innovative Business Models - Responsible
Innovation and Creativity.

TOTAL 45 : PERIODS

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

SUGGESTED READINGS:
Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
Innovation Management, C.S.G. Krishnamacharyulu, R. Lalitha, Himalaya Publishing House,
2010.
Strategic Innovation: Building and Sustaining Innovative Organizations - Course Era, Raj
Echambadi.

CMG340  PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS  L T P C
3 0 0 3

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

UNIT I INTRODUCTION TO MARKETING MANAGEMENT

UNIT II MARKETING ENVIRONMENT

UNIT III PRODUCT AND PRICING MANAGEMENT

UNIT IV PROMOTION AND DISTRIBUTUION MANAGEMENT

UNIT V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT

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

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

UNIT I  INTRODUCTION TO HRM  9

UNIT II  HUMAN RESOURCE PLANNING  9
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III  RECRUITMENT AND SELECTION  9
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV  TRAINING AND EMPLOYEE DEVELOPMENT  9

UNIT V  CONTROLLING HUMAN RESOURCES  9

COURSE OUTCOMES:
Upon completion of this course the learners will be able:
CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO 2 To learn about the HR Planning Methods and practices.
CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES:
COURSE OBJECTIVES:

- To develop the basics of business venture financing.
- To impart the knowledge essential for entrepreneurs for financing new ventures.
- To acquaint the learners with the sources of debt and equity financing.
- To empower the learners towards fund raising for new ventures effectively.

UNIT I    ESSENTIALS OF NEW BUSINESS VENTURE


UNIT II    INTRODUCTION TO VENTURE FINANCING


UNIT III    SOURCES OF DEBT FINANCING


UNIT IV    SOURCES OF EQUITY FINANCING

Own Capital, Unsecured Loan - Government Subsidies, Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.

UNIT V    METHODS OF FUND RAISING FOR NEW VENTURES


OUTCOMES:

Upon completion of this course, the students should be able to:

CO 1  Learn the basics of starting a new business venture.
CO 2  Understand the basics of venture financing.
CO 3  Understand the sources of debt financing.
CO 4  Understand the sources of equity financing.
CO 5  Acquaint with the methods of fund raising for new business ventures.

REFERENCES:

1) Principles of Corporate Finance by Brealey and Myers et al., 12TH ed, McGraw Hill Education (India) Private Limited, 2018
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

REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.
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:
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi.

CMG345   PUBLIC PERSONNEL ADMINISTRATION    L T P C  3 0 0 3

UNIT-I
1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

UNIT-II
1. Generalist Vs Specialist
2. Civil Servants’ Relationship with Political Executive
3. Integrity in Administration.

UNIT-III
1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

UNIT-IV
1. All India Services
2. Service Conditions
3. State Public Service Commission

UNIT-V
1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

REFERENCES:
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations

TOTAL: 45 PERIODS
CMG346 ADMINISTRATIVE THEORIES

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

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

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

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

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

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

TOTAL: 45 PERIODS

CMG347 INDIAN ADMINISTRATIVE SYSTEM

UNIT I
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV
Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V
Corruption – Ombudsman, Lok Pal & Lok Ayuktha

TOTAL: 45 PERIODS
REFERENCES:
1. S.R. Maheswari : Indian Administration
2. Khera. S.S : Administration in India
3. Ramesh K. Arora : Indian Public Administration
4. T.N. Chaturvedi : State administration in India
5. Basu, D.D : Introduction to the Constitution of India

CMG348 PUBLIC POLICY ADMINISTRATION L T P C 3 0 0 3

UNIT-I (9)

UNIT-II (9)
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System’s Approach – Dror’s Optimal Model

UNIT-III (9)

UNIT-IV (9)
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT-V (9)
Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

TOTAL: 45 PERIODS

REFERENCES:
4. Pradeep Saxena : Public Policy Administration and Development

VERTICAL 4: BUSINESS DATA ANALYTICS

CMG349 STATISTICS FOR MANAGEMENT L T P C 3 0 0 3

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

UNIT I INTRODUCTION 9
Basic definitions and rules for probability, Baye’s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.
UNIT III  TESTING OF HYPOTHESIS - PARAMETRIC TESTS  
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  

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

REFERENCES:  
OUTCOMES:
1. Learn to apply various data mining techniques into various areas of different domains.
2. Be able to interact competently on the topic of data mining for business intelligence.
3. Apply various prediction techniques.
4. Learn about supervised and unsupervised learning technique.
5. Develop and implement machine learning algorithms

REFERENCES:
1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
7. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011
9. Elizabeth Vitt, Michael Luckeivors Stacia Misner, Business Intelligence, Microsoft, 2011

CMG351 HUMAN RESOURCE ANALYTICS  L T P C
3 0 0 3

OBJECTIVES:
- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I  INTRODUCTION TO HR ANALYTICS
People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II  HR ANALYTICS I: RECRUITMENT
Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.

UNIT III  HR ANALYTICS - TRAINING AND DEVELOPMENT
Training & Development Metrics : Percentage of employees trained- Internally and externally trained - Training hours and cost per employee - ROI.

UNIT IV  HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION
Employee Engagement Metrics :Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.
UNIT V - HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics: Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

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

REFERENCES:

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS

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

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

UNIT II COMMUNITY BUILDING AND MANAGEMENT
History and Evolution of Social Media - Understanding Science of Social Media - Goals for using Social Media - Social Media Audience and Influencers - Digital PR - Promoting Social Media Pages - Linking Social Media Accounts - The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS
Social Media Policies - Etiquette, Privacy - Ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

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

TOTAL: 45 PERIODS
OUTCOME:
- The Learners will understand social media, web and social media analytics and their potential impact.

REFERENCES:
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004

CMG353 OPERATION AND SUPPLY CHAIN ANALYTICS L T P C 3 0 0 3

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

OUTCOME:
- 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

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

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

REFERENCES:

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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

OBJECTIVE:
- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I  SUSTAINABLE DEVELOPMENT GOALS  9
UNIT II  SUSTAINABLE INFRASTRUCTURE PLANNING  

UNIT III  SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES  

UNIT IV  SUSTAINABLE CONSTRUCTION MATERIALS  

UNIT V  SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS  

TOTAL: 45 PERIODS

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

CO1 Understand the environment sustainability goals at global and Indian scenario.
CO2 Understand risks in development of projects and suggest mitigation measures.
CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:
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CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:
- To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS
- Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT
- Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT
- Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use
UNIT IV   ENERGY AND WASTE MANAGEMENT
Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V   EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS
Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

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

CO1  Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture

CO2  Discuss the sustainable ways in managing soil health, nutrients, pests and diseases

CO3  Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources

CO4  Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas

CO5  Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

REFERENCES:
1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020

CO – PO Mapping - SUSTAINABLE AGRICULTURE PRACTICES

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CES333   SUSTAINABLE BIOMATERIALS

OBJECTIVES
- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.
UNIT I INTRODUCTION TO BIOMATERIALS

UNIT II BIO POLYMERS
Molecular structure of polymers -Molecular weight - Types of polymerization techniques-Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials -Polyethylene-Polymethylmethacrylate (PMMA)-Polylactic acid (PLA) and polyglycolic acid (PGA) -Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethane- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III BIO CERAMICS AND BIOCOMPOSITES
General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-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 NANOBIOATERIALS

TOTAL : 45 PERIODS

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

REFERENCES
6. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018
OBJECTIVES

- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I  SUSTAINABLE ENERGY SOURCES

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II  ELECTROCHEMICAL DEVICES

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO2, LiFePO4, LiMn2O4) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III  FUEL CELLS


UNIT IV  PHOTOVOLTAICS


UNIT V  SUPERCAPACITORS

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite- conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS
OUTCOMES
- Students will acquire knowledge about energy sustainability.
- Students understand the principles of different electrochemical devices.
- Students learn about the working of fuel cells and their application.
- Students will learn about various Photovoltaic applications and the materials used.
- The students gain knowledge on different types of supercapacitors and the performance of various materials

REFERENCES
5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

CES335 GREEN TECHNOLOGY

COURSE OBJECTIVE:
- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes - photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES
Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT V GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS
COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5 – To understand advanced technology in green synthesis

TEXT BOOKS

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

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

OBJECTIVES:
• to understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
• To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I ENVIRONMENTAL MONITORING AND STANDARDS

UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS

UNIT III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING
Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISKASSESSMENT

UNIT V AUTOMATED DATA ACQUISITION AND PROCESSING
Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

TOTAL: 45 PERIODS
COURSE OUTCOMES
After completion of this course, the students will know

- 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.

COURSE ARTICULATION MATRIX

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CES337 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT L T P C 3 0 0 3

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

UNIT I ENERGY SCENARIO 9
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT 9
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls
UNIT III  SUSTAINABLE DEVELOPMENT  9  

UNIT IV  RENEWABLE ENERGY TECHNOLOGY  9  

UNIT V  ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT  9  

TOTAL : 45 PERIODS

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

REFERENCES:  
7. https://www.niti.gov.in/verticals/energy

CES338  ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT  L T P C  3 0 0 3

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

UNIT I  ENERGY AND ENVIRONMENT  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

Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV  ENERGY CONSERVATION IN ELECTRICAL UTILITIES

Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V  SUSTAINABLE DEVELOPMENT


TOTAL:45 PERIODS

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

REFERENCES: