ANNA UNIVERSITY, CHENNAI
NON AUTONOMOUS AFFILIATED COLLEGES
REGULATIONS – 2021

B.E. GEOINFORMATICS ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)
I. To prepare the students for successful careers in Geospatial Industries and Information Technology that meet the needs of India and other Countries.
II. To develop the professional ability among the students to collect various Geospatial relates from various platform, data, analysis and synthesis that create user oriented real world applications.
III. To provide an opportunity for students to work as part of teams on multidisciplinary projects.
IV. To provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze engineering and multidisciplinary problems and to prepare them for graduate studies.
V. To promote students awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

PROGRAM OUTCOMES (POs)

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

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

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

**PROGRAMME SPECIFIC OUTCOMES (PSOs)**

Graduates of B.E. Geoinformatics students will be able to

**PSO1 Knowledge of Geoinformatics discipline**

Demonstrate in-depth knowledge of Geoinformatics engineering discipline with an ability to evaluate, analyze and synthesize existing and new knowledge.

**PSO2 Critical analysis of Geoinformatics Engineering problems and innovations**

Critically analyze complex Geoinformatics problems and apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical policy context.

**PSO3 Conceptualization and evaluation of engineering solutions to Geoinformatics engineering issues**

Conceptualize and solve Geoinformatics engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety and socio cultural factors.

**PEOS & Pos**

The B.E (Geoinformatics) Program outcomes leading to the achievements of the objectives are summarized in the following table.

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* Tamils and Technology

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* Mandatory course-II*

§ Professional Development
| YEAR 4 | SEMESTER 6 | Geospatial Analysis with R programming | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 |
|        |           | Airborne and Terrestrial Laser Mapping | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
|        |           | Open Elective I *                  |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Professional Elective V          |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Professional Elective VI         |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Professional Elective VII        |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Mandatory course-I &            |    |    |    |    |    |    |    |    |    |    |    |
|        |           | NCC Credit course level 3   |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Spatial Analysis and Applications Laboratory | 1 | 3 | 3 | 1 | 3 | 1 | 1 | 1 | 2 | 3 | 3 | 1 | 3 |
|        |           | Survey Camp (2 Weeks)             | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
|        | SEMESTER 7 | Spatial data adjustment           | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 3 | 2 | 1 | 1 | 2 |
|        |           | Web GIS                           | 3 | 2 | 2 | 3 |    |    |    |    |    |    |    |    |
|        |           | Human values and Ethics           | 3 | 2 | 2 | 3 |    |    |    |    |    |    |    |    |
|        |           | Total Quality Management          | 2.5 | 3 | 3 | 2.6 | 3 | 2 | 3 |    | 3 | 2.5 | 2 | 3 |
|        |           | Open Elective II *               |    |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Open Elective III *              |    |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Open Elective IV *               |    |    |    |    |    |    |    |    |    |    |    |    |
|        |           | Customization laboratory         | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
|        | SEMESTER 8 | Project Work/Internship          |    |    |    |    |    |    |    |    |    |    |    |    |

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

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* Skill Based Course

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

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

### 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 MC-II)

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

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

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

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

---

# SEMESTER VIII/VII*

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

**TOTAL NO. OF CREDITS: 164

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# MANDATORY COURSES I*

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*Mandatory Courses are offered as Non-Credit Courses

---

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

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<tr>
<th>VERTICAL I (Surveying &amp; Mapping)</th>
<th>VERTICAL II (Geospatial Data Analytics)</th>
<th>VERTICAL III (Image Processing and Analysis)</th>
<th>VERTICAL IV (Geo Spatial Applications)</th>
<th>VERTICAL V (Geodesy)</th>
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<tbody>
<tr>
<td>Terrestrial and Close Range Photogrammetry</td>
<td>GIS Customization and Scripting</td>
<td>Soft Computing Techniques</td>
<td>Environmental Geoinformatics</td>
<td>Advanced Geodesy</td>
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<tr>
<td>Terrestrial and Bathymetric Laser Scanning</td>
<td>Location Based GIS</td>
<td>Polarimetry and Interferometry</td>
<td>Geomatics for Hydrology and Water Resources</td>
<td>Physical Geodesy</td>
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<tr>
<td>Unmanned Aerial Vehicle (UAV) for Large Scale MAPPING</td>
<td>Enterprise GIS</td>
<td>AI / DL for image Processing</td>
<td>Satellite Meteorology</td>
<td>Geodetic Interferometry</td>
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<tr>
<td>Sub surface Survey Methods</td>
<td>GIS based Utility and Asset Management</td>
<td>Pattern Recognition (Satellite, Aerial, UAV)</td>
<td>Geomatics for Disaster and Risk Mitigation</td>
<td>Environmental Geodesy</td>
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<tr>
<td>Cadastral Surveying</td>
<td>Geo Computing</td>
<td>Raster Data Modelling</td>
<td>Geomatics for Agriculture and Forestry</td>
<td>Geodetic Control Survey and Adjustment</td>
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<td>Advanced Surveying Techniques</td>
<td>Geo Spatial Modelling and Simulation</td>
<td>SDG and Geomatics</td>
<td>Geomatics for ocean and Coastal Applications</td>
<td>Geodetic Astronomy</td>
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### Registration of Professional Elective Courses from Verticals:

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

### VERTICAL I: SURVEYING & MAPPING

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### VERTICAL II: GEOSPATIAL DATA ANALYTICS

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

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

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

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

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

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

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

<table>
<thead>
<tr>
<th>VERTICAL I</th>
<th>VERTICAL II</th>
<th>VERTICAL III</th>
<th>VERTICAL IV</th>
<th>VERTICAL V</th>
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<td>Constitution of India</td>
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<td>Administrative Theories</td>
<td>Marketing and Social Media Web</td>
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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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IP3151 INDUCTION PROGRAMME

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

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

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

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

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

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

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

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

(iii) Universal Human Values
This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and 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

HS3152 PROFESSIONAL ENGLISH I

COURSE OBJECTIVES:
- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
UNIT I  INTRODUCTION TO EFFECTIVE COMMUNICATION
What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

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

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

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

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

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

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

TOTAL : 45 PERIODS

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

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

CO’s-PO’s & PSO’s MAPPING

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

MA3151 MATRICES AND CALCULUS

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

UNIT I MATRICES

9+3

UNIT II DIFFERENTIAL CALCULUS

9+3
UNIT III  FUNCTIONS OF SEVERAL VARIABLES  9+3

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

UNIT V  MULTIPLE INTEGRALS  9+3

TOTAL : 60 PERIODS

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

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

REFERENCES :
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PH3151  
ENGINEERING PHYSICS  

L T P C  
3 0 0 3  

COURSE OBJECTIVES:

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

UNIT I  
MECHANICS  
9


UNIT II  
ELECTROMAGNETIC WAVES  
9

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

UNIT III  
OSCILLATIONS, OPTICS AND LASERS  
9


UNIT IV  
BASIC QUANTUM MECHANICS  
9

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

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students should be able to
CO1 Understand the importance of mechanics.
CO2 Express their knowledge in electromagnetic waves.
CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4 Understand the importance of quantum physics.
CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.

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

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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

CY3151  ENGINEERING CHEMISTRY  L T P C
3 0 0 3

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


UNIT II  NANO CHEMISTRY

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III  PHASE RULE AND COMPOSITES

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV  FUELS AND COMBUSTION


UNIT V  ENERGY SOURCES AND STORAGE DEVICES

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

COURSE OUTCOMES:

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

CO1 To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2 To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3 To apply the knowledge of phase rule and composites for material selection requirements.

CO4 To recommend suitable fuels for engineering processes and applications.

CO5 To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
TEXT BOOKS:

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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

GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C
3 0 0 3

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  9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional
(if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,
parameters, local and global scope, function composition, recursion; Strings: string slices,
immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV  LISTS, TUPLES, DICTIONARIES  9
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  9
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

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:
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and

REFERENCES:
1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition,
2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers
2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”,
5. https://www.python.org/

COs- PO's & PSO's MAPPING

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1 - low, 2 - medium, 3 - high, '-' - no correlation
அது இப்புத்தகங்களின் தமிழ் இந்திய இறக்குமதி அறக்கொட்பொடு தமிழகத்தின் விமளயொட்டுகள் ததருக்கூத்து மகொவில்களின் வீமண குமரிமுமனயில் தெய்யும் மற்றும் நடுகல் அலகு பொரதிதொென் நவீனதமிழ் இலக்கியத்தின் இந்திய அலகு.

GE3152

3. புத்தகங்களின் தமிழ் இந்திய இறக்குமதி: 3

மாற்றம் பற்றிய தமிழ் இந்திய இறக்குமதி - திறந்த பொருட்கள் - தமிழ் கல்விக் கொட்டு நுழைவு - தமிழ் மகொவில்களின் பதமக் கடனம் - தமிழ் பராமரிக்கும் அதிகாரம் - இசைத்தொன்மையில் வெப்போட்டு காலனித்தார் - இசைத் தடுப்புக் காலோனிக்காரள் - பயிற்சிக் கொண்டு வரும் வெப்போட்டு, முட்டங்கள், தொடர்பு விளக்கம் - தமிழகக் குழு வாழ்க்கைகளில் காலோனிக்காரள் பல்கலை கழகம்

4. பராமரிக்கும் தமிழ்கள்: 3

மாற்றம் பற்றிய தமிழ் இந்திய இறக்குமதி - திறந்த பொருட்கள் - தமிழ் கல்விக் கொட்டு நுழைவு - தமிழ் மகொவில்களின் பதமக் கடனம் - தமிழ் பராமரிக்கும் அதிகாரம் - இசைத்தொன்மையில் வெப்போட்டு காலனித்தார் - இசைத் தடுப்புக் காலோனிக்காரள் - பயிற்சிக் கொண்டு வரும் வெப்போட்டு, முட்டங்கள், தொடர்பு விளக்கம் - தமிழகக் குழு வாழ்க்கைகளில் காலோனிக்காரள் பல்கலை கழகம்

5. டெலிபாருந்த வேண்டும் வேண்டும் பதமக் கடனம்: 3

மாற்றம் பற்றிய தமிழ் இந்திய இறக்குமதி - திறந்த பொருட்கள் - தமிழ் கல்விக் கொட்டு நுழைவு - தமிழ் மகொவில்களின் பதமக் கடனம் - தமிழ் பராமரிக்கும் அதிகாரம் - இசைத்தொன்மையில் வெப்போட்டு காலனித்தார் - இசைத் தடுப்புக் காலோனிக்காரள் - பயிற்சிக் கொண்டு வரும் வெப்போட்டு, முட்டங்கள், தொடர்பு விளக்கம் - தமிழகக் குழு வாழ்க்கைகளில் காலோனிக்காரள் பல்கலை கழகம்

6. குடியேற்றம் தமிழில் பொருட்கள்: 3

மாற்றம் பற்றிய தமிழ் இந்திய இறக்குமதி - திறந்த பொருட்கள் - தமிழ் கல்விக் கொட்டு நுழைவு - தமிழ் மகொவில்களின் பதமக் கடனம் - தமிழ் பராமரிக்கும் அதிகாரம் - இசைத்தொன்மையில் வெப்போட்டு காலனித்தார் - இசைத் தடுப்புக் காலோனிக்காரள் - பயிற்சிக் கொண்டு வரும் வெப்போட்டு, முட்டங்கள், தொடர்பு விளக்கம் - தமிழகக் குழு வாழ்க்கைகளில் காலோனிக்காரள் பல்கலை கழகம்

7. மாற்றும் வேண்டும் வேண்டும் பதமக் கடனம்: 3

மாற்றம் பற்றிய தமிழ் இந்திய இறக்குமதி - திறந்த பொருட்கள் - தமிழ் கல்விக் கொட்டு நுழைவு - தமிழ் மகொவில்களின் பதமக் கடனம் - தமிழ் பராமரிக்கும் அதிகாரம் - இசைத்தொன்மையில் வெப்போட்டு காலனித்தார் - இசைத் தடுப்புக் காலோனிக்காரள் - பயிற்சிக் கொண்டு வரும் வெப்போட்டு, முட்டங்கள், தொடர்பு விளக்கம் - தமிழகக் குழு வாழ்க்கைகளில் காலோனிக்காரள் பல்கலை கழகம்

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. துரூன் வேண்டும் - வேண்டும் பதமக் கடனம் - சத.சு. பொருட்கள் (தமிழில்: துரூன் வேண்டும் பதமக் கடனம் கவிசைப் பொருட்கள் காலம்).
2. பொருட்கள் தொகுப்பு - மாற்றும் வேண்டும் தொகுப்பு. (சிங்கள பொருட்கள்)
3. துரூன் - வேண்டும் தொகுப்பு வேண்டும் தொகுப்பு (தில்லியில் துரூன் பொருட்கள்)
4. பாக்தூர் - தொகுப்பு வேண்டும் தொகுப்பு. (கிறித்தொன்மை தொகுப்பு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண்பொடும் – மக.மக.பிள்மள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல் வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முமனவர் இல.சுந்தரம் (விகடன் பிரசுரம்).
3. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
4. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
5. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
6. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
7. 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)
8. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
9. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

COURSE OBJECTIVES

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

EXPERIMENTS:

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

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

TOTAL: 60 PERIODS

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

TEXT BOOKS:

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

COs- PO's & PSO's MAPPING

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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 wavelength of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
    b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

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

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

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

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1-Low,2-Medium,3-High,”-“no correlation
Note: the average value of this course to be used for program articulation matrix.
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:
- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles
  1. Preparation of \( \text{Na}_2\text{CO}_3 \) 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 (\( \text{TiO}_2/\text{ZnO}/\text{CuO} \)) by Sol-Gel method.
  14. Estimation of Nickel in steel
  15. Proximate analysis of Coal

TOTAL : 30 PERIODS

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

TEXT BOOKS :

CO’s-PO’s & PSO’s MAPPING

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

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

UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION  6
Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions (filling out a bank application for example).

UNIT II  NARRATION AND SUMMATION  6
Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT  6
Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS  6
Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V  EXPRESSION  6
Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions-understanding a website-describing processes

TOTAL : 30 PERIODS

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

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

HS3252 PROFESSIONAL ENGLISH II

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

UNIT I MAKING COMPARISONS 6
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6
Reading - Reading longer technical texts— Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

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

UNIT IV REPORTING OF EVENTS AND RESEARCH 6

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

TOTAL: 30 PERIODS
COURSE OUTCOMES:
At the end of the course, learners will be able
CO1 To compare and contrast products and ideas in technical texts.
CO2 To identify and report cause and effects in events, industrial processes through technical texts
CO3 To analyse problems in order to arrive at feasible solutions and communicate them in the written format.
CO4 To present their ideas and opinions in a planned and logical manner
CO5 To draft effective resumes in the context of job search.

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

REFERENCES:

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

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.

MA3251 STATISTICS AND NUMERICAL METHODS

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

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

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

UNIT III  SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS  9+3

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

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  9+3

TOTAL: 60 PERIODS

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

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

TEXT BOOKS:

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

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PH3203 PHYSICS FOR GEO - INFORMATICS ENGINEERING

COURSE OBJECTIVES:

- To understand the fundamentals of electromagnetic radiation, measurement of radiation and physical laws.
- To introduce the concepts of atmosphere and scattering principles. To understand the interaction of EMR with atmosphere and to introduce the concept of imaging and non-imaging sensors for atmospheric probing.
- To gain knowledge about basic optical principles in remote sensing and to introduce the concept of photography and its development.
- To understand the basics of gravitation and the physics behind it, and to introduce satellites and its effectiveness in earth monitoring.
- To understand the different types of electro-optic sensors and its detection mechanism

UNIT I ELECTROMAGNETIC RADIATION


UNIT II INTERACTION OF EMR WITH ATMOSPHERE AND EARTH’S SURFACE


UNIT III OPTICS FOR REMOTE SENSING

Lenses, mirrors, prisms - Defects of lens - chromatic aberration - longitudinal chromatic aberration - achromatism of lenses - achromatism for two lenses in contact - separated by a distance - spherical aberration - minimization of Spherical aberration - coma astigmatism - Radiative Transfer Functions,

UNIT IV  GRAVITATION AND SATELLITES  9
Newton's law of gravitation - Gravitational field and potential - Determination of gravity, variation of acceleration due to gravity of the earth with depth and with altitude - Variation of acceleration due to gravity due to rotation of the earth – Refraction. Diffraction - Fresnel theory, Circular diffraction, Polarisation double refraction - Escape velocity - Kepler's law of planetary motion - Doppler effect – Satellites and its functions - Types of satellites – Indian satellites and their functions – contribution in earth observation, communication, navigation, weather, military and scientific purpose.

UNIT V  ELECTRO - OPTIC SENSORS  9
Photomultipliers, photo resistors, photodiodes, nonselective detectors - Optical receivers, PIN and APD, optical preamplifiers, Detectors: Basic detector mechanisms, noise in detectors. Thermal and photo emissive detectors, Photoconductive and photovoltaic detectors, performance limits, Photographic, - Sensitivity, time and frequency response - hybrid photo detectors - Imaging detectors - eye and vision, photographic film. Camera tubes, solid-state arrays, video, Detector electronics, detector interfacing - Different CCD cameras. Orbital Mechanics, Concept of orbits- propulsion, aero dynamics, navigation guidance and control.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 The students will gain knowledge about electromagnetic radiation and its principles.
CO2 The students will be able to understand the physics of atmosphere and the use of imaging and non-imaging sensor in atmospheric probing.
CO3 The students will gain knowledge about remote sensing and photography.
CO4 The students will be encouraged to learn the development of satellite technology in geo-informatics.
CO5 The students will gain knowledge about different electro optic sensors.

TEXT BOOKS:

REFERENCES:

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

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

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

UNIT I  ELECTRICAL CIRCUITS  

DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)

Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only), Three phase supply – star and delta connection – power in three-phase systems

UNIT II  MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS

Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.

Domestic wiring, types of wires and cables, earthing, protective devices- switch fuse unit- Miniature circuit breaker-moulded case circuit breaker- earth leakage circuit breaker, safety precautions and First Aid

UNIT III  ELECTRICAL MACHINES


UNIT IV  ANALOG ELECTRONICS


UNIT V  SENSORS AND TRANSDUCERS

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

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

TEXT BOOKS:

3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf’s Introduction to Electric Circuits, Wiley, 2018

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3201 GEOINFORMATICS SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To introduce the information concepts and systems used in Geoinformatics
- To familiarize the role of Internet and Networks in Geoinformatics.
- To familiarize web data services and geoinformation

UNIT I COMPUTER SYSTEMS 9

UNIT II DATA ACQUISITION 9
Acquisition and storage of Numeric data- Textual data - image data - Audio data - Animation and Video data - Data formats - fundamentals of image and video compression - introduction to geospatial data- remote sensing sensors, data organization

UNIT III NETWORKS AND COMMUNICATION 9

UNIT IV WEB DATA AND SERVICES 9
UNIT V GEOINFORMATION


TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1 Understand Computer systems and data formats
CO2 Understand basics of Geoinformation
CO3 Understand the role of network systems that handles Geoinformation.
CO4 Understand data and technologies related to Geoinformation.

TEXT BOOKS:

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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GE3251 ENGINEERING GRAPHICS

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

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

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

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

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.
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
CO1 Use BIS conventions and specifications for engineering drawing.
CO2 Construct the conic curves, involutes and cycloid.
CO3 Solve practical problems involving projection of lines.
CO4 Draw the orthographic, isometric and perspective projections of simple solids.
CO5 Draw the development of simple solids.
TEXT BOOKS:

REFERENCES:

Publication of Bureau of Indian Standards:

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

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NX3251  (ARMY WING) NCC Credit Course Level - I  

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### National Integration and Awareness

**NI 1** National Integration: Importance & Necessity

**NI 2** Factors Affecting National Integration

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

**NI 4** Threats to National Security

### Personality Development

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

**PD 2** Communication Skills

**PD 3** Group Discussion: Stress & Emotions

### Leadership

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

**L 2** Case Studies: Shivaji, Jhasi Ki Rani

### Social Service and Community Development

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

**SS 4** Protection of Children and Women Safety

**SS 5** Road / Rail Travel Safety

**SS 6** New Initiatives

**SS 7** Cyber and Mobile Security Awareness

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### NCC General

**NCC 1** Aims, Objectives & Organization of NCC

**NCC 2** Incentives

**NCC 3** Duties of NCC Cadet

**NCC 4** NCC Camps: Types & Conduct

### National Integration and Awareness

**NI 1** National Integration: Importance & Necessity

**NI 2** Factors Affecting National Integration

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

**NI 4** Threats to National Security

### Personality Development

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

**PD 2** Communication Skills

**PD 3** Group Discussion: Stress & Emotions

### Leadership

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

**L 2** Case Studies: Shivaji, Jhasi Ki Rani
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT  
SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 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

GE3252 தமிழரும் மதொழில்நுட்பம்  

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அணுத்து  தமிழாரும் பொறுத்தும் மதொழில்நுட்பம்: 3
என்று காலத்திற்கு விளக்க நேரடையுடன் - பலரலை முதலில் வாழ்க்கை - கூட்டு விளம்ப் பாணியில் நடைமுறை - பலரலை முதலில் விளங்கும் கூட்டு விளம்புகள்.
TEXT-CUM-REFERENCE BOOKS
2. Classical Tamil Dictionary - Dr. V.V. Thandai Sundaram. (சிலாமைப் பதிப்பு).
3. Classical Tamil Literature History - Dr. V.V. Thandai Sundaram. (சிலாமைப் பதிப்பு).
4. Tamil Literature - Dr. D. Muthukumar. (சிலாமைப் பதிப்பு).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (CUM: தமிழ் நகரங்கள் பதிப்பு).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (CUM: தமிழ் நகரங்கள் பதிப்பு).
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) (CUM: தமிழ் நகரங்கள் பதிப்பு).

TOTAL: 15 PERIODS
GE3252   TAMILS AND TECHNOLOGY   L T P C

UNIT I   WEAVING AND CERAMIC TECHNOLOGY   3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II   DESIGN AND CONSTRUCTION TECHNOLOGY   3
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III   MANUFACTURING TECHNOLOGY   3

UNIT IV   AGRICULTURE AND IRRIGATION TECHNOLOGY   3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT V   SCIENTIFIC TAMIL & TAMIL COMPUTING   3

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழகவரலொறு–மக்களும் பணம் பொடும் – மக.மக.பிள்மள (தவளியீடு:தமிழ்நொடுபொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கல்வியீடு கீழடி – நவீனவர்த்தி விளக்கம். (விகடன் பிரசுரம்)
3. சிங்குரீகையன் தமிழக நகரிகம் (ததொல்லியல் துமறதவளியீடு)
4. எண்ணிக்கையைத் தொடர்ந்து (தகராலியின் குறுக்கு பொருள்)
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)

GE3271 ENGINEERING PRACTICES LABORATORY L T P C 0 0 4 2
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:
- Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)
PART I CIVIL ENGINEERING PRACTICES 15
PLUMBING WORK:
- Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
- Preparing plumbing line sketches.
- Laying pipe connection to the suction side of a pump.
- Laying pipe connection to the delivery side of a pump.
- Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.
WOOD WORK:
- Sawing,
- Planing and
- Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

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

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

55
GROUP – B (MECHANICAL AND ELECTRONICS)

PART III  MECHANICAL ENGINEERING PRACTICES

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

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

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

SHEET METAL WORK:
   a) Making of a square tray

FOUNDERY 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:

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

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

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

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

CO’s-PO’s & PSO’s MAPPING

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

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

List of Experiments

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, the students will be able to

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

CO2: Analyze experimentally the load characteristics of electrical machines

CO3: Analyze the characteristics of basic electronic devices

CO4: Use LVDT to measure displacement

CO’s, PO’s & PSO’s MAPPING

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GE3272 COMMUNICATION LABORATORY

COURSE OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context
UNIT I
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

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

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

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

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

TOTAL: 60 PERIODS

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

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

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.
MA3302 TRANSFORMS AND STATISTICS L T P C

3 1 0 4

COURSE OBJECTIVES
- To acquaint the student with Fourier Series techniques used in wide variety of situations in which the functions used are not periodic and to solve boundary value problems.
- To understand the Fourier transform techniques to solve boundary value problems.
- To introduce the concept of Probability and random variables in Statistics which is central to many geometric applications.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

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

UNIT II FOURIER TRANSFORM 9+3

UNIT III RANDOM VARIABLES 9+3
Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

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

UNIT V ESTIMATION THEORY 9+3

TOTAL: 60 PERIODS

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

CO1 Apply Fourier series techniques used in wide variety of situations in which the functions used are not periodic and to solve boundary value problems.

CO2 Apply the Fourier transform techniques to solve boundary value problems.

CO3 To understand and apply the concept of Probability and random variables in Statistics which is central to many geometric applications.

CO4 To apply the basic concepts of two dimensional random variables.

CO5 To understand the knowledge of applying the concept of estimation theory which plays an important role in real life problems.

TEXTBOOKS:
REFERENCES:

COURSE OBJECTIVES:
- Introduce the students to the concepts of DBMS, Spatial Database Management System (SDBMS), Spatial Database design, basic application program development and user interfaces.

UNIT I INTRODUCTION
Data — Information - File system Vs DBMS — Database Management Systems — Database architectures, users and administrators — Classification of Database Management Systems — Spatial Data - Points, Lines, Polygons — definition of SDBMS — user classes of SDBMS — Multilayer architecture of SDBMS — GIS and SDBMS.

UNIT II SPATIAL CONCEPTS AND DATA MODELS
Field based model — object based model — spatial data types — operations on spatial objects - Entity Relationship Model (ER Model) — Relational Model — Constraints and Normal forms of Relational Model - mapping ER model to Relational model — ER model with spatial concepts — Object-oriented data modeling with Unified Modeling Language(UML).

UNIT III QUERY LANGUAGE
SQL — Data Definition — Data Manipulation - Basic structure of SQL — Set operations — Aggregate Functions – Simple queries — spatial Vs non spatial - Nested sub queries – Complex queries – Views – Trigger - OGIS standard for extending SQL - example spatial SQL queries – Object relational SQL.

UNIT IV SPATIAL STORAGE AND INDEXING
UNIT V SPATIAL DATABASE SYSTEMS AND APPLICATION DESIGN AND DEVELOPMENTS

Exploring Spatial Geometry – Organizing spatial data - spatial data relationships and functionalities of any one commercial and one FOS SDBMS each – Application program and user Interfaces.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
- CO1 Understand the concepts, classification, architectures of DBMS, SDBMS
- CO2 Provide the information on Field Based, Object Based, ER, Relational and UML models.
- CO3 Enable the SQL, Extended SQL for handling Spatial and Non-Spatial Queries.
- CO4 Show the methods of Storing, Indexing, Database Recovery and Data Security concepts
- CO5 Give the Design and Development Environment of Spatial Data

TEXTBOOKS:


REFERENCES:


CO’s, PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
- To introduce the rudiments of surveying and its principles to Geoinformatics Engineers.
- To learn the various methods of surveying to solve the real-world problems.
- To introduce the concepts of control surveying
- To introduce the basics of cadastral Surveying

UNIT I  FUNDAMENTALS OF CONVENTIONAL SURVEYING  9

UNIT II  LEVELLING  9

UNIT III  THEODOLITE SURVEYING  9

UNIT IV  CONTROL SURVEYING AND ADJUSTMENT  9

UNIT V  CADASTRAL SURVEYING  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Understand the rudiments of various surveying and its principles.
  CO2 Gain knowledge in computation of levels of terrain and ground features
  CO3 Understand the concepts of Theodolite Surveying for complex surveying operations
  CO4 Understand the procedure for establishing horizontal and vertical control
  CO5 Gain knowledge on cadastral survey

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GI3303 REMOTE SENSING L T P C
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COURSE OBJECTIVES:
- To introduce the concepts of remote sensing processes and its components.
- To expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9
reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III  ORBITS AND PLATFORMS  9
Motions of planets and satellites – Newton’s law of gravitation – Gravitational field and potential - Escape velocity - Kepler’s law of planetary motion - Orbit elements and types — Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Air borne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites — Lagrange Orbit.

UNIT IV  SENSING TECHNIQUES  9

UNIT V  DATA PRODUCTS AND INTERPRETATION  9

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Understand the concepts and laws related to remote sensing
CO2 Understand the interaction of electromagnetic radiation with atmosphere and Earth material
CO3 Acquire knowledge about satellite orbits and different types of satellites.
CO4 Understand the different types of remote sensors.
CO5 Gain knowledge about the concepts of interpretation of satellite imagery.

TEXTBOOKS:

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**COURSE OBJECTIVES:**
- To understand the geometry of the earth, Gravity, and its relationship with nature.

**UNIT I  FUNDAMENTALS**

**UNIT II GEOMETRIC GEODESY**

**UNIT III  CO-ORDINATE SYSTEMS**

**UNIT IV PHYSICAL GEODESY**

**UNIT V  GEODETIC ASTRONOMY**
Celestial Sphere – Astronomical triangle – celestial coordinates systems and its relationship with Cartesian Co-ordinates and Transformation between them - Special star positions, Major 44 constellations - time systems (sidereal, Universal, atomic and standard) rising and setting of Stars.
with respect to Declination, hour angle and Azimuth, Culmination, Prime Vertical Crossing and Elongation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
  
  **CO1** Learn about the fundamentals of Geodesy
  
  **CO2** Understand the concepts of geoid, ellipsoid and their interrelationship
  
  **CO3** Know about the various types of coordinate systems and relationship between them
  
  **CO4** Learn about the methods for measurement of gravity and gravity network
  
  **CO5** Understand the concepts of geodetic astronomy

TEXTBOOKS:


REFERENCES:


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CO3391 PHOTOGRAMMETRY

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COURSE OBJECTIVES:

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

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

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

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

UNIT V  DIGITAL PHOTOGRAMMETRY  9

TOTAL:45 PERIODS

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

CO1  Understand and appreciate the importance of photography as means of mapping, functional and physical elements of photography.

CO2  Understand the need of the photogrammetric mapping and the relevance of accuracy standards and means to achieve them for precise large-scale maps with scientific methods.

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

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

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

TEXTBOOKS:

REFERENCES:
### GI3311 SURVEYING LABORATORY I

**L T P C**

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#### COURSE OBJECTIVES:
- To familiarize with the various surveying instruments and methods.

#### EXERCISES:
1. Chain traversing
2. Compass traversing
3. Centre line marking of a building
4. Planimetric Mapping of an Area using Plane Table Surveying (Radiation, Intersection)
5. Map updation using Plane Table Surveying through Resection (Graphical Method)
6. Plane table surveying – Two point problem
7. Fly and Check Levelling using dumpy level / tilting level
8. Determination of horizontal and vertical angles using theodolite
9. Determination of tacheometric constants using horizontal and inclined line of sight
10. Single plane method using theodolite
11. Double plane method using theodolite
12. Determination of RL of a point on sloping terrain using tacheometric surveying
13. Preparation of Planimetric Map using stadia tacheometry

#### TOTAL: 60 PERIODS

**COURSE OUTCOMES:**
- On completion of the course, the student is expected to
  - **CO1** Gain knowledge on the usage of basic surveying instruments like chain/tape, compass, plane table and leveling instruments
  - **CO2** Use levelling instrument for surveying operations
  - **CO3** Use theodolite for various surveying operations
  - **CO4** Carry out the necessary surveys for social infrastructures
  - **CO5** Prepare the planimetric maps

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GI3312 REMOTE SENSING AND PHOTOGRAMMETRY LABORATORY  L T P C  0 0 2 1

COURSE OBJECTIVES:
- To facilitate the students with hands on experience on visual interpretation of satellite data products and conventional and digital interpretation of aerial photographs.

REMOTE SENSING EXERCISES
1. Preparation of Base Map from Survey of India Topo sheets
2. Introduction to various satellite data products and image interpretation keys
3. Preparation of Land use/land cover map using Satellite Data / Aerial Photograph.
4. Spectral measurements using spectroradiometer and processing for
   a. Water & Soil
   b. Vegetation
   c. Various surfaces and land cover
PHOTOGRAMMETRY EXERCISES
1. Testing stereovision with Stereogram card
2. Mirror stereoscope - base line, orientation of aerial photographs and Photo Interpretation
3. To find the height of point using Parallax bar
4. Scale of vertical photographs
5. Aerial Triangulation using digital photogrammetry
6. Bundle Block adjustment
7. Generation and editing of DTM and Contour
8. Orthophoto generation and Mosaic
9. Preparation of Planimetric map

TOTAL: 30 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Identify different features from satellite images
  CO2 Interpret images to prepare thematic maps
  CO3 Determine geometrical elements of aerial photograph
  CO4 Analyze the aerial photograph
  CO5 To generate Digital Elevation Model and Ortho photo from Stereo models

TEXTBOOKS:

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3401 SENSORS AND DATA PRODUCTS

COURSE OBJECTIVES:
- To familiarize the students with principle and operation of available sensing system, access protocols and its applicability.

UNIT I OPTICAL AND IR SENSORS
Land observation satellites, IRS series, LANDSAT series, SPOT series, High resolution satellites, character and applications, CARTOSAT series, IKONOS Series, QUICKBIRD series, Weather/Meteorological satellites, INSAT series – data formats

UNIT II MICROWAVE AND THERMAL SENSORS
Use of Microwave data - SeaWiFS, OCR, CZCs studies -chlorophyll production index -sea surface temperature (SST) sensors -NIMBUS, RADARSAT, CASI - MESSR, OCTS ATSR -Sensors - OCEANSAT ATSR on ERS TOPEX/Poseidon satellite data – NASA earth data, ESA, NCEL, GLOVIS, NEO, USGSEE - GOOGLE EARTH- SARAL.

UNIT III HYPERSPECTRAL SENSORS
Scanner types and characterization - specifications of various sensors Spectrographic imagers- hyperspectral sensors, Design tradeoffs. Data formats and systems, AVIRIS, CASI, NASA Terra Moderate Resolution Imaging Spectrometer (MODIS), Hyperion - VEDAS

UNIT IV GEO PORTALS

UNIT V APPLICATION AREAS
Data download – climatic data- oceanic data – coastal data – land data – rainfall data; applications – rainfall vs NDVI, PPI- LST vs land use – wind vector and oceans current; mini project

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

CO1 Gain knowledge on the current and historic satellite missions and sensors national and international importance and their relevance in the resource application

CO2 Gain information on the various types of primary and derived satellite data for earth resource management and their specifications

CO3 Acquire the knowledge about open geoportals that offer satellite data and related resource data and their applicability

CO4 Acquire knowledge on the methods to download satellite data or how to procure them from the authorized geoportals

CO5 Analyze critically and evaluate the quality, standards of satellite data and to use them for various applications.

TOTAL: 45 PERIODS
TEXTBOOKS:
2. Landsat Data Continuity Mission(L1) Data format Control Book – USGS

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3402 DIGITAL IMAGE PROCESSING L T P C
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COURSE OBJECTIVES:
- To make the undergraduate Engineering Students understand the concepts, principles, processing of Satellite data in order to extract useful information from them.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9
UNIT II  PREPROCESSING  9
Image Characteristics – Histograms – Scattergrams – Initial statistics – Univariate and multivariate
statistics-Initial image display- Ideal display, types, Sensor models - spatial, spectral, radiometric,
temporal -IFOV, GIFOV& GSI - geometry and Radiometry – Sources of Image degradation and
Correction procedures - Atmospheric, Radiometric, Geometric Corrections- Image Geometry
Restoration-Interpolation methods and resampling techniques.

UNIT III  IMAGE ENHANCEMENT  9
Image characteristics- point, local and regional operation – contrast, spatial feature and multi-image
manipulation techniques – level slicing, contrast stretching, spatial filtering, edge detections - Fourier
transform-FFT, DFT - Band ratio - Principal Component Analysis (PCA) – Scale-space transform-
multi-image fusion.

UNIT IV  IMAGE CLASSIFICATION  9
Pattern recognition concepts – Bayes approach – spectral Signature and training sets – Separability
test – Supervised Classification – stages – Minimum distance to mean, Parallelepiped, MLC –
matrix -Accuracy assessment – accuracy metrics: Kappa statistics, ERGAS, RMS.

UNIT V  ADVANCED CLASSIFIERS  9
Texture based classification -Segmentation (Spatial, Spectral)-regions Fuzzy set classification –
Object based classifiers – Deep Learning - Artificial Neural nets: Hebbian leaning - Adaline,
Madaline, BPN – hybrid classifiers – Neuro - Fuzzy models- Expert system – Knowledge based
systems,

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

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TOTAL:45 PERIODS

TEXTBOOKS:
dition.
2. Robert,A.Schwengerdt, Techniques for Image Processing and classification in Remote
sensing,1983.

REFERENCES:
,Falls ,Church, USA,1983.
2. John,A Richards, Remote sensing digital Image Analysis – An Introduction Springer-Verlag, Fifth
3. Digital Image Processing by Rafael C. Gonzalez, Richard Eugene Woods - Pearson/Prentice

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GI3403  MICROWAVE REMOTE SENSING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To impart the knowledge on Microwave Remote Sensing and its applications.

UNIT I  FUNDAMENTALS AND ACTIVE SYSTEM  9

UNIT II  RADAR INTERACTION WITH EARTH FEATURES  9

UNIT III  IMAGING AND NON IMAGING SENSING  9

UNIT IV  SAR APPLICATIONS  9

UNIT V  PASSIVE SYSTEM  9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Understand the fundamentals of microwave remote sensing system such as SLAR, RAR and SAR
CO2 Learn the interaction mechanism of Radar with target features
CO3 Understand the principles and applications of Imaging and Non-Imaging observation
CO4 Learn the about the satellite sensing system and applicability of SAR
CO5 Understand the concepts of passive microwave systems and applications

TEXTBOOKS:

REFERENCES:

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GI3491 CARTOGRAPHY AND GIS L T P C 3 0 0 3

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

UNIT I ELEMENTS OF CARTOGRAPHY 9

UNIT II MAP DESIGN AND PRODUCTION 9

UNIT III FUNDAMENTALS OF GIS 9

UNIT IV DATA INPUT AND TOPOLOGY 9

UNIT V DATA QUALITY AND OUTPUT 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Be familiar with appropriate map projection and co-ordinate system for production of Maps and shall able to compile and design maps for their required purpose.
  CO2 Be familiar with co-ordinate and Datum transformations
  CO3 Understand the basic concepts and components of GIS, the techniques used for storage of spatial data and data compression
  CO4 Understand the concepts of spatial data quality and data standard
  CO5 Understand the concept of spatial data inputs

TEXTBOOKS:
REFERENCES:

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GI3492 TOTAL STATION AND GPS SURVEYING

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

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

UNIT II ELECTRO-OPTICAL AND MICROWAVE
Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Care and maintenance of Total Station instruments.
COGO functions: Area, Inverse / MLM, REM, Resection, offsets and stakeout - Land survey applications.
UNIT III SATELLITE SYSTEM

UNIT IV GPS DATA PROCESSING

UNIT V SURVEYING METHODS AND APPLICATIONS
Total Station: Traversing and Trilateration measurement and adjustment –Planimetric map and Contour map and Topography Mapping. GNSS: Concepts of rapid, static, semi-Kinematic, pure Kinematic and RTK methods. Observation by Radiation, Lee frog and Trilateration measurement and processing -Topography mapping using PPK and RTK methods
Total Station and GNSS applications

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Learn about the fundamental concept of Total station.
CO2 Provide knowledge about electromagnetic waves and its usage in Total station and GNSS.
CO3 Gain Knowledge on basic concepts of GNSS
CO4 Understand the measuring and working principle of electro optical and Microwave Total station and GPS
CO5 Gain knowledge about Total station and GNSS data processing and Mapping.

TEXTBOOKS:

REFERENCES:

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GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

COURSE OBJECTIVES:
- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- 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 6

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

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

REFERENCES:

COs- PO’s & PSO’s MAPPING

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1-low, 2-medium, 3-high, ‘-'- no correlation
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**NX3451 (ARMY WING) NCC Credit Course Level - II**

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**TOTAL: 45 PERIODS**

### NCC Credit Course Level 2*

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

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DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9
DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION 3
EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS 4
GA 1 General Knowledge 4

NAVAL ORIENTATION 6
AF 1 Armed Forces and Navy Capsule 3
EEZ 1 EEZ Maritime Security and ICG 3

ADVENTURE 1
AD 1 Introduction to Adventure Activities 1

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

TOTAL: 45 PERIODS

NCC Credit Course Level 2*
NX3453 (AIR FORCE WING) NCC Credit Course Level - II L T P C 3 0 0 3

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

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

DISASTER MANAGEMENT 13
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DM 2 Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters 9
DM 3 Fire Service & Fire Fighting 1

ENVIRONMENTAL AWARENESS & CONSERVATION 3
EA 1 Environmental Awareness and Conservation 3

GENERAL AWARENESS 4
GA 1 General Knowledge 4

82
GENERAL SERVICE KNOWLEDGE  6
GSK 1  Armed Forces & IAF Capsule  2
GSK 2  Modes of Entry in IAF, Civil Aviation  2
GSK 3  Aircrafts - Types, Capabilities & Role  2

ADVENTURE  1
AD 1  Introduction to Adventure Activities  1

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

TOTAL: 45 PERIODS

GI3411  TOTAL STATION AND GPS SURVEYING LABORATORY  L T P C
0 0 4 2

COURSE OBJECTIVES:
• To train the students to acquire skill in making precise measurements and obtaining accurate results with Total Station and GPS.

EXERCISES:
1. Temporary adjustment of Total station and Angle, Distance and Coordinate measurement
2. Establishment of Horizontal control point by Traversing
3. To determine the instrument station coordinate by Resection method (Angles only and Distances only)
4. Application COGO function: Area, MLM / Inverse function, REM and offsets
5. Planimetric mapping using Total Station
6. Preparation of Contour map using Total Station
7. Setting out: by Coordinates, by Distance and angle, Points at equal length
8. Navigation and Feature collection using handheld GPS
9. GNSS Planning
10. Accuracy evaluation of baseline with different common observation times
11. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Lee Frog Method
12. Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Trilateration method
13. Preparation of Planimetric map using Post Processed Kinematic (PPK) method
14. Network Adjustment of GNSS observation

TOTAL: 60 PERIODS

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

CO1  Gain the basic idea about Total station and GNSS.
CO2  Acquire knowledge about establishment of horizontal control point using Total station and GNSS.
CO3  Impart Knowledge in preparation of contour map using Total station and GNSS.
CO4  Understand the various coordinate geometry function in Total station and GPS
CO5  Gain knowledge about Total station and GNSS data processing, network adjustment and Mapping.

REFERENCES:

**CO’s, PO’s & PSO’s MAPPING**

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**GI3412 CARTOGRAPHY AND GIS LABORATORY**

**COURSE OBJECTIVES:**
- Hands on experience of basics of cartography and GIS.
- Designing the map
- Development of GIS database and populating attribute data

**EXERCISES:**
1. Simple conical,cylindrical and planar projection for the reduced earth having 2to4 cm radius aspect and secant demo.
2. Graded symbolization and isopleth/choropleth map
3. Map compilation and Design
4. Data Input –Onscreen Digitization –Creation of Point, Line and Polygon layers
5. Projection, Reprojection and Coordinate Transformation of Maps
6. Attribute data input and Measurement of Distance, Area
7. Linking External Database and Tabular Data Analysis using SQL commands
8. Generating Graphs,Charts and Diagrams from Tabular data
9. Data Conversion –Vector to Raster and Raster to Vector
10. Map Joining, Edge Matching and Layout Design

TOTAL: 30 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Design and produce thematic maps with suitable projection, symbols and color codes
  CO2 Compile and develop digital maps
  CO3 Create spatial database and non-spatial databases in GIS environment
  CO4 Analyze spatial database and generate reports, maps
  CO5 Represent spatial data in a professional format

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3413 DIGITAL IMAGE PROCESSING LABORATORY

COURSE OBJECTIVES:
• To familiarize the undergraduate level students in the regular Image Processing Software.

EXERCISES:
1. Image reading and writing
2. Pre- Processing techniques: radiometric correction
3. Random and Periodic Noise removal
4. Pre- Processing techniques: Ground control and rectification
5. Enhancements – histogram, filters
6. Band_ratioing and normalization – NDVI, SAVI & NDWI
7. PCA
8. Image fusion

85
9. Classification – supervised & unsupervised
10. Sub pixel classification
11. Classification using Neural Network and Fuzzy Logic
12. Accuracy assessment – correlation, RMSE & kappa
13. Crop conditioning assessment/ inundation damage assessment/ forest fire/ change dynamic analysis

TOTAL: 60 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Enhance satellite imagery through filtering, band ratioing, PCA etc
  CO2 Georeference and project the satellite imagery
  CO3 Classify and assess accuracy of classification.
  CO4 Perform advanced classifier
  CO5 Carry out mini project in any of the application

TEXT BOOK

CO’s, PO’s & PSO’s MAPPING

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GI3501 SPATIAL ANALYSIS AND APPLICATIONS

COURSE OBJECTIVES:
• To provide exposure to Raster, Vector, Network and Geo-statistical Analysis Capabilities of GIS.

UNIT I RASTER ANALYSIS
UNIT II VECTOR ANALYSIS

UNIT III NETWORK ANALYSIS

UNIT IV SURFACE AND GEOSTATISTICAL ANALYSIS

UNIT V CUSTOMISATION, WEBGIS, MOBILE MAPPING

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Aware of different tools available in GIS for Raster and Vector data analysis
  CO2 Understand GIS functionalities to analyse network and surface dataset
  CO3 Know the possibilities of customization of GIS
  CO4 Understand the architecture of Web GIS and its applications
  CO5 Aware of concept of recent techniques like mobile mapping and LBS

TEXTBOOKS:

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3502 MAPPING TOOLBOXES FOR GEOMATICS

COURSE OBJECTIVES:
- To familiarize the available mapping toolboxes for geomatics applications.

UNIT I INTRODUCTION TO MATLAB PROGRAMMING 9

UNIT II GRAPHICS AND MATHEMATICAL COMPUTING WITH MATLAB 9
Graph elements; color - theme - type - title and label - drawing multiple functions - generating subplots - drawing bar chart - 3D plots - work with plotting: regression analysis and presentation - Algebraic equations - Basic Symbolic Calculus and Differential equations - Transforms

UNIT III TOOLBOXES FOR GEOSPATIAL DATA 9
Functions: To read and write geospatial data: geotiffwrite - read geotable - shaperead - Interface gateway to link external language programs: C-MEX or F-MEX - shapelib functions - poly(i).handles(k) function – make_map function - Spatial Econometrics and Spatial Statistics toolbox - arc moran plot function - Arc Mat Toolbox functions – Topo Toolbox: DEM Analysis

UNIT IV IMAGE PRE PROCESSING 9

UNIT V STATISTICAL DATA ANALYSIS 9
Image processing tool box – reading and writing of image– file format conversion – image display and fusion – image Enhancement - Image smoothening - histogram: Univariate and Multivariate statistical analysis

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Enable the student to understand basic MATLAB/Scilab functions
  CO2 Enable to understand graphics and mathematics using MATLAB/Scilab functions
  CO3 Enable to understand files and scripts using MATLAB/Scilab functions
  CO4 Enable the student to understand geospatial toolbox using MATLAB/Scilab functions
  CO5 Enable the student to understand Image processing with MATLAB functions

TEXTBOOKS:
learning, 2008.

REFERENCES:
Academic Press.
4. Getting Started with MATLAB 7: A Quick Introduction for Scientists and Engineers, by Rudra 
Pratap, OUP USA, 2005.
5. Programming and Engineering Computing with MATLAB 2018 by Huei-Huang Lee, SDC 

CO’s, PO’s & PSO’s MAPPING

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GI3511 MAPPING TOOLBOXES LABORATORY

COURSE OBJECTIVES:
- To inculcate the experimental skills to use mapping tool boxes for geomatics applications.

EXCERCISES:
1. Introduction to MATLAB functions
2. Loops in MATLAB
3. Arithmetic operations in matrix
4. Files and scripts
5. 2D and 3D plotting using MATLAB
6. MATLAB for transforms
7. Image reading and writing using matlab/Scilab
8. Enhancements–histogram, filters using matlab/Scilab
10. PCA and Image fusion using matlab/Scilab
11. Supervised and unsupervised classification using matlab/Scilab
12. Classification using Neural Network and Fuzzy Logic using matlab/Scilab

TOTAL: 30 PERIODS

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

CO1 Enable the student to understand basic MATLAB/Scilab functions familiar with the MATLAB GUI and basic toolboxes
CO2 Enable to understand graphics and mathematics using MATLAB/Scilab functions exposed to vector and matrix operations
CO3 Enable to understand files and scripts using MATLAB/Scilab functions familiar with arithmetic, logical and relational operations on matrix
CO4 Enable the student to understand geospatial toolbox using MATLAB/Scilab functions
CO5 Enable the student to understand Image processing with MATLAB functions problems and Use built-in toolboxes

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3601  GEOSPATIAL ANALYSIS WITH R PROGRAMMING  L T P C  2 0 2 3

COURSE OBJECTIVES:
- To expose the variables, expressions, control stations of R
- To use R Programming for Analysis of data and visualize outcome inform of graphs, charts
- To analysis data using various statistical tools like correlation and regression

UNIT I  INTRODUCTION TO R  6+3
Introduction - History and overview - elements and data structures - Sessions and Functions - Variables - DataTypes - Vectors - Scalars - Conclusion - DataFrames - Lists - Matrices - Arrays - Classes - Data input/output - Data storage formats - Sub setting objects - Vectorization

UNIT II  PROGRAMMING IN R  6+3
R Programming - Arithmetic and Boolean Operators and values - Structures - Control Statements - Loops - Pointers - Recursion - Scoping Rules - Loop functions - Array and Matrices

UNIT III  DATA MANIPULATION  6+3

UNIT IV  DATA VISUALISATION AND PROBABILITY DISTRIBUTION  6+3

UNIT V  STATISTICAL DATA ANALYSIS  6+3

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 State the capabilities of R and its data, variable types.
  CO2 Describe the various operators, control statements and scoping rules in R.
  CO3 Apply R programming for manipulation of datasets.
  CO4 Produce various graphs and distribution plots using R.
  CO5 Analyze dataset using Statistical Tools available in R.

TOTAL:45 PERIODS

REFERENCES:
### CO’s, PO’s & PSO’s MAPPING

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**GI3691  AIRBORNE AND TERRESTRIAL LASER MAPPING**  
**L T P C 3 0 0 3**

### COURSE OBJECTIVES:
- To introduce the concepts of Space Borne, Air Borne, Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping

### UNIT I  SPACE BORNE RADAR AND LIDAR ALTIMETER  
Principle and Properties of LASER- Production of Laser – Components of LASER – LiDAR – Types of LiDAR: Range Finder, DIAL and Doppler LiDAR - Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography , Moon Topography - Merits of ALS in comparison to Levelling, echo sounding, GPS leveling, Photogrammetry and Interferometry

### UNIT II  AIRBORNE LASER SCANNERS  

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

### UNIT IV  POST PROCESSING of LiDAR Data  
Post Processing – Geo location of Laser Foot Prints – Various Co-ordinate Transformations involved Filtering - Ground Point filtering – Digital Surface Model and Digital Elevation Model - LiDAR data

UNIT V  TERRESTRIAL LASER SCANNERS

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

TEXTBOOKS:

CO’s, PO’s & PSO’s MAPPING

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TOTAL: 45 PERIODS
## NCC Credit Course Level 3*

### NX3651
**AROUND WING** NCC Credit Course - III

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### BORDER & COASTAL AREAS

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<tr>
<td>INF 1</td>
<td>Organisation of Infantry Battalion &amp; its weapons</td>
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### MILITARY HISTORY

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<td>MH 1</td>
<td>Biographies of Renowned Generals</td>
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<td>War Heroes - PVC Awardees</td>
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<td>MH 3</td>
<td>Study of Battles - Indo Pak War 1965, 1971 &amp; Kargil</td>
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<td>MH 4</td>
<td>War Movies</td>
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**TOTAL: 45 PERIODS**

## NCC Credit Course Level 3*

### NX3652
**NAVAL WING** NCC Credit Course - III

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### BORDER & COASTAL AREAS

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### NAVAL ORIENTATION

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<td>AF 2</td>
<td>Naval Expeditions &amp; Campaigns</td>
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**TOTAL: 45 PERIODS**
### NAVAL COMMUNICATION
- **NC 1**: Introduction to Naval Communications (1 period)
- **NC 2**: Semaphore (1 period)

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

### SEAMANSHIP
- **MH 1**: Introduction to Anchor Work (2 periods)
- **MH 2**: Rigging Capsule (6 periods)
- **MH 3**: Boatwork - Parts of Boat (2 periods)
- **MH 4**: Boat Pulling Instructions (2 periods)
- **MH 5**: Whaler Sailing Instructions (3 periods)

### FIRE FIGHTING FLOODING & DAMAGE CONTROL
- **FFDC 1**: Fire Fighting (2 periods)
- **FFDC 2**: Damage Control (2 periods)

### SHIP MODELLING
- **SM**: Ship Modelling Capsule (3 periods)

TOTAL: 45 PERIODS

NCC Credit Course Level 3*

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

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<td><strong>FI 1</strong> Basic Flight Instruments</td>
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GI3611 SPATIAL ANALYSIS AND APPLICATIONS LABORATORY

COURSE OBJECTIVES:
- To experience the students in various Spatial and Network analysis of Spatial Data and develop problem-solving skills using GIS

EXERCISES:
A. Raster Analysis
   a. Data exploration – statistics and query analysis
   b. Map algebra, Reclassification, arithmetic and logical overlay.
   c. Focal and zonal operations.
   d. Distance and shortest path analysis.
B. Vector Analysis
   a. Attribute analysis and Data extraction.
   b. Overlay and Cost weighted overlay.
   c. Proximity–Buffer analysis.
C. Network Analysis
   a. Network Conflation, Geocoding.
   b. Short route analysis.
   c. Service area, closest facility analysis.
D. Surface Analysis
   a. Slope and Aspect calculation.
   b. Interpolation techniques.
   c. View shed analysis and Watershed Delineation.
E. Customization
   a. Scripting/embedded scripts.
   b. Batch Processing and Web GIS demo.

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Analyze the raster and vector data using various tools available in GIS.
  CO2 Customize the GIS environment and writing simple scripts.
  CO3 Appreciate the use of Web GIS in dissemination of spatial datasets.

TOTAL: 60 PERIODS
CO4  Understand the concepts of surface Analysis
CO5  Do GIS Customization

REFERENCES:

CO's, PO's & PSO's MAPPING

<table>
<thead>
<tr>
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<th>Graduate Attribute</th>
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<td>Problem Analysis</td>
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<td>PO4</td>
<td>Conduct Investigations of Complex Problems</td>
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<tr>
<td>PO6</td>
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<td>PO7</td>
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<td>PO8</td>
<td>Ethics</td>
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<td>PO9</td>
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<td>PO10</td>
<td>Communication</td>
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<td>PO12</td>
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<tr>
<td>PSO1</td>
<td>Knowledge of Geoinformatics discipline</td>
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<tr>
<td>PSO2</td>
<td>Critical analysis of Geoinformatics Engineering problems and innovations</td>
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<tr>
<td>PSO3</td>
<td>Conceptualization and evaluation of Design solutions</td>
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GI3612  SURVEY CAMP (2 WEEKS)  L T P C  0 0 0 1

COURSE OBJECTIVES:
- To provide practical knowledge for implementation of different survey works.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:
1. Traverse– using Theodolite / Total station
2. Contouring
   (i). Radial tachometric contouring -Radial Linear Every 45 Degree and Length not less than 60 Meter on each Radial Line
   (ii). L.S & C.S – Road and canal alignment for a Length of not less than1 Kilometer
3. Offset of Buildings and Plotting the Location
4. Sun observation to determine azimuth (guidelines to be given to the students)
5. Use of GPS to determine latitude and longitude and locate the survey camp location
6. Traversing using GPS
7. Curve setting by deflection angle
COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Handle the modern surveying instruments like Total station and GPS
  CO2 Apply modern surveying techniques in field to establish horizontal control.
  CO3 Understand the surveying techniques in field to establish vertical control
  CO4 Apply different survey adjustment techniques.
  CO5 Carry out different setting outworks in the field

CO’s, PO’s & PSO’s MAPPING

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GI3701 SPATIAL DATA ADJUSTMENT

OBJECTIVES:
• To impart skills in computational adjustment for Geomatics problems

UNIT I MEASUREMENT AND ERROR

UNIT II LEAST SQUARES ADJUSTMENT
Introduction - simple adjustment methods - Least squares method - Examples of least squares Problems – Techniques of least squares- concept of weight - least squares adjustment of indirect Observations –least square adjustment of observations only.
UNIT III VARIANCE COVARIANCE PROPAGATION
Random events and probability - Random variables - continuous probability distributions – normal
distribution - Expectation - measures of precision and accuracy - covariance and correlation -
covariance, cofactor and weight matrices - Introduction to sampling - Derivation of the propagation
laws-Examples-step wise propagation.

UNIT IV PRE-ANALYSIS OF SURVEY MEASUREMENTS
Pre analysis procedure- Horizontal angle measurement, Distance measurement and elevation

UNIT V GEODETIC COMPUTATIONS
Rectangular, Polar and Spherical Co -ordinates-First and Second geodetic problem- methods of
point determinations: intersection, resection, arc section and also with over determinations – Two
Dimensional and Three-Dimensional Transformation adjustments.

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Imparts concepts of error, error distribution and error adjustment procedures.
CO2 Understand the procedure involved in error adjustment using least square adjustment
CO3 Convey an idea about the quality of infinite size data by Variance and Covariance
CO4 Choose the suitable accuracy of instruments for their projects by pre-analysis, Technique
and to create database by collecting quality datasets
CO5 Computation of coordinate using adjusted measurements and its transformation

TEXTBOOKS:
   Reinhold, New York, 2005

REFERENCES:
2. OSCAR S. ADAMS, GEODESY: Application of the Theory of Least Squares to The Adjustment
4. Edward L. Ingram, Geodetic Surveying and the adjustment of observations (Method of Least

CO’s, PO’s & PSO’s MAPPING

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GI3702 WEB GIS

COURSE OBJECTIVES:
- This course provides skills in learning a set of scripts and their applications for providing web based services using GIS technology

UNIT I INTRODUCTION TO WEBGIS AND MARKUP LANGUAGE

UNIT II HTML AND CSS

UNIT III JAVA SCRIPT
Data types and Variables - Operators, Expressions, and Statements -Functions - Objects - Array, Date and Math related Objects - Document Object Model - Event Handling - Controlling Windows & Frames and Documents - Form handling and validations.

UNIT IV PHP

UNIT V GEOSERVER

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
CO1 Understand the concept web GIS and language
CO2 Understand the concept HTML
CO3 Understand the concept JAVA
CO4 Understand the concept PHP
CO5 Understand the concept Geoserver
REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GE3791 HUMAN VALUES AND ETHICS L T P C 2 0 0 2

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  6

UNIT II  SECULAR VALUES  6
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  6

Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

UNIT IV  SOCIAL ETHICS  6
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  6
Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.


TOTAL: 30 PERIODS

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

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

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

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

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

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

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

TEXT BOOK:
REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3711 CUSTOMIZATION LABORATORY

COURSE OBJECTIVES:
- To facilitate the students with hands on experience on GIS customization using programming concepts, testing and troubleshooting in the developmental frameworks.

EXCERCISES:
1. Basics of scripting Python, Open layers
   i. File Handling (reading/writing)
   ii. GUI based application development
2. Spatial Data handling using the scripts
   i. Reading of shape file (Point, Line and Poly)
   ii. Displaying shape file
   iii. Reading of Post GIS data
3. Displaying of Post GIS data
4. Changing layer symbology
5. Attribute handling
6. Simple Query and spatial Query builder
7. Simple Geo processing (Buffer and Overlay)
8. Reading WMS WFS data
9. Displaying WMS WFS data with symbology
10. Building small application having the above facilities
11. Statistical software interface using the scripts
   i. Linking to R-Stat to get statistical results

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Learning scripting Languages
  CO2 Understanding GIS Data Structure
  CO3 Reading and Displaying data through Scripting
  CO4 Developing Geo Processing Skills
  CO5 Learning Web Services and Statistics.

TOTAL: 30 PERIODS
REFERENCES:
3. https://www.rstudio.com/online-learning/#r-programming

CO’s, PO’s & PSO’s MAPPING

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

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

TOTAL: 300 PERIODS

COURSE OUTCOMES:
- On completion of the project works students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.
- CO1 Identify Geoinformatics engineering problems reviewing available literature.
- CO2 Identify appropriate techniques to analyze complex Geoinformatics engineering problems.
- CO3 Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.
CO’s, PO’s & PSO’s MAPPING

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PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I: SURVEYING & MAPPING

GI3001 TERRESTIAL AND CLOSE RANGE PHOTOGRAMMETRY

L T P C 3 0 0 3

COURSE OBJECTIVES:
- To learn the working principle and applications of terrestrial and close range photogrammetric system.

UNIT I FUNDAMENTALS OF TERRESTIAL AND CLOSE-RANGE PHOTOGRAMMETRY
Terrestrial cameras –metric and non-metric cameras – photo theodolites -stereometric cameras – Photogrammetric process, systems, products - aspects-image forming model-coordinate systems-transformations-adjustment techniques-geometric elements-horizontal and vertical angles from terrestrial photographs - Camera azimuth

UNIT II IMAGING SYSTEMS
Imaging concepts-geometric fundamentals-imaging systems-targeting and illumination-Image preprocessing-geometric image transformation-digital processing of single images-image matching and 3D object reconstruction

UNIT III ANALYTICAL METHODS
approach for self-calibration adjustment-control for terrestrial photogrammetry-analytical determination of horizontal position of a point from Photographic measurement - graphical method

UNIT IV   PHOTOGRAHMETRIC MEASURING SYSTEM
Comparators-single camera systems-stereoscopic processing systems-multi image measuring systems-systems of surface measurement-project planning-camera calibration-dynamic photogrammetry-close range aerial imagery

UNIT V   APPLICATION OF TERRESTRIAL AND CLOSE RANGE PHOTOGRAMMETRY
Architecture and cultural heritage-engineering surveying and civil engineering-industrial applications-forensic application-medicine-criminology-structural studies

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Describe fundamental concepts in terrestrial and close-range photogrammetry
CO2 Describe the imaging systems
CO3 Use analytical methods in parameter estimation
CO4 Use photogrammetric concepts in measurement
CO5 Application of terrestrial and close-range photogrammetry in problem domain

TEXTBOOKS:
3. Alex Alvarez, Reg Downing, “Image Based Modelling : Advanced 3D Modelling from Panoramas, 2005

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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**Course Objectives:**

- To understand the working principles of satellite geodesy and its applications to solve the surveying problems.

**Unit I**

**Introduction to GPS**

Overview-segments-satellite generations-current GPS satellite constellation-control sites-positioning service-signal structure-receivers-modernization-time systems-Pseudo range and carrier phase measurements-cycle slips-linear combinations

**Unit II**

**GPS Positioning Models and Errors**

Point and relative positioning-static surveying-stop and go surveying-RTK GPS-real time differential-real time versus post processing-communication links-GPS ephemeris errors-selective availability, multipath, Antenna-phase-center variation, receiver measurement noise, satellite and receiver clock errors, ionospheric and tropospheric delay, satellite geometry measures, GPS mission planning, user equivalent range error

**Unit III**

**GPS Data and Correction Services**

Datum-geodetic co-ordinate system-datum transformations-map projections-marine nautical charts-local arbitrary mapping systems-height systems-antenna swap method-on the fly ambiguity resolution-data service-DGPS radio beacon systems-wide area DGPS systems-multisite RTK system

**Unit IV**

**GPS Formats and Integration**

RINEX and NGS-SP3 format-RTCM SC104 standards for DGPS services-NMEA 0183-Integration-GPS/GIS, GPS/LRF, GPS/dead reckoning-GPS/INS, GPS / pseudolite, GPS/cellular-GLONASS satellite system-Chinese regional satellite navigation-regional augmentations-future European global satellite navigation system

**Unit V**

**Applications**

Utilities and industry-forestry and natural resources-precision farming-land seismic surveying-marine-airborne mapping-seafloor mapping-vehicle navigation-transit systems-cadastral surveying-navigation

TOTAL: 45 Periods

**Course Outcomes:**

- On completion of the course, the student is expected to
  - CO1 Understand the basic concepts of GPS.
  - CO2 Imparts knowledge in GPS models and errors
  - CO3 Develop the required skills in GPS data and correction services.
  - CO4 Understand the procedure of GPS formats and integration
  - CO5 Imparts knowledge in GPS applications
REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3003  
TERRESTRIAL AND BATHYMETRIC LASER SCANNING  
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COURSE OBJECTIVES:
- To introduce the concepts and applications of Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping

UNIT I  
TERRESTRIAL LASER SCANNING  9

UNIT II  
TLS – PROJECT PLANNING AND DATA ACQUISITION  9
UNIT III TLS APPLICATIONS

UNIT IV BATHYMETRIC LASER SCANNING

UNIT V BLS APPLICATIONS
Overview of BLS Applications – Preparation of Nautical Charts – Maintenance Dredging in Ports and Harbours – Submerged archaeological sites in shallow water – Shallow Water Bathymetry studies – Coastal Engineering Applications

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Understand the working principle of Terrestrial Laser Scanner
  CO2 Summarize the Project Planning and Data Acquisition Procedures
  CO3 Understands the applications of TLS in various domains/industry
  CO4 Understands the working principle of BLS
  CO5 Understands the applications of BLS in various domains/industry

TEXT BOOKS:

REFERENCES:

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GI3004  UNMANNED AERIAL VEHICLCE (UAV) FOR LARGE SCALE MAPPING  

**COURSE OBJECTIVE:**
- To impart knowledge and skill for preparation of large scale maps from UAV imagery.

**UNIT I  INTRODUCTION TO UAV/UAS/Drones/RPAS**
9
History of UAV - classification - Introduction to Unmanned Aircraft Systems - Application based UAVs for photogrammetry and others- Advantages and types for aerial production; planning for photogrammetry - filming and other applications introduction. Aerodynamics and Airframe Configurations- Characteristics of Aircraft Types- Design Standards and Regulatory Aspects- Introduction to Design and Selection of the System for applications- Category of UAVs- Fixed wing - VTOL - Quadcopters - Water landing - Nano - Mini - Micro (<2 kg) - (RPAS)-VLOS Small (MOW<25 kg) Medium (<150kg) Large (MTOW>150kg) - launching-hand - catapult - water surface - VTOL - civilian and military category classes.

**UNIT II  UAV HARDWARE AND CONTROL SYSTEMS**
9
Parts of UAV-Body - wings - propellers - sensors - pitot tubes - Autopilot or manual operating system - IMU - UAV IP datalink - UAV tracking (antenna) - Mimo tracking antenna - Ground control systems - UAV gimbal - propeller and accessories - ground detecting sensors - wing types and systems - source of energy (fuel) - Telemetry-tracking-Aerial photography-controls-PIO feedback-radio control frequency range -modems-memory system-simulation-ground test-analysis-trouble shooting. Anti-drone systems

**UNIT III  PAYLOADS FOR UAV SYSTEM**
9
Sensors: Payloads Dispensable Payloads (deliverable payloads to the consumer) - Non-Dispensable Payloads - Active Payloads (surveillance:active throughout the mission ) - Passive Payloads- special sensors for UAV systems - payloads - RGB - MSS - TIR - Lidar - magnetometer.

**UNIT IV  OPERATIONAL AND DATA PROCESSING SOFTWARE**
9
Flight planning – features of mission planning - intuitive workflow - polygon of AOI - automatic 3D flight planning - photogrammetry based flight simulation (flight altitude - resolution overlap etc) - oblique and ortho imagery coverage - waypoints - directional take-off - realtime flight status - after flight raw image development Processing of data- work flow of UAV photogrammetry - configure image properties - selecting image coordinate system - camera model - purpose of GCPS - point cloud and mesh - raycloud DSM - Orthomosoaic DTM and other products -

**UNIT V  APPLICATIONS**
9
VALUE ADDITION TO UAV DATA: Topographic maps - volume estimate from point cloud - Mapping - Surveillance - Wildlife Monitoring - Forestry - Agriculture - Water resources - urban planning - archeology - energy sector (solar - windmill - high tension electrical) - medical applications - mountain applications etc

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
• On completion of the course, the student is expected to
  
CO1 Understanding the different types of UAV and their characteristics
CO2 Synthesize the function of various components
CO3 Know various payload available for mapping
CO4 Plan and process UAV based mapping missions
CO5 Assimilate possible UAV applications

TEXT BOOKS:

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:

- To impart skills in subsurface surveying for Geomatic applications

UNIT I  HYDROGRAPHIC SURVEYING

UNIT II  MINE SURVEYING
Measuring the depth of shaft and other working - underground benchmark - Datum - determining throw of fault - gradient of underground road - Measuring subsidence. Determining the true and apparent dip and strike from bore hole data - Determining the deviation in the borehole drilling - Determining the throw of fault and length of drift to cross the fault - Finding out the bearings and dip of various mine working.

UNIT III  UNDERGROUND SURVEYING
Introduction - purpose - advantages of correlation surveys - Description of methods used in correlation survey - underground traversing and setting of new road ways - Stope surveying - purpose and advantages - Classification of stope surveying - Methods and instruments used.

UNIT IV  GROUND PENETRATING RADAR SURVEY

UNIT V  APPLICATIONS
Applications in Ground Water Resources: Depth to water from the land surface - Archeological Science: Identification and Mapping Buried Structures - Mapping of Underground utilities like power cables - Pipelines and other buried utilities - Containment Mapping.

COURSE OUTCOMES:

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

CO1 Plan the subsurface survey for a given project also capable of extending consultancy service for real time Hydrographic and Mining operations

CO2 Apply the knowledge of different methods of survey to map the investigating real field condition.

CO3 Apply the knowledge of survey to measure stope and traverse underground

CO4 Plan the subsurface investigation program for a given project also capable of extending consultancy service for real time Soil Mechanics and Foundation Engineering problems

CO5 Apply the knowledge of different methods of exploration to select appropriate method of boring for investigating real field condition.

REFERENCES:


**CO’s, PO’s & PSO’s MAPPING**

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**GI3006 CADASTRAL SURVEYING**

**COURSE OBJECTIVES:**
- To inform the students about the raster data model and the way to handle raster database.
- To educate the student about various statistical and numerical tools with techniques to handle image.
- To make the student capable of handling images from various sources to extract basic information for application.

**UNIT I CADASTRE- INTRODUCTION**

**UNIT II METHODS OF SURVEYING**
UNIT III  MAINTAINENCE AND MEASUREMENT  

UNIT IV  LAND INFORMATION SYSTEM  

UNIT V  MODERN TECHNOLOGY  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Understand the principles  Cadastral system, records and taxation
  CO2 Apply various methods used for surveying, mapping and maintenance of cadastral records
  CO3 Know the procedure of maintenance and documentation of land records and the current national developments in this regard
  CO4 Update with modern surveying technology and geospatial solutions for creation, maintenance and documentation of land records
  CO5 Frame the methodology to create and maintain digital cadastre, LIS, etc.

TEXT BOOKS:

REFERENCES:
1. The (TAMIL NADU) survey and boundaries act, 1923, Tamil Nadu Act No.VIII.

CO’s, PO’s & PSO’s MAPPING

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GI3007 ADVANCED SURVEYING TECHNIQUES (MINING, HYDROLOGY, ROUTE, ASTRONOMY) L T P C 3 0 0 3

COURSE OBJECTIVES:
- To learn the various methods and adjustments principles of plane and geodetic surveying to solve the real world problems

UNIT I SURVEY ADJUSTMENTS AND THEORY OF ERRORS 9

UNIT II FIELD ASTRONOMY 9

UNIT III TOPOGRAPHIC AND ROUTE SURVEYING 9

UNIT IV MINE SURVEYING 9

UNIT V HYDROGRAPHIC SURVEYING 9
Tides and Datums: Overview of hydrographic surveying concepts - bathymetric and nautical chart - Basic tidal theory - tidal observations and prediction - common types of recording tide gauges - Different vertical datums - Soundings: Overview of depth data types - Working principle of echo sounder - characteristics of underwater acoustic signals – transducers - Error sources and calibration - Advanced instrumentation - Navigation and Position Fixing: Horizontal positioning methods and
requirements - Concept of line and surface of position - Positioning and navigation using satellite positioning systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand the rudiments of various surveying measurement and its adjustment.

CO2 Imparts knowledge in computation of positions and azimuth using astronomical observation.

CO3 Develop the required skills in route surveying fundamentals necessary to provide geomatic solutions.

CO4 Understand the procedure of conducting the mine surveying.

CO5 Imparts knowledge in computation of positions and levels waterbodies.

TEXT BOOKS:


REFERENCES:


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COURSE OBJECTIVES:

- This course enables the student to understand the fundamentals of GIS customization using the programming concepts, testing and troubleshooting in the developmental frameworks.

UNIT I INTRODUCTION TO GIS CUSTOMIZATION FUNDAMENTALS 6+3
Need for Customization in GIS, Introduction to customization environments and platforms, Introducing Python, Introducing Model Builder, Programming Basics – Objects, Classes, Methods, Functions, Attributes and Variables. Introduction to Data types and Arguments

UNIT II PROGRAMMING IN GIS AND BASICS 6+3
Objects in GIS - maps, tables, layers, symbols and features, Programming with Objects, Concept of Lists, Loops, Decision structures, Strings, Inheritance, Polymorphism, encapsulation, and abstraction

UNIT III GIS DATA ACCESS AND MANIPULATIONS 6+3
Reading Attribute Data, accessing data fields, reading through records. Retrieving records using attribute and spatial queries, working with cursors, Working with raster data, Events and Triggers, Reading and Parsing text files, Writing Geometries, Working with Map Documents

UNIT IV TESTING AND TROUBLESHOOTING 6+3
Testing concepts – Unit testing, Integration testing, recursive testing and performance testing. Trouble shooting and identifying problems, Diagnosis, Using the spyder debugger, Printing messages from the geoprocessor, Code standardization and Optimization technique

UNIT V GIS DEVELOPMENTAL FRAMEWORKS 6+3
Introduction to Desktop Development Frameworks (Python, .net, Java), Web Development frameworks (JS, Angular, React, Leaflets), Mobile Development Frameworks (Android, IOS, Xamarin), Database Customization frameworks (PL/SQL, Post GIS/Postgres)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

- On completion of the course, the student is expected to
- CO1 Employ different programming languages commonly used in GIS customization and describe how to use these technologies to expand upon existing GIS software functionality.
- CO2 Perform object-oriented programming tasks using various programming languages, such as Python.
- CO3 Analyze procedures and interactions for workflows within GIS.
- CO4 Program small-scale GIS-based models in Python, integrated within a GIS software.
- CO5 Recognize and employ general software engineering concepts and good programming methods and practices.

TEXT BOOKS:

REFERENCES:
1. QGIS Python Programming Cookbook, Joel Lawhead, 2015.
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GI3009 OPEN SOURCE GIS

COURSE OBJECTIVES:
- This course supports students ability to act autonomously and think creatively when implementing geoinformatics projects and also provide total freedom to change the programme as necessary.

UNIT I BASICS

UNIT II DEVELOPMENT ENVIRONMENT
Linux and Windows–PostgreSQL and Database Engines-C,C++,OOP and Java streams-GNU, Mosix–WAP and Android stack–Scripts and Macros

UNIT III DATA MODELS FOR GIS
View Graphics–Data exchanges-portability and interoperability–Raster handling and Image analysis–vector data management–Raster and vector analysis-2D/3Dvectors with topology,3D Voxel,2D Raster

UNIT IV DATABASE MANAGEMENT AND USER INTERFACE
Files vs Database-Distributed operations and Architecture–ODBC-Open source Database management tools- Database: Spatial and Attribute queries Spatial functions and Analysis–Map Server, Application Server and Database server concepts.

UNIT V OPEN SOFTWARE AND WEB MAPPING

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Understand the concepts and protocols used in Opensource GIS.
CO2 Know the functionalities of Opensource GIS software in Desktop and Web based environments.
CO3 Understand the GIS data models
CO4 Understand the concepts of DBMS and user interface
CO5 Acquire the knowledge of open-source software in web mapping

TEXT BOOKS:

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GI3010 LOCATION BASED SERVICES

COURSE OBJECTIVES:
• To impart knowledge to design and develop next generation location based information systems involving mobile devices.
UNIT I   INTRODUCTION
Introduction - Evolution of Location Based Services - Application Areas of Location Based Services (LBS) - Application Taxonomy – LBS Privacy – LBS Markets and Customer Segments

UNIT II   PLATFORM AND ARCHITECTURE
LBS Components - Data Capture and Collection – LBS Middleware Standards (Open GML,KML) – Mobile Platform Technologies for LBS

UNIT III   DATA AND VISUALIZATION TOOLS
LBS Data – Crowd Sourcing and Open street Maps ,Google Earth, Google Maps, Bing Maps – Content Distribution formats – GeoJSON, GeoRSS, KML - Generating KML"s Dynamically – Location determination: Indoor GPS, Network based positioning techniques, short range positioning, Hybrid Positioning

UNIT IV   LBS APPLICATIONS
Vehicle Tracking: Tracking concepts, components of vehicle tracking, online and offline tracking. Alarms used in vehicle tracking, Fleet Management – Vehicle Navigation: Navigation concepts for Road, Waterways and Airways – components of vehicle navigation, file formats used for navigation – Distress call management

UNIT V   COMMUNICATION & BUSINESS IN LBS

COURSE OUTCOMES:
*On completion of the course, the student is expected to
CO1 Understand the evolution and application of Location Based Services
CO2 The concepts of Location Based Services and architecture
CO3 Summarize the tools available for data and visualization of LBS
CO4 Identify the various feasible LBS applications
CO5 Identify the communication modes and business in LBS

TOTAL :45 PERIODS

TEXT BOOKS:
1. Location-Based Services and Geo-Information Engineering by Allan Brimicombe, Chao Li, ISBN: 978-0-470-85737-3 August 2009
2. Jochen Schiller & Agnes Voisard “Location-Based Services” Morgan Kaufmann Publishers, 2004

REFERENCES:

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**GI3011 ENTERPRISE GIS (API, REST SOAP SOA, SAS, OGC, WEB SERVICES)**

**COURSE OBJECTIVES:**
- To expose students on technical requirements for establishment of an enterprise GIS.

**UNIT I ENTERPRISE GEOGRAPHICAL INFORMATION SYSTEM**

**UNIT II ENTERPRISE ARCHITECTURE**
Enterprise architecture – Capabilities – Flexible Architecture – Designing an enterprise architecture – Establishing goals – Introduction to GIS Web services – WCS, WMS, WFS, WMTS, WPS. Web Service Communication protocols – REST Vs SOAP

**UNIT III DATA ARCHITECTURE**
Data architecture – Data Vs information – Enterprise data – Metadata – System hierarchies - Data Standards – Data Formatting - Geodatabase domains. Data Security and Access Controls, Data Sharing – Service Oriented Architecture, Daas (Data as a service) Vs Saas (Software as a Service), Data Exchange formats – CSV, XML, GML, Json, YAML, HTTP content

**UNIT IV DESIGNING AN ENTERPRISE GIS SYSTEM**
Designing a Conceptual reference architecture, Design Considerations – Automation, Collaboration, Integration considerations, High Availability Scenarios, Deployment considerations, Data Governance, Load Balancing, Security and Workload Separation considerations, Designing the enterprise GIS for different Scenarios

**UNIT V GIS VISUALISATION**
Web administration, Connecting to Enterprise Geo database, Publishing the GIS data services, Styling, Tiling and Caching considerations, Performance Considerations, Using the web services, Hosting the Enterprise GIS application.

**TOTAL:45 PERIODS**
COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Understand the concept and working principle of Enterprise GIS
  CO2 Summarize the architecture of Enterprise GIS
  CO3 Understand how data standards security adopted in Enterprise GIS
  CO4 Design an Enterprise GIS system for different scenarios
  CO5 Publish and view the data across platform by tuning different publishing parameters

TEXT BOOKS:

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GI3012 GIS BASED UTILITY AND ASSET MANAGEMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
• To inculcate the implementational GIS concepts for the Utility sectors and asset management.

UNIT I INTRODUCTION
9
History of AM/FM Systems, Moving from CAD to GIS, Introducing Key components of Utility GIS, Unique Utility GIS requirements, Introduce various products available in the market towards utility GIS.

UNIT II DATAMODELS
9

UNIT III DATA COLLECTION METHODOLOGIES
9
Identify various data to be collected (Primary, Secondary and Tertiary datasources), Introduction to Mobile Mapping data collection, Drone based survey, Door-to-Door Survey (for consumer index) etc. Introduction to Quality Control framework, Implementation of Data Governance within Organization

UNIT IV BUSINESS PROCESS IMPLEMENTATION
Identifying Business process, Integration with external systems (ERP, EAM, SCADA etc.), Introduction to typical electric utility business process, Introduction to typical Telco utility business process, Introduction to typical Gas utility business process, Introduction to typical Water utility business process

UNIT V MODERN SYSTEM FOR SMART UTILITIES

TOTAL:45 PERIODS

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

CO1 Know What constitutes a Utility GIS and why they are different from a typical GIS implementation
CO2 Know organization of the utility sector (electric, gas, telco, water) can benefit
CO3 Understand Importance of System (various software/hardware), Data (to be modelled and collected), Business process (to make GIS work for the organization) and People (to train, mentor the end users)
CO4 Get Introduced to designing, developing and Implementing a Utility GIS
CO5 Explore modern GIS systems that various utilities are currently embarking on

TEXT BOOKS:
4. Empowering Electric and Gas Utilities with GIS (Case Studies in GIS) Bill Meehan (Author)

REFERENCES:

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GI3013 GEO COMPUTING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To learn about the computational aspects and its implementation with raster and vector data formats using python scripting.

UNIT I INTRODUCTION AND PYTHON FUNDAMENTALS  9
Understanding geospatial data formats and file organization - Programming basics & Python core concepts – Functions - Flow control.

UNIT II PYTHON ADVANCED CONCEPTS  9
Introduction to numpy, Containers - Copies, Reading and Writing files& Python system access - Classes and objects - Plotting with Python.

UNIT III PYTHON FOR GIS  9
Raster Processing with GDAL - Vector Processing with OGR - Geoprocessing with ArcPy - Interactive Mapping and Geoprocessing on Jupyter Notebook.

UNIT IV ADVANCED GIS ALGORITHMS  9
Vector Data Algorithms (Spatial data clustering) - Raster Data Algorithms (classification, change detection) - Network Data Algorithms (shortest path, centrality) - Geospatial Big Data Visualization Methods and Tools - Spatiotemporal Data Analytics

UNIT V OPEN-SOURCE GEOSPATIAL BIG DATA ANALYSIS AND APPLICATIONS  9
Machine learning and deep Learning for remote sensing imagery analytics – Tensor flow - LiDAR Point Cloud analytics - GPS Trajectory Data analytics - Textual Documents analytics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Be familiar with major geospatial vector and raster file formats and specifications for spatial reference coordinate systems.
CO2 Have used and be comfortable with online resources that support geocomputing and programming in the GIS profession.
CO3 Learn newly developed GIS computation tools/libraries and platforms.
CO4 Understand the concepts of raster, vector and data analytics
CO5 Do ML/DL data analytics for imagery, LiDAR and GPS

TEXT BOOKS:
1. Think Python: How to Think Like a Computer Scientist by Allen Downey et al., 2014, O'Reilly.
2. Introduction to GIS Programming and Fundamentals with Python and ArcGIS, Chaowei Yang et al., 2017, CRC Press

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**GI3014 GEOSPATIAL MODELLING AND SIMULATION**

**COURSE OBJECTIVES:**
- To expose students on capabilities of spatial tools for modelling and simulation of physical and biological systems.

**UNIT I CONCEPTS OF MATHEMATICAL MODEL**


**UNIT II ATMOSPHERIC MODELLING**

and climate modelling – numerical weather prediction model global and regional climate models – Air quality model – Gaussian dispersion model.

UNIT III HYDROLOGICAL MODELLING 9

UNIT IV BIOLOGICAL / ECOLOGICAL SYSTEM MODELLING 9

UNIT V SIMULATION MODEL FOR FOREST MANAGEMENT 9
Types of fires - Empirical approaches to modelling wild land fire – simulating forest fire regimes – simulation of broad – scale fire – natural forest landscape disturbance – forest fire – timber harvesting – forest management using decision support system – developing forest management strategies based on fire regimes.

TOTAL:45 PERIODS

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

CO1 Gain knowledge on concepts for building mathematical models
CO2 Apply mathematical models in hydrology, Atmosphere; Biological / Ecological Domains
CO3 Develop mathematical models for modelling hydrological phenomena
CO4 Apply Modelling techniques for ecological system
CO5 Develop simulations for sufficient management of forests.

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PO 12: Life-long Learning

PSO 1 Knowledge of Geoinformatics discipline | 2 | 3 | 3 | 3 | 3 | 3

PSO 2 Critical analysis of Geoinformatics Engineering problems and innovations | 1 | 3 | 3 | 3 | 3 | 3

PSO 3 Conceptualization and evaluation of Design solutions | 2 | 3 | 3 | 3 | 3 | 3

VERTICAL III: IMAGE PROCESSING AND ANALYSIS

GI3015 SOFT COMPUTING TECHNIQUES L T P C 3 0 0 3

COURSE OBJECTIVES:
- The objective of the course is to make the students to understand the concepts of Artificial Neural Network, Fuzzy logic and Genetic algorithms and also their application in Geomatics.

UNIT I SOFT COMPUTING AND ARTIFICIAL NEURAL NETWORKS 9

UNIT II FUZZY SYSTEMS 9

UNIT III NEURO-FUZZY MODELLING 9

UNIT IV GENETIC ALGORITHM 9
Genetic algorithm : Fundamentals, basic concepts, working principle, encoding, fitness function, reproduction, Genetic modeling: Inheritance operator, cross over, inversion & deletion, mutation operator, Bitwise operator, Generational Cycle, Convergence of GA, Applications & advances in GA, Differences & similarities between GA & other traditional method

UNIT V APPLICATIONS OF SOFT COMPUTING IN GEOMATICS 9
Image registration – Object recognition – Automated feature extraction – navigation – Integration of soft computing and GIS for flood forecasting and monitoring, Landslide susceptibility, Highway alignment, smart city planning, agriculture, solid waste disposal

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
- CO1 Understand the necessity of soft computing techniques and fundamentals of Artificial Neural Networks
- CO2 Imparts the concepts of uncertainty and its impacts on artificial intelligence

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CO3 Helps to realize the merits of hybrid computing techniques
CO4 Introduces the concepts of heuristic search methods and optimization of solutions
CO5 Gain knowledge on utility of soft computing on multidisciplinary problems

TEXTBOOKS:

REFERENCES

CO’s, PO’s & PSO’s MAPPING

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GI3016 THERMAL, HYPERSPECTRAL AND PLANETARY REMOTE SENSING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- This course provides opportunity to explore diverse remote sensing sensors for a wide range of applications.

UNIT I THERMAL REMOTE SENSING 9

UNIT II THERMAL DATA ANALYSIS

UNIT III HYPERSONSPECTRAL REMOTE SENSING
Diffraction principles - field spectrum – BDRF and spectral reflectance & imaging spectrometry- sensors - virtual dimensionality-Viewing – Hughe's phenomenon - Data reduction, Calibration and normalization

UNIT IV HYPERSONSPECTRAL DATA ANALYSIS

UNIT V PLANETARY EXPLORATION

TOTAL :45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Understand the concepts of Thermal Remote Sensing
CO2 Understand the thermal data analysis and applications
CO3 Understand the Principles of Hyperspectral Remote sensing
CO4 Workout Hyperspectral data analysis and Applications
CO5 Acquire Knowledge at terrestrial planet and applicability of thermal and hyperspectral remote sensing

TEXTBOOKS:

REFERENCES
GI3017 POLARIMETRY AND INTERFEROMETRY

COURSE OBJECTIVES:
- To familiarize the students with the concepts of polarimetric and Interferometric observation and its applicability.

UNIT I BASICS OF SAR POLARIMETRY

UNIT II PROCESSING OF SAR POLARIMETRY DATA
Polarization Signature: single bounce, double bounce,multi-bounce scatterers and Bragg scatterer – Coherent polarimetric decomposition methods: Pauli,Krogager, Cameron decompositions and Touzi criterion – Incoherent polarimetric decomposition methods: Freeman,Huynen-Barnes, Eigen vector-Eigen value decomposition – Polarimetric classifications :Unsupervised H/A/α, Supervised Bayes maximum likelihood classifications-Overview of Data formats and software ( Both free and commercial) availability for SAR and polarimetric- Limitation of polarimetry for practical use and future technological and processing trends.

UNIT III BASICS OF SAR INTERFEROMETRY
Basics principle – Interference pattern : Point source, Constructive and Destructive interference - Interferogram - Interference fringe : intensity and visibility of fringes – localization of fringes –
Complex SAR image - Interferometric data structure/Single Look Complex data – Classes of SAR Interferometry- Single Pass/across track, repeat pass/along track and differential SAR Interferometry – INSAR viewing geometry – Sensitivities and errors.

UNIT IV PROCESSING OF SAR DATA FOR INTERFEROMETRY

UNIT V MISSIONS AND APPLICATIONS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Understand the basic concepts of Polarimetry and Interferometry
  CO2 Gain knowledge about polarimetric processing concepts
  CO3 Acquire the knowledge about the fundamentals of SAR Interferometry
  CO4 Learn about the grammetric concepts of Interferometric techniques
  CO5 Familiarize about the applicability of SAR Polarimetry and Interferometry

TEXTBOOKS:

REFERENCES

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GI3018  AI / DL FOR IMAGE PROCESSING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To familiarize the undergraduate level students to understand the concepts of AI/DL and their applications.

UNIT I  EXPLORATORY DATA ANALYSIS  9

UNIT II  ARTIFICIAL INTELLIGENCE  9
Foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation – AI problems

UNIT III  LEARNING BASED CLASSIFIERS  9

UNIT IV  DEEP LEARNING CONCEPTS AND METHODS  9

UNIT V  APPLICATIONS OF CNN  9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
• On completion of the course, the student is expected
  CO1 To provide Knowledge about exploratory data analysis
  CO2 To understand concept of Artificial Intelligence
  CO3 To understand about learning based classifiers
  CO4 To learn concepts and various methods of deep learning
  CO5 To learn about various applications of CNN

TEXTBOOKS:

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GI3019 PATTERN RECOGNITION (SATTELITE, AERIAL, UAV) L T P C
3 0 0 3

COURSE OBJECTIVES:
• To make the undergraduate level students to understand the concepts of pattern recognition, feature extraction and other advanced methods.

UNIT I  PATTERN CLASSIFIER
Overview of Pattern Recognition, Types of Pattern recognition – Discriminant Functions – Supervised Learning – Parametric Estimation – Maximum Likelihood Estimation – Bayes Theorem – Bayesian Belief Network, Naive Bayesian Classifier, non-parametric density estimation, histograms, kernels, window estimators.

UNIT II  CLUSTERING
Unsupervised learning - Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering – Density Based Clustering.

UNIT III  FEATURE EXTRACTION AND SELECTION
Entropy Minimization – Karhunen Loeve Transformation – Feature Selection Through Functions Approximation – Binary Feature Selection – K-NN.

UNIT IV  HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINES

UNIT V  RECENT ADVANCES
Fuzzy Classification: Fuzzy Set Theory, Fuzzy And Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition – Introduction to Neural Networks: Elementary Neural Network For Pattern Recognition, Hebbnet, Perceptron, ADALINE, Back Propagation.

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1  Provide basic knowledge about the fundamentals of pattern recognition and its applications.
  CO2  Understand about unsupervised algorithms suitable for pattern classification.
  CO3  Familiarize with the feature selection algorithms and methods of implementing them in applications.
  CO4  Learn about the basis of algorithms used for training and testing the dataset.
  CO5  Learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

TEXTBOOKS:

REFERENCES

CO’s, PO’s & PSO’s MAPPING

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GI3020 **RASTER DATA MODELLING**  

L T P C  
3 0 0 3

**COURSE OBJECTIVES:**
- To inform the student of raster data model and the way to handle raster database.
- To educate the student about various statistical and numerical tools and techniques to handle image.
- To make student capable of handling images from various sources to extract basic information for application.

**UNIT I** **POINT BASED FUNCTION**  

**UNIT II** **NEIGHBORHOOD AND PROXIMITY ANALYSIS**  
8, 4 D neighborhood – texture computation – GLCM – distance measurement – buffers (point, line, area).

**UNIT III** **AREA DESCRIPTORS / BOUNDARIES**  

**UNIT IV** **MULTILAYER MODELING**  

**UNIT V** **STATISTICAL METRICS**  

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Acquaint with the raster data structure and its relevance in from pint based, neighbourhood based and region based geospatial data analysis
  CO2 Understand the various raster based data modeling applied on the earth observation data for resource management
  CO3 Evaluate the procedures of spatial data handling using raster data model for solving resource management problems
  CO4 Acquire knowledge on the current development, issues methods and solutions in raster data analysis using earth observation data.
  CO5 Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation and integration of geospatial data modeling

TEXTBOOKS:

REFERENCES

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COURSE OBJECTIVES:
- To inform students about the importance of sustainable development and the responsiveness to that.
- To educate the students about the SDG goals and India’s initiative to address them.
- To make the student aware of geospatial technology as a central idea in achieving the SDGs.

UNIT I SDG EVOLUTION

UNIT II 17 SDGs
SDGs – 17 goals – targets and indicators global sustainable development report 2019 and 2023 - yearly SDG reports (2016 to 2022) – capacity development – international scenario - geospatial capacity in India - Niti Ayog – cooperative federalism, sub groups and task force- -key initiatives-verticals - reports – model agreements-SDG scope in Tamil Nadu - TNAPOCC 2

UNIT III SDG-WORLD EXPERIENCE

UNIT IV GEOMATIC TOOLS FOR GIS

UNIT V SDG–GEOSPATIAL ROAD MAP

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Appreciate the importance of sustainable development and the understand history of worlds unified effort to achieve through SDGs and the participation of the partner countries including India to achieve the same
CO2 Understand the relevance of SDGs, the role of the geospatial technology as central idea to realize the SDGs and the status of this technology worldwide
CO3 Acquire the knowledge about the standard geospatial focus indicators to achieve SDGs and evaluate the methodology to formulate them
CO4 Acquire knowledge on the current development, issues, methods and solutions in application of geospatial technology in comprehending the SDGs for a better world future
CO5 Analyze critically and evaluate methods by applying the knowledge gained and to be a part of innovation efforts and capacity building of geospatial technology to achieve SDGs

TEXTBOOKS:
2. Dilip Kumar, R.B. Singh, Ranjeet Kaur “Spatial Information Technology for sustainable


REFERENCES
1. UNDP, INEGI, The SGD s Geospatial Roadmap, 2019 – OPEN ACCESS
2. UNDP, UNHABITAT, GLOBAL TASK FORCE, “Road map for localizing the SDG: implementation and monitoring at sub national level
3. WWW.NITIAYOG.IN
4. UNDP, "global consultation draft: strategies pathways" 2020

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VERTICAL IV: GEO SPATIAL APPLICATIONS

GI3022 ENVIRONMENTAL GEOINFORMATICS

COURSE OBJECTIVES:
- The objective of this course is to expose the students to the applications of Remote Sensing and GIS for water quality assessment, soil degradation assessment and monitoring pollution.

UNIT I WATER AND THE ENVIRONMENT

Sources and demands of water – Characteristics of water – Point and non-point sources of water pollution – Spectral responses of clear and contaminated water – chlorophyll – Remote Sensing of
Water quality assessment - Classification of water quality for various purposes, Sampling procedure, quality analysis, Database creation and quality modeling using GIS. Database Creation and designing water supply network, sewerage network using GIS. Runoff estimation – flood prediction modeling – aquifer vulnerability modeling.

UNIT II SOIL CONSERVATION AND MANAGEMENT 9

UNIT III SOLID WASTE MANAGEMENT 9

UNIT IV AIR POLLUTION 9

UNIT V GLOBAL PROSPECTIVE AND CLIMATE CHANGE 9
Prevention and Control measures – Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status - case studies - Definitions- Climate, Climate system, climate change – Drivers of Climate change – Characteristics of climate system components - Green house effect – Carbon cycle - case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
•On completion of the course, the student is expected to
  CO1  Understand the possible applications of remote sensing and GIS in water quality analysis and network design
  CO2  Understand the possible applications of remote sensing and for soil conservation
  CO3  Understand the possible applications of remote sensing and for solid waste management
  CO4  Understand the possible applications of remote sensing and for air pollution mapping and modelling
  CO5  Understand the possible applications of remote sensing and for climate change perspectives

TEXTBOOKS:

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GI3023 GEOMATICS FOR URBAN INFRASTRUCTURE

COURSE OBJECTIVES:
- To expose students the relevance of Geoinformatics to Urban Planning and Management
- To introduce the latest developments in Remote Sensing methods useful for Urban Planning and Management
- To impart knowledge on possible applications of Geoinformatics for Urban planning and Management

UNIT I INTRODUCTION 9

UNIT II REMOTE SENSING FOR URBAN MAPPING 9

UNIT III GEOINFORMATICS FOR URBAN PLANNING 9

UNIT IV GEOINFORMATICS FOR URBAN ANALYSIS 9

UNIT V VISUALIZATION, SIMULATION AND MODELING OF URBAN AREAS 9
Urban Growth Modelling – Air quality indexing and mapping – Noise pollution modeling - 3D City Modelling – Flood Modeling in Urban Areas – Geoinformatics for Smart Cities–IOT integration-BIM-Recent Advancements – Case Studies

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 The basics of Urban mapping and Plan preparation.
  CO2 The application of remote sensing in urban mapping.
  CO3 The role of remote sensing in preparation of urban plans.
  CO4 The modeling techniques for modeling and prediction of future land use scenarios
  CO5 Understanding the Visualization, simulation and modelling of urban area.

TEXTBOOKS:

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COURSE OBJECTIVES:
- To impart knowledge in various applications of hydrology and water resources using Geomatic technology.

UNIT I  HYDROLOGIC COMPONENTS  9

UNIT II  SURFACE WATER MODELLING  9

UNIT III  RISK AND DAMAGE ASSESSMENT  9

UNIT IV  GROUND WATER MODELLING  9

UNIT V  IRRIGATION AND WATERSHED MANAGEMENT  9

TOTAL: 45 PERIODS

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

CO1  Understand various components of Hydrologic Cycle
CO2  Apply remote sensing & GIS concepts for surface water resources applications
CO3  Apply remote sensing & GIS concepts for risk and damage assessment
CO4  Apply remote sensing & GIS concepts for ground water modelling
CO5  Estimate water requirement and to apply best practices for watershed management.

TEXTBOOKS:

REFERENCES
2.  Dorota Swiatek, Stefan Ignar, Modelling of Hydrological Processes in the Narew Catchment, Springer Berlin Heidelberg - 2013
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### GI3025 SATELLITE METEOROLOGY

#### COURSE OBJECTIVES:
- To introduce the basic concepts of atmospheric science and meteorology.
- To impart the knowledge on surface, upper air and space based meteorological observation and its applicability.

#### UNIT I STANDARD ATMOSPHERIC CHARACTERISTICS AND OBSERVATION


#### UNIT II WEATHER AND CLIMATE SYSTEM

UNIT III  METEOROLOGICAL SATELLITES AND SENSING SYSTEM  

UNIT IV  ATMOSPHERIC SOUNCING  

UNIT V  APPLICATIONS  

COURSE OUTCOMES:

• On completion of the course, the student is expected to
  CO1 Understand the fundamental concepts on atmospheric science.
  CO2 Gain knowledge on various weather and climate features and system.
  CO3 Familiarize about the historical and current operational meteorological sensing system.
  CO4 Acquire knowledge about the principle of atmospheric sounding and vertical profile retrieval methods
  CO5 Be able to analyze the critical weather and climatic issues and to develop the solutions.

TEXTBOOKS:

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### GI3026 GEOMATICS FOR DISASTER AND RISK MITIGATION

**COURSE OBJECTIVES:**

- To understand various technological options especially Remote Sensing and GIS in Disaster management.

**UNIT I** INTRODUCTION TO DISASTERS

Disaster: Definition and Classification - Hydrological and geological disasters, characteristics crisis and consequences - Role of Government administration, University research organization and NGO's - International disaster assistance - Sharing technology and technical expertise.

**UNIT II** LONG TERM MITIGATION MEASURES


**UNIT III** SAFETY RATING OF STRUCTURES

Slope stability of Ghat roads - Structural safety of Dams, Bridges, Hospitals, Industrial structures, - Disaster resistant structures - Low cost housing for disaster prone areas - Cyclones shelter projects and their implications - Reconstruction after disasters: Issues of practices.

**UNIT IV** SPACE SCIENCE INPUT IN DISASTER MANAGEMENT

Remote sensing in Hazard evaluation - Zonation – Risk assessment - Damage assessment - Land use planning and regulation for sustainable development - Communication satellite application - Network - Use of Internet – Warning system - Post disaster review - Case studies

**UNIT V** EMERGENCY PLANNING USING SPATIAL AND NON-SPATIAL DATA
Information systems management-Spatial and non-spatial data bank creation– Operational emergency management - Vulnerability analysis of infrastructure and settlements – Pre disaster and post disaster planning for relief operations - Potential of GIS application in development planning – Disaster management plan-Case studies

TOTAL:45 PERIODS

**COURSE OUTCOMES:**
- On completion of the course, the student is expected to
- **CO1** Gain knowledge on various types of disasters and infrastructural facilities available for managing disasters
- **CO2** Plan long term disaster mitigation measures
- **CO3** Evaluate the safety of the various social structures
- **CO4** Use remote sensing data products for disaster management
- **CO5** Apply GIS concepts in disaster management

**TEXTBOOKS:**

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GI3027 GEOMATICS FOR AGRICULTURE AND FORESTRY

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COURSE OBJECTIVES:
• Through this course students can learn about remote sensing and GIS techniques to use in a variety of applications related to agriculture, soil, land and forest resources.

UNIT I CROP INVENTORY AND REMOTE SENSING 9

UNIT II REMOTE SENSING FOR SOIL 9

UNIT III LAND EVALUATION AND MANAGEMENT 9
Introduction- land use/land cover definition-land use/land cover classification-concepts and approaches of land evaluation–Change dynamics–Land capability assessments-decision support system for land use planning-optimum land use planning for sustainable agriculture

UNIT IV DAMAGE ASSESSMENT 9
Introduction-damage by pests and diseases-crop loss assessment by floods-flood hazard zone mapping-remote sensing capabilities and contributions for drought management-landdegradationdueto waterloggingandsalinity-cropstress-reflectance properties of stressed crops-identification of crop stress–Agricultural insurance in India–CCIS,ECIS,FIIS and NAIS

UNIT V FOREST MANAGEMENT 9
Introduction-forest taxonomy-inventory of forests-forest type and density mapping-bio mass assessment-timber volume estimation-factors for forest degradation-mapping degraded forests deforestation and afforestation-forest fire mapping and damage assessment–species mapping -sustainable development of forests

TOTAL:45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Characterize the crops using Remote Sensing tools
  CO2 The concepts of soil mapping through remote sensing
  CO3 The evaluation of land capability for better land use planning
  CO4 Acquire Knowledge in damage assessment using remote sensing
  CO5 Understand the forest management using remote sensing

TEXTBOOKS:

REFERENCES

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GI3028 GEOMATICS FOR OCEAN AND COASTAL APPLICATIONS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To familiarize the students about the basics and Geomatics applications in the field of Oceanography and coastal processes

UNIT I FUNDAMENTAL OCEANOGRAPHY AND COASTAL PROCESSES 9

UNIT II SEA WATER CHARACTERISTICS AND MEASUREMENT 9

UNIT III COASTAL HYDRODYNAMICS AND SENSING SYSTEMS 9
Sea water intrusion – pollution dispersion – coastal protection structures – platforms and sensing systems – payloads - past and current operational satellites: NOAA, SeaSTAR, Adeos, ERS, Topex/ Poseidon, QikSCAT and sentinel 3 – Indian missions: Oceansat1 and 2, SARAL and SCATSAT.

UNIT IV REMOTE SENSING RETRIEVAL AND MAPPING

UNIT V APPLICATIONS AND MANAGEMENT

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO1 Understand the basic concepts of Ocean and Coastal processes.
  CO2 Gain knowledge on physical, chemical and biological characteristics of sea water.
  CO3 Familiarize about coastal hydro dynamism and operational sensing systems
  CO4 Acquire knowledge on retrieval through remote sensing methods.
  CO5 Analyze the applicability of retrievals for solving critical issues and develop strategic management plan.

TEXTBOOKS:

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GI3029 ADVANCED GEODESY

COURSE OBJECTIVES:

- The objective of this course is to expose the students to the advancement in geodesy and to understand the international perspective of advanced geodesy and be able to cooperate internationally.

UNIT I GEODETIC CONTROL

UNIT II GEODETIC COMPUTATIONS
Rectangular and Polar Co - ordinates - First and Second geodetic problem – Similarity, Affine Projective and Polynomial transformation - methods of point determinations – problems on intersection, resection, arc section and also with over determinations, polar method and its extension.

UNIT III ASTRONOMICAL COMPUTATIONS
Variation in celestial co - ordinates, Determination of Astronomical Azimuth- stars altitude and hour angle methods, astronomical latitude and longitude determination – sources of errors and its eliminations- problems

UNIT IV HEIGHT SYSTEMS

UNIT V MISCELLANEOUS TOPICS
Crystal movements and plate motion – methods of determination of horizontal and vertical movements – dam deformation - earth tides – tidal forces, tidal response of the solid earth, tidal loading, analyzing and predicting earth tides, earth tide instrumentation – satellite altimetry – observations, computation and interpretation and application – Gravity Field Missions: satellite-to-satellite tracking – CHAMP and GRACE Satellite gravity gradiometry: GOCE.

TOTAL: 45 PERIODS

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

CO1 Identify and relate various methods available for Horizontal and Vertical Control
CO2 Understand methods available for computation of coordinates of control points
CO3 Understand procedure for computation of azimuth, latitude, longitude by astronomical observations
CO4 Identify various methods to represent height and compute the same
CO5 Summarize various applications of geodetic observations and gravity measurements

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COURSE OBJECTIVES:
- This subject deals with satellites in space, which are used for the geodetic applications. Several satellites launched will transmit the carrier signal, by receiving the ground position are determined.

UNIT I INTRODUCTION
Introduction to satellite geodesy- Overview of GNSS: Introduction to GPS- GLONASS- GALILEO- BIDOU- IRNSS satellite systems etc. Keplerian laws of satellite motion- geometry of ellipse and Keplerian ellipse in space- transformation of coordinates from Keplerian elements to Earth centered Earth fixed (ECEF) coordinate system- perturbed satellite motion- Lagrangian and Gaussian forms of perturbation equations- gravitational and non-gravitational perturbing forces- geodetic applications of satellite missions.

UNIT II DIFFERENT TECHNIQUES

UNIT III SATELLITE SYSTEM
GPS – Different segments – space- control and user segments – GPS signal structure and code modulation- pseudo range measurements and navigation solution signal structure – Accuracy of navigation position: UERE and DOP. Intentional degradation of GPS signals: Selective availability (SA) and anti-spoofing (AS). GPS receiver’s components. Differential GPS: Space based augmentation systems (e.g.- GAGAN- WAAS- EGNOS) and ground-based augmentation systems (GBAS).

UNIT IV GPS DATA OBSERVATION
GPS observables - code and carrier phase observation. Single differencing- double differencing and triple differencing in GPS measurements. ambiguity resolution- multi path and other observational errors- doppler effect on GPS signals- cycle slip detection. GNSS observation- data downloading-processing and discussion of processed data. Relative positioning: Static – Rapid static and pseudo kinematic; kinematic positioning – pure kinematic- semi kinematic and real time kinematic (RTK) methods of observations. Real time network (VRS) services.

UNIT V GPS DATA PROCESSING AND APPLICATIONS OF SATELLITE GEODESY

TOTAL:45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to
  CO1 Recognize the factors affecting satellite motion and laws governing the motion
  CO2 Summarize various techniques available for geodetic measurements from space
  CO3 Understand the concepts and components of GNSS
CO4 Choose appropriate methods for GNSS surveying
CO5 Summarize various applications of Satellite Geodesy

TEXTBOOKS:

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COURSE OBJECTIVES:
- To understand the concepts of gravimetry, gravity field and their statistics.

UNIT I INTRODUCTION 9
Need to study gravity- historical review- research areas- applications. Potential theory: some vector calculus- attraction and potential- potential of a solid body- Laplace equation – exterior potential field- Poisson equation – interior potential field- spherical harmonics- boundary-value problems.

UNIT II GRAVITY FIELD OF THE EARTH 9
Gravitation- gravity- attraction of a point mass- attraction of a point mass- rigid body- gravity and shape of the Earth- level surfaces and plumb lines- natural coordinates- Normal gravity: Superposition principle- ellipsoid as an approximation of the Earth- the level ellipsoid- series expansion of the normal gravity field.

UNIT III GRAVIMETRY 9

UNIT IV GRAVITY FIELD AND HEIGHT SYSTEMS 9
Statistics of the gravity field: The power spectrum- Kaula’s rule of thumb- covariance functions- Height systems: Height measurements- physical and geometric heights and their relationship- height systems around the world- Geoid as a vertical reference frame.

UNIT V TEMPORAL VARIATIONS OF THE GRAVITY FIELD 9
Geophysical effects on gravity- loading theory- tides- hydrological loading- atmospheric loading- ocean loading- ice-mass loading- glacial isostatic adjustment.

TOTAL:45 PERIODS

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

| CO1 | Understand the physics of gravity and governing equations |
| CO2 | Define gravity and surfaces generated through gravity observations |
| CO3 | Identify methods and techniques for Earth’s gravity field determination |
| CO4 | Acquire knowledge of earth’s gravity field parameters computations |
| CO5 | Understand the factors affecting gravity field and their influence. |

REFERENCES

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**GI3032 GEODETIIC INTERFEROMETRY**

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<td>To understand the concepts of geodetic interferometry techniques, measurements and very long baseline interferometry</td>
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**UNIT I INTRODUCTION**

**UNIT II GEODETIIC INTERFEROMETRY TECHNIQUES**
ScanSAR interferometry - solutions for baseline and source position vectors - Phase Referencing – position – frequency - Precession and Nutation - Measurement of Polar Motion and UTI

**UNIT III GEODETIIC MEASUREMENTS**
Geodetic Measurements- Proper Motion and Parallax Measurements- Solar Gravitational Deflection- Imaging Astronomical Masers- Least-Mean-Squares Analysis- Second-order effects in phase referencing

**UNIT IV VLBI IN GEODETIIC INTERFEROMETRY**
Introduction- VLBI elements- techniques-space segment- propagation media- ground segment interferometer and interferometric principle- carrier of interferometer baseline- determination of observables- precision and analysis of group delays

**UNIT V DATA ANALYSIS**
Automated geodetic VLBI- antenna and receiving systems- data acquisition systems- monitoring and control systems- observations- data reduction and analysis

**TOTAL:45 PERIODS**

**COURSE OUTCOMES:**
- On completion of the course, the student is expected to
  - CO1 Apprehend the fundamentals of interferometry
  - CO2 Identify various interferometric techniques
  - CO3 Understand different geodetic measurements for Geodetic observations
  - CO4 Comprehend the components and working principle of VLBI
  - CO5 Summarize the methods for VLBI data analysis and reduction.
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GI3033 ENVIRONMENTAL GEODESY

COURSE OBJECTIVES:
- To introduce concepts of the Earth system and its observation techniques.
- To expose the observables of hydrological, oceanographic, cyrospheric and atmosphere.

UNIT I THE EARTH SYSTEM
Systems approach to studying Earth, climate and weather systems, mass distribution, transport and exchange in the Earth system, Impact of physical processes on the geometry and gravity of the Earth, loading theory and the sea level equation.
UNIT II  OBSERVATION TECHNIQUES IN GEODESY  

UNIT III  TIDES AND HYDROLOGICAL OBSERVABLES  
Gravitational interaction of the Sun, Moon and the Earth, ocean tides, atmospheric tides, solid Earth tides, Doodson numbers, Water storage change, soil moisture, river run off and lake levels, groundwater variability.

UNIT IV  OCEANOGRAPHIC AND CRYOSPHERIC OBSERVABLES  
Sea surface topography and the mean sea level, ocean currents, ocean mass redistribution, ocean bathymetry, Sea ice thickness observations, ice mass balance, glacier thickness and drift.

UNIT V  ATMOSPHERIC AND SOLID EARTH OBSERVABLES  
Total precipitable water, ionospheric total electron content, atmospheric circulation and mass redistribution, Elastic, viscoelastic and episodic deformation and gravity responses to geodynamic processes like plate tectonics, Earthquakes and volcanic activity. Tsunami early warning, atmospheric / ionospheric seismology.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
• On completion of the course, the student is expected to
CO1 Summarize the concept of earth system and processes influencing the system
CO2 Explore various geodetic techniques for observation of earth system
CO3 Identify the observations used for measurement of tides and hydrological parameters
CO4 Identify the observations used for measurement of Ocean and Cryospheric parameters
CO5 Identify the observations used for measurement of Atmospheric and Solid earth parameters

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

UNIT I HORIZONTAL CONTROL SURVEYING
Definition – Uses and Establishment of Horizontal control – Methods: Triangulation, Traversing and Trilateration – Classification and accuracy - Instruments: Theodolite, Total Station and GNSS – Field procedure for Triangulation, Traversing and Trilateration: Horizontal angle measurements methods – Base line measurement – Elimination of blunder and systematic errors - Computation of weight of observation for length and angle.

UNIT II ADJUSTMENT OF HORIZONTAL CONTROL
Introduction - simple adjustment methods - Error propagation and linearization - Least squares adjustment method for Triangulation, Traversing and Trilateration – least squares adjustment of indirect Observations - least squared adjustment of observations only.

UNIT III VERTICAL CONTROL SURVEYING
Definition – Uses and Establishment of Vertical control – Methods: Sprit levelling, Reciprocal levelling, Trigonometric levelling, GNSS Surveying and Precise Levelling – Instruments: Dumpy level, Tilting level, Auto level, Digital level, Total Station and GNSS - Field procedure for different methods - Elimination of blunder and systematic errors - Computation of weight of observation

UNIT IV ADJUSTMENT OF VERTICAL CONTROL
Introduction - simple adjustment methods - Error propagation and linearization - Least squares adjustment method for Level Net and Trigonometrical levelling – least squares adjustment of indirect Observations - least squared adjustment of observations only.

UNIT V COORDINATE COMPUTATION
Plane and Spherical coordinate system – Computation of plane coordinate for horizontal control point of Triangulation, Traversing and Trilateration stations - Computation of Spherical coordinate for horizontal control point of Triangulation, Traversing and Trilateration stations – Computation of bearing and length from plane coordinates - Computation of forward azimuth, backward azimuth and length from spherical- coordinates

TOTAL: 45 PERIODS
COURSE OUTCOMES:
• On completion of the course, the student is expected to
  CO 1 Apprise various methods used for horizontal control surveying and the process involved
  CO 2 Develop the error identification and adjustment methods for horizontal control
  CO 3 Apprise various methods used for vertical control surveying and measurement process
  CO 4 Develop methods for identification of error and its adjustment
  CO 5 Derive the 3-dimensional coordinates for adjusted observations

TEXT BOOKS:

REFERENCES

CO’s, PO’s & PSO’s MAPPING

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GI3035 GEODETIC ASTRONOMY L T P C 3 0 0 3

COURSE OBJECTIVES:
• The overall objective is the development of a set of practical models for the determination of astronomic azimuth, latitude and longitude that utilize observations made to celestial objects.
UNIT I  INTRODUCTION  9
Definition and application of geodetic astronomy- Spherical Trigonometry- Spherical excess-
Celestial sphere- definition of terms in astronomy- solution of astronomical triangle celestial
coordinate systems

UNIT II  CELESTIAL COORDINATE SYSTEM  9
Celestial coordinate system: Horizon system- Hour angle system- Right Ascension system- Ecliptic
system and their inter-transformations- derivation and problems. Variation in celestial coordinates:
precession- nutation and polar motion. Reduction of star position

UNIT III  TIME SYSTEMS  9
Sidereal time- universal time- relation between Sidereal time and universal time- irregularities of
rotational time systems- Proper motion time systems: solar- sidereal- ephemerides- atomic- time
dissemination- the astronomical basis of time keeping and time recording. Rotational time systems:
UT0- UT1- UT2 and UTC- polar motion CIO- Earth rotation- leap second

UNIT IV  DETERMINATION OF POSITION AND ASTRONOMIC AZIMUTH  9
Determination of astronomical azimuth- latitude and longitude- Azimuth by star hour angle and star
altitudes- latitude by meridian zenith distance and Polaris at any hour angle- longitude by meridian
transit distance

UNIT V  STAR CATALOGUES AND APPLICATION OF GEODE蒂C ASTRONOMY  9
Historical and Types of Star catalogues- ephemerides - time span- observer location- target body-
almanacs. Star almanacs for Land Surveyors – Astrometry: precise positions- angular proper

TOTAL: 45 PERIODS

COURSE OUTCOMES:
*On completion of the course, the student is expected to
CO1  Understand the principles and mathematics involved in Geodetic Astronomy
CO2  Summarize and relate Coordinate Systems used for Astronomical observations
CO3  Understand and relate various time system used in astronomy
CO4  Apply astronomical observations for determination of azimuth, latitude and longitude
CO5  Identify the contents of Star Catalogues, Almanacs and their applications

REFERENCES
Publications

CO’s, PO’s & PSO’s MAPPING

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**MANDATORY COURSES I**

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

**COURSE OUTLINE**

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

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

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

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

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

**TOTAL : 45 PERIODS**

**MX3082**  
**ELEMENTS OF LITERATURE**  
**L T P C**  
**3 0 0 0**

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

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

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

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

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

3. READINGS:

3.1 Textbook:
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:
   5.1HA:
   5.2Quizzes-HA:
   5.3Periodical Examination: one
   5.4Project/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.
   5.5Final 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

CO’s – PO’s & PSO’s MAPPING

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MANDATORY COURSES II

MX3085 WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA L T P C 3 0 0 0

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

UNIT I HEALTH AND ITS IMPORTANCE 2+4

Health: Definition - Importance of maintaining health - More importance on prevention than treatment
Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.

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

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

UNIT II DIET 4+6
Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.


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

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

Common cooking mistakes
Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4
AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

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

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

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

UNIT IV MENTAL WELLNESS 3+4
Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion.

Immunity - Types and importance - Ways to develop immunity

UNIT V          YOGA

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

TOTAL : 45 PERIODS

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

REFERENCES:
1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue, Suite 1200, New York, NY 10001

1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
2. Simple lifestyle modifications to maintain health
   https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.
3. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html
7. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/
   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
UNIT-I  CONCEPTS AND PERSPECTIVES
Meaning of History
Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation versus evidence, concept of historical inevitability, Historical Positivism.
Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

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

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

UNIT-IV  SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA
Legacy of technology in Medieval India, Interactions with Arabs
Development in medical knowledge, interaction between Unani and Ayurveda and alchemy
Astronomy and Mathematics: interaction with Arabic Sciences
Science and Technology on the eve of British conquest

UNIT-V  SCIENCE AND TECHNOLOGY IN COLONIAL INDIA
Science and the Empire
Indian response to Western Science
Growth of techno-scientific institutions

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

TOTAL : 45 PERIODS

MX3087  POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY  L T P C  3 0 0 0
Pre-Requisite: None. (Desirable: Universal Human Values 1, Universal Human Values 2)

OBJECTIVES:
- This course will begin with a short overview of human needs and desires and how different political-economic systems try to fulfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.
**COURSE TOPICS:**
Considerations for humane society, holistic thought, human being’s desires, harmony in self, harmony in relationships, society, and nature, societal systems. *(9 lectures, 1 hour each)*

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. *(5 lectures)*

(Refs: Adam Smith, J S Mill)

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

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) *(5 lectures)*

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

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one’s lives. Relationship with nature. *(6 lectures)*

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. *(3 lectures)*

(Refs: Pt Sundaralal, 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.
OBJECTIVE:
The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

TOPICS:
Understanding the need and role of State and politics.

Development of Nation-State, sovereignty, sovereignty in a globalized world.

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government-unitary-federal, Presidential-Parliamentary,
The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies. Constitution making and the Constitution of India.
Goals, objective and philosophy.
Why a federal system?
National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari)
New social movements.
The changing nature of Indian Political System, the future scenario.
What can we do?

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

SUGGESTED READING:
OBJECTIVES

- To understand the introduction and basic terminologies of safety.
- To enable the students to learn about the important statutory regulations and standards.
- To enable students to conduct and participate in 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

Toolbox talk - Role of safety committee - Responsibilities of safety officers and safety representatives - Safety training and safety incentives - Mock drills - On-site emergency action plan - Off-site emergency action plan - Safety poster and display - Human error assessment

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 - Hazard identification and risk assessment

Course outcomes on completion of this course the student will be able:

- Understand the basic concept of safety.
- Obtain knowledge of statutory regulations and standards.
- Know about the safety activities of the working place.
- Analyze on the impact of occupational exposures and their remedies.
- Obtain knowledge of risk assessment techniques.

TEXTBOOKS

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

REFERENCES

5. Society of Safety Engineers, USA

**ONLINE RESOURCES**

**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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<tbody>
<tr>
<td>CO1</td>
<td>Understand the basic concept of safety.</td>
<td>3 3 3 1 1 3 2 2 3 3 1 3 3 3 3</td>
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<tr>
<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>2 2 2 1 2 2 2 3 2 1 2 3 3 3 3</td>
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<tr>
<td>CO4</td>
<td>Analyze on the impact of Occupational Exposures and their Remedies</td>
<td>3 3 3 2 2 3 2 3 2 1 3 3 3 3 3</td>
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<tr>
<td>CO5</td>
<td>Obtain knowledge of Risk Assessment Techniques.</td>
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<td><strong>Industrial safety</strong></td>
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**OPEN ELECTIVE I AND II**

**OCS351 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS**

| L T P C | 2 0 2 3 |

**COURSE OBJECTIVES:**
The main objectives of this course are to:
- Understand the importance, principles, and search methods of AI
- Provide knowledge on predicate logic and Prolog.
- Introduce machine learning fundamentals
- Study of supervised learning algorithms.
- Study about unsupervised learning algorithms.
UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH


UNIT II PROBLEM SOLVING WITH SEARCH TECHNIQUES

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

UNIT III LEARNING


UNIT IV SUPERVISED LEARNING


UNIT V UNSUPERVISED LEARNING

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

PRACTICAL EXERCISES: 30 PERIODS

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

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

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

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

TOTAL : 60 PERIODS
COURSE OUTCOMES:
CO1: Understand the foundations of AI and the structure of Intelligent Agents
CO2: Use appropriate search algorithms for any AI problem
CO3: Study of learning methods
CO4: Solving problem using Supervised learning
CO5: Solving problem using Unsupervised learning

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

REFERENCES

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

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

UNIT I INTRODUCTION TO INTERNET OF THINGS 5

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

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT 6

UNIT IV OPEN PLATFORMS AND PROGRAMMING 7

UNIT V IOT APPLICATIONS 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

30 PERIODS
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

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

TOTAL PERIODS: 60

TEXTBOOKS

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

OCS353 DATA SCIENCE FUNDAMENTALS

COURSE OBJECTIVES:
- Familiarize students with the data science process.
- Understand the data manipulation functions in Numpy and Pandas.
- Explore different types of machine learning approaches.
- Understand and practice visualization techniques using tools.
- Learn to handle large volumes of data with case studies.

UNIT I INTRODUCTION
Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – data preparation - Exploratory Data analysis – build the model – presenting findings and building applications - Data Mining - Data Warehousing – Basic statistical descriptions of Data

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UNIT II DATA MANIPULATION 9

UNIT III MACHINE LEARNING 5
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 5

UNIT V HANDLING LARGE DATA 5
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: 30 PERIODS

LAB EXERCISES 30 PERIODS
1. Download, install and explore the features of Python for data analytics.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Basic plots using Matplotlib
5. Statistical and Probability measures
   a) Frequency distributions
   b) Mean, Mode, Standard Deviation
   c) Variability
   d) Normal curves
   e) Correlation and scatter plots
   f) Correlation coefficient
   g) Regression
6. Use the standard benchmark data set for performing the following:
   a) Univariate Analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
   b) Bivariate Analysis: Linear and logistic regression modelling.
7. Apply supervised learning algorithms and unsupervised learning algorithms on any data set.
8. Apply and explore various plotting functions on any data set.

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

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

TOTAL:60 PERIODS
TEXT BOOKS

REFERENCES

CCS333 AUGMENTED REALITY/VIRTUAL REALITY

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

UNIT I INTRODUCTION

UNIT II VR MODELING

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

UNIT IV APPLICATIONS

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

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand the basic concepts of AR and VR
CO2: Understand the tools and technologies related to AR/VR
CO3: Know the working principle of AR/VR related Sensor devices
CO4: Design of various models using modeling techniques
CO5: Develop AR/VR applications in different domains

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

CO’s – PO’s & PSO’s MAPPING

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OPEN ELECTIVE III

OHS351 ENGLISH FOR COMPETITIVE EXAMINATIONS

Course Description:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.
COURSE OBJECTIVES:
- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students' confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

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

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

TOTAL: 45 PERIODS
Evaluative Pattern:
Internal Tests – 50%
End Semester Exam - 50%

TEXTBOOKS:

REFERENCES:

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

CO’s – PO’s & PSO’s MAPPING

| CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 |
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1-low, 2-medium, 3-high, ‘-‘- no correlation

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

OMG352 NGOS AND SUSTAINABLE DEVELOPMENT

COURSE OBJECTIVES
- To understand the importance of sustainable development
- To acquire a reasonable knowledge on the legal frameworks pertaining to pollution control and environmental management
- To comprehend the role of NGOs in attaining sustainable development

UNIT I ENVIRONMENTAL CONCERNS
Introduction to sustainable development goals, Global responsibility of environmental concern, Importance of environmental preservation, Environmental threats, Pollution and its types, Effects of Pollution, Pollution control, Treatment of wastes

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

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

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

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

TOTAL : 45 PERIODS

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

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

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

CO3 present strategies for NGOs in attaining sustainable development

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

CO5 understand the environmental legislations

REFERENCES

OMG353 DEMOCRACY AND GOOD GOVERNANCE

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

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

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

UNIT IV
Contemporary Political Economy of Development in India: Policy Debates over Models of Development in India, Recent trends of Liberalisation of Indian Economy in different sectors, E-governance
UNIT V
Dynamics of Civil Society: New Social Movements, Role of NGO’s, Understanding the political significance of Media and Popular Culture.

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

CME365 RENEWABLE ENERGY TECHNOLOGIES

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

UNIT I ENERGY SCENARIO 9
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 I SOLAR ENERGY 9

UNIT III WIND ENERGY 9

UNIT IV BIO-ENERGY 9

UNIT V OCEAN AND GEOTHERMAL ENERGY 9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course the students would be able to

CO1 Discuss the Indian and global energy scenario.
CO2 Describe the various solar energy technologies and its applications.
CO3 Explain the various wind energy technologies.
CO4 Explore the various bio-energy technologies.
CO5 Discuss the ocean and geothermal technologies.

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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

OM354

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

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

UNIT II ENDUSER-CENTRIC INNOVATION
Importance of customer-centric innovation - Problem Validation and Customer Discovery - Understanding problem significance and problem incidence - Customer Validation. Target user, User persona & user stories. Activity: Customer development process - Customer interviews and field visit
UNIT III  APPLIED DESIGN THINKING TOOLS  
Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design

UNIT IV  CONCEPT GENERATION  
Solution Exploration, Concepts Generation and MUP design- Conceptualize the solution concept; explore, iterate and learn; build the right prototype; Assess capability, usability and feasibility. Systematic concept generation; evaluation of technology alternatives and the solution concepts

UNIT V  SYSTEM THINKING  
System Thinking, Understanding Systems, Examples and Understandings, Complex Systems

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

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

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

REFERENCES
1. https://www.ideo.com/pages/design-thinking#process
4. https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e
6. https://blog.forgeforward.in/star-tup-failure-is-like-true-lie-7812cde9b85

MF3003  REVERSE ENGINEERING  
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

TOTAL: 45 PERIODS
UNIT I  INTRODUCTION & GEOMETRIC FORM  9

UNIT II  MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION  9

UNIT III  DATA PROCESSING  9

UNIT IV  3D SCANNING AND MODELLING  9

UNIT V  INDUSTRIAL APPLICATIONS  9

TOTAL : 45 PERIODS

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

TEXT BOOKS:

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

UNIT I  ECONOMIC SUSTAINABILITY  9

UNIT II  SOCIAL AND ENVIRONMENTAL SUSTAINABILITY  9
Social sustainability – Introduction-Work management -Human rights - Societal commitment - Customers -Business practices -Modelling and assessing social sustainability. Environmental issues pertaining to the manufacturing sector: Pollution - Use of resources -Pressure to reduce costs - Environmental management: Processes that minimize negative environmental impacts - environmental legislation and energy costs - need to reduce the carbon footprint of manufacturing Operations-Modelling and assessing environmental sustainability

UNIT III  SUSTAINABILITY PRACTICES  9
Sustainability awareness - Measuring Industry Awareness-Drivers and barriers -Availability of sustainability indicators - Analysis of sustainability practicing -Modeling and assessment of sustainable practicing -Sustainability awareness -Sustainability drivers and barriers - Availability of sustainability indicators- Designing questionnaires- Optimizing Sustainability Indexes-Elements – Cost and time model.

UNIT IV  MANUFACTURING STRATEGY FOR SUSTAINABILITY  9
Concepts of competitive strategy and manufacturing strategies and development of a strategic improvement programme - Manufacturing strategy in business success strategy formation and formulation - Structured strategy formulation - Sustainable manufacturing system design options - Approaches to strategy formulation - Realization of new strategies/system designs.

UNIT V  TRENDS IN SUSTAINABLE OPERATIONS  9

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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CO/PO & PSO Average: 2

1 – Slight, 2 – Moderate, 3 – Substantial

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

TEXT BOOKS:

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OAS352  SPACE ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- Use the standard atmosphere tables and equations.
- Find lift and drag coefficient data from NACA plots.
- Apply the concept of static stability to flight vehicles.
- Describe the concepts of stress, strain, Young’s modulus, Poisson’s ratio, yield strength.
- Demonstrate a basic knowledge of dynamics relevant to orbital mechanics.

UNIT I  STANDARD ATMOSPHERE  6
History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II  AERODYNAMICS  10
Aerodynamic forces – Lift generation Viscosity and its implications - Shear stress in a velocity profile - Lagrangian and Eulerian flow field - Concept of a streamline – Aircraft terminology and geometry - Aircraft types - Lift and drag coefficients using NACA data.
UNIT III PERFORMANCE AND PROPULSION
Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations - thrust/power available and thrust/power required.

UNIT IV AIRCRAFT STABILITY AND STRUCTURAL THEORY

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

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

TEXT BOOKS:

REFERENCE:

OIM351 INDUSTRIAL MANAGEMENT

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

UNIT I INTRODUCTION

UNIT II FUNCTIONS OF MANAGEMENT
UNIT III  ORGANIZATIONAL BEHAVIOUR  9

UNIT IV  GROUPDYNAMICS  9

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

TOTAL: 45 PERIODS

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

REFERENCES:

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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   CONTROLCHARTS 9
Chance and assignable causes of process variation, statistical basis of the control chart, control charts for variables- X, R and S charts, attribute control charts - p, np, c and u- Construction and application.

UNIT III   SPECIAL CONTROL PROCEDURES 9
Warning and modified control limits, 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   STATISTICALPROCESSCONTROL 9
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

UNIT V   ACCEPTANCESAMPLING 9
The acceptance sampling fundamental, OC curve, sampling plans for attributes, simple, double, multiple and sequential, sampling plans for variables, MIL-STD-105D and MIL-STD-414E & IS2500 standards.

TOTAL: 45 PERIODS

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

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OSF351        FIRE SAFETY ENGINEERING        L T P C
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COURSE OBJECTIVES
• To enable the students to acquire knowledge of Fire and Safety Studies
• To learn about the effect of fire on materials used for construction, the method of test for non-combustibility & fire resistance
• To learn about fire area, fire stopped areas and different types of fire-resistant doors
• To learn about the method of fire protection of structural members and their repair due to fire damage.
• To develop safety professionals for both technical and management through systematic and quality-based study programmes
UNIT I INHERENT SAFETY CONCEPTS
Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials - concrete, steel, masonry and wood; Behavior of non-structural materials on fire - plastics, glass, textile fibres and other house hold materials.

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

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

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

UNIT V WORKING AT HEIGHTS

TOTAL : 45 PERIODS

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

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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195
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Selecting sensors to develop mechatronics systems.
- Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
- Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
- Applying PLC as a controller in mechatronics system.
- Designing and develop the apt mechatronics system for an application.

UNIT I  INTRODUCTION AND SENSORS  

UNIT II  8085 MICROPROCESSOR  

UNIT III  PROGRAMMABLE PERIPHERAL INTERFACE  

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

UNIT V  ACTUATORS AND MECHATRONICS SYSTEM DESIGN  

TOTAL: 45 PERIODS

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

TEXT BOOKS

REFERENCES

CO’s – PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

ORA351 FOUNDATION OF ROBOTICS

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

UNIT I FUNDAMENTALS OF ROBOT

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

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS

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-Effectors Commands, and simple
programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL : 45 PERIODS

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

CO1: Interpret the features of robots and technology involved in the control.
CO2: Apply the basic engineering knowledge and laws for the design of robotics.
CO3: Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.
CO4: Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.
CO5: Demonstrate the image processing and image analysis techniques by machine vision system.

TEXT BOOKS:

REFERENCES:

CO's – PO's & PSO's MAPPING

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OAE352 FUNDAMENTALS OF AERONAUTICAL ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To acquire the knowledge on the Historical evaluation of Airplanes
- To learn the different component systems and functions
- To know the concepts of basic properties and principles behind the flight
- To learn the basics of different structures & construction
- To learn the various types of power plants used in aircrafts

UNIT I HISTORY OF FLIGHT
8
Balloon flight-ornithopter – Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

UNIT II AIRCRAFT CONFIGURATIONS AND ITS CONTROLS 10
Different types of flight vehicles, classifications-Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

UNIT III  BASICS OF AERODYNAMICS  9

UNIT IV BASICS OF AIRCRAFT STRUCTURES  9

UNIT V  BASICS OF PROPULSION  9
Basic ideas about piston, turboprop and jet engines – use of propeller and jets for thrust production-Comparative merits, Principle of operation of rocket, types of rocket and typical applications, Exploration into space.

TOTAL : 45 PERIODS

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

TEXT BOOKS

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

OCE353 LEAN CONCEPTS, TOOLS AND PRACTICES

199
Introduction to lean management - Toyota's management principle-Evolution of lean in construction industry - Production theories in construction –Lean construction value - Value in construction - Target value design - Lean project delivery system- Forms of waste in construction industry - Waste Elimination.

UNIT III CORE CONCEPTS IN LEAN 9

UNIT IV LEAN TOOLS AND TECHNIQUES 9

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

TOTAL : 45 PERIODS

COURSE OUTCOME:
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 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 9
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 9

UNIT III  SOIL LESS CULTIVATION 9
Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyard gardens- tactical gardens- street landscaping- forest gardening, greenhouses, urban beekeeping

UNIT IV  MODERN CONCEPTS 9
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 9
Concept, scope and maintenance of waste management- recycle of organic waste, garden wastes-solid waste management-scope, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues, waste utilization.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Demonstrate the principles behind crop production and various parameters that influences the crop growth on roof tops
CO2 Explain different methods of crop production on roof tops
CO3 Explain nutrient and pest management for crop production on roof tops
CO4 Illustrate crop water requirement and irrigation water management on roof tops
CO5 Explain the concept of waste management on roof tops

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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201
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| PO2 | Problem Analysis | 1 | 1 | 1 | 1 | 1 | 2 |
| PO3 | Design/ Development of Solutions | 1 | 2 | 1 | 1 | 3 | 2 |
| PO4 | Conduct Investigations of Complex Problems | 1 | 1 | 2 | 2 | 1 | 1 |
| PO5 | Modern Tool Usage | 1 | 2 | 1 | 1 | 1 | 2 |
| PO6 | The Engineer and Society | 1 | 2 | 1 | 2 | 1 | 1 |
| PO7 | Environment and sustainability | 1 | 2 | 1 | 1 | 2 | 1 |
| PO8 | Ethics | 2 | 1 | 1 | 1 | 2 | 1 |
| PO9 | Individual and team work | 1 | 1 | 2 | 1 | 1 | 1 |
| PO10 | Communication | 1 | 2 | 1 | 1 | 2 | 1 |
| PO11 | Project management and finance | 1 | 1 | 1 | 1 | 1 | 2 |
| PO12 | Life-long learning | 1 | 2 | 1 | 1 | 3 | 2 |
| PSO1 | To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill | 1 | 2 | 1 | 1 | 2 | 1 |
| PSO2 | To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 2 | 1 | 2 | 1 | 1 | 1 |
| PSO3 | To inculcate entrepreneurial skills through strong Industry-Institution linkage. | 1 | 2 | 1 | 2 | 1 | 2 |

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

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

UNIT I SOURCES OF WATER 9

UNIT II CONVEYANCE FROM THE SOURCE 9

UNIT III WATER TREATMENT 9
Objectives – Unit operations and processes – Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation -- sand filters - Disinfection -- Construction, Operation and Maintenance aspects.
UNIT IV ADVANCED WATER TREATMENT

UNIT V WATER DISTRIBUTION AND SUPPLY

TOTAL: 45 PERIODS

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

TEXTBOOKS :

REFERENCES :

CO’s- PO’s & PSO’s MAPPING

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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  

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

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

UNIT IV  HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS  

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

TOTAL: 45 PERIODS

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

REFERENCES:

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204
OEI353  INTRODUCTION TO PLC PROGRAMMING  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION TO PLC  9
Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, PLC Special I/O, PLC Types.

UNIT II  PLC INSTRUCTIONS  9
PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters, Examples.

UNIT III  PLC PROGRAMMING  9
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions

UNIT IV  COMMUNICATION OF PLC AND SCADA  9
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

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

TOTAL: 45 PERIODS

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

205
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 and Applications, Pearson publication

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

CO’s – PO’s & PSO’s MAPPING

<table>
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<tr>
<th>PO, PSO CO</th>
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OCH351 NANO TECHNOLOGY

UNIT I INTRODUCTION
General definition and size effects—important nano structured materials and nano particles—importance of nano materials- Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials- surface area - band gap energy and applications. Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials- Nano catalysis.

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

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

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES

206
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.

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

TEXT BOOKS

REFERENCES

CO’s – PO’s & PSO’s MAPPING

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techniques for nanomaterials

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OCH352 FUNCTIONAL MATERIALS

COURSE OBJECTIVE:
- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I INTRODUCTION 9

UNIT II MOLECULAR SELF ASSEMBLY 9

UNIT III BIO-INSPIRED MATERIALS 9

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

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

TOTAL: 45 PERIODS

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

TEXT BOOK:

REFERENCE:

OFD352 TRADITIONAL INDIAN FOODS

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

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

UNIT II  TRADITIONAL METHODS OF FOOD PROCESSING

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:
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, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

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

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

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

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

COURSE OUTCOMES:
On completion of the course the students are expected to
CO1 Be aware of the different methods applied to processing foods.
CO2 Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods.

TEXT BOOKS/REFERENCES:
To provide the basic fundamental knowledge of different forms of Intellectual Property Rights in national and international level.

To provide the significance of the Intellectual Property Rights about the patents, copyrights, industrial design, plant and geographical indications.

This paper is to study significance of the amended patent act on pharma industry.

UNIT I  INTRODUCTION- INTELLECTUAL PROPERTY RIGHTS  9
Introduction, Types of Intellectual Property Rights - patents, plant varieties protection, geographical indicators, copyright, trademark, trade secrets.

UNIT II  PATENTS  9
Patents-Objective, Introduction, Requirement for patenting- Novelty, Inventive step (Non-obviousness) and industrial application (utility), Non-patentable inventions, rights of patent owner, assignment of patent rights, patent specification (provisional and complete), parts of complete specification, claims, procedure for obtaining patents, compulsory license.

UNIT III  PLANT VARIETY-TRADITIONAL KNOWLEDGE –GEOGRAPHICAL INDICATIONS  9
Plant variety- Justification, criteria for protection of plant variety and protection in India. Traditional knowledge- Concept of traditional knowledge, protection of traditional knowledge under Intellectual Property frame works in national level and Traditional knowledge digital library (TKDL). Geographical Indications – Justification for protection, National and International position.

UNIT IV  ENFORCEMENT AND PRACTICAL ASPECTS OF IPR  9

UNIT V  INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY  9

TOTAL:45 PERIODS

TEXT BOOKS:

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

COURSE OUTCOME
The student will be able to
CO1 Understand and differentiate the categories of intellectual property rights.
CO2 Describe about patents and procedure for obtaining patents.
CO3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
CO4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.
CO5 Provide different organizations role and responsibilities in the protection of IPR in the international level.
CO6 Understand the interrelationships between different Intellectual Property Rights on International Society

CO’s – PO’s & PSO’s MAPPING

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OTT351 BASICS OF TEXTILE FINISHING

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

UNIT I RESIN FINISHING

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

UNIT III SOIL RELEASE AND ANTISTATIC FINISHES
Soil Release Finishing: Mechanism of soil retention & soil release, Anti pilling Finishing: chemical and mechanical methods to produce anti pilling. Concept of UV Protection finishes- Concept of 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.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

OTT352 INDUSTRIAL ENGINEERING FOR GARMENT INDUSTRY  L T P C
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COURSE OBJECTIVES:
• To enable the students to learn about basics of industrial engineering and different tools of industrial engineering and its application in apparel industry

UNIT I INTRODUCTION
Scope of industrial engineering in apparel Industry, role of industrial engineer.
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.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon the completion of the course the student shall be able to understand
CO1: Fundamental concepts of industrial Engineering and productivity
CO2: Method study
CO3: Motion analysis
CO4: Work measurement and SAM
CO5: Ergonomics and its application to garment industry

TEXTBOOKS:

REFERENCES

CO’s – PO’s & PSO’s MAPPING

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

OTT353 BASICS OF TEXTILE MANUFACTURE

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

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

UNIT II REGENERATED AND SYNTHETIC FIBRES
9
Production sequence of regenerated and modified cellulosic fibres: viscose rayon, Acetate Rayon, high wet modulus and high tenacity fibres; synthetic fibres – chemical structure, fibre forming polymers, production principles.

UNIT III BASICS OF SPINNING
9
Spinning – principle of yarn formation, sequence of machines for yarn production with short staple fibres and blends, principles of opening and cleaning machines; yarn numbering - calculations

UNIT IV BASICS OF WEAVING
9
Woven fabric – warp, weft, weaving, path of warp; looms – classification, handloom and its parts, powerloom, automatic looms, shuttleless looms, special type of looms; preparatory machines for weaving process and their objectives; basic weaving mechanism - primary, secondary and auxiliary mechanisms,

UNIT V BASICS OF KNITTING AND NONWOVEN
9

TOTAL : 45 PERIODS

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

TEXTBOOKS

CO’s – PO’s & PSO’s MAPPING

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

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

UNIT I ORIGIN, FORMATION AND REFINING OF CRUDE OIL

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

UNIT III REFORMING AND HYDROTREATING

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On the completion of the course students are expected to
CO1: Understand the classification, composition and testing methods of crude petroleum and its products. Learn the mechanism of refining process.
CO2: Understand the insights of primary treatment processes to produce the precursors.
CO3: Study the secondary treatment processes cracking, vis-breaking and coking to produce more petroleum products.
CO4: Appreciate the need of treatment techniques for the removal of sulphur and other impurities from petroleum products.
CO5: Understand the societal impact of petrochemicals and learn their manufacturing processes.
CO6: Learn the importance of optimization of process parameters for the high yield of petroleum products.

TEXT BOOKS

REFERENCES
CPE334 ENERGY CONSERVATION AND MANAGEMENT

COURSE OBJECTIVES:
At the end of the course, the student is expected to
- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I INTRODUCTION

UNIT II ELECTRICAL SYSTEMS

UNIT III THERMAL SYSTEMS

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

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

TOTAL: 45 PERIODS

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

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

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

CO3: Skills on combustion thermodynamics and kinetics.

CO4: Apply calculation and design tube still heaters.

CO5: Studied different heat treatment furnace.

CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

REFERENCES:
OPT351  BASICS OF PLASTICS PROCESSING   L T P C
                                                3 0 0 3

COURSE OBJECTIVES
- Understand the fundamentals of plastics processing, such as the relationships between material structural properties and required processing parameters, and so on
- To gain practical knowledge on the polymer selection and its processing
- Understanding the major plastic material processing techniques (Extrusion, Injection molding, Compression and Transfer molding, Blow molding, Thermoforming and casting)
- To understand suitable additives for plastics compounding
- To Propose troubleshooting mechanisms for defects found in plastics products manufactured by various processing techniques

UNIT I  INTRODUCTION TO PLASTICS PROCESSING   9

UNIT II  EXTRUSION   9

UNIT III  INJECTION MOLDING   9
Injection molding – Principles and processing outline, machinery, accessories and functions, specifications, process variables, mould cycle. Types of clamping: hydraulic and toggle mechanisms. Start-up and shut down procedures-Cylinder nozzles- Press capacity projected area -Shot weight Basic theoretical concepts and their relationship to processing - Interaction of moulding process aspect effects in quoted variables. Basic mould types. Reciprocating vs. plunger type injection moulding. Thermoplastic vs. thermosetting injection moulding. Injection moulding vs. other plastic processing techniques. State-of-the art injection moulding techniques - Introduction to trouble shooting

UNIT IV  COMPRESSION AND TRANSFER MOLDING   9
Compression moulding – Basic principles of compression and transfer moulding-Meaning of terms-Bulk factor and flow properties, moulding materials, process variables and process cycle, Inter relation between flow properties-Curing time-Mould temperature and Pressure requirements. Preforms and preheating- Techniques of preheating. Machines used-Types of compression mould- positive, semi-positive and flash. Common moulding faults and their correction- Finishing of mouldings. Transfer moulding: working principle, equipment, Press capacity-Integral moulds and auxiliary ram moulds, moulding cycle, moulding tolerances, pot transfer, plunger transfer and screw transfer moulding techniques, advantages over compression moulding
UNIT V  BLOW MOLDING, THERMOFORMING AND CASTING  9

TOTAL  45 PERIODS

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

REFERENCES

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

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

UNIT I  CLASSIFICATION OF SIGNALS AND SYSTEMS  9

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

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

UNIT V  LINEAR TIME IN Variant-DISCRETE TIME SYSTEMS 9

TOTAL: 45 PERIODS

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

CO1: determine if a given system is linear/causal/stable
CO2: determine the frequency components present in a deterministic signal
CO3: characterize continuous LTI systems in the time domain and frequency domain
CO4: characterize discrete LTI systems in the time domain and frequency domain
CO5: compute the output of an LTI system in the time and frequency domains

TEXT BOOKS:

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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

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

UNIT I  SEMICONDUCTOR DEVICES 9
PN junction diode, Zener diode, BJT, MOSFET, UJT –structure, operation and V-I characteristics, Rectifiers – Half Wave and Full Wave Rectifier, Zener as regulator
UNIT II  AMPLIFIERS
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 convetors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1: Explain the structure and working operation of basic electronic devices.
CO2: Design and analyze amplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Design and analyze power amplifiers and supply circuits

TEXT BOOKS :

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CBM348    FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT    L T P C
3 0 0 3

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

UNIT I  BASICS OF PRODUCT DEVELOPMENT  9

UNIT II  REQUIREMENTS AND SYSTEM DESIGN  9

UNIT III  DESIGN AND TESTING  9

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

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY  9

TOTAL: 45 PERIODS

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

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

CO’s- PO’s & PSO’s MAPPING

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CBM333 ASSISTIVE TECHNOLOGY

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

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

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

UNIT III HEARING AIDS
Anatomy of ear, Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV PROSTHETIC AND ORTHODIC DEVICES
Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

UNIT V RECENT TRENDS
Transcutaneous electrical nerve stimulator, bio-feedback, assistive devices in drug delivery

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

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

CO’s – PO’s & PSO’s MAPPING

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OMA352 OPERATIONS RESEARCH
L T P C 3 0 0 3

COURSE OBJECTIVES:
This course will help the students to
- determine the optimum solution for Linear programming problems.
- study the Transportation and assignment models and various techniques to solve them.
- acquire the knowledge of optimality, formulation and computation of integer programming problems.
- acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
- determine the optimum solution for non-linear programming problems.

UNIT I LINEAR PROGRAMMING 9

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEMS 9

UNIT III INTEGER PROGRAMMING 9

UNIT IV DYNAMIC PROGRAMMING PROBLEMS 9
UNIT V  NON - LINEAR PROGRAMMING PROBLEMS


TOTAL: 45 PERIODS

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

CO1 Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.

CO2 analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.

CO3 solve the integer programming problems using various methods.

CO4 conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.

CO5 determine the optimum solution for non linear programming problems.

TEXT BOOKS:

REFERENCES :

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OMA353 ALGEBRA AND NUMBER THEORY

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

226
UNIT I  GROUPS AND RINGS  
Groups: Definition - Properties - Homomorphism - Isomorphism - Cyclic groups - Cosets - Lagrange's theorem. 
Rings: Definition - Sub rings - Integral domain - Field - Integer modulo n - Ring homomorphism. 

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

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

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

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

TOTAL: 45 PERIODS 

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

TEXT BOOKS: 

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

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9

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

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

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

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9

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

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
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## OBT352  BASICS OF MICROBIAL TECHNOLOGY  L T P C

### 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

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

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

UNIT I  CARBOHYDRATES  9
Introduction to carbohydrate, classification, properties of monosaccharide, structural aspects of monosaccharides. Introduction to disaccharide (lactose, maltose, sucrose) and polysaccharide (Heparin, starch, and glycogen) biological function of carbohydrate.

UNIT II  LIPID AND FATTY ACIDS  9
Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipid, sphingolipid and glycerolipid. Biological function of lipid. Fatty acid, Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.

UNIT III  AMINO ACIDS AND PROTEIN.  9

UNIT IV  NUCLEIC ACIDS  9
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & amp; RNA Structure of Nitrogen bases in DNA and RNA along with the nomenclature· DNA double helix (Watson and crick) model, types of DNA, RNA.

UNIT V  VITAMINS AND HORMONES  9

TOTAL: 45 PERIODS

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

TEXT BOOKS

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

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

UNIT II | CELL ORGANELLES
Molecular organisation, biogenesis and function Mitochondria, endoplasmic 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

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

TEXTBOOKS:

REFERENCES:
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

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

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

OMA355 ADVANCED NUMERICAL METHODS

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

UNIT I ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM

UNIT II INTERPOLATION
- Central difference: Stirling and Bessel's interpolation formulae; Piecewise spline interpolation: Piecewise linear, piecewise quadratic and cubic spline; Least square approximation for continuous data (upto 3rd degree).

UNIT III NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS

UNIT IV FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS
- Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes - Leibmann's iterative methods - Dirichlet's and Neumann conditions – Laplace equation in polar coordinates: Finite difference schemes.

UNIT V FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS

TOTAL: 45 PERIODS

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

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

CO2: understand the interpolation theory;

CO3: understand the concepts of numerical methods for ordinary differential equations;
CO4: demonstrate the understandings of common numerical methods for elliptic equations;
CO5: understand the concepts of numerical methods for time dependent partial differential equations

TEXT BOOKS:

REFERENCES:

CO's – PO's & PSO's MAPPING

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OMA356 RANDOM PROCESSES L T P C 3 0 0 3

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

UNIT I RANDOM VARIABLES

UNIT II RANDOM PROCESSES

UNIT III SPECIAL RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES
UNIT V  LINEAR SYSTEMS WITH RANDOM INPUTS  
Linear time invariant system – System transfer function – Linear systems with random inputs – Auto correlation and cross correlation functions of input and output.  
TOTAL: 45 PERIODS  

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

TEXT BOOKS  

REFERENCES  

CO’s – PO’s & PSO’s MAPPING  

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OMA357  
QUEUEING AND RELIABILITY MODELLING  

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

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UNIT I  RANDOM PROCESSES  9

UNIT II  MARKOVIAN QUEUEING MODELS  9
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  9
M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/E_k/1 as special cases – Series queues – Open Jackson networks.

UNIT IV  SYSTEM RELIABILITY  9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1 Enable the students to apply the concept of random processes in engineering disciplines.
CO2 Students acquire skills in analyzing various queueing models.
CO3 Students can understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
CO4 Students can analyze reliability of the systems for various probability distributions.
CO5 Students can be able to formulate problems using the maintainability and availability analyses by using theoretical approach.

TEXT BOOKS

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COURSE OBJECTIVES:

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

UNIT I INTRODUCTION TO PRODUCTION AND OPERATIONS MANAGEMENT

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

UNIT II PRODUCTION & OPERATION SYSTEMS

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

UNIT III PRODUCTION & OPERATIONS PLANNING

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

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS


UNIT V CONTROLING PRODUCTION & OPERATIONS MANAGEMENT


TOTAL 45 : PERIODS

COURSE OUTCOMES

Upon completion of this course the learners will be able:

CO1 To understand the basics and functions of Production and Operation Management for business owners.

CO2 To learn about the Production & Operation Systems.

CO3 To acquaint on the Production & Operations Planning Techniques followed by entrepreneurs in Industries.

CO4 To known about the Production & Operations Management Processes in organisations.

CO5 To comprehend the techniques of controlling , Production and Operations in industries.
REFERENCES

OMG355 MULTIVARIATE DATA ANALYSIS

COURSE OBJECTIVE:
- To know various multivariate data analysis techniques for business research.

UNIT I INTRODUCTION
Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation.

UNIT II PREPARING FOR MULTIVARIATE ANALYSIS
Conceptualization of research model with variables, collection of data – Approaches for dealing with missing data – Testing the assumptions of multivariate analysis.

UNIT III MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS
Multiple Linear Regression Analysis – Inferences from the estimated regression function – Validation of the model. - Approaches to factor analysis – Interpretation of results.

UNIT IV LATENT VARIABLE TECHNIQUES
Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES
Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.

CO2 Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.

CO3 Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.

CO4 Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.

CO5 Make better business decisions by using advanced techniques in data analytics.

REFERENCES:
OME352 ADDITIVE MANUFACTURING

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

UNIT I INTRODUCTION

UNIT II VAT POLYMERIZATION AND MATERIAL EXTRUSION

UNIT III POWDER BED FUSION AND BINDER JETTING

UNIT IV MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CME343 NEW PRODUCT DEVELOPMENT LT P C 3 0 0 3

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

UNIT I FUNDAMENTALS OF NPD

UNIT II MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS
Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT III ESSENTIALS OF NPD
details to machine shop and CAM programing. Tool assembly and shop floor trials. Initial sample submission with PPAP documents.

UNIT IV  CRITERIONS OF NPD
New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

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

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

CO1 Discuss fundamental concepts and customer specific requirements of the New Product development

CO2 Discuss the Material specification standards, analysis and fabrication, manufacturing process Develop Feasibility Studies & reporting of New Product development

CO3 Analyzing the New product qualification and Market Survey on similar products of new product development

CO4 Develop Reverse Engineering. Cloud points generation, converting cloud data to 3D model

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

REFERENCES:
Revolutionizing Product Development – Steven C Wheelwright & Kim B. Clark
Change by Design
Toyota Product Development System – James Morgan & Jeffrey K. Liker
Winning at New Products – Robert Brands 3rd Edition
Product Design & Value Engineering – Dr. M.A. Bulsara &Dr. H.R. Thakkar

CO’s – PO’s & PSO’s MAPPING

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OME355  INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES  L T P C
3 0 0 3

COURSE OBJECTIVES:
The course aims to

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

UNIT I    UI/UX  9

UNIT II    APP DEVELOPMENT  9
SDLC - Introduction to App Development - Types of Apps - web Development - understanding Stack - Frontend - backend - Working with Databases - Introduction to API - Introduction to Cloud services - Cloud environment Setup - Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III    INDUSTRIAL DESIGN  9
Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV    MECHANICAL RAPID PROTOTYPING  9
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping: 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V    ELECTRONIC RAPID PROTOTYPING  9
Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1 Create quick UI/UX prototypes for customer needs
CO2 Develop web application to test product traction / product feature
CO3 Develop 3D models for prototyping various product ideas
CO4 Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

MF3010    MICRO AND PRECISION ENGINEERING  3 0 0 3

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

UNIT I  INTRODUCTION TO MICROSYSTEMS  9
Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical, electrical properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems.

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

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

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

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
CO1 Select suitable precision machine tools and operate
CO2 Apply the macro and micro components for fabrication of micro systems.
CO3 Apply suitable machining process
CO4 Able to work with miniature models of existing machine tools/robots and other instruments.
CO5 Apply metrology for micro system

TEXT BOOKS:

REFERENCES:

OMF354  COST MANAGEMENT OF ENGINEERING PROJECTS  LT P C
3 0 0 3

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

UNIT I  INTRODUCTION TO COSTING CONCEPTS  9
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.'

UNIT II  INTRODUCTION TO PROJECT MANAGEMENT  9
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts

UNIT III  PROJECT EXECUTION AND COSTING CONCEPTS  9
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

UNIT IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  9

UNIT V  QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The objective of this course is to make the students
- To understand the working and characteristics of different types of batteries and their management

UNIT I  ADVANCED BATTERIES  9
Li-ion Batteries-different formats, chemistry, safe operating area, efficiency, aging. Characteristics-SOC, DOD, SOH. Balancing-Passive Balancing Vs Active Balancing. Other Batteries-NCM and NCA Batteries. NCR18650B specifications.

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

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

UNIT IV  BATTERY STATE ESTIMATION  9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, students will be able to
CO1 Acquire knowledge of different Li-ion Batteries performance.
CO2 Design a Battery Pack and make related calculations.
CO3 Demonstrate a Battery Model or Simulation.
CO4 Estimate State-of-Charges in a Battery Pack.
CO5 Approach different BMS architectures during real world usage.

TEXT BOOKS

REFERENCES
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet
COURSE OBJECTIVES:
- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I  INTRODUCTION TO MEASUREMENTS AND SENSORS  9

UNIT II  VARIABLE RESISTANCE AND INDUCTANCE SENSORS  9
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors- Inductive potentiometer- Variable reluctance transducers- El pick up and LVDT

UNIT III  VARIABLE AND OTHER SPECIAL SENSORS  9
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV  AUTOMOTIVE ACTUATORS  9

UNIT V  AUTOMATIC TEMPERATURE CONTROL ACTUATORS  9
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL :45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1 List common types of sensor and actuators used in vehicles.
CO2 Design measuring equipment's for the measurement of pressure force, temperature and flow.
CO3 Generate new ideas in designing the sensors and actuators for automotive application
CO4 Understand the operation of the sensors, actuators and electronic control.
CO5 Design temperature control actuators for vehicles.

TEXT BOOKS:

REFERENCES:
OAS353 SPACE VEHICLES

COURSE OBJECTIVES:
- To interpret the missile space stations, space vs earth environment.
- To explain the life support systems, mission logistics and planning.
- To deploy the skills effectively in the understanding of space vehicle configuration design.
- To explain Engine system and support of space vehicle
- To interpret nose cone configuration of space vehicle

UNIT I FUNDAMENTAL ASPECTS
9
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II SELECTION OF ROCKET PROPULSION SYSTEMS
9
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III ENGINE SYSTEMS, CONTROLS, AND INTEGRATION
9

UNIT IV THRUST VECTOR CONTROL
9
TVC Mechanisms with a Single Nozzle – TVC with Multiple Thrust Chambers or Nozzles – Testing – Integration with Vehicle – SITVC method – other jet control methods - exhaust plume problems in space environment

UNIT V NOSE CONE CONFIGURATION
9
Aerodynamic aspects on the selection of nose shape of a launch vehicle - design factors in the finalization of nose configuration with respect to payload - nose cone thermal protection system - separation of fairings - payload injection mechanism

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1 Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
CO2 Apply knowledge in selecting the appropriate rocket propulsion systems.
CO3 Interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
CO4 Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
CO5 Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.

TOTAL: 45 PERIODS

OIM352 MANAGEMENT SCIENCE

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, TrainingandDevelopment,WageandSalaryAdministration,Promotion,Transfer,PerformanceApprais al, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating –Capability Maturity Model (CMM)Levels.

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

UNIT V STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, Students will be able to
CO1: Plan an organizational structure for a given context in the organization to carryout production operations through Work-study.
CO2: Survey the markets,customers and competition better and price the given products appropriately
CO3: Ensure quality for a given product or service.
CO4: Plan, schedule and control projects through PERTandCPM.
CO5: Evaluate strategyforabusiness orserviceorganisation.

TEXTBOOKS:

REFERENCES:
CO’s – PO’s & PSO’s MAPPING

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OIM353 PRODUCTION PLANNING AND CONTROL

COURSE OBJECTIVES:
- To understand the concept of production planning and control act work study,
- To apply the concept of product planning,
- To analyze the production scheduling,
- To apply the Inventory Control concepts.
- To prepare the manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION
Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

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

UNIT IV PRODUCTION SCHEDULING

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

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course,
CO1: The students can able to prepare production planning and control act work study,
CO2: The students can able to prepare product planning,
CO3: The students can able to prepare production scheduling,
CO4: The students can able to prepare Inventory Control.
CO5: They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

REFERENCES
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corp. 1984

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OIE353 OPERATIONS MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVE:
- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
- Relate the interdependence of the operations function with the other key functional areas of a firm.
- Teach analytical skills and problem-solving tools to the analysis of the operations problems.
- Apply scheduling and Lean Concepts for improving System Performance.
UNIT I  INTRODUCTION TO OPERATIONS MANAGEMENT

Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy - Strategic fit, framework; Supply Chain Management

UNIT II  FORECASTING, CAPACITY AND FACILITY DESIGN


UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS


UNIT IV  MATERIALS MANAGEMENT


UNIT V  SCHEDULING AND PROJECT MANAGEMENT

Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.

CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.

CO3: The students will be able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.

CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.

CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

TEXT BOOKS


REFERENCES


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OSF352 INDUSTRIAL HYGIENE

COURSE OBJECTIVES:
- Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
- Compare and contrast the roles of environmental and biological monitoring in work health and safety.
- Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.
- Discuss how personal protective equipment can be used to reduce risks associated with workplace exposures.
- Provide high-level advice on managing and controlling noise and noise-related hazards.

UNIT I: INTRODUCTION AND SCOPE

UNIT II: MONITORING FOR SAFETY, HEALTH & ENVIRONMENT

UNIT III: OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY EDUCATION

UNIT IV: OCCUPATIONAL SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT
UNIT-V INDUSTRIAL HAZARDS

i. Radiation: Types and effects of radiation on human body, Measurement and detection of radiation intensity. Effects of radiation on human body, Measurement – disposal of radioactive waste, Control of radiation


TOTAL PERIODS: 45

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:


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OSF353 CHEMICAL PROCESS SAFETY L T P C

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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

TEXT BOOK

REFERENCES:

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**OML352 ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS**

**COURSE OBJECTIVES:**
The main learning objective of this course is to prepare the students for:
- Understanding the importance of various materials used in electrical, electronics and magnetic applications
- Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
- Gaining knowledge on the selection of suitable materials for the given application
- Knowing the fundamental concepts in Semiconducting materials
- Getting equipped with the materials used in optical and optoelectronic applications.

**UNIT I DIELECTRIC MATERIALS**

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics. Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials.

**UNIT II MAGNETIC MATERIALS**

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials. Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

**UNIT III SEMICONDUCTOR MATERIALS**

Properties of semiconductors, Silicon wafers, integration techniques. Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

**UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS**

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, 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**

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials -
photo detectors - applications of optoelectronic materials - optical fibres and materials - electro optic modulators - Kerr effect - Pockels effect.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1 Understand various types of dielectric materials, their properties in various conditions.
CO2 Evaluate magnetic materials and their behavior.
CO3 Evaluate semiconductor materials and technologies.
CO4 Select suitable materials for electrical engineering applications.
CO5 Identify right material for optical and optoelectronic applications.

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OML353 NANTOMATERIALS AND APPLICATIONS

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

- Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- Gaining knowledge on dimensionality effects on different properties of nanomaterials
- Getting acquainted with the different processing techniques employed for fabricating nanomaterials
- Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
- Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.

UNIT I Nanomaterials
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.
UNIT II  THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS  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

CO1  Evaluate nanomaterials and understand the different types of nanomaterials

CO2  Recognise the effects of dimensionality of materials on the properties

CO3  Process different nanomaterials and use them in engineering applications

CO4  Use appropriate techniques for characterising nanomaterials

CO5  Identify and use different nanomaterials for applications in different engineering fields.

TEXT BOOKS:
2. Carl C. Koch (ed.), NANOSTRUCTURED MATERIALS, Processing, Properties and Potential
Applications, NOYES PUBLICATIONS, Norwich, New York, U.S.A.

REFERENCES:
2. Nalwa H.S., Encyclopedia of Nanoscience and Nanotechnology, American Scientific Publishers
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2004

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COURSE OBJECTIVES:
- To knowledge on fluid power principles and working of hydraulic pumps
- To obtain the knowledge in hydraulic actuators and control components
- To understand the basics in hydraulic circuits and systems
- To obtain the knowledge in pneumatic and electro pneumatic systems
- To apply the concepts to solve the trouble shooting

UNIT I FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS
- Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids
- Properties of fluids and selection – Basics of Hydraulics – Pascal’s Law – Principles of flow
- Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory
- Pump Classification – Construction, Working, Design, Advantages, Disadvantages, Performance
- Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

UNIT II HYDRAULIC ACTUATORS AND CONTROL COMPONENTS
- Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning –
- Hydraulic motors - Control Components : Direction Control, Flow control and pressure control valves
- Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories

UNIT III HYDRAULIC CIRCUITS AND SYSTEMS
- Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double
- Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe,
- Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo
- systems.

UNIT IV PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS
- Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air
- control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade
- fluidics and pneumatic logic circuits.

UNIT V TROUBLE SHOOTING AND APPLICATIONS
- Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic
- systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and
- Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Analyze the methods in fluid power principles and working of hydraulic pumps
CO2: Recognize the concepts in hydraulic actuators and control components
CO3: Obtain the knowledge in basics of hydraulic circuits and systems
CO4: Know about the basics concept in pneumatic and electro pneumatic systems
CO5: Apply the concepts to solve the trouble shooting hydraulic and pneumatics

TEXT BOOKS

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OMR353 SENSORS L T P C

COURSE OBJECTIVES:

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

UNIT I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES 9

UNIT II DISPLACEMENT, PROXIMITY AND RANGING SENSORS 9

UNIT III FORCE, MAGNETIC AND HEADING SENSORS 9

UNIT IV OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS 9
UNIT V  SIGNAL CONDITIONING


TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors. They can also analyze the sensor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.

CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.

CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

TEXT BOOKS


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1 – Slight, 2 – Moderate, 3 – Substantial

ORA352  CONCEPTS IN MOBILE ROBOTS

L T P C
3 0 0 3

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  9
Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Roots –
Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues –
Unmanned Aerial and Underwater Vehicles

UNIT II  KINEMATICS  9
Kinematic Models – Representation of Robot – Forward Kinematics – Wheel and Robot Constraints
– Degree of Mobility and Steerability – Manoeuvrability – Workspace – Degrees of Freedom – Path
and Trajectory Considerations – Motion Controls - Holonomic Robots

UNIT III  PERCEPTION  9
Sensor for Mobile Robots – Classification and Performance Characterization – Wheel/Motor
Sensors – Heading Sensors - Ground-Based Beacons - Active Ranging - Motion/Speed Sensors –
Camera - Visual Appearance based Feature Extraction.

UNIT IV  LOCALIZATION  9
Localization Based Navigation Versus Programmed Solutions - Map Representation - Continuous
Representations - Decomposition Strategies - Probabilistic Map-Based Localization - Landmark-
Based Navigation - Globally Unique Localization - Positioning Beacon Systems - Route-Based
Localization - Autonomous Map Building - Simultaneous Localization and Mapping (SLAM).

UNIT V  PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS  9
Introduction - Competences for Navigation: Planning and Reacting - Path Planning - Obstacle
Avoidance - Navigation Architectures - Control Localization - Techniques for Decomposition - Case
Studies – Collaborative Robots – Swarm Robots.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Evaluate the appropriate mobile robots for the desired application.
CO2: Create the kinematics for given wheeled and legged robot.
CO3: Analyse the sensors for the intelligence of mobile robotics.
CO4: Create the localization strategies and mapping technique for mobile robot.
CO5: Create the collaborative mobile robotics for planning, navigation and intelligence for desired
applications.

TEXTBOOK
1. Roland Siegwart and IllahR.Nourbakish, “Introduction to Autonomous Mobile Robots” MIT

REFERENCES:
1. Dragomir N. Nenchev, Atsushi Konno, TeppeiTsujita, “Humanoid Robots: Modelling and
Control”, Butterworth-Heinemann, 2018
5. Xiao Qi Chen, Y.Q. Chen and J.G. Chase, “Mobile Robots - State of the Art in Land, Sea, Air,
6. Alonzo Kelly, Mobile Robotics: Mathematics, Models, and Methods, Cambridge University
COURSE OBJECTIVES:
- To impart knowledge on basics of propulsion system and ship dynamic movements
- To educate them on basic layout and propulsion equipment’s
- To impart basic knowledge on performance of the ship
- To impart basic knowledge on Ship propeller and its types
- To impart knowledge on ship rudder and its types

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

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

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

UNIT IV BASICS OF PROPELLER

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

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Explain the basics of propulsion system and ship dynamic movements
CO2: Familiarize with various components assisting ship stabilization.
CO3: Demonstrate the performance of the ship.
CO4: Classify the Propeller and its types, Materials etc.
CO5: Categories the Rudder and its types, design criteria of rudder.

TEXT BOOKS:

REFERENCES BOOKS:
CO’s – PO’s & PSO’s MAPPING

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OMV351                                    MARINE MERCHANT VESSELS                                      LT P C

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

UNIT I INTRODUCTION to HYDROSTATICS  9

UNIT II TYPES OF SHIP  10
General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships – Oil tankers-
Bulk carriers - Liquefied Natural Gas carriers - Liquefied Petroleum Gascarriers - Chemical tankers
- Passenger ships

UNIT III SHIPBUILDING MATERIALS  9
Types of Steels used in Shipbuilding - High tensile steels, Corrosion resistant steels, Steel sandwich panels, Steel castings, Steel forgings - Other shipbuilding materials, Aluminium alloys, Aluminium alloy sandwich panels, Fire protection especially for Aluminium Alloys, Fiber Reinforced Composites

UNIT IV MARINE PROPELLER AND RUDDER  8
Types of rudder, construction of Rudder-Types of Propeller, Propeller material-Cavitations and its effects on propeller

UNIT V GOVERNING BODIES FOR SHIPPING INDUSTRY  9
Role of IMO (International Maritime Organization), SOLAS (International Convention for the Safety of Life at Sea), MARPOL (International Convention for the Prevention of Pollution from Ships ), MLC (Maritime Labour Convention), STCW 2010 (International Convention on Standards of Training, Certification and Watch keeping for Seafarers), Classification societies Administration authorities

COURSE OUTCOMES:
Upon completion of this course, students would
CO1 Acquire Knowledge on floatation of ships
CO2 Acquire Knowledge on features of various ships
CO3 Acquire Knowledge of Shipbuilding Materials

TOTAL: 45 PERIODS
CO4 Acquire Knowledge to identify the different types of marine propeller and rudder

CO5 Understand the Roles and responsibilities of governing bodies

TEXT BOOKS:
2. Dr.DA Taylor, “Merchant Ship Naval Architecture” I. Mar EST publications, 2006

REFERENCES:
2. MARPOL Consolidated Edition, Bhandakar Publications, 2018

OMV352 ELEMENTS OF MARINE ENGINEERING

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

UNIT I ELEMENTARY KNOWLEDGE ON MARINE MACHINERY SYSTEMS
Marine Engineering Terminologies, Parts of Ship, Introduction to Machinery systems on board ships – Propulsion Machinery system, Electricity Generator system, Steering gear system, Air compressors & Air reservoirs, Fuel oil and Lubricating Oil Purifiers, Marine Boiler systems

UNIT II MARINE PROPULSION MACHINERY SYSTEM
Two stroke Large Marine slow speed Diesel Engine – General Construction, Basic knowledge of Air starting and reversing mechanism, Cylinder lubrication oil system, Main lubricating oil system and cooling water system

UNIT III MARINE AUXILIARY MACHINERY SYSTEM
Four stroke medium speed Diesel engine – General Construction, Inline, V-type arrangement of engine, Difference between slow speed and medium speed engines – advantages, limitations and applications

UNIT IV MARINE BOILER SYSTEM
Types of Boiler – Difference between Water tube boiler and Fire tube boiler, Need for boiler on board ships, Uses of steam, Advantages of using steam as working medium, Boiler mountings and accessories – importance of mountings, need for accessories

UNIT V SHIP PROPELLERS AND STEERING MECHANISM
Importance of Propeller and Steering gear, Types of propellers - Fixed pitch propellers, Controllable pitch propellers, Water jet propellers, Steering gear systems - 2-Ram and 4 Ram steering gear, Electric steering gear

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course, students should be able to,
CO1 Distinguish the role of various marine machinery systems
CO2 Relate the components of marine propulsion machinery system
CO3 Explain the importance of marine auxiliary machinery system
CO4 Acquire knowledge of marine boiler system
CO5 Understand the importance of ship propellers and steering system

TEXT BOOKS:

REFERENCES:
1. Alan L.Rowen, “Introduction to Practical Marine Engineering, Volume 1&2, The Institute of Marine Engineers (India), Mumbai, 2006
2. A.S.Tambwekar, “Naval Architecture and Ship Construction”, The Institute of Marine Engineers (India), Mumbai, 2015

CRA332 DRONE TECHNOLOGIES LT P C
3 0 0 3

COURSE OBJECTIVES:
• To understand the basics of drone concepts
• To learn and understand the fundamentals of design, fabrication and programming of drone
• To impart the knowledge of an flying and operation of drone
• To know about the various applications of drone
• To understand the safety risks and guidelines of fly safely

UNIT I INTRODUCTION TO DRONE TECHNOLOGY
Drone Concept - Vocabulary Terminology - History of drone - Types of current generation of drones based on their method of propulsion - Drone technology impact on the businesses - Drone business through entrepreneurship - Opportunities/applications for entrepreneurship and employability

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING
Classifications of the UAV - Overview of the main drone parts - Technical characteristics of the parts - Function of the component parts - Assembling a drone - The energy sources - Level of autonomy - Drones configurations - The methods of programming drone - Download program - Install program on computer - Running Programs - Multi rotor stabilization - Flight modes - Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION
Concept of operation for drone - Flight modes - Operate a small drone in a controlled environment - Drone controls Flight operations - management tool - Sensors - Onboard storage capacity - Removable storage devices - Linked mobile devices and applications

UNIT IV DRONE COMMERCIAL APPLICATIONS
Choosing a drone based on the application - Drones in the insurance sector - Drones in delivering mail, parcels and other cargo - Drones in agriculture - Drones in inspection of transmission lines and power distribution - Drones in filming and panoramic picturing

UNIT V FUTURE DRONES AND SAFETY
The safety risks - Guidelines to fly safely - Specific aviation regulation and standardization - Drone license - Miniaturization of drones - Increasing autonomy of drones - The use of drones in swarms

TOTAL: 45 PERIODS
COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Create the programs for various drones

TEXT BOOKS

REFERENCES

CO’s – PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

OAI352 AGRICULTURE ENTREPRENEURSHIP DEVELOPMENT L T P C 3 0 0 3

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

UNIT I ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT 9
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 AGRIPRENURSHIP IN GLOBAL ARENA: LEGAL PERSPECTIVE 9
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
Entrepreneurship - Essence of managerial Knowledge -Management functions- Planning-organizing-Directing-Motivation-ordering-leading-supervision- communication and control-Understanding Financial Aspects of Business - Importance of financial statements-liquidity ratios-
leverage ratios, coverage ratios-turnover ratios-Profitability ratios. Agro-based industries-Project-Project cycle-Project appraisal and evaluation techniques-undiscounted measures-Payback period-proceeds per rupee of outlay, Discounted measures-Net Present Value (NPV)-Benefit-Cost Ratio(BCR)-Internal Rate of Return(IRR)-Net benefit investment ratio(N/K ratio)-sensitivity analysis.

UNIT IV ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.

UNIT V ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis-Government schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) - overview of agricultural engineering industry, characteristics of Indian farm machinery industry.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Judge about agricultural finance, banking and cooperation
CO2 Evaluate basic concepts, principles and functions of financial management
CO3 Improve the skills on basic banking and insurance schemes available to customers
CO4 Analyze various financial data for efficient farm management
CO5 Identify the financial institutions

TEXT BOOKS

REFERENCES

CO’s – PO's & PSO's MAPPING

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OCE354 **BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT**

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

**UNIT I OVERVIEW OF IWRM**

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

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

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

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

**TOTAL: 45 PERIODS**

**COURSE OUTCOMES**
- On completion of the course, the student will be able to apply appropriate management techniques towards managing the water resources.
  
**CO1** Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

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

**CO3** Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
Illustrate the recent trends in water management.
Understand the implementation hitches and the institutional frameworks.

TEXT BOOKS

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

OEN352 BIODIVERSITY CONSERVATION L T P C 3 0 0 3

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

UNIT I INTRODUCTION
Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III MICROBIAL DIVERSITY
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis.

UNIT IV MEGA DIVERSITY
Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio-economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNIT V CONSERVATIONS OF BIODIVERSITY
In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

TOTAL: 45 PERIODS
TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES
Upon successful completion of this course, students will:
CO1: An insight into the structure and function of diversity for ecosystem stability.
CO2: Understand the concept of animal diversity and taxonomy
CO3: Understand socio-economic issues pertaining to biodiversity
CO4: An understanding of biodiversity in community resource management.
CO5: Student can apply fundamental knowledge of biodiversity conservation to solve problems associated with infrastructure development.

CO’s- PO’s & PSO’s MAPPING

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

OEE353 INTRODUCTION TO CONTROL SYSTEMS L T P C 3 0 0 3

COURSE OBJECTIVES
- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems
- To analyze the stability of linear systems in frequency domain and time domain
- To develop linear models mainly state variable model and transfer function model

UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS 9
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction—Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS & ROOTLOCUSTECHNIQUE 9

UNIT III FREQUENCY RESPONSE ANALYSIS 9
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.
UNIT IV             STABILITY CONCEPTS & ANALYSIS


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.

COURSE OUTCOMES:

Ability to
CO1: Design the basic mathematical model of physical System.
CO2: Analyze the time response analysis and techniques.
CO3: Analyze the transfer function from different plots.
CO4: Apply the stability concept in various criterion.
CO5: Assess the state models for linear and continuous Systems.

TEXTBOOKS

REFERENCES
2. Control System Dynamics" by Robert Clark, Cambridge University Press, 1996 USA.

CO’s – PO’s & PSO’s MAPPING

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OEI354             INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS

COURSE OBJECTIVES:

- To educate on design of signal conditioning circuits for various applications.
- To Introduce signal transmission techniques and their design.
- Study of components used in data acquisition systems interface techniques
- To educate on the components used in distributed control systems
- To introduce the communication buses used in automation industries.
UNIT I INTRODUCTION

UNIT II AUTOMATION COMPONENTS
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)
5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1 Design a signal conditioning circuits for various application (L3).
CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:

REFERENCES:

List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063

CO’s- PO’s & PSO’s MAPPING

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OCH353 ENERGY TECHNOLOGY
L T P C
3 0 0 3

UNIT I INTRODUCTION 8
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources.

UNIT II CONVENTIONAL ENERGY 8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY 10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY 10
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.
UNIT V 
ENERGY CONSERVATION

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL: 45 PERIODS

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

CO1: Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.

CO2: Students will excel as professionals in the various fields of energy engineering.

CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.

CO4: Explain the technological basis for harnessing renewable energy sources.

CO5: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

TEXT BOOKS

REFERENCES

CO’s – PO’s & PSO’s MAPPING

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the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level

OVERALL CO | 2 | 2 | 1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 3 | 2 | 1 | 3

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

OCH354 SURFACE SCIENCE

COURSE OBJECTIVE:

- To enable the students to analyze properties of 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, Fisher-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS

COURSE OUTCOME:

- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena

TEXT BOOK:
COURSE OBJECTIVES
The course aims to
• acquaint and equip the students with different techniques of measurement of engineering properties.
• make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydation: 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
understand the effect of various methods of processing on the structure and texture of food materials

understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.

**TEXTBOOKS:**

**OFD355 FOOD SAFETY AND QUALITY REGULATIONS**

**COURSE OBJECTIVES**
- To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
- To help become skilled in systems for food safety surveillance
- To be aware of the regulatory and statutory bodies in India and the world
- To ensure processed food meets global standards

**UNIT I**
Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

**UNIT II**
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

**UNIT III**
Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law. Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

**UNIT IV**
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

**UNIT V**
Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
CO1 Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
CO2 Awareness on regulatory and statutory bodies in India and the world

REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
4. Microbiological safety of Food by Hobbs BC, 1973

OPY353 NUTRACEUTICALS

COURSE OBJECTIVES:
- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, caratenoids. 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 synbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT V SAFETY ISSUES
Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues International and national.

TOTAL: 45 PERIODS

TEXT BOOKS:
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006

REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE OUTCOMES
CO1 acquire knowledge about the Nutraceuticals and functional foods, their classification and benefits.
CO2 acquire knowledge of phytochemicals, zoochemicals and microbes in food, plants, animals and microbes
CO3 attain the knowledge of the manufacturing practices of selected nutraceutical components and formulation considerations of functional foods.
CO4 distinguish the various In vitro and In vivo assessment of Antioxidant activity of compounds from plant sources.
CO5 gain information about the health benefits of various functional foods and nutraceuticals in the prevention and treatment of various lifestyle diseases.
CO6 Attain the knowledge of the regulatory and safety issues of nutraceuticals at national and international level.

CO’s – PO’s & PSO’s MAPPING

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OTT354 BASICS OF DYEING AND PRINTING L T P C 3 0 0 3

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

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

UNIT II PRE TREATMENT 9
UNIT III  DYEING  9
Dye - Affinity, Substantively, Reactivity, Exhaustion and Fixation. Classification of dyes. Direct dyes:
General properties, principles and method of application on cellulosic materials. Reactive dyes –
principles and method of application on cellulosic materials hot brand, cold brand.

UNIT IV  PRINTING  9
Definition of printing – Difference between printing and dyeing- Classification thickeners –
Requirements to be good thickener, printing paste Preparation - different styles of printing.

UNIT V  MACHINERIES  9
Fabric Processing - winch, jigger and soft flow machines. Beam dyeing machines: Printing -flat

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand the
CO1: Basics of grey fabric
CO2: Basics of pre treatment
CO3: Concept of Dyeing
CO4: Concept of Printing
CO5: Machinery in processing industry

TEXT BOOKS:

REFERENCES:
2. Dr. N N Mahapatra., “Textile dyeing”, Wood head publishing India, 2018
   Wood head publishing India , 2021
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series

CO’s – PO’s & PSO’s MAPPING

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and
Substantial (High) respectively.
FT3201  FIBRE SCIENCE  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION TO TEXTILE FIBRES  9
Definition of various forms of textile fibres - staple fibre, filament, bicomponent fibres. Classification of Natural and Man-made fibres, essential and desirable properties of Fibres. Production and cultivation of Natural Fibers: Cotton, Silk, Wool - Physical and chemical structure of the above fibres.

UNIT II  REGENERATED FIBRES  9
Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel, Tencel

UNIT III  SYNTHETIC FIBRES  9
Production Sequence of Synthetic Fibers: polymer-Polyester, Nylon, Acrylic and polypropylene. Mineral fibres: fibre glass, carbon. Introduction to spin finishes and texturization

UNIT IV  SPECIALITY FIBRES  9
Properties and end uses of high tenacity and high modulus fibres, high temperature and flame retardant fibres, Chemical resistant fibres

UNIT V  FUNCTIONAL SPECIALITY FIBRES  9
Properties and end uses: Fibres for medical application – Biodegradable fibres based on PLA, Super absorbent fibres elastomeric fibres, ultra-fine fibres, electrospun nano fibres, metallic fibres – Gold and Silver coated.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1 Understand the process sequence of various fibres
CO2 Understand the properties of various fibres

TEXT BOOKS:

REFERENCES:

OTT355  GARMENT MANUFACTURING TECHNOLOGY  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To enable the students to understand the basics of pattern making, cutting and sewing.
- To expose the students to various problems & remedies during garment manufacturing
UNIT I  PATTERN MAKING, MARKER PLANNING, CUTTING  
Anthropometry, specification sheet, pattern making – principles, basic pattern set drafting, grading, marker planning, spreading & cutting

UNIT II  TYPES OF SEAMS, STITCHES AND FUNCTIONS OF NEEDLES  
Different types of seams and stitches; single needle lock stitch machine – mechanism and accessories; needle – functions, special needles, needlepoint

UNIT III  COMPONENTS AND TRIMS USED IN GARMENT  
Sewing thread - construction, material, thread size, packages, accessories – labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons

UNIT IV  GARMENT INSPECTION AND DIMENSIONAL CHANGES  
Raw material, in process and final inspection; needle cutting; sewability of fabrics; strength properties of apparel; dimensional changes in apparel due to laundering, dry-cleaning, steaming and pressing.

UNIT V  GARMENT PRESSING, PACKING AND CARE LABELING  
Garment pressing – categories and equipment, packing; care 282abelling of apparels

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand
CO1: Pattern making, marker planning, cutting
CO2: Types of seams, stitches and functions of needles
CO3: Components and trims used in garment
CO4: Garment inspection and dimensional changes
CO5: Garment pressing, packing and careabelling

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

REFERENCES:

CO’s – PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
- Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards

UNIT I INTRODUCTION
Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS

UNIT IV HAZARDS AND RISK MANAGEMENT

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

COURSE OUTCOMES:
After completion of this course, the student is expected to be able to:
CO1 Describe, with example, the common work-related diseases and accidents in occupational setting
CO2 Name essential members of the Occupational Health team
CO3 What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES
COURSE OBJECTIVES:
- To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I FLUID MECHANICS CONCEPTS
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton's Law of viscosity. Fluid statics-Pascal's law, Hydrostatic equilibrium, Barometric equation and...
pressure measurement (problems). Basic equations of fluid flow - Continuity equation, Euler’s equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numericals.

UNIT II FLOW MEASUREMENTS & MECHANICAL OPERATIONS 9

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER 9
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV BASICS OF MASS TRANSFER 9

UNIT V MASS TRANSFER OPERATIONS 9
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction). Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method. Drying- drying operations, batch and continuous drying. Conceptual numerical.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:
CO1 State and describe the nature and properties of the fluids.
CO2 Study the different flow measuring instruments, the principles of various size reductions, conveying equipment’s, sedimentation and mixing tanks.
CO3 Comprehend the laws governing the heat and mass transfer operations to solve the problems.
CO4 Design the heat transfer equipment suitable for specific requirement.

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

REFERENCES
2. Unit Operations of Chemical Engineering, Vol I &II Chattopadhyaya Khanna Publishers, Delhi-6 1996
COURSE OBJECTIVES

- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
- Understand the basics as well as the advanced applications of various plastic materials in the industry
- To understand the preparation methods of thermosetting materials
- Select suitable specialty plastics for different end applications

UNIT I  INTRODUCTION TO PLASTIC MATERIALS

Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)

UNIT II  ENGINEERING THERMOPLASTICS AND APPLICATIONS

Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)

UNIT III  THERMOSETTING PLASTICS

Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV  MISCELLANEOUS PLASTICS FOR END APPLICATIONS

Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers-their synthesis, properties and applications

UNIT V  PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS

Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1 To study the importance, advantages and classification of plastic materials
CO2 Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
CO3 To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
CO4 Know the manufacture, properties and uses of thermosetting resins based onpolyester, epoxy, silicone and PU
CO5 To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES

OPT353 PROPERTIES AND TESTING OF PLASTICS

COURSE OBJECTIVES
- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
- To study about the environmental effects and prevent polymer degradation.

UNIT I INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS

UNIT II MECHANICAL PROPERTIES

UNIT III THERMAL RHEOLOGICAL PROPERTIES
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

UNIT IV ELECTRICAL AND OPTICAL PROPERTIES
Electrical properties: volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

UNIT V ENVIRONMENTAL AND CHEMICAL RESISTANCE

COURSE OUTCOMES
CO1 Understand the relevance of standards and specifications.
CO2 Summarize the various test methods for evaluating the mechanical properties of the polymers.
CO3 To know the thermal, electrical & optical properties of polymers.

TOTAL: 45 PERIODS
CO4 Identify various techniques used for characterizing polymers.

CO5 Distinguish the processability tests used for thermoplastics, thermosets and elastomers.

REFERENCES

OEC353 VLSI DESIGN

COURSE OBJECTIVES
- Understand the fundamentals of IC technology components and their characteristics.
- Understand combinational logic circuits and design principles.
- Understand sequential logic circuits and clocking strategies.
- Understand Interconnects and Memory Architecture.
- Understand the design of arithmetic building blocks

UNIT I MOS TRANSISTOR PRINCIPLES
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor DC transfer Characteristics ,small signal analysis of MOSFET.

UNIT II COMBINATIONAL LOGIC CIRCUITS

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE
Interconnect Parameters – Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS
Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course the student will be able to
CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combinational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.
TEXTBOOKS

REFERENCES

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CBM370  WEARABLE DEVICES  L T P C  3 0 0 3

COURSE OBJECTIVES
The student should be made to:
- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

UNIT I  INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS  9

UNIT II  SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES  9
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III  WIRELESS HEALTH SYSTEMS  9
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.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile
CO5: Compare the various wearable devices in healthcare system

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM356  
MEDICAL INFORMATICS  
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

289
UNIT II  COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING  9
Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

UNIT III  COMPUTERISED PATIENT RECORD  9
Introduction - conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT IV  COMPUTER ASSISTED MEDICAL DECISION-MAKING  9
Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis in clinical 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.

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1 Explain the structure and functional capabilities of Hospital Information System.
CO2 Describe the need of computers in medical imaging and automated clinical laboratory.
CO3 Articulate the functioning of information storage and retrieval in computerized patient record system.
CO4 Apply the suitable decision support system for automated clinical diagnosis.
CO5 Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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

UNIT I  BIOLOGICAL TREATMENT PROCESS  9
UNIT II WASTE BIOMASS AND ITS VALUE ADDITION
Types of waste biomass – Solid waste management - Nature of biomass feedstock – Biobased economy/process – Value addition of waste biomass – Biotransformation of biomass – Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

UNIT III BIOCONVERSION OF WASTES TO ENERGY
Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies

UNIT IV CHEMICALS AND ENZYME PRODUCTION FROM WASTES
Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases - Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

UNIT V BIOCOMPOSTING OF ORGANIC WASTES
Overview of composting process - Benefits of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should be able
CO1 To learn the various methods biological treatment
CO2 To know the details of waste biomass and its value addition
CO3 To develop the bioconversion processes to convert wastes to energy
CO4 To synthesize the chemicals and enzyme from wastes
CO5 To produce the biocompost from wastes
CO6 To apply the theoretical knowledge for the development of value added products

TEXT BOOKS

REFERENCES

OBT356 LIFESTYLE DISEASES

UNIT I INTRODUCTION
Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.
UNIT II  CANCER  9
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III  CARDIOVASCULAR DISEASES  9
Coronary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV  DIABETES AND OBESITY  9
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V  RESPIRATORY DISEASES  9
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TEXT BOOKS:

REFERENCES:

OBT357  BIOTECHNOLOGY IN HEALTH CARE  L T P C  3 0 0 3

COURSE OBJECTIVES
The aim of this course is to

- Create higher standard of knowledge on healthcare system and services
- Prioritize advanced technologies for the diagnosis and treatment of various diseases

UNIT I  PUBLIC HEALTH  9

UNIT II  CLINICAL DISEASES  9
Communicable diseases: Chickenpox / Shingles, COVID-19, Tuberculosis, Hepatitis B, Hepatitis C, HIV / AIDS, Influenza, Swine flu. Non Communicable diseases: Diabetes mellitus, atherosclerosis, fatty liver, Obesity, Cancer

UNIT III  VACCINOLOGY  9
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment.

UNIT IV  OUTPATIENT & IN PATIENT SERVICES  9
Radiotherapy, Nuclear medicine, surgical units, OT Medical units, G & Obs. units Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation, Neurology, Gastroenterology, Endoscopy, Pulmonology, Cardiology.
UNIT V  BASICS OF IMAGING MODALITIES  

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

VERTICAL 1: FINTECH AND BLOCK CHAIN

UNIT I  INTRODUCTION TO FINANCIAL MANAGEMENT  
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

UNIT II  SOURCES OF FINANCE  
Long term sources of Finance - Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources. Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III  INVESTMENT DECISIONS:  
Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV  FINANCING AND DIVIDEND DECISION  
Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure •
Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy
UNIT V  WORKING CAPITAL DECISION


TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
2. Prasanna Chandra, Financial Management,

CMG332  FUNDAMENTALS OF INVESTMENT  LT P C
3 0 0 3

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

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

UNIT II  FIXED INCOME SECURITIES
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT III  APPROACHES TO EQUITY ANALYSIS
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

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

UNIT V  INVESTOR PROTECTION
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism

TOTAL : 45 PERIODS

REFERENCES

294
CMG333  BANKING, FINANCIAL SERVICES AND INSURANCE  LT P C
3 0 0 3

COURSE OBJECTIVES
- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM  9
Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/PRODUCTS  9

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY  9

UNIT IV FINANCIAL SERVICES  9

UNIT V INSURANCE  9

TOTAL: 45 PERIODS

REFERENCES:
UNIT II INTRODUCTION TO CRYPTOCURRENCY


UNIT III ETHEREUM

Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptography / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV WEB3 AND HYPERLEDGE


UNIT V EMERGING TRENDS


REFERENCE

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


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

CMG336 INTRODUCTION TO FINTECH

COURSE OBJECTIVES:

● To learn about history, importance and evolution of FinTech
● To acquire the knowledge of FinTech in payment industry
● To acquire the knowledge of FinTech in insurance industry
● To learn the FinTech developments around the world
● To know about the future of FinTech

UNIT I INTRODUCTION

UNIT II PAYMENT INDUSTRY
FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III INSURANCE INDUSTRY

UNIT IV FINTECH AROUND THE GLOBE
UNIT V FUTURE OF FINTECH
How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

REFERENCES
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

VERTICAL 2: ENTREPRENEURSHIP
CMG337 FOUNDATIONS OF ENTREPRENEURSHIP L T P C 3 0 0 3

COURSE OBJECTIVES
- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businessess.
- To empower the learners to run a Technology driven business efficiently and effectively

UNIT I INTRODUCTION TO ENTREPRENEURSHIP
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT II BUSINESS OWNERSHIP & ENVIRONMENT

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characterisitcs of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship --- Success Stories of Technopreneurs - Case Studies
UNIT V  EMERGING TRENDS IN ENTREPRENEURSHIP

Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing-
Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entrepreneruship - NGO Entrepreneurship

TOTAL : 45 PERIODS

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

CO1 Learn the basics of Entrepreneurship
CO2 Understand the business ownership patterns and environment
CO3 Understand the Job opportunities in Industries relating to Technopreneurship
CO4 Learn about applications of technopreneurship and successful technopreneurs
CO5 Acquaint with the recent and emerging trends in entrepreneuruship

TEXT BOOKS:

REFERENCES :
4)  David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
7)  Basics of Technopreneurship: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8)  Journal articles pertaining to Entrepreneurship

CMG338  TEAM BUILDING & LEADERSHIP MANAGEMENT FOR BUSINESS  L T P C
3  0  0  3

COURSE OBJECTIVES
• To develop and strengthen the Leadership qualities and motivation of learners.
• To impart the Leadership skills and traits essential to become successful entrepreneurs.
• To apply the principles and theories of Team Building in managing Technology oriented businesses.
• To empower the learners to build robust teams for running and leading a business efficiently and effectively

UNIT I  INTRODUCTION TO MANAGING TEAMS
Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development -
Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams -
Self Directed Work Teams (SDWTs) - Multicultural Teams.

UNIT II  MANAGING AND DEVELOPING EFFECTIVE TEAMS
Team-based Organisations - Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.
UNIT III  INTRODUCTION TO LEADERSHIP  9
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  9

UNIT V  LEADERSHIP EFFECTIVENESS  9

TOTAL 45 : PERIODS

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

CO1 Learn the basics of managing teams for business.
CO2 Understand developing effective teams for business management.
CO3 Understand the fundamentals of leadership for running a business.
CO4 Learn about the importance of leadership for business development.
CO5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs .

REFERENCES:

CMG339  CREATIVITY & INNOVATION IN ENTREPRENEURSHIP  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

UNIT IV  INNOVATION AND ENTREPRENEURSHIP  9

UNIT V  INNOVATIVE BUSINESS MODELS  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:
CO1 Learn the basics of creativity for developing Entrepreneurship
CO2 Understand the importance of creative intelligence for business growth
CO3 Understand the advances through innovation in Industries
CO4 Learn about applications of innovation in building successful ventures
CO5 Acquaint with developing innovative business models to run the business efficiently and effectively

Suggested Readings:
Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

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  9

UNIT II  MARKETING ENVIRONMENT  9
Introduction - Environmental Scanning - Analysing the Organisation’s Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment
Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

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
CO2 Understand the marketing environment
CO3 Acquaint about product and pricing strategies
CO4 Knowledge of promotion and distribution in marketing management.
CO5 Comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCES:

CMG341 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS

COURSE OBJECTIVES:
- To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.
- To create an awareness of the roles, functions and functioning of human resource department.
- To understand the methods and techniques followed by Human Resource Management practitioners.
UNIT I  INTRODUCTION TO HRM  9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course the learners will be able:
CO1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO2 To learn about the HR Planning Methods and practices.
CO3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO4 To known about the methods of Training and Employee Development.
CO5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES
UNIT II  INTRODUCTION TO VENTURE FINANCING

UNIT III  SOURCES OF DEBT FINANCING

UNIT IV  SOURCES OF EQUITY FINANCING
Own Capital, Unsecured Loan - Government Subsidies , Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.

UNIT V  METHODS OF FUND RAISING FOR NEW VENTURES

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students should be able to:
CO1  Learn the basics of starting a new business venture.
CO2  Understand the basics of venture financing.
CO3  Understand the sources of debt financing.
CO4  Understand the sources of equity financing.
CO5  Acquaint with the methods of fund raising for new business ventures.

REFERENCES :
1) Principles of Corporate Finance by Brealey and Myers et al.,12TH ed, McGraw Hill Education (India) Private Limited, 2018

VERTICAL 3: PUBLIC ADMINISTRATION

CMG343  PRINCIPLES OF PUBLIC ADMINISTRATION  L T P C 3 0 0 3

UNIT I  
1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration
UNIT II  
1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT III  
1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT IV  
1. Bureaucratic Approach: Max Weber
2. Human Relations Approach: Elton Mayo
3. Ecological Approach: Riggs

UNIT V  
1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers

TOTAL: 45 PERIODS

REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.
UNIT V
1. Secularism
2. Social Justice
3. Minority Safeguards

TOTAL: 45 PERIODS

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

CMG345
PUBLIC PERSONNEL ADMINISTRATION

UNIT I
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

TOTAL: 45 PERIODS

REFERENCES:
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations
CMG346 ADMINISTRATIVE THEORIES

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

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

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

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

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

REFERENCES:
1. Crozier M : The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis : Organization Theory (MAC)

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

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

UNIT I INTRODUCTION 9
Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.
UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETRIC TESTS 9
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS 9

UNIT V CORRELATION AND REGRESSION 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1 To facilitate objective solutions in business decision making.
CO2 To understand and solve business problems.
CO3 To apply statistical techniques to data sets, and correctly interpret the results.
CO4 To develop skill-set that is in demand in both the research and business environments.
CO5 To enable the students to apply the statistical techniques in a work setting.

REFERENCES:

CMG350 DATAMINING FOR BUSINESS INTELLIGENCE L T P C
3 0 0 3

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

UNIT I INTRODUCTION 9
Data mining, Text mining, Web mining, Data ware house.

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

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

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES 9
Classification, Association, Clustering.
UNIT V MACHINE LEARNING AND AI

Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Learn to apply various data mining techniques into various areas of different domains.
CO2 Be able to interact competently on the topic of data mining for business intelligence.
CO3 Apply various prediction techniques.
CO4 Learn about supervised and unsupervised learning technique.
CO5 Develop and implement machine learning algorithms

REFERENCES:

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kaufmann 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 Luckевич Stacia Misner, Business Intelligence, Microsoft, 2011

CMG351 HUMAN RESOURCE ANALYTICS

COURSE OBJECTIVE:

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I INTRODUCTION TO HR ANALYTICS

People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II HR ANALYTICS I: RECRUITMENT

Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

UNIT III HR ANALYTICS - TRAINING AND DEVELOPMENT

Training & Development Metrics : Percentage of employees trained - Internally and externally trained - Training hours and cost per employee - ROI.
UNIT IV HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION

Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover, grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT

Workforce Diversity and Development Metrics: Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

COURSE OUTCOME:
CO1 The learners will be conversant about HR metrics and ready to apply at work settings.
CO2 The learners will be able to resolve HR issues using people analytics.

REFERENCES:

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS

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

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

UNIT II COMMUNITY BUILDING AND MANAGEMENT
History and Evolution of Social Media- Understanding Science of Social Media - Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts- The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.
UNIT V  SEARCH ANALYTICS  9
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

COURSE OUTCOME:
- The Learners will understand social media, web and social media analytics and their potential impact.

REFERENCES:
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004

CMG353  OPERATION AND SUPPLY CHAIN ANALYTICS  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I  INTRODUCTION  9
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

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

UNIT III  INVENTORY MANAGEMENT  9
Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV  TRANSPORTATION NETWORK MODELS  9

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

COURSE OUTCOME:
CO1 To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:

CMG354 FINANCIAL ANALYTICS

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

UNIT I CORPORATE FINANCE ANALYSIS
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
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
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

UNIT V CREDIT RISK ANALYSIS
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

COURSE OUTCOME
CO1 The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:
COURSE OBJECTIVE:

- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES

UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS
Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management

TOTAL: 45 PERIODS

COURSE OUTCOME:
On completion of the course, the student is expected to be able to
CO1 Understand the environment sustainability goals at global and Indian scenario.
CO2 Understand risks in development of projects and suggest mitigation measures.
CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:
5. New Building Materials and Construction World magazine
7. Munier N, "Introduction to Sustainability", Springer2005

CO’s- PO’s & PSO’s MAPPING

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CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT LT PC 3 0 0 3

COURSE OBJECTIVES:
• To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.
UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS
Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT
Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT
Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT
Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS
Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

COURSE OUTCOME
• On completion of the course, the student is expected to be able to
CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture
CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases
CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources
CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas
CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

REFERENCES:
1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
CO’s- PO’s & PSO’s MAPPING

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CES333  SUSTAINABLE BIOMATERIALS

COURSE OBJECTIVES

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT I  INTRODUCTION TO BIOMATERIALS


UNIT II  BIO POLYMERS

Molecular structure of polymers -Molecular weight - Types of polymerization techniques–Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Poly(methylmethacrylate) (PMMA-Polyactic acid (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers –Polyurethan - reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III  BIO CERAMICS AND BIOCOMPOSITES

General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites-Polymer Matrix Composite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)--glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV  METALS AS BIOMATERIALS

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V  NANOBIOMATERIALS

Metallic nanobiomaterials--Nanopolymers-Nanoceramics- Nanocomposites -Carbon based nanobiomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize-

TOTAL : 45 PERIODS

COURSE OUTCOMES
CO1 Students will gain familiarity with Biomaterials and they will understand their importance.
CO2 Students will get an overview of different biopolymers and their properties
CO3 Students gain knowledge on some of the important Bioceramics and Biocomposite materials
CO4 Students gain knowledge on metals as biomaterials
CO5 Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES

CES334 MATERIALS FOR ENERGY SUSTAINABILITY L T P C

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.

COURSE OBJECTIVES
• To familiarize the students about the challenges and demands of energy sustainability
• To provide fundamental knowledge about electrochemical devices and the materials used.
• To introduce the students to various types of fuel cell
• To enable students to appreciate novel materials and their usage in photovoltaic application
• To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I SUSTAINABLE ENERGY SOURCES

9 Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES
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

COURSE OUTCOMES
CO1 Students will acquire knowledge about energy sustainability.
CO2 Students understand the principles of different electrochemical devices.
CO3 Students learn about the working of fuel cells and their application.
CO4 Students will learn about various Photovoltaic applications and the materials used.
CO5 The students gain knowledge on different types of supercapacitors and the performance of various materials

REFERENCES
5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

COURSE OBJECTIVES:
- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES
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

COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5: To understand advanced technology in green synthesis

TEXT BOOKS

REFERENCE
1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017
Course Objectives:

- To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

Unit I: Environmental Monitoring and Standards


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) & Risk Assessment


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.

Course Outcomes

After completion of this course, the students will know

- CO1 Basic concepts of environmental standards and monitoring.
- CO2 the ambient air quality and water quality standards;
- CO3 the various instrumental methods and their principles for environmental monitoring
- CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
- CO5 the various ways of raising environmental awareness among the people.
- CO6 Know the standard research methods that are used worldwide for monitoring the environment.

Textbooks

2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc
REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

CO’s- PO’s & PSO’s MAPPING

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CES337 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT L T P C
3 0 0 3

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

UNIT I ENERGY SCENARIO
9
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT
9
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT
9

UNIT IV RENEWABLE ENERGY TECHNOLOGY
9

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT
9

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1 Understand the world and Indian energy scenario
CO2 Analyse energy projects, its impact on environment and suggest control strategies
CO3 Recognise the need of Sustainable development and its impact on human resource development
CO4 Apply renewable energy technologies for sustainable development
CO5 Fathom Energy policies and planning for sustainable development.

REFERENCES:
7. https://www.niti.gov.in/verticals/energy

CES338 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT

COURSE OBJECTIVES:
- To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
- To create awareness on energy audit and its impacts
- To acquaint the techniques adopted for performance evaluation of thermal utilities
- To familiarise on the procedures adopted for performance evaluation of electrical utilities
- To learn the concept of sustainable development and the implication of energy usage

UNIT I ENERGY AND ENVIRONMENT
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING
Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVTION 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

CO1 Understand the prevailing energy scenario
CO2 Familiarise on energy audits and its relevance
CO3 Apply the concept of energy audit on thermal utilities
CO4 Employ relevant techniques for energy improvement in electrical utilities
CO5 Understand Sustainable development and its impact on human resource development

REFERENCES: