I. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Preparations: Acquire the knowledge that prepares them for professional careers / higher studies in the field of Medical Electronics.

II. Core competence: Apply the core concepts of Medical Electronics, its underlying sciences, and relevant technologies in their chosen profession.

III. Multidisciplinary: An ability to use their multidisciplinary background to foster communication across professional and disciplinary boundaries with the highest professional and ethical standards.

IV. Professional Environment: Possess a high standard of personal and professional integrity, human values in multicultural and multidisciplinary environments to progress into positions of increasing leadership responsibilities.

V. Learning Environment: The ability to recognize the limits of their knowledge and initiate self-directed learning opportunities to be able to continue to identify and create the opportunities for themselves in the field of Medical Electronics.

II. PROGRAM OUTCOMES (POs)

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.

### III. PROGRAM SPECIFIC OUTCOMES (PSOs)

1. **Living and Nonliving Interaction**: Solve the problems associated with the interaction between the living and non-living materials and system.

2. **Investigation on physiological system**: Make measurements on and interpret data from living systems.

3. **Design and Development**: Design the Prototype for healthcare solutions to exhibit quality control, Medical ethics and standards.
## Mapping of Course Outcome and Programme Outcome

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1 - low, 2 - medium, 3 - high, '-' - no correlation
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$ Skill Based Course

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

$* Skill Based Course
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*Skill Based Course*

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## PRACTICALS

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TOTAL 17 1 9 27 22.5

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

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

### SEMESTER VI

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**TOTAL**                                      |           |      |     |     |                     | 23      |         |

*Open Elective – I Shall be chosen from the list of open electives offered by other Programmes

*Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under Mandatory Course-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 - IV (Shall be chosen from the list of open electives offered by other Programmes).

* Management – Elective shall be chosen from the Management Elective courses.

### SEMESTER VIII / VII*

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

**TOTAL CREDITS: 163**

### MANAGEMENT – ELECTIVE

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# MANDATORY COURSES I

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*Mandatory Courses are offered as Non-Credit Courses

# MANDATORY COURSES II

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

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<th>Vertical II</th>
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<tr>
<td>Bio Engineering</td>
<td>Medical Device Innovation and Development</td>
<td>Management (Healthcare)</td>
<td>Mechanics</td>
<td>Signal and Image Processing</td>
<td>Communication</td>
<td>Advanced Healthcare Devices</td>
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<td>Artificial Organs and Implants</td>
<td>Medical Device Design</td>
<td>Rehabilitation</td>
<td>Computer Vision</td>
<td>Wearable devices</td>
<td>Critical Care Equipment</td>
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<td>Biomedical Optics and Photonics</td>
<td>Patient safety, Standards and Ethics</td>
<td>Medical waste Management</td>
<td>Physiological modeling</td>
<td>Speech and audio signal Processing</td>
<td>Body Area Networks</td>
<td>Human Assist Devices</td>
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<td>Neural Engineering</td>
<td>Medical Device Regulations</td>
<td>Economics and management for Engineers</td>
<td>Assistive Technology</td>
<td>Medical Imaging Systems</td>
<td>Virtual reality and Augmented Reality in Healthcare</td>
<td>Advancements in Healthcare Technology</td>
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<tr>
<td>Principles of Tissue Engineering</td>
<td>Medical Innovation and Entrepreneurship</td>
<td>Biostatistics</td>
<td>Ergonomics</td>
<td>Brain Computer Interface and Applications</td>
<td>Telehealth Technology</td>
<td>Robotics in Medicine</td>
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<tr>
<td>Genetic Engineering</td>
<td>Rapid Prototyping</td>
<td>Forensic Science in healthcare</td>
<td>Haptics</td>
<td>Biometrics</td>
<td>Medical Informatics</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 1: BIO ENGINEERING

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## VERTICAL 2: MEDICAL DEVICE INNOVATION AND DEVELOPMENT

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## VERTICAL 3: MANAGEMENT (HEALTHCARE)

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### OPEN ELECTIVES
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### SUMMARY

**Name of the Programme: B.E. Medical Electronics**

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

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

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

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

Complete details are available in clause 4.10 (Amendments) of Regulations 2021.
### VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

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(choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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

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

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have a 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, make decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and don'ts, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.
(iv) Literary Activity

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

(v) Proficiency Modules

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

(vi) Lectures by Eminent People

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

(vii) Visits to Local Area

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

(viii) Familiarization to Dept./Branch & Innovations

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

(ix) Department Specific Activities

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

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

References:
Guide to Induction program from AICTE
COURSE OBJECTIVES:

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

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

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

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

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

UNIT II NARRATION AND SUMMATION

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

UNIT III DESCRIPTION OF A PROCESS / PRODUCT

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

UNIT IV CLASSIFICATION AND RECOMMENDATIONS

Reading – Newspaper articles; Journal reports –and Non Verbal Communication ( tables, pie charts etc., ). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal ( chart , graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.
UNIT V     EXPRESSION  
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

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

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

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

UNIT I MATRICES

UNIT II DIFFERENTIAL CALCULUS

UNIT III FUNCTIONS OF SEVERAL VARIABLES

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

UNIT V MULTIPLE INTEGRALS

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:

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

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PH3151 ENGINEERING PHYSICS L T P C
3 0 0 3

COURSE OBJECTIVES:
- To make the students effectively 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 successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational

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

UNIT III OSCILLATIONS, OPTICS AND LASERS

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

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students should be able to
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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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: 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. TOTAL: 45 PERIODS

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:

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GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING  L T P C

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

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING  9

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS  9
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.
UNIT III CONTROL FLOW, FUNCTIONS, STRINGS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

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

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/
GE3152  HERITAGE OF TAMILS

UNIT I  LANGUAGE AND LITERATURE  3

UNIT II  HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

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

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

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

TOTAL : 15 PERIODS
TEXT-CUM-REFERENCE BOOKS

1. Civilization of the Tamils (Dr.K.K.Pillay) A joint publication of TTB & ESC and RMRL – (in print)

2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).

3. Contribution of the Tamil to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies).

4. ‘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)

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

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


GE3152

இலக்கியத்திற்கு முன் வரலாற் 

1. Civilization of the Tamils (Dr.K.K.Pillay) – A joint publication of TTB & ESC and RMRL – (in print).

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GE3152

தமிழ் மொழி
அலகு III காலப்பொருள் குறித்து விளக்கக் குறியீடுகள்: 3
தமிழியக்கியாகது, நூற்றாண்டு போன்று, தொட்டையில் காட்டி, விளக்கம், தமிழ் பொருள் குறியீடு, நூற்றாண்டுக் குறியீட்டு, தமிழியக்கியாகது விளக்கக் குறியீடுகள்.

அலகு IV தமிழியக்கியாகது குறித்து விளக்கக் குறியீடுகள்: 3
தமிழியக்கியாகது குறியீடுகள், விளக்கக் குறியீடுகள் - தமிழ் பொருள் குறியீடு, தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம், குறியீடு - தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம் - குறியீடு - தமிழியக்கியாகது விளக்கக் குறியீடு.

அலகு V தமிழியக்கியாகது குறித்து விளக்கக் குறியீடுகளைக் கூறும் பக்கப்பக்கியம்: 3
தமிழியக்கியாகது குறியீடுகள் - தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம், தமிழியக்கியாகது விளக்கம் - குறியீடு - தமிழியக்கியாகது விளக்கம் - குறியீடு - தமிழியக்கியாகது விளக்கம் - குறியீடு - தமிழியக்கியாகது விளக்கம்.

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

TOTAL : 15 PERIODS
COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

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

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
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/

CO’s- PO’s & PSO’s MAPPING

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

BS3171 PHYSICS AND CHEMISTRY LABORATORY L T P C 0 0 4 2

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 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

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

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

1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in a 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.
12. Estimation of sodium /potassium present in water using a flame photometer.
13. Preparation of nanoparticles (TiO$_2$/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES :
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

GE3172 ENGLISH LABORATORY L T P C
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COURSE OBJECTIVES :
- To improve the communicative competence of learners
- To help learners use language effectively in academic/work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.
UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION  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’s- PO’s & PSO’s MAPPING

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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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MA3251 STATISTICS AND NUMERICAL METHODS

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

To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I  TESTING OF HYPOTHESIS  
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  
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  

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

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  

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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BM3251 BIOSCIENCES FOR MEDICAL ENGINEERING

COURSE OBJECTIVES:
The student should be:
- To study structural and functional properties of carbohydrates, proteins, lipids and amino acids
- To emphasize the role of these biomolecules by providing basic information on specific metabolic diseases and disorders of these biomolecules
- Gain knowledge on the structural and functional aspects of living organisms.
- Know the etiology and remedy in treating the pathological diseases.

UNIT I FUNDAMENTALS TO BIOCHEMISTRY
Introduction to Biochemistry, water as a biological solvent, weak acid and bases, pH, buffers, Handerson - Hasselbalch equation, physiological buffers in living systems, Energy in living organism. Properties of water and their applications in biological systems. Introduction to Biomolecules, Biological membrane, Clinical application of Electrolytes and radioisotopes.

UNIT II CARBOHYDRATES, LIPIDS, PROTEIN
UNIT III  CELL DEGENERATION, REPAIR AND NEOPLASIA  9
Cell injury - Reversible cell injury and Irreversible cell injury and Necrosis, Apoptosis, Intracellular accumulations, Pathological calcification- Dystrophic and Metastatic. cellular adaptations of growth and differentiation, Inflammation and Repair including fracture healing, Neoplasia, Classification, Benign and Malignant tumours, carcinogenesis, spread of tumours Autopsy and biopsy.

UNIT IV  FLUID AND HEMODYNAMIC DERANGEMENTS  9

UNIT V  FUNDAMENTALS OF MICROBIOLOGY AND IMMUNOPATHOLOGY  9

COURSE OUTCOMES:
At the end of the course, the student should be able to:
CO1: Explain the fundamentals of biochemistry
CO2: Analyze structural and functional aspects of living organisms.
CO3: Explain the function of microscope
CO4: Describe methods involved in treating the pathological diseases.

TEXT BOOKS:

REFERENCES:

BE3251  BASIC ELECTRICAL AND ELECTRONICS ENGINEERING  L T P C
3 0 0 3
COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
• To introduce analog devices and their characteristics
• To educate on the fundamental concepts of digital electronics
• To introduce the functional elements and working of measuring instruments

UNIT I  ELECTRICAL CIRCUITS  9
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

UNIT II  ELECTRICAL MACHINES  9

UNIT III  ANALOG ELECTRONICS  9

UNIT IV  DIGITAL ELECTRONICS  9
Review of number systems, binary codes, error detection and correction codes, Combinational logic - representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only).

UNIT V  MEASUREMENTS AND INSTRUMENTATION  9

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 working principle and applications of electrical machines
CO3:  Analyze the characteristics of analog electronic devices
CO4:  Explain the basic concepts of digital electronics
CO5:  Explain the operating principles of measuring instruments

TEXT BOOKS:


REFERENCES:

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BM3252 MEDICAL PHYSICS  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To provide understanding of the application of the radiation concepts and methods of Physics in Medical science
- To accentuate the principle, effects and clinical applications of ionizing, non-ionizing and electromagnetic radiation.
- To enunciate the fundamentals of acoustic waves and their interaction with human tissues.
- To explore the effects of radiation in matter and how isotopes are produced
- To study effects of sound and light in human body

UNIT I LOW ENERGY ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION
Physics of light, Intensity of light, limits of vision and color vision an overview, Non-ionizing Electromagnetic Radiation: Overview of non-ionizing radiation effects-Tissue as a leaky dielectric-Low Frequency Effects- Higher frequency effects., Thermography– Application

UNIT II PRINCIPLES OF RADIOACTIVE NUCLIDES
Radioactive Decay – Spontaneous Emission – Isometric Transition – Gamma ray emission, alpha, beta, Positron decay, electron capture, Sources of Radioisotopes Natural and Artificial radioactivity, Radionuclide used in Medicine and Technology, Decay series, Production of radionuclides – Cyclotron produced Radionuclide- Reactor produced Radionuclide-fission and neutron capture reaction, radionuclide Generator-Technetium generator
UNIT III  INTERACTION OF RADIATION WITH MATTER LIPIDS
Interaction of charged particles with matter –Specific ionization, Linear energy transfer range, Bremsstrahlung, Annihilation, Interaction of X and Gamma radiation with matter- Photoelectric effect, Compton Scattering, Pair production, Attenuation of Gamma Radiation, Interaction of neutron with matter and their clinical significance

UNIT IV  RADIATION DOSE AND ITS EFFECTS
Dose and Exposure measurements – Units (SI), Inverse square law, Maximum permissible exposure, relationship between the dosimetric quantities, Radiation biology – effects of radiation, concept of LD 50, Stochastic and Non-stochastic effects, Radiation Syndrome.

UNIT V  PRINCIPLES AND APPLICATIONS OF SOUND IN MEDICINE
Physics of sound, Normal sound levels, ultrasound fundamentals, Generation of ultrasound (Ultrasound Transducer), Interaction of Ultrasound with matter- Cavitations, Reflection, Transmission, Scanning methods, Artifacts, Ultrasound- Doppler effect, Clinical Applications

TOTAL : 45 PERIODS

Course Outcomes:
Upon completion of the course, students will be able to:
CO1: Interpret the properties of electromagnetic radiations and its effect on human.
CO2: Apply the principles and understand the production of radioactive nuclides.
CO3: Explain the interaction of radiation with matter.
CO4: Identify and Analyse the radiation quantities and its effects.
CO5: Demonstrate the knowledge on the properties of sound and its application in medicine.

TEXT BOOKS:

REFERENCES:

e-RESOURCES:
1. http://www.nptel.ac.in/courses/115102017/, “Nuclear science and Engineering”, Dr. Santanu Gosh, Department of Physics, IIT, Delhi.

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.

**CO’s- PO’s & PSO’s MAPPING**

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

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

UNIT III  MANUFACTURING TECHNOLOGY  

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

UNIT V  SCIENTIFIC TAMIL & TAMIL COMPUTING  

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண்பொடும் – கக கக பிள்ளள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கன்னிதங்க கம்பிய – வகைகள் விளைக்கட்டம் (மினவு பிரசுரம்).
3. சிற்று - கல்விக் குறிக்கல்லுக்கு முன்னைய கம்பிய – வகைக்கட்டம் (அரசியல்பிள்ளள தொல்லியல் துளற தவளியீடு).
4. பொருளங்கள் அரசியல் விளைக்கட்டம் (அரசியல்பிள்ளள தொல்லியல் துளற தவளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmath) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by:
10. பெருந்தோற்ற வரலாற்று கல்வியியல்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - பெருந்தோற்ற - கல்வியியல் நம்பிக்கை - கல்வியியல் நம்பிக்கை - கல்வியியல் நம்பிக்கை.

11. பொறுகையான வரலாற்று கல்வியியல்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - பொருந்தோற்ற பாணிப் பணியியல் - பொருந்தோற்ற பாணிப் பணியியல் - பொருந்தோற்ற பாணிப் பணியியல்.

12. குருக்குகள் இருப்புக் கல்வியியல்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - குருக்குக் கல்வியியல் - குருக்குக் கல்வியியல் - குருக்குக் கல்வியியல்.

13. முன்னெச்சரிக் தமிழ் கல்வியியல்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - முன்னெச்சரிக் தமிழ் கல்வியியல் - முன்னெச்சரிக் தமிழ் கல்வியியல் - முன்னெச்சரிக் தமிழ் கல்வியியல்.

14. மூலக்கூறல் கல்வியியல்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - மூலக்கூறல் கல்வியியல் - மூலக்கூறல் கல்வியியல் - மூலக்கூறல் கல்வியியல்.

15. தொல்லியல் நூலகம்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - தொல்லியல் நூலகம் - தொல்லியல் நூலகம் - தொல்லியல் நூலகம்.

16. தொல்லியல் நூலகம்: 3
அறக்கை கல்வியியல் நிறுவனத்தில் - தொல்லியல் நூலகம் - தொல்லியல் நூலகம் - தொல்லியல் நூலகம்.

TOTAL: 15 PERIODS
TEXT-CUM-REFERENCE BOOKS

2. கணினித் தமிழ் – முளனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி – பலகைத் தமிழகப்பில் வரலைக் கற்க நகரிகம் (தமிழில் கற்க நகரிகம்)
4. வரலைக்குறிப்பு – கணினித் தமிழ் பலகை (தமிழில் கற்க நகரிகம்)
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 Bookand Educational Services Corporation, Tamil Nadu)
### NCC Credit Course Level 1*

**ARMY WING**

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**TOTAL: 30 PERIODS**
### NCC Credit Course Level 1*  
(NAVAL WING)

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

**Total:** 6 Periods

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

**Total:** 4 Periods

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

**Total:** 7 Periods

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

**Total:** 5 Periods

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

**Total:** 8 Periods

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

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

GROUP – A (CIVIL & ELECTRICAL)

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

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

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

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

PART III  MECHANICAL ENGINEERING PRACTICES  

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

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

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

SHEET METAL WORK:
 a) Making of a square tray

FOUNDRY WORK:
 a) Demonstrating basic foundry operations.

PART IV  ELECTRONIC ENGINEERING PRACTICES  

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

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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TOTAL : 60 PERIODS
BM3271  
BIOSCIENCES LABORATORY  
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COURSE OBJECTIVES:
To provide practice on:
- Estimation and quantification of biomolecules.
- Separation of macromolecules.
- Use Compound microscope
- Practice on chemical examinations, Histopathological examinations etc

LIST OF EXPERIMENTS:
1. Preparation of solutions: 1) percentage solutions, 2) molar solutions, 3) normal solutions
2. Standardization of pH meter, preparation of buffers, emulsions.
3. Spectroscopy: Determination of absorption maxima (λmax) of a given solution
4. General tests for carbohydrates, proteins and lipids.
5. Identification of Blood Collection Tubes and Phlebotomy equipment
6. Preparation of serum and plasma from blood
7. Estimation of Haemoglobin and blood glucose
8. Estimation of creatinine, urea and Uric acid
9. Separation of proteins by SDS electrophoresis(Demo) and amino acids by thin layer chromatography (Demo).
10. Urine physical and chemical examination (protein, reducing substances, ketones, bilirubin and blood)
11. Basic staining – Hematoxylin and eosin staining.
12. Special stains – cresyl fast Blue (CFV) - Trichrome – oil red O – PAS
13. Types of Staining : Simple stain, Gram stain
14. Study of parts of compound microscope
15. Study of Histopathological slides of benign and malignant tumours.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1:Understand the Biochemistry laboratory functional components
CO2:Have a sound knowledge of qualitative test of different biomolecules.
CO3:Understand the basics knowledge of Biochemical parameter and their interpretation in Blood sample.
CO4:Have a sound knowledge of separation technology of proteins and amino acids.
CO5:Student can perform practical experiments on staining Processes.

TEXT BOOK :
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: 12
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences-discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II: 12
Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures-talking about travel problems-making arrangements-describing arrangements-discriminating plans and decisions-discussing purposes and reasons-understanding common technology terms-Writing: writing different types of emails.

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

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

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

TOTAL: 60 PERIODS

LEARNING OUTCOMES
CO1: Speak effectively in group discussions held in 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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MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

COURSE OBJECTIVES

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

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

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

UNIT II FOURIER SERIES

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

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

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

UNIT IV FOURIER TRANSFORMS

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

TOTAL: 60 PERIODS

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

TEXT BOOKS:
   New Delhi, 2018.
   2016.

REFERENCES:
   Delhi, 2016.
   Delhi, 2018.

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

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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 6+6
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant& Time-invariant,Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 6+6
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III LINEAR TIME ININVARIANT CONTINUOUS TIME SYSTEMS 6+6

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 6+6
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 6+6

TOTAL: 30+30 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 continuous 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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BM3352 ELECTRIC CIRCUIT ANALYSIS

COURSE OBJECTIVES:
- To introduce the basic concepts of DC and AC circuits behavior
- To study the transient and steady state response of the circuits subjected to step and sinusoidal excitations.
- To introduce different methods of circuit analysis using Network theorems, duality and topology

UNIT I BASIC CIRCUITS ANALYSIS

UNIT II NETWORK THEOREM AND DUALITY

UNIT III SINUSOIDAL STEADY STATE ANALYSIS

UNIT IV TRANSIENTS AND RESONANCE IN RLC CIRCUITS

UNIT V COUPLED CIRCUITS AND TOPOLOGY
Magnetically Coupled Circuits, mutual Inductance, the Linear Transformer, the Ideal Transformer, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.
COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- CO1: Comprehend and design ac/dc circuits.
- CO2: Apply circuit theorems in real time.
- CO3: Evaluate ac/dc circuits.
- CO4: Analyse electrical circuits
- CO5: Develop and understand ac/dc circuits.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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BM3353 FUNDAMENTALS OF ELECTRONICS DEVICES AND CIRCUITS

COURSE OBJECTIVES:
The objective of this unit is to make the student learn and understand
- Introduce the concept of diodes, Bipolar Junction Transistors and FET.
- Study the various model parameters of Transistors
- Learn the concept of special semiconductor devices, Power & Display devices
- Impart the knowledge of various configurations, characteristics, applications.
- To have knowledge of display and power devices.
UNIT I  SEMICONDUCTOR DIODE
PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II  BIPOLAR JUNCTION TRANSISTORS

UNIT III  FIELD EFFECT TRANSISTORS
MOSFETs – Drain and Transfer characteristics - Current equations-Pinch off voltage and its significance- Threshold voltage - Channel length modulation, small signal Characteristics, D-MOSFET, E-MOSFET- Characteristics – Comparison of MOSFET with BJT.

UNIT IV  SPECIAL SEMICONDUCTOR DEVICES
Metal-Semiconductor Junction - MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Point Contact Diode, p-i-n Diode, Avalanche Photodiode, Schottky barrier diode- Zener diode- Varactor diode – Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V  POWER DEVICES AND DISPLAY DEVICES
UJT, Thyristor - SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Opto Coupler, Solar cell, CCD.

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

**CO1:** Analyze the characteristics of semiconductor diodes.

**CO2:** Analyze and solve problems of Transistor circuits using model parameters.

**CO3:** Identify and characterize diodes and various types of transistors.

**CO4:** Analyze the characteristics of special semiconductor devices.

**CO5:** Analyze the characteristics of Power and Display devices.

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES
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BM3351 ANATOMY AND HUMAN PHYSIOLOGY  L T P C

3 0 2 4

COURSE OBJECTIVE

- To integrate the individual functions of all the cells and tissues and organs into functional whole, the human body.
- Function is dependent on a structure, the curriculum lays stress on functional anatomy of the organs.
- Emphasizes on the cardiovascular, respiratory, urinary and nervous system and their interrelatedness.
- Stimulate the students to understand the basic functioning of every system and the resultant unified organization.

UNIT I BASIC ELEMENTS OF HUMAN BODY  9


UNIT II SKELETAL AND MUSCULAR SYSTEM  9


UNIT III CARDIOVASCULAR AND RESPIRATORY SYSTEM  9


UNIT IV DIGESTIVE AND EXCRETORY SYSTEMS  9

Structure and functions of gastrointestinal system - secretory functions of the alimentary tract - digestion and absorption in the gastrointestinal tract - structure of nephron - mechanism of urine formation - skin and sweat gland - temperature regulation.
UNIT V  NERVOUS AND SENSORY SYSTEM

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS
1. Collection of Blood Samples
2. Identification of Blood groups (Forward and Reverse)
3. Bleeding and Clotting time
4. Estimation of Hemoglobin
5. Total RBC and WBC Count
6. Differential count of Blood cells
7. Estimation of ESR, PCV, MCH, MCV, MCHC
8. Hearing test – Tuning fork
9. Visual Activity – Snellen’s Chart and Jaeger’s Chart

TOTAL: 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES:
Upon completion of this course, students will be able to:
CO1 Identify and explain basic elements of human body
CO2 Explain the functions of skeletal and muscular system
CO3 Describe the structure, function of cardiovascular system and respiratory system
CO4 Discuss the structure of digestive and excretory system.
CO5 Describe the physiological process of Nervous and sensory system

TEXT BOOKS:
2. Gopal B. Saha “Physics and Radiobiology of Nuclear Medicine” Third edition Springer, 2006. (Unit 2, 3, 4)

REFERENCES:

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COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To design and build Graphical User Interface Application using JAVAFX

UNIT I: INTRODUCTION TO OOP AND JAVA

UNIT II: INHERITANCE, PACKAGES AND INTERFACES

UNIT III: EXCEPTION HANDLING AND MULTITHREADING

UNIT IV: I/O, GENERICS, STRING HANDLING

UNIT V: JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS

COURSE OUTCOMES:
On completion of this course, the students will be able to
CO1: Apply the concepts of classes and objects to solve simple problems
CO2: Develop programs using inheritance, packages and interfaces
CO3: Make use of exception handling mechanisms and multithreaded model to solve real world problems
CO4: Build Java applications with I/O packages, string classes, Collections and generics concepts
CO5: Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

TOTAL:45 PERIODS
TEXT BOOKS:

REFERENCES:

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BM3361 FUNDAMENTALS OF ELECTRONIC DEVICES AND CIRCUITS LABORATORY

COURSE OBJECTIVE:
- To supplement the theory courses Semiconductor Devices and Basic Electrical Engineering.
- To assist the students in obtaining a better understanding of the operation of electronic circuits and devices.
- To provide experience in analyzing network theorems.

LIST OF EXPERIMENTS
1. Characteristics of PN and zener diode.
2. Characteristics of CE, CB configurations.
3. Half wave and Full wave rectifier with capacitor filter.
5. Study of characteristics of photo diodes
6. Study of characteristics of SCR
7. Verification of KVL and KCL
8. Verification of Thevenin’s and Norton’s Theorems.
9. Verification of superposition Theorem.
10. Verification of Maximum power transfer and reciprocity theorems.

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Experiment and determine the VI characteristics of given PN junction diode, Zener diode, Photo diode and Silicon Controlled Rectifier.

TOTAL : 45 PERIODS

69
CO2: Experiment and determine the Input & output characteristics of BJT
CO3: Experiment and test half wave and full wave rectifier circuit using PN Junction diode and obtain the ripple factor, rectifier efficiency and experiment and test voltage regulation characteristics using Zener diode voltage regulator circuit.
CO4: Experiment and test the given electric circuit using Kirchhoff's laws and obtain the mesh current & node voltage and obtain the load current for the given circuit using Superposition, Thevenin's, and Norton's and Reciprocity theorems.
CO5: Construct and test RLC series and parallel circuits to compute the resonant frequency and bandwidth by plotting the frequency response.

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GE3361 PROFESSIONAL DEVELOPMENT L T P C

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COURSE OBJECTIVES:

To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.

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

MS WORD:

10 Hours

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

**MS EXCEL:**

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

**MS POWERPOINT:**

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

**TOTAL: 30 PERIODS**
COURSE OUTCOMES:

On successful completion the students will be able to

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

CO2: Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding

CO3: Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

CS3381 OBJECT ORIENTED PROGRAMMING LABORATORY

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

LIST OF EXPERIMENTS:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.
3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10% of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads.
   First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

Lab Requirements: for a batch of 30 students
Operating Systems: Linux / Windows
Front End Tools: Eclipse IDE / Netbeans IDE

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, the students will be able to
CO1: Design and develop java programs using object oriented programming concepts
CO2: Develop simple applications using object oriented concepts such as package, exceptions
CO3: Implement multithreading, and generics concepts
CO4: Create GUIs and event driven programming applications for real world problems
CO5: Implement and deploy web applications using Java

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MA3355 RANDOM PROCESSES AND LINEAR ALGEBRA L T P C
3 1 0 4

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

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

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

UNIT – III: RANDOM PROCESSES 9 + 3
Classification – Stationary process – Markov process - Poisson process - Discrete parameter Markov chain – Chapman Kolmogorov equations (Statement only) - Limiting distributions.
UNIT - IV: VECTOR SPACES
Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT - V: LINEAR TRANSFORMATION AND INNER PRODUCT SPACES

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
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: Apply the concept of random processes in engineering disciplines.
CO4: Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.
CO5: Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

TEXT BOOKS:

REFERENCE:

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MD3401 ANALOG AND DIGITAL ELECTRONICS

COURSE OBJECTIVES:
- To understand the basic building blocks of linear integrated circuits
- To learn the linear and non-linear applications of operational amplifiers
- To know the theory of timer, regulator, ADC and DAC
- To present the digital fundamentals and combinational circuits
- To familiarize the sequential and programmable circuits

UNIT I BASICS OF OPERATIONAL AMPLIFIERS

UNIT II LINEAR AND NON-LINEAR APPLICATIONS

UNIT III TIMER REGULATOR A/D AND D/A

UNIT IV DIGITAL NUMBER SYSTEM AND COMBINATIONAL CIRCUITS

UNIT V SEQUENTIAL AND PROGRAMMABLE CIRCUITS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- CO1: Design linear and non-linear applications of op-amps
- CO2: Design timer, regulator, DAC, ADC using op-amps
- CO3: The analysis and design combinational and sequential circuits
CO4: Analysis and design programmable memory applications.

TEXT BOOK
1. D. Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., New Delhi, 2018
3. B. Venkataramani & M-Bhaskar- "Digital Signal Processor Architecture-

REFERENCES

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BM3451    BIO CONTROL SYSTEMS    L T P C
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COURSE OBJECTIVES
The objective of this course is to enable the student to
- Understand the concept behind feedback and continuum in various systems and subsystems and the need for mathematical modeling of various systems.
- Analyze the systems in time and frequency domains
- Understand the concept of stability of various systems.
- Apply mathematical modeling principles in understanding the various fundamental biological systems.

UNIT I    INTRODUCTION
Open and Closed loop Systems, Mathematical Modeling of systems, Block diagram and signal flow graph representation of systems - reduction of block diagram and signal flow graph, Introduction to Physiological control systems- Illustration, Linear models of physiological systems, Difference between engineering and physiological control systems.

UNIT II    TIME RESPONSE ANALYSIS
Step and impulse responses of first order and second order systems - time domain specifications of first and second order systems - steady state error constants.
UNIT III STABILITY ANALYSIS

UNIT IV FREQUENCY RESPONSE ANALYSIS

UNIT V BIOLOGICAL CONTROL SYSTEM ANALYSIS

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Interpret the need for mathematical modeling of various systems, representation of systems in block diagrams and signal flow graphs and are introduced to biological control systems
CO2: Determine the time response of various systems
CO3: discuss the concept of system stability
CO4: Examine the frequency response characteristics of various systems using different charts
CO5: Appraise the concept of modeling basic physiological systems

TEXT BOOKS

REFERENCES:

ONLINE RESOURCES
1. https://nptel.ac.in/courses/108/101/108101037/
2. https://nptel.ac.in/content/storage2/courses/112104158/lecture14.pdf
3. https://nptel.ac.in/content/storage2/courses/112104158/lecture16.pdf
4. https://nptel.ac.in/content/storage2/courses/112104158/lecture17.pdf

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COURSE OBJECTIVES:

- To understand the purpose of measurements and characteristics
- To know the principle of transduction, classification and the characteristics of transducers
- To know the different bridges for measurement
- To know the different display and recording devices

UNIT I  SENSOR BASED MEASUREMENT SYSTEM  9
Generalized measurement system- Sensor classification- Static characteristics- Dynamic characteristics- Primary sensors and materials for sensor

UNIT II  DISPLACEMENT, PRESSURE AND TEMPERATURE SENSORS  9
Strain Gauge: Gauge factor- Sensing elements- Bonded and Unbonded strain gauge, Capacitive transducer, Inductive transducer, LVDT, Pressure transducer, Temperature Sensors: Passive type: RTD materials and range- Relative resistance versus temperature characteristics- Characteristics of Thermistor, Active type: Characteristics of Thermocouple, Case Study: Sensors for Environmental monitoring.

UNIT III  PHOTOELECTRIC AND PIEZOELECTRIC SENSORS  9
Phototube - Scintillation counter - Photo multiplier tube - Photovoltaic - Photo conductive cells - Photo detector-Phototransistor - Comparison of photoelectric transducers, Optical displacement sensors, Piezoelectric active transducer: Equivalent circuit and its characteristics, Case study: Optical sensors for diagnosis - Oxygen Saturation monitor.

UNIT IV  SIGNAL CONDITIONING CIRCUITS  9

UNIT V  DISPLAY AND RECORDING DEVICES  9
Digital voltmeter, Multimeter, CRO: Block diagram, CRT, Vertical & horizontal deflection system, DSO, LCD monitor, PMMC writing systems, Servo recorders, Photographic recorder, Magnetic tape recorder, Inkjet recorder, Thermal recorder.

COURSE OUTCOMES:

At the end of the course, the student should be able to:

CO1: Measure various electrical parameters with accuracy, precision, resolution
CO2: Select appropriate passive or active transducers for measurement of physical phenomenon
CO3: Use AC and DC bridges for relevant parameter measurement
CO4: Employ multimeter, CRO, and recorders for appropriate measurements

TOTAL: 45 PERIODS

TEXT BOOK

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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EC3492 DIGITAL SIGNAL PROCESSING L T P C 3 0 2 4

COURSE OBJECTIVES:
- To learn discrete fourier transform, properties of DFT and its application to linear filtering
- To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
- To understand the effects of finite precision representation on digital filters
- To understand the fundamental concepts of multi rate signal processing and its applications
- To introduce the concepts of adaptive filters and its application to communication engineering

UNIT I DISCRETE FOURIER TRANSFORM 9

UNIT II INFINITE IMPULSE RESPONSE FILTERS 9
UNIT III  FINITE IMPULSE RESPONSE FILTERS  9
Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations

UNIT IV  FINITE WORD LENGTH EFFECTS  9
Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

UNIT V  DSP APPLICATIONS  9
Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor – Adaptive Filters: Introduction, Applications of adaptive filtering to equalization-DSP Architecture-Fixed and Floating point architecture principles

PRACTICAL EXERCISES:  30 PERIODS
MATLAB / EQUIVALENT SOFTWARE PACKAGE/ DSP PROCESSOR BASED IMPLEMENTATION
1. Generation of elementary Discrete-Time sequences
2. Linear and Circular convolutions
3. Auto correlation and Cross Correlation
4. Frequency Analysis using DFT
5. Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation
6. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations
7. Study of architecture of Digital Signal Processor
8. Perform MAC operation using various addressing modes
9. Generation of various signals and random noise
10. Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering
11. Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering
12. Implement an Up-sampling and Down-sampling operation in DSP Processor

TOTAL:75 PERIODS

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

CO1: Apply DFT for the analysis of digital signals and systems
CO2: Design IIR and FIR filters
CO3: Characterize the effects of finite precision representation on digital filters
CO4: Design multirate filters
CO5: Apply adaptive filters appropriately in communication systems

TEXT BOOK

REFERENCES

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

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

UNIT I ENVIRONMENT AND BIODIVERSITY 6

UNIT II ENVIRONMENTAL POLLUTION 9

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

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

UNIT V SUSTAINABILITY PRACTICES

6


TOTAL: 30 PERIODS

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

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

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

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NCC Credit Course Level 2*

NX3451 (ARMY WING) NCC Credit Course Level - II

PERSONALITY DEVELOPMENT

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

LEADERSHIP

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

DISASTER MANAGEMENT

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

ENVIRONMENTAL AWARENESS & CONSERVATION

EA 1  Environmental Awareness and Conservation 3

GENERAL AWARENESS

GA 1  General Knowledge 4

ARMED FORCES

AF 1  Armed Forces, Army, CAPF, Police 6

ADVENTURE

AD 1  Introduction to Adventure Activities 1

BORDER & COASTAL AREAS

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

TOTAL: 45 PERIODS
# NCC Credit Course Level 2*

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

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## LEADERSHIP

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## DISASTER MANAGEMENT

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## ENVIRONMENTAL AWARENESS & CONSERVATION

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## GENERAL AWARENESS

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## NAVAL ORIENTATION

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## ADVENTURE

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## BORDER & COASTAL AREAS

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**TOTAL: 45 PERIODS**
### NCC Credit Course Level 2*

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

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

#### DISASTER MANAGEMENT
- DM 1 Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation 3
- DM 2 Initiative Training, Organising Skills, Do's & Don'ts, Natural Disasters, Man Made Disasters 9
- DM 3 Fire Service & Fire Fighting 1

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

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

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

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

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

**TOTAL: 45 PERIODS**

### MD3411 ANALOG AND DIGITAL ELECTRONICS LABORATORY

- Course Code: MD3411
- Course Title: ANALOG AND DIGITAL ELECTRONICS LABORATORY
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**COURSE OBJECTIVES:**
- To study the characteristics of inverting, non-inverting, and instrumentation amplifier
- To learn the linear and non-linear applications of operational amplifiers
- To know the combinational circuits
- To understand the function of sequential circuits
LIST OF EXPERIMENTS
1. Design of inverting and non-inverting amplifier
2. Design of Integrator and Differentiator
3. Design of Instrumentation amplifier
4. Design of Active low pass, High pass filter and Band pass filter
5. Design of Astable and Monostable multivibrator using 555 timer.
9. Design and implementation of code converters using logic gates
10. Design and implementation of 4 bit binary Adder/Subtractor and BCD adder using IC 7483.
11. Design and implementation of multiplexer and Demultiplexer
12. Design and implementation of encoder and decoder using logic gates.
13. Design and implementation of shift registers.
14. Design and implementation of Synchronous and asynchronous counters.
15. Design and implementation of sequence detector.
16. Simulation and analysis of circuits using software (any open access).

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

- **CO1**: Design amplifiers using op-amp
- **CO2**: Design filters, and multivibrator
- **CO3**: Design and test the performance of combinational circuits
- **CO4**: Design and test the performance of sequential circuits.

TOTAL: 60 PERIODS

CO’s- PO’s & PSO’s MAPPING

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MD3412 BIOMEDICAL SENSORS AND INSTRUMENTATION LABORATORY

COURSE OBJECTIVES:
To impart knowledge on:
- Characteristics of various biomedical sensors.
- Different bridge circuits for the measurement of resistance, capacitance and inductance.
- Recording and analyzing bio signals.
- Comprehension of suitable preamplifiers used for amplifying the bio signals.
- Monitoring and Measurements of physiological parameters.
LIST OF EXPERIMENTS:
1. Characteristics of various Biomedical sensors
   (Pulse sensor, Galvanic skin Response, Glucose sensor, EMG sensor, e-health shield, MQ-3 Alcohol sensor)
3. Measurement of temperature using thermistor and RTD.
4. Design of preamplifiers to acquire bio-signals along with impedance matching circuit using suitable IC’s.
5. Design of EEG, ECG amplifiers and Measurement of heart rate.
6. Acquire and display electrical and biological biosignals on a computer using the appropriate hardware and software tools.
11. Measurement of heart sounds from PCG.
12. e-Health Sensor Platform V2.0 using Arduino and Raspberry Pi
13. Study of optical Isolation amplifier

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:
CO1: Apply appropriate measurement techniques.
CO2: Analyze the performance characteristics of various sensors & biomedical equipments and infer their safety aspects.
CO3: Evaluate the performance of medical instruments.
CO4: Design portable instruments capable of recording bio signals.

CO’s- PO’s & PSO’s MAPPING

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BM3551 EMBEDDED SYSTEMS AND IoMT L T P C 3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to enable the student to

- Acquire knowledge and understand fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
- Understand the hardware architecture and features of embedded microcontrollers and peripherals.
- Understand programming aspects of embedded system design.
• Understand IoT architecture and Build simple IoT Systems using embedded target boards.
• Understand IoMT infrastructure for healthcare applications.

UNIT I INTRODUCTION TO EMBEDDED SYSTEM DESIGN

UNIT II PERIPHERAL INTERFACING
I/O Devices-Timers and Counters- Watchdog Timers, Interrupt Controllers- A/D and D/A, Interfacing- Memory interfacing with a case study- I/O Device Interfacing with case Study-Programmed IO-Memory Mapped IO, Interfacing Protocols-SPI, I^2C, USB, CAN, Ethernet/WiFi, Bluetooth

UNIT III EMBEDDED SYSTEM SOFTWARE DESIGN

UNIT IV DESIGN AND DEVELOPMENT OF IOT
Definition and characteristics of IoT, Technical Building blocks of IoT, Communication Technologies, Physical design of IoT - system building blocks - sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino), Benefits and impact of IoMT. Cybersecurity – vulnerability, penetration & encryption technologies

UNIT V INTERNET OF MEDICAL THINGS

TOTAL: 45 PERIODS

COURSE OUTCOME:
At the end of this course, the student should be able to
CO1: Explain fundamental embedded systems design paradigms, architectures, possibilities, and challenges, both with respect to software and hardware.
CO2: Describe the hardware architecture and features of embedded microcontrollers and peripherals.
CO3: Explain software design tools and embedded system design programming phases.
CO4: Describe IoT Architectures and Build simple IoT Systems using embedded target boards.
CO5: Exhibit understanding of IoMT infrastructure for healthcare applications.
TEXT BOOKS:


REFERENCES:


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BM3591 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT L T P C

COURSE OBJECTIVES:
The student should be made to:
- Understand the devices for measurement of parameters related to cardiology.
- Illustrate the recording and measurement of EEG
- Demonstrate EMG recording unit and its uses.
- Explain diagnostic and therapeutic devices related to respiratory parameters.
• Understand the various sensory measurements that hold clinical importance.

UNIT I CARDIAC EQUIPMENT
Electrocardiograph, Normal and Abnormal Waves, Heart rate monitor, Holter Monitor, Phonocardiography, ECG machine maintenance and troubleshooting, Cardiac Pacemaker- Internal and External Pacemaker– Batteries, AC and DC Defibrillator- Internal and External, Defibrillator Protection Circuit, Cardiac ablation catheter.

UNIT II NEUROLOGICAL EQUIPMENT
Clinical significance of EEG, Multi-channel EEG recording system, Epilepsy, Evoked Potential– Visual, Auditory and Somatosensory, MEG (Magneto Encephalo Graph). EEG Bio Feedback Instrumentation. EEG system maintenance and troubleshooting.

UNIT III MUSCULAR AND BIOMECHANICAL EQUIPMENT

UNIT IV RESPIRATORY MEASUREMENT AND ASSIST SYSTEM

UNIT V SENSORY DIAGNOSTIC EQUIPMENT
Psychophysiological Measurements – polygraph, basal skin resistance (BSR), galvanic skin resistance (GSR), Sensory responses - Audiometer-Pure tone, Speech, Eye Tonometer, Applanation Tonometer, slit lamp, auto refractometer.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Describe the working and recording setup of all basic cardiac equipment.
CO2: Understand the working and recording of all basic neurological equipment’s.
CO3: Discuss the recording of diagnostic and therapeutic equipment’s related to EMG.
CO4: Explain about measurements of parameters related to respiratory system.
CO5: Describe the measurement techniques of sensory responses.

TOTAL:45 PERIODS

TEXT BOOKS

REFERENCES

**CO’s- PO’s & PSO’s MAPPING**

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**BM3561 DIAGNOSTIC AND THERAPEUTIC EQUIPMENT LAB**

L T P C 0 0 4 2

**COURSE OBJECTIVES:**
The student should be made to
- To demonstrate recording and analysis of different Bio potentials
- To examine different therapeutic modalities.

**LIST OF EXPERIMENTS:**
1. Measurement of visually and auditory evoked potential
2. Galvanic skin resistance (GSR) measurement
3. Measurement of output intensity from shortwave and ultrasonic diathermy
4. Measurement of various physiological signals using biotelemetry
5. Electrical safety measurements
6. Measurement of various physiological signals using biotelemetry
7. Measurement of stimulation current waveforms used in medical stimulator
8. Analyze the working of ESU—cutting and coagulation modes
9. Recording of Audiogram
10. Study the working of Defibrillator and pacemakers
11. Study of ECG, EEG and EMG electrodes.
12. Study of ventilators and Ultrasound Scanners
13. Study of speech signals using speech signal trainer kit.
14. Measurement of Oxygen Saturation and Heart Rate using Pulse-oximeter
15. Study of heart lung machine model

**COURSE OUTCOMES:**
On successful completion of this course, the student will be able to
- CO1: Measure the different bioelectrical signals.
- CO2: Record the various physiological signals using telemetry.
- CO3: Demonstrate various diagnostic and therapeutic techniques.
- CO4: Examine the electrical safety measurements.
- CO5: Analyse the different bio signals using suitable tools.
ONLINE RESOURCES

http://bmsp-coep.vlabs.ac.in/List%20of%20experiments.html?domain=Biotechnology

TOTAL: 60 PERIODS

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BM3562 EMBEDDED SYSTEMS AND IOMT LAB

COURSE OBJECTIVES:
The student should be made to:
- Acquire knowledge and understand the hardware architecture and programming aspects of embedded system design.
- Understand IoT architecture and Build simple IoT Systems using embedded target boards.
- Understand IoMT infrastructure for healthcare applications.

LIST OF EXPERIMENTS

1. Explore AVR/ARM based controllers using Embedded C.
2. Write Basic and arithmetic Programs Using Embedded C.
3. Write Embedded C program to test interrupt and timers.
4. Develop Real time applications – clock generation, waveform generation, counter using embedded C.
5. Explore different communication methods with IoT devices.
6. To interface LED/Buzzer with platform/ Aurdino /Raspberry Pi. and write an embedded C program to turn on / off LED/Buzzer with specified delay.
7. To interface DC/stepper motor using relay with open platform/ Aurdino /Raspberry Pi. and write an embedded C program to turn on motor if push button is pressed.
9. Develop simple application to interface DHT11 sensor with and write a program to display temperature humidity readings in LCD.
10. Develop IoMT Application using open platform/ Aurdino. /Raspberry Pi. and sensors such as temperature, ECG, Pulse etc.
11. Deploy IoMT applications using platforms.
12. Mini Project

TOTAL: 45 PERIODS
COURSE OUTCOMES:

On completion of the course, the student should be able to:
CO1: Explain hardware architecture of embedded systems and use of software design tools.
CO2: Describe IoT Architectures and Build simple IoT Systems using embedded target boards.
CO3: Exhibit understanding of IoMT infrastructure for healthcare with simple applications.

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CS3491 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

COURSE OBJECTIVES:
The main objectives of this course are to:
- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

UNIT I PROBLEM SOLVING

UNIT II PROBABILISTIC REASONING

UNIT III SUPERVISED LEARNING

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING
Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

93
UNIT V  
NEURAL NETWORKS  
Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks – Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

PRACTICAL EXERCISES:  
30 PERIODS
1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models
12. Build deep learning NN models

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Use appropriate search algorithms for problem solving
CO2: Apply reasoning under uncertainty
CO3: Build supervised learning models
CO4: Build ensembling and unsupervised models
CO5: Build deep learning neural network models

TOTAL: 75 PERIODS

TEXT BOOKS:

REFERENCES
BM3651  FUNDAMENTALS OF HEALTHCARE ANALYTICS

COURSE OBJECTIVES:
The objective of this course is to enable the student to
- Understand the statistical methods for the design of biomedical research.
- Comprehend the fundamental of mathematical and statistical theory in the application of Healthcare.
- Apply the regression and correlation analyze in the healthcare data.
- Understand the Meta analysis and variance analysis.
- Interpret the results of the investigational methods.

UNIT I  INTRODUCTION
Introduction, Computers and bio statistical analysis, Introduction to probability, likelihood & odds, distribution variability. Finding the statistical distribution using appropriate software tool like R/Python.

UNIT II  STATISTICAL PARAMETERS
Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing - single population proportion, difference between two population proportions, single population variance, tests of homogeneity. Testing of statistical parameters using appropriate software R / Python.

UNIT III  REGRESSION AND CORRELATION ANALYSIS
Regression model, evaluating the regression equation, correlation model, correlation coefficient. Finding regression, correlation for the data using appropriate software like R / Python.

UNIT IV  ANALYSIS OF VARIANCE
META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, randomized complete block design, repeated measures design, factorial experiment. Testing the variance using appropriate software tool like R / Python.

UNIT V  CASE STUDIES
Epidemical reading and interpreting of epidemiical studies, application in community health, Case study on Medical Imaging like MRI, CT. Case study on respiratory data, Case study on ECG data.

TOTAL: 45 PERIODS
COURSE OUTCOMES
On successful completion of this course, the student will be able to
1. Define the new and existing statistical methodology for their research problem.
2. Explain p-values for different statistical test.
3. Analyze the biomedical research data and able to report the study results.
4. Enumerate the Meta analysis and variance analysis.
5. Describe problems of human health and disease for the interest of advancing the public's Health.

TEXT BOOKS:

REFERENCE BOOKS:

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

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BM3652  MEDICAL IMAGE PROCESSING  L T P C
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COURSE OBJECTIVES
The objective of this course is to enable the student to

• Learn the fundamental concepts of medical Image Processing techniques.
• Understand the concepts of various image intensity transformation and filtering operations.
• Be familiar in the techniques of segmentation and restoration of medical images.
• Gain knowledge in medical image registration and visualization.
• Be familiar with the application of medical image analysis.
UNIT I  FUNDAMENTALS OF MEDICAL IMAGE PROCESSING AND TRANSFORMS  
Overview of Image Processing system and human Visual system- Image representation – pixel and voxels, Gray scale and color models- Medical image file formats- DICOM, ANALYZE 7.5, NIFTI and INTERFILE- Discrete sampling model and Quantization- Relationship between the pixels, Arithmetic and logical operations- Image quality and Signal to Noise ratio- Image Transforms- 2D DFT, DCT, KLT. Interpret the basics of image models, Digitization of images and the transformations of medical images using Matlab.

UNIT II  ENHANCEMENT TECHNIQUES  

UNIT III  SEGMENTATION AND RESTORATION TECHNIQUES  

UNIT IV  REGISTRATION AND VISUALISATION  
Registration–Rigid body transformation, principal axes registration, and feature based. Visualisation-Orthogonal and perspective projection in medicine, Surface based rendering, Volume visualization in medical image. Explain the significance of registration of various imaging modalities and appraise the concepts of image visualization in healthcare using Matlab.

UNIT V  APPLICATIONS OF MEDICAL IMAGE ANALYSIS  

TOTAL: 60 PERIODS

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

CO1: Explain and apply the fundamental concepts of image processing techniques for the analysis of medical images.

CO2: Identify and apply suitable filtering and intensity transformation techniques for given medical applications.

CO3: Identify and segment the Region of Interest from the given medical image.

CO4: Explore and apply current research in registration and visualization for medical image analysis.

CO5: Explain and apply the image compression techniques.

CO6: Design and evaluate the use of image processing fundamentals in healthcare applications, as well as their impact on health and society, and any underlying ethical issues, then communicate effectively through reflections, reports, and presentations (Target CO).
TEXT BOOKS


REFERENCES

1. Atam P. Dhawan, Medical Image Analysis, Wiley-Interscience Publication, NJ, USA 2003

CO’s- PO’s & PSO’s MAPPING

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NCC Credit Course Level 3*
NX3651
(ARMY WING) NCC Credit Course - III

PERSONALITY DEVELOPMENT

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

BORDER & COASTAL AREAS

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

ARMED FORCES

AF 2  Modes of Entry to Army, CAPF, Police 3

COMMUNICATION

C 1  Introduction to Communication & Latest Trends 3

INFANTRY

INF 1  Organisation of Infantry Battalion & its weapons 3
### Military History

| MH 1 | Biographies of Renowned Generals | 4 |
| MH 2 | War Heroes - PVC Awardees        | 4 |
| MH 3 | Study of Battles - Indo Pak War 1965, 1971 & Kargil | 9 |
| MH 4 | War Movies                      | 6 |

**Total: 45 Periods**

### NCC Credit Course Level 3*

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

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### Border & Coastal Areas

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

### Naval Orientation

|                  | 6 |   |   |   |
| NO 3 Modes of Entry - IN, ICG, Merchant Navy | 3 |   |   |   |
| AF 2 Naval Expeditions & Campaigns | 3 |   |   |   |

### Naval Communication

|                  | 2 |   |   |   |
| NC 1 Introduction to Naval Communications | 1 |   |   |   |
| NC 2 Semaphore | 1 |   |   |   |

### Navigation

|                  | 2 |   |   |   |
| N 1 Navigation of Ship - Basic Requirements | 1 |   |   |   |
| N 2 Chart Work | 1 |   |   |   |

### Seamanship

|                  | 15 |   |   |   |
| MH 1 Introduction to Anchor Work | 2 |   |   |   |
| MH 2 Rigging Capsule | 6 |   |   |   |
| MH 3 Boatwork - Parts of Boat | 2 |   |   |   |
| MH 4 Boat Pulling Instructions | 2 |   |   |   |
| MH 5 Whaler Sailing Instructions | 3 |   |   |   |

### Fire Fighting, Flooding & Damage Control

|                  | 4 |   |   |   |
| FFDC 1 Fire Fighting | 2 |   |   |   |
| FFDC 2 Damage Control | 2 |   |   |   |

### Ship Modelling

|                  | 3 |   |   |   |
| SM 1 Ship Modelling Capsule | 3 |   |   |   |

**Total: 45 Periods**

### NCC Credit Course Level 3*

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

|                  | 9 |   |   |   |
| PERSONALITY DEVELOPMENT | 9 |   |   |   |
| PD 3 Group Discussion: Team Work | 2 |   |   |   |
| PD 4 Career Counselling, SSB Procedure & Interview Skills | 3 |   |   |   |
GE3791  HUMAN VALUES AND ETHICS

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
Understanding Democratic values: Equality, Liberty, Fraternity, Freedom, Justice, Pluralism, 
Tolerance, Respect for All, Freedom of Expression, Citizen Participation in Governance – World 
Reading Text: Excerpts from John Stuart Mills’ On Liberty

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
Scientific thinking and method: Inductive and Deductive thinking, Proposing and testing 
Hypothesis, Validating facts using evidence based approach – Skepticism and Empiricism – 
Rationalism and Scientific Temper. 
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. 
Reading Text: Excerpt from American Prometheus: The Triumph and Tragedy of J.Robert 
Oppenheimer by Kai Bird and Martin J. Sherwin.

TOTAL: 30 PERIODS

REFERENCES:
2. Secularism: A Dictionary of Atheism, Bullivant, Stephen; Lee, Lois, Oxford University Press, 
   2016.
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.

MD3711                      HOSPITAL TRAINING                      L T P C
                              0 0 0 2

COURSE OBJECTIVES:
The student should be made to
- Observe medical professionals at work in the wards and the roles of Allied Health Professionals;
- Provide access to healthcare Professionals to get a better understanding of their work;
- Demonstrate patient-care in a hospital setting.

ASSESSMENT:
- Students need to complete training in any leading Multi-speciality hospital for a period of 15 days. They need to prepare an extensive report and submit to their respective course in-charges during the session.
- Out of the following departments, it is mandatory to complete training in any 10. The students can give a presentation of the remaining departments during laboratory hours.

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TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- Advocate a patient-centred approach in healthcare
- Communicate with other health professionals in a respectful and responsible manner
- Recognize the importance of inter-professional collaboration in healthcare.
- Propose a patient-centred inter-professional health improvement plan based upon the patient’s perceived needs
- Use the knowledge of one's own role and those of other professions to address the healthcare needs of populations and patients served.

MD3811 PROJECT WORK/INTERNSHIP

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

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.

A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

COURSE OUTCOMES:
On Completion of the project work students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.
COURSE OBJECTIVES:
The student should be made to:

- Learn characteristics and classification of Biomaterials
- Understand different metals, ceramics and its nanomaterial's characteristics as biomaterials
- Learn polymeric materials and its combinations that could be used as a tissue replacement implants
- Get familiarized with the concepts of Nano Science and Technology
- Understand the concept of biocompatibility and the methods for biomaterials testing

UNIT I INTRODUCTION TO BIO-MATERIALS 9
Definition and classification of bio-materials, mechanical properties, visco elasticity, biomaterial performance, body response to implants, wound healing, blood compatibility, Nano scale phenomena.

UNIT II METALLIC AND CERAMIC MATERIALS 9
Metallic implants - Stainless steels, co-based alloys, Ti-based alloys, shape memory alloy, nanostructured metallic implants, degradation and corrosion, ceramic implant – bio inert, biodegradable or bioresorbable, bioactive ceramics, nanostructured bio ceramics.

UNIT III POLYMERIC IMPLANT MATERIALS 9

UNIT IV TISSUE REPLACEMENT IMPLANTS 9

UNIT V TESTING OF BIOMATERIALS 9
Biocompatibility, blood compatibility and tissue compatibility tests, Toxicity tests, sensitization, carcinogenicity, mutagenicity and special tests, Invitro and Invivo testing; Sterilisation of implants and devices: ETO, gamma radiation, autoclaving. Effects of sterilization.

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

- CO1: Analyze different types of Biomaterials and its classification and apply the concept of nanotechnology towards biomaterials use.
- CO2: Identify significant gap required to overcome challenges and further development in metallic and ceramic materials
- CO3: Identify significant gap required to overcome challenges and further development in polymeric materials
- CO4: Create combinations of materials that could be used as a tissue replacement implant.
- CO5: Understand the testing standards applied for biomaterials.

TOTAL: 45 PERIODS
TEXTBOOKS

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM332  ARTIFICIAL ORGANS AND IMPLANTS  L T P C 3 0 0 3

COURSE OBJECTIVES:
The student should be made to:

- To have an overview of artificial organs & transplants
- To describe the principles of implant design with a case study
- To explain the implant design parameters and solution in use
- To study about various blood interfacing implants
- To study about soft tissue replacement and hard tissue replacement

UNIT I  ARTIFICIAL ORGANS & TRANSPLANTS  9
ARTIFICIAL ORGANS:-Introduction, outlook for organ replacements, design consideration, evaluation process.
TRANSPLANTS:-Overview, Immunological considerations, Blood transfusions, individual organs – kidney, liver, heart and lung, bone marrow, cornea.

UNIT II  PRINCIPLES OF IMPLANT DESIGN  9
Principles of implant design, Clinical problems requiring implants for solution, Permanent versus absorbable devices, the missing organ and its replacement, Tissue engineering, scaffolds, cells and regulators criteria for materials selection, Case study of organ regeneration.
UNIT III  IMPLANT DESIGN PARAMETERS AND ITS SOLUTION  
Biocompatibility, local and systemic effects of implants, Design specifications for tissue bonding and modulus matching, Degradation of devices, natural and synthetic polymers, corrosion, wear and tear, Implants for Bone, Devices for nerve regeneration.

UNIT IV  BLOOD INTERFACING IMPLANTS  
Neural and neuromuscular implants, heart valve implants, heart and lung assist devices, artificial heart, cardiac pacemakers, artificial kidney- dialysis membrane and artificial blood.

UNIT V  IMPLANTABLE MEDICAL DEVICES AND ORGANS  
Gastrointestinal system, Dentistry, Maxillofacial and craniofacial replacement, Soft tissue repair, replacement and augmentation, recent advancement and future directions.

COURSE OUTCOMES:  
On successful completion of this course, the student will be able to  
CO1: Gain adequate knowledge about artificial organs & transplants  
CO2: Get clear idea about implant design and its parameters and solution  
CO3: Have in-depth knowledge about blood interfacing implants  
CO4: Explain different types of soft tissue replacement and hard tissue replacement  
CO5: Assess compatibility and functioning of artificial organs inside the living system.

TOTAL:45 PERIODS

TEXT BOOK

REFERENCES

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

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COURSE OBJECTIVES

- To acquire knowledge about the physical properties of light and optical properties of tissues.
- Learn the design and working principle of various optical components.
- Understand the principles and applications of optical biosensors.
- Understand the engineering and practical applications of optics related to diagnostic and surgical applications.
- Understand the phenomenon of laser tissue interaction and practical applications of optics related to therapeutic applications.

UNIT I  OPTICAL PROPERTIES  6

UNIT II  OPTICAL INSTRUMENTATION  6

UNIT III  OPTICAL BIOSENSORS  6

UNIT IV  APPLICATIONS OF LASERS  6
Diagnostic - Optical coherence tomography, Fluorescence, Raman, Photoacoustic tomography, Laser induced breakdown spectroscopy (LIBS), Hyperspectral imaging. Surgical - Lasers in dentistry, Dermatology, Ophthalmology.

UNIT V  LASER TISSUE INTERACTION  6
Laser tissue interactions via photochemical, Photothermal, Photomechanical techniques, Photodynamic therapy (PDT) - Oncological and non-oncological applications, Low level laser therapy (LLLT) - Biostimulation applications.

30 PERIODS

Lab course/Mini projects/Hospital visit - Presentations (30 hours)

Students need to visit Hospitals/Research Institutes/Industry and understand the working and applications of various Optical Techniques in the Biomedical field.
- Lab course/Mini projects on interferometry techniques (Young’s double slit, Michelson and Mach-zehnder interferometry).
- Lab course/Mini projects on various spectroscopic techniques (absorption/transmission, scattering and emission spectroscopy).
- Lab course/Mini projects on optical simulations and image processing – MATLAB, COMSOL, optical softwares.
• Mini projects on Laser based Biomedical Applications
• Hospital visit to understand the working of Optical Coherence Tomography technique
  Hospital visit to understand the clinical applications of Lasers used in ophthalmology, dermatology, dentistry, etc.,

30 PERIODS
TOTAL: 60 PERIODS

COURSE OUTCOMES
On successful completion of this course, the student will be able to
  CO1: Explain the various physical properties of light and optical properties of tissues.
  CO2: Consolidate the working principles of optical components.
  CO3: Discuss the various applications of biosensors in medicine.
  CO4: Summarize the diagnostic and surgical applications of lasers in medicine.
  CO5: Explain the laser tissue interaction and various therapeutic applications of lasers.

TEXT BOOKS
  2. Jurgen Popp, Valery V. Tuchin, Arthur Chiou and Stefen Heinemann, Handbook of

REFERENCES

ONLINE RESOURCES
  1. https://nptel.ac.in/courses/127/105/127105225/
  2. https://onlinecourses.nptel.ac.in/noc21_ge13/preview

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
The student should be made to:

- To be familiar with the nervous system development
- To be exposed to neuronal diseases and disorders
- To be familiar with nerve reconstruction and repairing

UNIT I  BASICS OF NEURON STRUCTURE AND FUNCTIONS  9

UNIT II  BRAIN, BRAIN STEM AND SPINAL CORD  9

UNIT III  NEURONAL DISEASES AND DISORDERS  9

UNIT IV  NEUROPHYSIOLOGY & NEURORADIOLOGY  9

UNIT V  NERVE RECONSTRUCTION AND REHABILITATION  9
Neural plasticity; Neurological dysfunctions - Regeneration of the peripheral nervous system. Neural tissue engineering; Nerve graft; Drug delivery system in CNS. Rehabilitation: Mechanisms for Neuromotor rehabilitation; Robotics and virtual reality in physical therapy; Transcranial magnetic stimulation

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Explain the basic structure and functions of human nervous system.
CO2: Understand diseases and degeneration related to nervous system.
CO3: Analyze visualization and radiological assessment of nervous system.
CO4: Apply neural tissue engineering for rehabilitation.
CO5: Discuss about Regeneration of nervous system.

TOTAL:45 PERIODS

TEXT BOOKS

REFERENCES
CBM362  PRINCIPLES OF TISSUE ENGINEERING  L T P C
3 0 0 3

COURSE OBJECTIVES:
- To study the cell types and differentiation.
- To study basics about stem cells and its applications
- To understand the methods and design involved in tissue engineering

UNIT I  INTRODUCTION TO CELL BIOLOGY  9

UNIT II  FUNDAMENTALS OF TISSUE ENGINEERING  9

UNIT III  STEM CELLS  9
Definition of stem cells – Types of stem cells – Differentiation, dedifferentiation maturation, proliferation, pluripotency and immortalization - Sources of stem cells: Haematopoetic – Fetal - cord blood – Placenta - Bone marrow - Primordial germ cells - Cancer stem cells - Induced pluripotent stem cells.

UNIT IV  ENGINEERING METHODS AND DESIGN  9
Soft lithography - Self-assembled monolayer, Micro contact printing, Micro fluidic patterning - Laminar flow patterning - Cell interaction with Polymer scaffolds and gels - Polymer scaffolds fabrications: Electro spinning - Solvent casting and particulate leaching - Micro fabrication of cell seeded scaffolds.

UNIT V  APPLICATION OF TISSUE ENGINEERING  9
Replacement Engineering: Bone, cartilage, skin, blood, pancreas, kidney, heart valve and liver - Regenerative engineering: Peripheral Nerve regeneration, Cardiac tissue regeneration, Muscle regeneration – Regulation, Commercialization and Patenting.

COURSE OUTCOMES:
At the end of the course, the student should be able to:
- **CO1**: Understand the basic concepts of tissue engineering
- **CO2**: Acquire ability to function on multi-disciplinary teams
- **CO3**: Apply the knowledge of professional and ethical responsibility in use of stem cells and gene therapy in creating tissue engineered therapies
- **CO4**: Design and develop different biomaterial in tissue engineering application
- **CO5**: Gain knowledge in research or clinical application on tissue repair/ engineering

TOTAL : 45 PERIODS

TEXT BOOK
REFERENCES

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CBM349 GENETIC ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:
- To discuss the gene cloning methods and the tools and techniques involved in gene cloning and genome analysis and genomics.
- To explain the heterologous expression of cloned genes in different hosts.

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 9
Manipulation of DNA – Restriction and Modification enzymes - Design of linkers and adaptors - Characteristics of cloning and expression vectors - Introduction of recombinant DNA in to host cells and selection methods.

UNIT II DNA LIBRARIES 9
Construction of genomic and cDNA libraries, Artificial chromosomes – Bacteria, Yeast - Chromosomal walking.

UNIT III SEQUENCING AND AMPLIFICATION OF DNA 9
Maxam Gilbert’s and Sanger’s methods of DNA sequencing – PCR: Inverse PCR, Nested PCR, Allele specific PCR, Hot start PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT IV ORGANIZATION AND STRUCTURE OF GENOMES 9
Organization and structure of genomes - Genome sequencing methods: Conventional and shotgun genome sequencing methods, Next generation sequencing technologies - Ordering the genome sequence - Genetic maps and Physical maps, STS content based mapping, Hybridization mapping, Optical mapping.
UNIT V  CURRENT STATUS OF GENOME SEQUENCING PROJECTS  9

Introduction to Functional genomics – Microarrays - Serial Analysis of Gene expression (SAGE), Subtractive hybridization, Comparative Genomics, Proteogenomics, Web resources for Genomics, Applications of genome analysis and genomics.

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

CO1: Would be aware of how to clone commercially important genes.

CO2: The students would be aware of how to produce the commercially important recombinant proteins.

CO3: Will be familiarized with gene and genome sequencing techniques

CO4: Will be aware of microarrays, Analysis of Gene expression and proteomics.

CO5: Acquire ability to function on multi-disciplinary teams

TOTAL:45 PERIODS

TEXT BOOK


REFERENCES


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:
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CBM353 MEDICAL DEVICE DESIGN  
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COURSE OBJECTIVES:
The student should be made to:
- Introduce the Medical device standards and requirements.
- Illustrate the design procedure of medical devices.
- Outline the quality assessment in design.
- Describe about the design realization.
- Understand the validation and verification of various medical devices

UNIT I NEEDS FINDING AND CONCEPT GENERATION 9

UNIT II MEDICAL DEVICES STANDARDS AND REQUIREMENTS 9

UNIT III DESIGN ENGINEERING 9

UNIT IV TESTING AND VALIDATION 9
Basis and Types of Testing, Hardware Verification and Data Analysis, Software Verification and Data Analysis.

UNIT V DESIGN TRANSFER AND MANUFACTURING 9

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
- CO1: Define the medical devices standards and requirements.
- CO2: Summarise the concept of medical device development.
CO3: Recall the engineering design and project metrics.
CO4: Demonstrate the testing and validation of medical equipment.
CO5: Interpret the various design transfer and manufacturing methods.

**TOTAL :45 PERIODS**

**TEXT BOOKS**
1. Zenios, Makower and Yock, —Biodesign – The process of innovating medical technologies‖, Cambridge University Press, 2009

**REFERENCES**

**CO’s-PO’s & PSO’s MAPPING**

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**CBM360**

**PATIENT SAFETY, STANDARDS AND ETHICS**

**COURSE OBJECTIVE:**
- To understand the importance of patient safety against electrical hazards
- To explain the patient safety laws and regulations
- To understand the standards and testing of patient
- To know the patient safety specialities in clinical
- To know about the health care organization

**UNIT I**

**EFFECTS OF ELECTRICITY**
Physiological effects of electricity - important susceptibility parameters - microshock - macroshock hazards -patients electrical environment - isolated power system - conductive surfaces

**UNIT II**

**PATIENT SAFETY LAWS AND REGULATIONS**

115

UNIT III  STANDARDS AND TESTING  
Guidelines and safety practices to improve patient safety, Electrical safety codes and standards - IEC 60601-1 2005 standard, Basic Approaches to protection against shock, protection equipment design, Electrical safety analyser - Testing the electric system

UNIT IV  PATIENT SAFETY IN MAIN CLINICAL SPECIALITIES  
Intensive care and Anesthesiology, safety surgery save lives, Emergency department clinical risk, Obstetric safety patient, Patient safety in internal medicine, Patient safety in Radiology.

UNIT V  MEDICAL ETHICS  
Definition of Medical ethics, Scope of ethics in medicine, American medical Association code of ethics, CMA code of ethics- Fundamental Responsibilities, The Doctor and The Patient, The Doctor and The Profession, Professional Independence, The Doctor And Society, Case Studies.

COURSE OUTCOME:
At the end of this course, the student will be able to
CO1:Outline the importance of patient safety against electrical hazards.
CO2:Brief out the patient safety laws and regulations
CO3:explain the standards and testing of patient
CO4:Understand the concept of the patient safety specialities in clinical
CO5:know about various health care organization

TEXT BOOKS:

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
The objective of this course is to enable the student to
- To study the regulation of medical devices, process of development, ethical and quality considerations.
- To learn the various ISO standards of quality and risk management for regulatory purposes.
- To explore the process of approval and marketing of medical devices.
- To comprehend the regulatory process for medical devices in India, US, and EU.
- To familiarize with clinical evaluation and investigation of medical devices.

UNIT I  MEDICAL DEVICE REGULATIONS
History of medical device regulation, regulatory affairs professional’s roles, required competencies, medical device classification: scope, definitions, main classifications, Risk based classification, practical examples, labeling of medical devices: definition, elements, risk management, clinical evaluation and labeling, language level and intended users. differentiating medical devices IVDs and combination products from that of pharmaceuticals.

UNIT II  ISO STANDARDS

UNIT III  IEC, REGULATORY SYSTEMS IN USA & EU
IEC international standards and conformity assessment for medical devices, Good submission process, medical device regulatory system in the USA and European Union.

UNIT IV  INDIAN REGULATORY SYSTEM
India: Medical device regulatory system: market environment, functions undertaken by DGGI, central government, FDA and state governments, guidance documents, details of key regulators, IMDRF and CDSCO, regulatory overview in India, product registration on conformity assessment, quality system regulation, technical material and labeling requirements, commercial aspects, upcoming regulation changes.

UNIT V  CLINICAL TRIALS AND DIGITAL REGULATIONS
Regulatory strategy and competitive advantage, Preclinical and Clinical Trial Design for Medical Devices in India; FDA approved devices, post-market surveillance/vigilance, Digital health regulations: Connected care, intelligent design control, reducing design time and cost with in-silico clinical trials.

COURSE OUTCOMES:
On completion of the course, the student should be able to:
- CO1: Define and explain the basic concepts of medical device regulations.
- CO2: Decipher the meaning of ISO standards from a regulatory perspective.
- CO4: Discuss regulations in India.
- CO5: Explain the regulatory aspects of clinical trials and digital alternatives.

TOTAL: 45 PERIODS
TEXTBOOKS:

REFERENCES:

ONLINE RESOURCES
1. Regulatory requirements for medical devices including in vitro diagnostics in India (Version 2.0), IIT Madras, Prof. Arun B.Ramteke, Prof. Aseem Sahu, Prof. Malay Mitra. https://nptel.ac.in/courses/127106136
3. FOOD AND DRUG ADMINISTRATION USA, http://www.fda.gov/medicaldevices/deviceregulationandguidance/default.htm

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

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CBM372 MEDICAL INNOVATION AND ENTREPRENEURSHIP L T P C 3 0 0 3

COURSE OBJECTIVES:
The student should be made to:
• To learn fundamentals of entrepreneurship
• To apply the methods of entrepreneurship in medical field
• To evaluate the medical devices and market trends

UNIT I CREATIVITY, INNOVATION AND IPR 9

UNIT II SCOPE FOR BIOMEDICAL ENGINEERING ENTREPRENEURSHIP 9
UNIT III  NEW VENTURE

UNIT IV  FINANCING THE NEW VENTURE AND GLOBALIZATION

UNIT V  MARKETING FUNCTION

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Describe the role of biomedical engineers in entrepreneurship
CO2: Interpret the background for biomedical engineers in entrepreneurship
CO3: Acquire the skills and techniques required towards innovation
CO4: Categorize the resources and funding agencies and judge the right product based on market needs
CO5: Compile and quantify the opportunities and challenges

TOTAL :45 PERIODS

TEXT BOOKS

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CBM363  
**RAPID PROTOTYPING**  
**L T P C**  
3 0 0 3

**COURSE OBJECTIVES:**
The student should be made to:
- Learn the need and fundamentals of rapid prototyping
- Understand the concepts of design and assembling of various parts
- Study the process and material selection for UV and Laser based AM
- Investigate the process of fused deposition moulding and sheet lamination
- Explore droplet formation and beam deposition process

**UNIT I  INTRODUCTION**  
9

**UNIT II  DESIGN FOR ADDITIVE MANUFACTURING**  
9

**UNIT III  PHOTO POLYMERIZATION AND POWDER BED FUSION PROCESSES**  
9

**UNIT IV  EXTRUSION BASED AND SHEET LAMINATION PROCESSES**  
9

**UNIT V  PRINTING PROCESSES AND BEAM DEPOSITION PROCESSES**  
9
COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Demonstrate the basics of Additive manufacturing.
CO2: Design and assembly of various parts for the desired task.
CO3: Explain the process involved in laser and UV based AM
CO4: Illustrate the process of fused deposition moulding and sheet lamination
CO5: Support design and manufacturing, case studies relevant to mass customized manufacturing, and some of the important research challenges associated with AM and its data processing tools.

TOTAL: 45 PERIODS

TEXT BOOKS

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CBM343 CLINICAL ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:
- This course will provide a basic understanding of the clinical engineering profession, qualifications, roles, activities, and expectations.
- This course will enhance students to practice medical equipment and analyze challenges with their healthcare technology.
- This course will engage the students to work as a team to address problems and errors in medical devices.
- This course will help students to design better medical devices with computerized approaches.
- This course will expose students to explore the Health Technology Management systems
with medical devices and supportive services with advanced application.

UNIT – I  INTRODUCTION  9

UNIT – II  MEDICAL TECHNOLOGY MANAGEMENT PRACTICES  9
Strategic Medical Technology Planning, Scope, Clinical necessity operational support, strategic planning process – Technology assessment: Technology audit, Budget strategies, Prerequisite for medical technology assessment – Management Practice for Medical Equipment - Device evaluation, Risk reduction, Asset management, ESHTA

UNIT – III  ESSENTIAL HEALTH CARE TECHNOLOGY PACKAGE (EHTP)  9

UNIT – IV  CLINICAL ENGINEERING PROGRAM INDICATOR  9
Clinical engineering: program services, Program database – Clinical Engineering Program management, Program indicator, Managing clinical engineering performance using program indicators – Indicator management process.

UNIT – V  ADVANCED TECHNOLOGY FOR PATIENT SAFETY  9
Factors Contributing to Medical Errors: Heath Care Reimbursement, Health Care Failure Mode and Effect Analysis (HFMEA), Patient Safety Best Practices Model: Bar coding, Computerized Physician Order Entry (CPOE), and Clinical data repositories – Process analysis, Methodology. Computerized medical equipment management systems.

TOTAL : 45 PERIODS

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

CO1: State the role of clinical engineers and discuss the basic concepts of medical and healthcare technology
CO2: Give the program and framework to recognize the errors of medical equipment
CO3: State the issues or errors in patient safety and formulate patient safety package system
CO4: Define the problem precisely and examine the possible issues using program indicators.
CO5: Demonstrate computer based equipment with automated system by using CPOE method.

TEXT BOOKS:

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CBM351 HOSPITAL PLANNING AND MANAGEMENT L T P C

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COURSE OBJECTIVES:

To Study about:

- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
- The student should be made to understand the principles, practices and areas of application in Hospital management.

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION

9

Distinction between Hospital and Industry, Challenges in Hospital Administration – Hospital Planning – Equipment Planning- AMC – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL

9


UNIT III MARKETING RESEARCH & CONSUMER BEHAVIOUR

9

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer behaviour - Model of consumer behaviour - Types of buying decision behaviour - The buyer decision process - Model of business buyer behaviour - Major types of buying situations - global marketing in the medical sector - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES

9


UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL

9


COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Explain the principles, practices and areas of application in Hospital Management.

CO2: Understand the biomedical waste disposal concept.

CO3: Explain the importance of supportive services.
CO4: Comprehend the quality aspect specified by the international standards.
CO5: Knowledge on Hospital safety.

**TEXT BOOKS**


**REFERENCES**


**CBM358 MEDICAL WASTE MANAGEMENT**

**COURSE OBJECTIVES:**
The student should be made to:

- Understand the hazardous materials used in hospital and its impact on health
- Understand various waste disposal procedures and management.

**UNIT I HEALTHCARE HAZARD CONTROL AND UNDERSTANDING ACCIDENTS**

UNIT II  BIOMEDICAL WASTE MANAGEMENT
Biomedical Waste Management : Types of wastes, major and minor sources of biomedical waste, Categories and classification of biomedical waste, hazard of biomedical waste, need for disposal of biomedical waste, waste minimization, waste segregation and labeling, waste handling, collection, storage and transportation, treatment and disposal.

UNIT III  HAZARDOUS MATERIALS

UNIT IV  FACILITY SAFETY

UNIT V  INFECTION CONTROL, PREVENTION AND PATIENT SAFETY

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Analyse various hazards, accidents and its control
CO2: Design waste disposal procedures for different biowastes
CO3: Categorise different biowastes based on its properties
CO4: Design different safety facility in hospitals
CO5: Propose various regulations and safety norms

TOTAL: 45 PERIODS

TEXT BOOKS

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COURSE OBJECTIVE:

- To understand the concepts of Economics with respect to the demand and supply analysis.
- To analyze the theory of production and the analysis of the cost parameter by using the Elasticity.
- To manage and plan the situation with the help of the available strategies to support the decision making process.

UNIT I  INTRODUCTION TO ECONOMICS  9

UNIT II  DEMAND AND SUPPLY ANALYSIS  9

UNIT III  THEORY OF PRODUCTION AND ANALYSIS OF COST  9

UNIT IV  INTRODUCTION TO MANAGEMENT  9

UNIT V  PLANNING  9

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Summarize how to solve economics principles to solve economic problems in engineering discipline by satisfying the economic laws.

CO2: Discuss the demand and supply process for a market analysis using Price elasticity, Cross elasticity and Income elasticity.

CO3: Interpret short run and long run costs in the process of production for carrying out a business.
CO4: Apply managerial skills to make decisions and solve problems for achieving organizational objectives.

CO5: Express the principles of effective planning for survival and success of all organizations using standing and single use planning methods.

TEXT BOOKS:

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CBM336 BIOSTATISTICS

COURSE OBJECTIVES
The objective of this course is to enable the student to

- Understand the statistical methods for the data.
- Comprehend the fundamental of mathematical and statistical theory in the application of biomedical field.
- Apply the regression and correlation analyze in the physiological data.
- Understand the source of Medical data
- Understand the Visual analytics of Healthcare data.

UNIT I INTRODUCTION
Introduction, Some basic concepts, Measurement and Measurement Scales, Simple random sample, Computers and medical data analysis, Introduction to probability, likelihood & odds, distribution variability.

UNIT II STATISTICAL PARAMETERS
Statistical parameters p-values, computation, level chi square test and distribution and hypothesis testing - single population proportion, difference between two population proportions, single
population variance, ratio of two population variances and tests of goodness of fit, tests of independence, tests of homogeneity.

UNIT III REGRESSION AND CORRELATION ANALYSIS 6
Introduction, regression model, sample regression equation, evaluating the regression equation, using the regression equation, correlation model, correlation coefficient.

UNIT IV INTERPRETING DATA 6
Interpreting life tables clinical trials, epidemiological reading and interpreting of epidemiological studies, application in community health.

UNIT V ANALYSIS OF VARIANCE 6
META analysis for research activities, purpose and reading of META analysis, kind of data used for META analysis, completely randomized design, randomized complete block design, repeated measures design, factorial experiment.

LAB COMPONENT
Students need to use appropriate software tools to implement the following,
1. Identify quantitative, ordinal, and categorical measurements from the data
2. Construct and interpret stem plots and histograms,
3. Construct and interpret frequency tables, calculate and interpret means, standard deviations, medians, and quartiles
4. Calculate and interpret Normal probabilities and values.
5. Calculate and interpret confidence intervals for means
6. Calculate hypothesis test means and power or sample size estimates when testing means.
7. Tests of goodness of fit tests of independence, tests of homogeneity
8. Calculate the regression equation
9. Calculate correlation coefficient
10. Interpreting life tables clinical trials
11. Calculate and interpret relative risks and confidence intervals for relative risks
12. Data can be downloaded from following or from any known data source
   https://hbiostat.org/data/
   https://biolincc.nhlbi.nih.gov/teaching/
   https://libguides.denison.edu/c.php?g=776168&p=5661119
   https://guides.lib.berkeley.edu/publichealth/healthstatistics/rawdata

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Define the new and existing statistical methodology for their research problem.
CO2: Explain p-values for different statistical tests.
CO3: Analyze the biomedical research data and be able to report the study results.
CO4: Describe the various sources of medical data
CO5: Demonstrate the visual analytical procedure of Medical Data.

TEXT BOOKS
REFERENCES


ONLINE RESOURCES

1. https://nptel.ac.in/courses/106/107/106107220/
2. https://onlinecourses.nptel.ac.in/noc21_cs45/preview

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

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CBM347 FORENSIC SCIENCE IN HEALTHCARE L T P C
3 0 0 3

COURSE OBJECTIVE:
By the end of the course each student will be familiar with:
- the history of the forensic sciences and its place in popular culture
- the roles of different types of professionals involved in evaluating a crime scene and the collected evidence
- forensic microscope and Anthropology
- The Blood stain identification
- the methodology of collecting & interpreting data for fingerprint application

UNIT I BASICS OF FORENSIC SCIENCE
UNIT- II OBSERVATION AND CRIME SCENE

UNIT III FORENSIC MICROSCOPE AND ANTHROPOLOGY

UNIT IV BLOOD STAIN IDENTIFICATION

UNIT V FINGERPRINT APPLICATION
Fingerprints - Fundamental Principles of Fingerprint Analysis, Classification of Fingerprints, Collection of Fingerprint Evidence, Automated Fingerprint Identification Systems (AFIS), Track marks, Case Studies.

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to
- CO1: Define the significance of forensic sciences
- CO2: Observe and document crime scenes
- CO3: Determine Trauma and Diseases.
- CO4: Describe the various sources of medical data related to forensic science.
- CO5: Demonstrate the visual analytical procedure of fingerprint application.

TEXT BOOKS

REFERENCES
2. Deforest, Gansellen & Lee : Introduction to Criminalistics.

CO’s- PO’s & PSO’s MAPPING

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CBM338 BIOMECHANICS L T P C 2 0 2 3

COURSE OBJECTIVES

The objective of this course is to enable the student to

- Learn the fundamental concepts of the principles of mechanics.
- Understand the basics of biofluid mechanics.
- Review the mechanical properties of musculoskeletal elements.
- Study the biomechanics of joints and implants.
- Learn the application of biomechanics into modelling and ergonomic design.

UNIT I INTRODUCTION TO MECHANICS

Introduction – Scalars and vectors, Statics – Resolution and composition of forces, Moments, couple, Resultant, equilibrium of coplanar forces, Dynamics – Linear motion, Newton’s laws of motion, Velocity and acceleration, Kinematics – Models, Transducers Constitutive equations – Non-viscous fluid, Newtonian Viscous fluid and Hookean Elastic solid

UNIT II BIOFLUID MECHANICS

Intrinsic fluid properties, Rheological properties of blood, Pressure-flow relationship for Non-Newtonian Fluids, Fluid mechanics in straight tube, Structure of blood vessels, Material properties and modelling of Blood vessels, Heart – Cardiac muscle characterization, Native heart valves, Prosthetic heart valve fluid dynamics.

UNIT III MUSCULOSKELETAL MECHANICS


UNIT IV BIOMECHANICS OF JOINTS AND IMPLANTS

Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, Free body diagrams, Structure of joints, Types of joints, Biomechanical analysis of elbow, shoulder, spinal column, hip, knee and ankle, Lubrication of synovial joints, Gait analysis, Motion analysis using video.

UNIT V MODELLING AND ERGONOMICS

Introduction to Finite Element Analysis, finite element analysis of lumbar spine; models for voice biomechanics, Ergonomics –Musculoskeletal disorders, Ergonomic principles contributing to good workplace design, Design of a Computer work station, Whole body vibrations, Hand transmitted and whole-body vibrations.

30 PERIODS
LAB COMPONENT

1. MATLAB implementation of Vector algebra, force and moment calculation
2. Program used in conjunction with the EMG system to analyse muscle activation patterns.
3. Biomechanical analysis of voice
4. Cardiovascular models
5. Musculoskeletal models
6. Finite element analysis.

TOTAL: 60 PERIODS

SOFTWARE TOOLS
1. MATLAB/ Python
2. CVSIM/Equivalent tools
3. OpenSim/FEBIO/ Equivalent tools.

COURSE OUTCOMES

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

CO1: Understand and apply the principles of mechanics, kinetics and kinematics in the context of biological systems Appraise the basics of biofluid mechanics as applied to heart valve design and blood vessel models.

CO2: Describe the basics of biofluid mechanics as applied to heart valve design and blood vessel models.

CO3: Describe the mechanical properties of musculoskeletal elements to develop the mathematical models of joints and implants.

CO4: Apply the knowledge of biomechanics into analysis of human joints and motion

CO5: Apply Biomechanics principles to “real-world” problem and describe their impact on health, safety, society, environment as well as underlying legal and ethical considerations.

TEXT BOOKS


REFERENCES


CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES
The objective of this course is to enable the student to
• Explain the need for medical aids.
• Understand the sensory rehabilitation systems.
• Learn the use of orthopedic prosthetics and orthotics in rehabilitation.
• Understand virtual reality in rehabilitation
• Have an understanding of rehabilitation medicine and advocacy.

UNIT I  INTRODUCTION TO REHABILITATION

UNIT II  ENGINEERING CONCEPTS IN SENSORY AUGMENTATION AND SUBSTITUTION

UNIT III  ORTHOPEDIC PROSTHETICS AND ORTHOTICS
Engineering concepts in motor rehabilitation, Artificial limbs- body powered, externally powered and controlled orthotics and prosthetics, Myoelectric hand and arm prosthetics. Functional Electrical Stimulation systems-Restoration of hand function, restoration of standing and walking, Hybrid Assistive Systems (HAS).

UNIT IV  VIRTUAL REALITY
Introduction to virtual reality, Virtual reality based rehabilitation, Hand motor recovery systems with Phantom haptics, Robotics and Virtual Reality Applications in Mobility Rehabilitation.

UNIT V  REHABILITATION MEDICINE AND ADVOCACY
Physiological aspects of Function recovery, Psychological aspects of Rehabilitation therapy, Legal aspect available in choosing the device and provision available in education, job and in day-to-day life.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Summarize the key terminologies used by the rehabilitation team.
CO3: Design different orthotics and prosthetics for rehabilitation applications.
CO4: Summarize the need of virtual reality tools for different aids.
CO5: Appraise the legal aspects for building rehabilitation aids for the needed people.

TEXTBOOKS


REFERENCES

7. Roy A Cooper (Editor), Hisaichi Ohnabe (Editor), Douglas A. Hobson (Editor), “An Introduction to Rehabilitation Engineering (Series in Medical Physics and Biomedical Engineering” CRC Press, 2000

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CBM361 PHYSIOLOGICAL MODELLING L T P C

3 0 0 3

COURSE OBJECTIVES:
The student should be made to:
- To explain the application of Physiological models and vital organs.
- To Formulate the methods and techniques for analysis and synthesis of dynamic models
- To describe the dynamic models, simulate and visualize, dynamic responses of physiological models using software.
- To describe nonlinear models of physiological systems
- To compute the Simulation of physiological systems
UNIT I  INTRODUCTION TO PHYSIOLOGICAL MODELING  9
Approaches to modelling: The technique of mathematical modelling, classification of models, characteristics of models. Time invariant and time varying systems for physiological modelling. Introduction to physiology (homeostasis, cell biology) Modelling physical systems, linear models of physiological systems, the Laplace transform, Transfer functions and block diagram analysis Physiology.

UNIT II  MODELING OF DYNAMIC PHYSIOLOGICAL SYSTEM  9
Dynamic systems and their control, modelling and block diagrams, the pupil control systems(Human Eye), general structure of control systems, the dynamic response characteristics of the pupil control system, open & close loop systems instability, automatic aperture control.

UNIT III  NONLINEAR MODELS OF PHYSIOLOGICAL SYSTEMS  9

UNIT IV  COMPARTMENTAL PHYSIOLOGICAL MODEL  9
Modeling the body as compartments, behaviour in simple compartmental system, pharmacokinetic model, and multi compartmental system. Physiological modelling: Electrical analogy of blood vessels, model of systematic blood flow and model of coronary circulation. Mathematical modelling of the system: Thermo regulation, Thermoregulation of cold bloodedness & warm bloodedness, the anatomy of thermo regulation, lumping & partial differential equations, heat transfer examples, mathematical model of the controlled process of the body.

UNIT V  SIMULATION OF PHYSIOLOGICAL SYSTEMS  9
Simulation of physiological systems using Open CV / MATLAB software. Biological receptors: - Introduction, receptor characteristics, transfer function models of receptors, receptor and perceived intensity. Neuromuscular model, Renal System, Drug Delivery Model.

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

CO1: Explain the application of Physiological models
CO2: Describe the methods and techniques for analysis and synthesis of Linear and dynamic system
CO3: Develop differential equations to describe the compartmental physiological model
CO4: Describe Nonlinear models of physiological systems
CO5: Illustrate the Simulation of physiological systems

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES
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CBM333 ASSISTIVE TECHNOLOGY L T P C

COURSE OBJECTIVES:
The student should be made to:

- To know the hardware requirement various assistive devices
- To understand the prosthetic and orthotic devices
- To know the developments in assistive technology

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

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

UNIT III HEARING AIDS 9
Common tests – audiograms, air conduction, bone conduction, masking techniques, SISI, Hearing aids – principles, drawbacks in the conventional unit, DSP based hearing aids.

UNIT IV PROSTHETIC AND ORTHODIC DEVICES 9
Hand and arm replacement – different types of models, externally powered limb prosthesis, feedback in orthotic system, functional electrical stimulation, sensory assist devices.

UNIT V RECENT TRENDS 9
Transcutaneous electrical nerve stimulator, bio-feedback

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.

TOTAL: 45 PERIODS
TEXT BOOKS

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

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CBM346 ERGONOMICS L T P C 3 0 0 3

COURSE OBJECTIVE
- To get exposed to principles of visual capabilities.
- To learn the mechanics of muscle physiology and significance of rest cycle.
- To learn spatial compatibility and the relation between control orders and control response.
- To know about the measurements and proportions of the human body.
- To be familiar with the mathematical models, analysis and design of biomedical devices using case studies.

UNIT I VISUAL AND AUDITORY ERGONOMICS

UNIT II MUSCLE PHYSIOLOGY
UNIT III  CONTROLS AND DISPLAYS  9
Spatial compatibility and physical arrangement of displays and controls - Design of displays and controls – movement capability – rotary controls and rotor displays – movement of displays orientation of the operator and movement relationships control orders and control responses – human limitations in tracking task

UNIT IV  ANTHROPOMETRY  9
Anthropometry – anthropometric design principles – Physical work load and energy expenditure - work space envelope – factors in design of work space surfaces – principles of seat design – principles of control panel. ergonomic implications. Organization classification of human errors theories of accident causation-reducing accidents by altering behavior.

UNIT V  CASE STUDIES  9
Case Study 1: computer design, control panel design of an electronic instrument, computer key board, hand drill etc.
Case Study 2: Biomedical Application, Design optimization of Medical Equipment.

COURSE OUTCOMES:
At the end of the course student will be able to,
CO1: Understand principles of ergonomics.
CO2: Understand the significance of posture
CO3: Learn about tracking tasks.
CO4: Learn about ergonomics and its implications to various domain
CO5: Perform case studies on electronic instruments and medical equipment.

TEXT BOOKS:

REFERENCES:

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COURSE OBJECTIVES

The objective of this course is to enable the student to
● Expose to basic principles of Haptics and their property.
● Give knowledge on machines in haptics.
● Learn types of sensors and actuators.
● Understand basic concepts of human locomotion, biomechanical analysis using Finite Element Analysis.

UNIT I         HUMAN HAPTICS
Somatosensory System; Motor System, Muscle Physiology; Haptics Psychophysical experiments.

UNIT II         MACHINE HAPTICS
Design Haptic devices; Human factors involved;

UNIT III        HAPTIC SENSORS AND ACTUATORS
barriers in human haptics; Ergonomics.

UNIT IV        COMPUTATIONAL HAPTICS
Haptic Rendering; Rigid bodies, Deformable bodies, Stability Rendering effects, Human performance and evaluation; Biomechanics of manipulation; Neuromuscular Models.

UNIT V         HAPTICS FOR MEDICAL APPLICATIONS
Applications: Telemedicine; Rehabilitation; Medical Simulations for education

TOTAL: 45 PERIODS

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

CO1: Explain the laws of principles of haptics for human
CO2: Discuss the behavior of machines in haptics
CO3: Analyse the suitable sensor and actuator for haptics
CO4: Identify suitable computation for haptics
CO5: Describe the finite element analysis, design the work station depending upon the haptics

TEXT BOOKS:


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CBM335    BIOSIGNAL PROCESSING    L T P C
          3 0 0 3

**COURSE OBJECTIVES:**
The student should be made to:
- To study the characteristics of different biosignals
- To learn linear and non-linear filtering techniques to extract desired information
- To understand various techniques for automated classification and decision making to aid diagnosis

**UNIT I    BIOSIGNAL AND SPECTRAL CHARACTERISTICS**    9

**UNIT II    TIME SERIES ANALYSIS AND SPECTRAL ESTIMATION**    9

**UNIT III    ADAPTIVE FILTERING AND WAVELET DETECTION**    9
Filtering – LMS adaptive filter, adaptive noise canceling in ECG, improved adaptive filtering in ECG, Wavelet detection in ECG – structural features, matched filtering, adaptive wavelet detection, detection of overlapping wavelets.
UNIT IV  BIOSIGNAL CLASSIFICATION AND RECOGNITION  9

UNIT V  TIME FREQUENCY AND MULTIVARIATE ANALYSIS  9
Time frequency representation, spectrogram, Wigner distribution, Time-scale representation, scalogram, wavelet analysis – Data reduction techniques, ECG data compression, ECG characterization, Feature extraction- Wavelet packets, Multivariate component analysis-PCA,ICA.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Preprocess the Biosignals.
CO2: Analyze biosignals in time domain & to estimate the spectrum.
CO3: Apply wavelet detection techniques for biosignal processing.
CO4: Classify Biosignals using neural networks and statistical classifiers.
CO5: Extract the features using multivariate component analysis.

TOTAL: 45 PERIODS

TEXT BOOKS

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COURSE OBJECTIVES:

- To review image processing techniques for computer vision.
- To understand various features and recognition techniques
- To learn about histogram and binary vision
- Apply three-dimensional image analysis techniques
- Study real world applications of computer vision algorithms

UNIT I  INTRODUCTION

6


UNIT II  FEATURE EXTRACTION

6

Feature Extraction - Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space 69 Analysis - Image Pyramids and Gaussian derivative filters, Gabor Filters.

UNIT III  COLOR IMAGES, BINARY VISION

6


UNIT IV  3D VISION

6


UNIT V  MOTION

6


30 PERIODS

PRACTICALS:

1. Document Image Analysis
2. Biometrics based Recognition
3. Object Recognition
4. Object Tracking
5. Medical Image Analysis
6. Content-Based Image Retrieval
7. Video Data Processing

30 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: explain low level processing of image and transformation techniques applied to images.
CO2: develop the feature extraction and object recognition methods
CO3: apply Histogram transform for detection of geometric shapes like line, ellipse and objects.
CO4: illustrate 3D vision process and motion estimation techniques.
CO5: apply vision techniques to real time applications.

TOTAL: 60 PERIODS
TEXT BOOKS

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CBM366 SPEECH AND AUDIO SIGNAL PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVES
The objective of this course is to enable the student to
- Provide students with basic knowledge about speech production and hearing.
- Understand time-frequency analysis concepts.
- Learn fundamentals of audio coding and transform coders.
- Understand time and frequency domain methods for speech processing.
- Study linear predictive analysis of speech.

UNIT I MECHANICS OF SPEECH AND AUDIO
9

UNIT II TIME-FREQUENCY ANALYSIS: FILTER BANKS AND TRANSFORMS 9
Introduction - Analysis-Synthesis Framework for M-band Filter Banks- Filter Banks for Audio Coding: Design Considerations - Quadrature Mirror and Conjugate Quadrature Filters- Tree-Structured QMF and CQF M-band Banks - Cosine Modulated “Pseudo QMF” M-band Banks -
Cosine Modulated Perfect Reconstruction (PR) M-band Banks and the Modified Discrete Cosine Transform (MDCT) - Discrete Fourier and Discrete Cosine Transform - Pre-echo Distortion- Pre-echo Control Strategies.

UNIT III AUDIO CODING AND TRANSFORM CODERS


UNIT IV TIME AND FREQUENCY DOMAIN

Time domain parameters of Speech signal – Methods for extracting the parameters: Energy, Average Magnitude – Zero crossing Rate – Silence Discrimination using ZCR and energy Short Time Fourier analysis – Formant extraction – Pitch Extraction using time and frequency domain methods


UNIT V LINEAR PREDICTIVE ANALYSIS


TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students will be able to
CO1: Examine auditory models to design perceptual audio quality measure.
CO2: Design analysis-by-synthesis model for speech perception.
CO3: Analyze and design algorithms for speech and audio coding.
CO4: Analyze and design algorithms for extracting parameters from the speech signal.
CO5: Implement pitch detection and formant analysis in speech signals.

TEXT BOOKS


REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM355  MEDICAL IMAGING SYSTEMS

COURSE OBJECTIVES:
- To understand the generation of X-ray and its uses in Medical imaging
- To describe the principle of Computed Tomography.
- To know the techniques used for visualizing various sections of the body.
- To learn the principles of different radio diagnostic equipment in Imaging.
- To discuss the radiation therapy techniques and radiation safety

UNIT I  X RAYS

UNIT II  COMPUTED TOMOGRAPHY

UNIT III  MAGNETIC RESONANCE IMAGING
Fundamentals of magnetic resonance- properties of electromagnetic waves : speed, amplitude, phase, orientation and waves in matter - Interaction of Nuclei with static magnetic field and Radio frequency wave- rotation and precession – Induction of magnetic resonance signals – bulk magnetization – Relaxation processes T1 and T2. Block Diagram approach of MRI system – system magnet (Permanent, Electromagnet and Superconductors), generations of gradient magnetic fields, Radio Frequency coils (sending and receiving), shim coils, Electronic components, fMRI.

UNIT IV  NUCLEAR IMAGING

UNIT V RADIATION THERAPY AND RADIATION SAFETY


TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to:
CO1: Describe the working principle of the X-ray machine and its application.
CO2: Illustrate the principle computed tomography
CO3: Interpret the technique used for visualizing various sections of the body using Magnetic Resonance Imaging.
CO4: Demonstrate the applications of radionuclide imaging.
CO5: Analyze different imaging techniques and choose appropriate imaging equipment for better diagnosis and outline the methods of radiation safety.

TEXT BOOKS:
2. Jacob Beutel (Editor), M. Sonka (Editor), Handbook of Medical Imaging, Volume 2. Medical Image Processing and Analysis, SPIE Press 2000

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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CBM342 BRAIN COMPUTER INTERFACE AND APPLICATIONS

L T P C
3 0 0 3

COURSE OBJECTIVES:
The student should be made to:
- To understand the basic concepts of brain computer interface
- To study the various signal acquisition methods
• To study the signal processing methods used in BCI

UNIT I INTRODUCTION TO BCI

UNIT II ELECTROPHYSIOLOGICAL SOURCES

UNIT III FEATURE EXTRACTION METHODS

UNIT IV FEATURE TRANSLATION METHODS

UNIT V APPLICATIONS OF BCI

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Describe BCI system and its potential applications.
CO2: Analyze event related potentials and sensory motor rhythms.
CO3: Compute features suitable for BCI.
CO4: Design classifier for a BCI system.
CO5: Implement BCI for various applications.

TOTAL:45 PERIODS

TEXT BOOKS

REFERENCES

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COURSE OBJECTIVES:
To Study about:
- To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues.
- To understand the general principles of design of biometric systems and the underlying trade-offs.
- To study the technologies of fingerprint, iris, face and speech recognition.
- To study of evaluation of biometrics systems.

UNIT I  INTRODUCTION TO BIOMETRICS  9
Introduction and back ground – biometric technologies – passive biometrics – active biometrics – Biometric characteristics, Biometric applications – Biometric Authentication systems- Taxonomy of Application Environment, Accuracy in Biometric Systems- False match rate- False non match rate- Failure to enroll rate- Derived metrics-Biometrics and Privacy.

UNIT II  FINGERPRINT TECHNOLOGY  9
History of fingerprint pattern recognition - General description of fingerprints- fingerprint sensors, fingerprint enhancement, Feature Extraction- Ridge orientation, ridge frequency, fingerprint matching techniques- correlation based, Minutiae based, Ridge feature based, fingerprint classification, Applications of fingerprints, Finger scan- strengths and weaknesses, Evaluation of fingerprint verification algorithms.

UNIT III  FACE RECOGNITION AND HAND GEOMETRY  9

UNIT IV  IRIS RECOGNITION  9
Introduction, Anatomical and Physiological underpinnings, Iris sensor, Iris representation and localization- Daugman and Wilde’s approach, Iris matching, Iris scan strengths and Weaknesses, System performance, future directions.

UNIT V  VOICE SCAN AND MULTIMODAL BIOMETRICS  9
Voice scan, speaker features, short term spectral feature extraction, Mel frequency cepstral coefficients, speaker matching, Gaussian mixture model, NIST speaker Recognition Evaluation Program, Introduction to multimodal biometric system – Integration strategies – Architecture – level of fusion – combination strategy, examples of multimodal biometric systems, Securing and trusting a biometric transaction – matching location – local host - authentication server – match on card (MOC).

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Demonstrate the principles of biometric systems.
CO2: Develop fingerprint recognition technique.
CO3: Design face recognition and hand geometry system.
CO4: Design iris recognition system.
CO5: Develop speech recognition and multimodal biometric systems.

**TEXT BOOKS**

**REFERENCES**

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**CBM354 COMMUNICATION SYSTEMS**

**COURSE OBJECTIVES:**
The student should be made to:
- To study the various analog and digital modulation techniques
- To study the principles behind various error control coding
- To study the various digital communication techniques

**UNIT I ANALOG MODULATION**
Amplitude Modulation – AM, DSBSC, SSBSC, VSB – Angle modulation – PM and FM – Modulators and Demodulators

**UNIT II RECEIVER CHARACTERISTICS**

**UNIT III INFORMATION THEORY**
UNIT IV  BANDPASS SIGNALING  9
Geometric representation of signals – Correlator and matched filter – ML detection – generation and detection, PSD, BER of coherent BPSK, BFSK, QPSK – Principles of QAM – Structure of non-coherent receivers – BFSK, DPSK

UNIT V  ERROR CONTROL CODING TECHNIQUES  9
Channel coding theorem – Linear block codes – Hamming codes – Cyclic codes (CRC) – Convolutional codes – Viterbi decoding (Soft/Hard decision decoding).

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: comprehend and appreciate the significance and role of this course in the present contemporary world.
CO2: Apply analog modulation techniques.
CO3: Apply digital modulation techniques.
CO4: Knowledge on various types of noises during transmission.
CO5: Analyze various error control coding techniques.

TOTAL: 45 PERIODS

TEXT BOOKS

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CBM370  WEARABLE DEVICES  L T P C
WEARABLE DEVICES  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

UNIT II SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES
Wearability issues -physical shape and placement of sensor, Technical challenges - sensor design, signal acquisition, sampling frequency for reduced energy consumption, Rejection of irrelevant information. Power Requirements- Solar cell, Vibration based, Thermal based, Human body as a heat source for power generation, Hybrid thermoelectric photovoltaic energy harvests, Thermopiles.

UNIT III WIRELESS HEALTH SYSTEMS

UNIT IV SMART TEXTILE

UNIT V APPLICATIONS OF WEARABLE SYSTEMS
Medical Diagnostics, Medical Monitoring-Patients with chronic disease, Hospital patients, Elderly patients, neural recording, Gait analysis, Sports Medicine.

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

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

### CBM341 BODY AREA NETWORKS

#### COURSE OBJECTIVES:
The student should be made to:
- To know the hardware requirement of BAN
- To understand the communication and security aspects in the BAN
- To know the applications of BAN in the field of medicine

#### UNIT I INTRODUCTION

#### UNIT II HARDWARE FOR BAN

#### UNIT III WIRELESS COMMUNICATION AND NETWORK
RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand–Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1,IEEE P802.15.13, IEEE 802.15.14, Zigbee.

#### UNIT IV COEXISTENCE ISSUES WITH BAN
Interferences – Intrinsic - Extrinsic, Effect on transmission, Counter measures- on physical layer and data link layer, Regulatory issues-Medical Device regulation in USA and Asia, Security and Self-protection-Bacterial attacks, Virus infection, Secured protocols, Self-protection.

#### UNIT V APPLICATIONS OF BAN
Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrythmias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

#### COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Comprehend and appreciate the significance and role of this course in the present contemporary world.

CO2: Design a BAN for appropriate application in medicine.

CO3: Assess the efficiency of communication and the security parameters.

CO4: Understand the need for medical device regulation and regulations followed in various regions.

CO5: Extend the concepts of BAN for medical applications.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

CO’s - PO’s & PSO’s MAPPING

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CBM369 VIRTUAL REALITY AND AUGMENTED REALITY IN HEALTHCARE L T P C 3 0 0 3

COURSE OBJECTIVES
The objective of this course is to enable the student to:
- Introduce the relevance of this course to the existing technology through demonstrations, case studies and applications with a futuristic vision along with socio-economic impact and issues.
- Understand virtual reality, augmented reality and using them to build Biomedical engineering applications.
- Know the intricacies of these platforms to develop PDA applications with better optimality.
- Learn the various applications of VR.
- Learn the possibilities of implementing target-specific VR applications on mobile.

UNIT I INTRODUCTION
UNIT II VR DEVELOPMENT PROCESS 9
Geometric modeling - kinematics modeling - physical modeling - behaviour modeling - model management.

UNIT III CONTENT CREATION CONSIDERATIONS 9
Methodology and terminology-user performance studies-VR health and safety issues-Usability of virtual reality system- cyber sickness -side effects of exposures to virtual reality environment

UNIT IV VR ON THE WEB & VR ON THE MOBILE 10

UNIT V APPLICATIONS 8
Medical applications-military applications-robotics applications- Advanced Real time Tracking-other applications- games, movies, simulations, therapy

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Analyze and Design a system or process to meet given specifications with realistic engineering constraints.
CO2: Identify problem statements and function as a member of an engineering design team.
CO3: Analyze the implications and issues pertaining to VR
CO4: Propose technical documents and give technical oral presentations related to design VR mini project results.
CO5: Develop simple and portable VR applications using appropriate software.

TEXT BOOKS

REFERENCES
ONLINE RESOURCES

1. http://www.vrtechnology.org/resources.html

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CBM367  TELEHEALTH TECHNOLOGY  L T P C

COURSE OBJECTIVES:
- Learn the key principles for telemedicine and health
- Understand telemedical technology.
- Know telemedical standards, mobile telemedicine and its applications

UNIT I  FUNDAMENTALS OF TELEMEDICINE  6

UNIT II  TYPE OF INFORMATION & COMMUNICATION INFRASTRUCTURE FOR TELEMEDICINE  6
Audio, video, still images, text and data, internet, air/wireless communications, GSM satellite, microwave, Mobile health and ubiquitous healthcare.

UNIT III  ETHICAL AND LEGAL ASPECTS OF TELEMEDICINE  6
Confidentiality, patient rights and consent: confidentiality and the law, the patient-doctor relationship, access to medical records, consent treatment - data protection & security, jurisdictional issues.

UNIT IV  PICTURE ARCHIVING AND COMMUNICATION SYSTEM  6
Introduction to radiology information system and ACS, DICOM, PACS strategic plan and needs assessment, technical Issues, PACS architecture.

UNIT V  APPLICATIONS OF TELEMEDICINE  6
Teleradiology, telepathology, telecardiology, teleoncology, teledermatology, telesurgery.

30 PERIODS

PRACTICALS:
1. Porting sensor data on mobile devices
2. IoT for healthcare monitoring
3. Porting medical data on cloud platform
4. Cloud computing applications in health informatics
5. Study of telemedicine tools
6. Design of an application for mobile devices
COURSE OUTCOMES:
CO1: To analyze the benefits and limitations of telemedicine.
CO2: To apply multimedia technologies in telemedicine.
CO3: To explain protocols behind encryption techniques for secure transmission of data.
CO4: To develop radiology based information system.
CO5: To apply telemedicine in various healthcare domains.

TEXT BOOKS

REFERENCES

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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 9
Introduction - Structure of Medical Informatics – Internet and Medicine - Security issues ,
Computer based medical information retrieval, Hospital management and information system,
Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics,
Bioinformatics

UNIT II    COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9
Automated clinical laboratories-Automated methods in hematology, cytology and histology,
Intelligent Laboratory Information System - Computerized ECG, EEG and EMG, 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 - History taking by computer, Dialogue with the computer, 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
Neurocomputers and Artificial Neural Networks application, Expert system-General model of CMD,
Computer-assisted decision support system rule system cognitive model, semantic networks,
decision 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.

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Explain the structure and functional capabilities of Hospital Information System.
CO2: Describe the need of computers in medical imaging and automated clinical laboratory.
CO3: Articulate the functioning of information storage and retrieval in computerized patient record system.
CO4: Apply the suitable decision support system for automated clinical diagnosis.
CO5: Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

REFERENCES:

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CBM334 BIO MEMS

UNIT I MEMS MATERIALS AND FABRICATION
Semiconductor materials; photo lithography; doping; thin film growth and deposition; CVD and Ion Implantation, metallization; wet and dry etching; silicon micromachining; metal MEMS processes; submicron optical lithography; electron beam lithography; soft lithography and printing.

UNIT II MECHANICAL AND THERMAL SENSORS AND ACTUATORS
Mechanical sensors and actuators – beam and cantilever –microplates, strain, pressure and flow measurements, Thermal sensors and actuators- actuator based on thermal expansion, thermal couples, thermal resistor, Shape memory alloys- Inertia sensor, flow sensor.

UNIT III ELECTROSTATIC AND PIEZOELECTRIC SENSORS AND ACTUATOR
Electrostatic sensors and actuators- Inertia sensor, Pressure sensor, flow sensor, tactile sensor, comb drive. Piezoelectric sensor and actuator – inchworm motor, inertia sensor, flow sensor.

UNIT IV MICROFLUIDIC SYSTEMS
Laminar flow in circular conduits, fluid flow in micro conduits, in submicrometer and nanoscale. microfluidic components (filters, mixers, valves, and pumps)

UNIT V APPLICATIONS OF BIOMEMS
CAD for MEMS,DNA sensor, MEMS based drug delivery. Biosensors- sensors for glucose, uric acid, urea and triglyceride sensor. Introduction to the MATLAB/Simulink/ CAD tool for modelling/simulations of bioelectronics systems.

TOTAL: 30 Theory+15 lab PERIODS

LABORATORY EXPERIMENTS
1. Modeling and Simulation of MEMS sensors Using MATLAB (SIMULINK) such as Accelerometer, Current and Voltage Sensor.
2. Design of 3D CAD of BIOMEMS sensors.
3. Analysis of 3D CAD of BIOMEMS sensor.

**COURSE OUTCOMES**

On successful completion of this course, the student will be able to

**CO1**: Summarize various MEMS fabrication techniques.

**CO2**: Elucidate different types of mechanical and thermal sensors and actuators and their principles of operation at the micro Scale level.

**CO3**: Describe different types of various electrostatic and piezoelectric sensors and actuators and their principles of operation at the micro Scale level.

**CO4**: Explain microfluidic systems.

**CO5**: Illustrate MEMS in different field of medicine.

**TEXT BOOKS:**


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**CBM344 CRITICAL CARE AND OPERATION THEATRE EQUIPMENT**

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**COURSE OBJECTIVES:**

The student should be made to:

- To offer clear understanding of various intensive care equipment and their working.
- To understand the necessity of different operation theatre equipment.
- To know about different dialyzers and ventilators.
UNIT I INTENSIVE CARE UNIT EQUIPMENT
Suction apparatus, Different types; Sterilizers, Chemical, Radiation, Steam for small and large units. ICU ventilators. Automated drug delivery systems, Infusion pumps, components of drug infusion system, closed loop control infusion system, implantable infusion system. BMD Measurements – SXA – DXA - Quantitative ultrasound bone densitometer

UNIT II CRITICAL CARE EQUIPMENT
Defibrillators, Hemodialysis Machine, Different types of Dialyzers, Membranes, Machine controls and measurements. Heart Lung Machine, different types of oxygenators, peristaltic pumps, Incubators.

UNIT III OPERATION THEATRE EQUIPMENT

UNIT IV CENTRALISED SYSTEMS

UNIT V PATIENT SAFETY
Patient electrical safety, Types of hazards, Natural protective mechanisms against electricity, Leakage current, Inspection of grounding and patient isolation, Hazards in operation rooms, ICCU and IMCUs, Opto couplers and Pulse transformers.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Apply the knowledge acquired, in designing new monitoring devices for ICU and assist the medical personnel’s during emergency situations
CO2: Suggest suitable surgical instruments and operational devices.
CO3: Compare the various techniques for clinical diagnosis, therapy and surgery, and its recent methods
CO4:: Assess the merits of the operation theatre equipment based on its applications
CO5: Design the devices for the particular application based on given specifications.

TOTAL:45 PERIODS

TEXT BOOKS

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CBM352 HUMAN ASSIST DEVICES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To study the role and importance of machines that takes over the functions of the heart and lungs,
- To study various mechanical techniques that help a non-functioning heart.
- To learn the functioning of the unit which does the clearance of urea from the blood
- To understand the tests to assess the hearing loss and development of electronic devices to compensate for the loss.
- To study about recent techniques used in modern clinical applications

UNIT I HEART LUNG MACHINE AND ARTIFICIAL HEART
Condition to be satisfied by the H/L System. Different types of Oxygenators, Pumps, Pulsatile and Continuous Types, Monitoring Process, Shunting, The Indication for Cardiac Transplant, Driving Mechanism, Blood Handling System, Functioning and different types of Artificial Heart, Schematic for temporary bypass of left ventricle.

UNIT II CARDIAC ASSIST DEVICES
Assisted through Respiration, Right and left Ventricular Bypass Pump, Auxiliary ventricle, Open Chest and Closed Chest type, Intra Aortic Balloon Pumping, Prosthetic Cardiac valves, Principle of External Counter pulsation techniques.

UNIT III ARTIFICIAL KIDNEY
Indication and Principle of Haemodialysis, Membrane, Dialysate, types of filter and membranes, Different types of hemodialyzers, Monitoring Systems, Wearable Artificial Kidney, Implanting Type.

UNIT IV RESPIRATORY AND HEARING AIDS
Ventilator and its types-Intermittent positive pressure, Breathing Apparatus Operating Sequence, Electronic IPPB unit with monitoring for all respiratory parameters. Types of Deafness, Hearing Aids, SISI, masking techniques, wearable devices for hearing correction.

UNIT V RECENT TRENDS
Transcutaneous electrical nerve stimulator, bio-feedback, Diagnostic and point-of-care platforms.
COURSE OUTCOMES:
At the end of this course the students will be able to:

CO1: Explain the principles and construction of artificial heart
CO2: Understand various mechanical techniques that improve therapeutic technology
CO3: Explain the functioning of the membrane or filter that cleanses the blood.
CO4: Describe the tests to assess the hearing loss and development of wearable devices for the same.
CO5: Analyze and research on electrical stimulation and biofeedback techniques in rehabilitation and physiotherapy.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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CBM365  
ROBOTICS IN MEDICINE  
L T P C  
3 0 0 3

COURSE OBJECTIVES

The objective of this course is to enable the student to:

- Get introduced to the fundamental of robotics and position analysis
- Learn about Parallel robots, different types of motions and force analysis
- Know the basics of trajectory planning. Motion control systems and actuators
- Have an insight into various sensors and vision systems
- Be acquainted to Fuzzy control and Applications of Robotics in Medicine

UNIT I  
FUNDAMENTALS AND POSITION ANALYSIS  
9

Fundamentals – Classification, Advantages and disadvantages, Components, Degrees of freedom, Joints, Coordinates, Reference frames, Programming modes, Characteristics, Workspace,
Languages, Collaborative robots, Position analysis – Robots as mechanisms, Conventions, Transformations, Forward and inverse kinematics, Denavit Hartenberg Representation, Degeneracy and Dexterity, Screw based robots, Position analysis of Articulated robot Case studies

UNIT II PARALLEL ROBOTS, DIFFERENTIAL MOTIONS AND FORCE ANALYSIS  9
Parallel robots – Physical characteristics, Forward and Inverse Kinematic approaches, Planar and Spatial parallel robots, Differential relationships, The Jacobian, Large scale motions, Frame vs Robot, Differential motions and change, Hand frame, Operator, Jacobian and Inverse for Screw based and Parallel Robots, Differential operator, Lagrangian mechanics, Moments of Inertia, Dynamic Equations of Multiple DOF Robots, Static force analysis, Transformation of forces and moments between coordinate framesCase studies

UNIT III TRAJECTORY PLANNING, MOTION CONTROL SYSTEMS AND ACTUATORS10
Path and Trajectory, Joint Space and Cartesian Space Descriptions and Trajectory Planning, Cartesian, Trajectory Recording, Basics, Block diagrams, Laplace Transform, Block diagram Algebra, Transfer Functions, Characteristic equation, Steady state error, Root locus, Proportional, Integral and Derivative controllers, Compensators, Bode, Loops, Multiple IO systems, Control - State space and Digital, Nonlinear systems, Characteristics of Hydraulic, Pneumatic, Electric motors, Other actuators, Speed reductionCase studies

UNIT IV SENSORS, IMAGE PROCESSING AND ANALYSIS WITH VISION SYSTEMS  9

UNIT V FUZZY CONTROL AND APPLICATIONS IN MEDICINE 8
Fuzzy control - Crisp vs Fuzzy, Sets, Inference rules, Defuzzification, Simulation, Applications in Biomedical Engineering, Applications in rehabilitation, Nanobots in medicine, Clinical diagnosis and Surgery – Cardiac and abdominal procedures with teleoperated robots, Orthopedic surgery with cooperative robotsCase studies

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students will be able to
CO1: Describe the fundamental of robotics and position analysis
CO2: Outline the functioning of parallel robots, different types of motions and force analysis.
CO3: Portray the basics of trajectory planning, Motion control systems and actuators.
CO4: Recognize and explain the use of various sensors and vision systems in robotics.
CO5: Employ Fuzzy control in robotics and apply it to Robotics in Medicine

TEXT BOOKS
REFERENCES

ONLINE RESOURCES
2. https://onlinecourses.nptel.ac.in/noc21_me49/preview

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CBM368 THERAPEUTIC EQUIPMENT

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COURSE OBJECTIVES:
- To learn the principles of cardiac assist devices.
- To understand the need and use of extracorporeal devices, and the use of lasers in medicine.
- To enable the students to gain knowledge on the working of therapeutic clinical equipment.

UNIT I CARDIAC AND RESPIRATORY THERAPY EQUIPMENT
Cardiac Pacemaker: Internal and External Pacemaker– Programmable pacemakers. Cardiac Defibrillators: AC and DC Defibrillator- Internal and External Defibrillators - Protection Circuit, Defibrillator analyzers. Cardiac ablation catheter.

UNIT II BIOMECHANICAL THERAPEUTIC EQUIPMENT
Electrodiagnosis, Therapeutic radiation, Electrotherapy, Electrodes, Stimulators for Nerve and Muscle, Functional Electrical Stimulation. peripheral nerve stimulator, ultrasonic stimulators, Stimulators for pain and relief - Inferential Therapy Unit, TENS. GAIT Assessment and Therapy. Continuous Passive Motion unit, Cervical / Lumber Traction Machine -Traction Table.
UNIT III BODY CARE EQUIPMENT

UNIT IV DENTAL CARE EQUIPMENT

UNIT V HEAT & PHOTON THERAPY EQUIPMENT
High frequency heat therapy, Principle, Short wave diathermy, Microwave diathermy, Ultrasonic therapy, Lithotripsy. Therapeutic UV and IR Lamps. Basic principles of Biomedical LASERS: Applications of lasers in medicine, CO2laser, He-Ne laser, Nd-YAG and Ruby laser.

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Suggest suitable therapeutic devices for ailments related to cardiology, pulmonology, neurology, etc
CO2: Comprehend the principles of bodycare equipment
CO3: Understand the operation of dental care equipment.
CO4: Analyze the different types of therapies for suitable applications.
CO5: Appreciate the application of lasers in biomedical applications.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCES

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UNIT I  DIGITAL HEALTH
Digital Health: Requirements and best practices, Laws and regulations in Digital health, Ethical issues, barriers and strategies for innovation.

UNIT II  DIGITAL RADIOLOGY
Digital radiology for digital hospital, picture archiving and communication, system integration, digital history of radiology, medical image archives, storage and networks.

UNIT III  E-HEALTH
E-Health: Health care networking, medical reporting using speech recognition, physiological tests and functional diagnosis with digital methods, tele-consultation in medicine and radiology.

UNIT IV  M-HEALTH CARE AND WEARABLE DEVICES
Introduction to mobile healthcare devices-economy-average length of stay in hospital, outpatient care, health care costs, mobile phones, 4G, smart devices, wearable devices, Uptake of e-health and m-health technologies. Standards, system Design and case study.

UNIT V  MODALITY AND STANDARDS FOR INTER-OPERABILITY

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Interpret the need for digital methods of handling medical records
CO2: Explain the digital radiology
CO3: Modify the tools and methods for work flow in E-Health
CO4: Identify the available technology for wearable healthcare devices
CO5: Compare various standards for inter-operability of devices, quality and safety standards for developing healthcare systems

TOTAL:45 PERIODS

TEXT BOOKS

REFERENCES

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

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS  

UNIT II  PLANNING  

UNIT III  ORGANISING  

UNIT IV  DIRECTING  

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

TOTAL: 45 PERIODS

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

**CO5**: Ability to understand management concept of controlling.

**TEXT BOOKS:**

**REFERENCES:**

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**GE3752 TOTAL QUALITY MANAGEMENT**

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

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

**UNIT II TQM PRINCIPLES**
Continuous process improvement – Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I

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

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

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

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TEXT BOOK:

REFERENCES:
3. Oakland, J. S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford,
GE3753 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING

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

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

UNIT II PRODUCTION AND COST ANALYSIS

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

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GE3754                                    HUMAN RESOURCE MANAGEMENT        L T P C
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COURSE OBJECTIVE:
- To provide knowledge about management issues related to staffing,
- To provide knowledge about management issues related to training,
- To provide knowledge about management issues related to performance
- To provide knowledge about management issues related to compensation
- To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT I      INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

UNIT II     HUMAN RESOURCE PLANNING

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

UNIT V PERFORMANCE EVALUATION AND CONTROL

TOTAL: 45 PERIODS

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

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GE3755 KNOWLEDGE MANAGEMENT

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

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

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

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

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

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TEXT BOOK:
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GE3792  INDUSTRIAL MANAGEMENT

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COURSE OBJECTIVES

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

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

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

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

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

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

TOTAL: 45 PERIODS

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

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

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

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

CO4 Discuss the organizational theory in professional organization.

CO5 Apply principles of productivity and modern concepts in management in professional organization.

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MANDATORY COURSES I
MX3081 INTRODUCTION TO WOMEN AND GENDER STUDIES L T P C
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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

COURSE 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**

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

**Theme - A: The Component of Films**

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

**Theme - B: Evolution of Film Language**

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

B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation

C-1: Realist theory; Auteurists
C-2: Psychoanalytic, Ideological, Feminists
C-3: How to read films?

C-4: Film Criticism / Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films
D-2: Representative Japanese films
D-3: Representative Italian films

D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era
E-2: The important films made by the directors
E-3: The regional films

E-4: The documentaries in India

READING:

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

MX3084 DISASTER RISK REDUCTION AND MANAGEMENT L T P C

COURSE OBJECTIVE

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

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals
UNIT II DISASTER RISK REDUCTION (DRR) 9
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 9
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 9

UNIT V DISASTER MANAGEMENT: CASE STUDIES 9
Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES

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

CO’s-PO’s & PSO’s MAPPING

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MANDATORY COURSES II

MX3085 WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA

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

UNIT I  HEALTH AND ITS IMPORTANCE

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

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


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

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

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


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

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

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

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

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

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

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

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


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

**Immunity** - Types and importance - Ways to develop immunity

**UNIT V YOGA**

**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/
COURSE OUTCOMES:
After completing the course, the students will be able to:
CO1: Learn the importance of different components of health
CO2: Gain confidence to lead a healthy life
CO3: Learn new techniques to prevent lifestyle health disorders
CO4: Understand the importance of diet and workouts in maintaining health

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

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

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

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

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)

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

COURSE TOPICS:
Considerations for humane society, holistic thought, human being’s desires, harmony in self, harmony in relationships, society, and nature, societal systems. (9 lectures, 1 hour each)

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

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

(Refs: Adam Smith, J S Mill)

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

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

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

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

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

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. (3 lectures)

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. (4 lectures) (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)
Conclusion (2 lectures)

Total lectures: 39

Preferred Textbooks: See Reference Books

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

GRADING:

- Mid sems: 30
- End sem: 20
- Home Assign: 10
- Term paper: 40

TOTAL: 45 PERIODS

COURSE OUTCOME:

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

MX3088 STATE, NATION BUILDING AND POLITICS IN INDIA

COURSE 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:


TOTAL : 45 PERIODS

MX3089 INDUSTRIAL SAFETY L T P C 3 0 0 0

COURSE OBJECTIVES

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

UNIT I SAFETY TERMINOLOGIES

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

UNIT III SAFETY ACTIVITIES

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

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

TOTAL : 45 PERIODS

COURSE OUTCOMES
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
Indian Standard code of practice on occupational safety and health audit
Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006
https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

**CO’s-PO’s & PSO’s MAPPING**

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**Industrial safety**

1 - low, 2 - medium, 3 - high, '-' - no correlation
OPEN ELECTIVE I

OAS351 SPACE SCIENCE L T P C 3 0 0 3

COURSE OBJECTIVES:

- To outline the space environment and their effects.
- To extend the origin of universe and development.
- To classify the galaxies and their evolution.
- To interpret the variable stars in the galaxies.
- To explain theory of formation of our solar system.

UNIT I INTRODUCTION 9

UNIT II ORIGIN OF UNIVERSE 9
Early history of the universe – Big-Bang and Hubble expansion model of the universe – cosmic microwave background radiation – dark matter and dark energy.

UNIT III GALAXIES 7
Galaxies, their evolution and origin – active galaxies and quasars – Galactic rotation – Stellar populations – galactic magnetic field and cosmic rays.

UNIT IV STARS 10

UNIT V SOLAR SYSTEM 10

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Obtain a broad, basic knowledge of the space sciences.
CO2: Explain the scientific concepts such as evolution by means of natural selection, age of the Earth and solar system and the Big-Bang.
CO3: Describe the main features and formation theories of the various types of observed galaxies, in particular the Milky Way.
CO4: Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories;
CO5: Describe the presently accepted formation theories of the solar system based upon observational and physical constraints;

TEXT BOOKS:

REFERENCES:

OIE351 INTRODUCTION TO INDUSTRIAL ENGINEERING L T P C 3 0 0 3

COURSE OBJECTIVES:
The objective of this course is to provide foundation in Industrial Engineering in order to enable the students to make significant contributions for improvements in diverse organizations.
- Explain the concepts productivity and productivity measurement approaches.
- Explain the basic principles in facilities planning and plant location.
- Apply work study and ergonomic principles to design workplaces for the improvement of human performance.
- Impart knowledge to design and implement Statistical Process control in any industry.
- Recognize the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.

UNIT I INTRODUCTION

UNIT II PLANT LOCATION AND LAYOUT

UNIT III WORK SYSTEM DESIGN& ERGONOMICS

UNIT IV STATISTICAL QUALITY CONTROL
UNIT V  PRODUCTION PLANNING AND CONTROL


TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, Students will be able to
CO1: Ability To define the concepts of productivity and productivity measurement approaches.
CO2: Ability to evaluate appropriate location models for various facility types and design various facility layouts
CO3: Ability To conduct a method study and time study to improve the efficiency of the system.
CO4: Ability to Control the quality of processes using control charts in manufacturing/service industries.
CO5: Ability to define the Planning strategies and Material Requirement Plan.

CO’S- PO’S & PSO’S MAPPING

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

TEXT BOOK:

REFERENCES:
2. Martand Telsang, 2006, Industrial Engineering and Production Management, S. Chand and Company

OBT351  FOOD, NUTRITION AND HEALTH  L T P C  3 0 0 3

COURSE OBJECTIVES:

- Build knowledge and an overview on general aspects of nutrition and health.
- Distinguish the nutritive value of various food items, BMI calculation differentiating super junk, and functional foods in the market.
- To Solve the real-world problems based on nutrition and health.
UNIT-I FOOD AND MICROBIOLOGY OF HEALTH: 9


UNIT-II NUTRIENTS AND FOOD ADDITIVES: 9


UNIT-III NANO FOOD TECHNOLOGY: 9

Nano materials as food components, food packaging and nano materials, policies on usage of nanomaterials in foods. Food product development: steps involved in food product development, shelf-life assessment.

UNIT-IV FOOD RELATED NUTRITIONAL DISORDERS AND ENERGY CALCULATION: 9


UNIT-V CONSUMERS ON GM FOODS AND CONTEMPORARY ISSUES: 9

Global perspective of consumers on GM foods; Major concerns of transgenic, foods GM ingredients in food products. (labeling, bioavailability, safety aspects); regulatory agencies involved in GM foods, Case studies- GM foods.

TOTAL:45 PERIODS

TEXT BOOK(S):


REFERENCE BOOKS:

EXPECTED COURSE OUTCOME:

1. To be able to understand the nutritional values of the various types of foods
2. To be able to Analyze the role of food in the metabolic activity of the healthy diet
3. To be able to Infer the BMI calculation and stress related diseases.
4. To be able to Elaborate the independent decision on the choice of food to prevent life style disorders and diseases
5. To be able to Assess about the food laws governance
6. To be able to Compare junk, modified and super foods

OCE351  ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT  L T P C

3  0  0  3

COURSE OBJECTIVE:
- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects

UNIT I  INTRODUCTION

UNIT II  ENVIRONMENTAL ASSESSMENT
Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives

UNIT III  ENVIRONMENTAL MANAGEMENT PLAN

UNIT IV  SOCIO ECONOMIC ASSESSMENT
Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis-

UNIT V  CASE STUDIES

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The students completing the course will have ability to

- carry out scoping and screening of developmental projects for environmental and social assessments
- explain different methodologies for environmental impact prediction and assessment
- plan environmental impact assessments and environmental management plans
- evaluate environmental impact assessment reports

TEXTBOOKS:

REFERENCES:

OEE351 RENEWABLE ENERGY SYSTEM L T P C 3 0 0 3

COURSE OBJECTIVES:
- To Provide knowledge about various renewable energy technologies
- To enable students to understand and design a PV system.
- To provide knowledge about wind energy system.
- To Provide knowledge about various possible hybrid energy systems
- To gain knowledge about application of various renewable energy technologies

UNIT I INTRODUCTION 9
Primary energy sources, renewable vs. non-renewable primary energy sources, renewable energy resources in India, Current usage of renewable energy sources in India, future potential of renewable energy in power production and development of renewable energy technologies.

UNIT II SOLAR ENERGY 9
UNIT III WIND ENERGY
Wind energy principles, wind site and its resource assessment, wind assessment, Factors influencing wind, wind turbine components, wind energy conversion systems (WECS), Classification of WECS devices, wind electric generating and control systems, characteristics and applications.

UNIT IV BIO-ENERGY

UNIT V OTHER TYPES OF ENERGY
Energy conversion from Hydrogen and Fuel cells, Geo thermal energy Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants and their economics.

COURSE OUTCOMES:
At the end of the course students will be able to:
CO1: Attained knowledge about various renewable energy technologies
CO2: Ability to understand and design a PV system.
CO3: Understand the concept of various wind energy system.
CO4: Gained knowledge about various possible hybrid energy systems
CO5: Attained knowledge about various application of renewable energy technologies

TOTAL: 45 PERIODS

REFERENCES
2. Tiwari and Ghosal/ Narosa,’Renewable energy resources’.

CO’s-PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
- To introduce common unit operations carried out in process industries.
- To impact knowledge about the important unit operations taking place in process industries.
- To prepare them to take up a case study on selected process industries like petrochemical industry, power plant industry and paper & pulp industry to make the students understand the different measurement and control techniques for important processes.
- Facilitate the students to apply knowledge to select appropriate measurement technique and control strategy for a given process.

UNIT - I COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES -I
Unit Operation, Measurement and Control: Transport of solid, liquid and gases - Evaporators – Crystallizers-Dryers.

UNIT -II COMMON UNIT OPERATIONS IN PROCESS INDUSTRIES -II
Unit Operation, Measurement and Control: Distillation – Refrigeration processes – Chemical reactors.

UNIT - III PROCESS MEASUREMENT AND CONTROL IN PETROCHEMICAL INDUSTRY
Process flow diagram of Petro Chemical Industry - Gas oil separation in production platform – wet gas processing – Fractionation Column – Catalytic Cracking unit – Catalytic reforming unit

UNIT - IV PROCESS MEASUREMENT AND CONTROL IN THERMAL POWER PLANT INDUSTRY
Process flow diagram of Coal fired thermal Power Plant– Coal pulverizer - Deaerator – Boiler drum - Superheater – Turbines.

UNIT - V PROCESS MEASUREMENT AND CONTROL IN PAPER & PULP INDUSTRY
Process flow diagram of paper and pulp industry – Batch digestor – Continuous sulphated digestor – Control problems on the paper machine.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)
- Study the characteristics of various processing units involved in chemical plant.
- Develop the process model by using predefined unit operations (e.g. mixing, distillation, heating) from the library of any process simulator.
- Analyse the functioning of each processing units with help of virtual unit operations packages.
- Perform a physical property analysis using simulation packages.
- Implement distillation column analysis using simulation software.
- Create process flow models and diagrams.
COURSE OUTCOMES:
Students able to
CO1 understand common unit operations in process industries. L2
CO2 Identify the dynamics of important unit operations in petro chemical industry. L2
CO3 develop understanding of important processes taking place selected case studies namely petrochemical industry, power plant industry and paper & pulp industry. L5
CO4 Select appropriate measurement techniques for selective processes. L5
CO5 Develop controller structure based on the process knowledge. L5
CO6 Analyze the operation and challenges in integrated industrial processes. L4

TEXT BOOKS:

REFERENCES:

List of Open Source Software/ Learning website:
5. https://www.cocosimulator.org/
6. https://dwsim.fossee.in/

CO’s-PO’s & PSO’s MAPPING

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COURSE OBJECTIVES

- To understand the graph models and basic concepts of graphs.
- To study the characterization and properties of trees and graph connectivity.
- To provide an exposure to the Eulerian and Hamiltonian graphs.
- To introduce Graph colouring and explain its significance.
- To provide an understanding of Optimization Graph Algorithms.

UNIT I  INTRODUCTION TO GRAPHS  9

UNIT II  TREES AND CONNECTIVITY  9
Bridges – Trees – Characterization and properties of trees – Cut vertices – Connectivity.

UNIT III  TRAVERSABILITY  9

UNIT IV  PLANARITY AND COLOURING  9

UNIT V  OPTIMIZATION GRAPH ALGORITHMS  9

TOTAL: 45 PERIODS

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

CO1: Apply graph models for solving real world problem.
CO2: Understand the importance the natural applications of trees and graph connectivity.
CO3: Understand the characterization study of Eulerian graphs and Hamiltonian graphs.
CO4: Apply the graph colouring concepts in partitioning problems.
CO5: Apply the standard optimization graph algorithms in solving application problems.
TEXT BOOKS

REFERENCES

CO’s-PO’s & PSO’s MAPPING

| CO01 | CO02 | CO03 | CO04 | CO05 | CO06 | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
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CCS355  NEURAL NETWORKS AND DEEP LEARNING  L T P C  2 0 2 3

COURSE OBJECTIVES:
• To understand the basics in deep neural networks
• To understand the basics of associative memory and unsupervised learning networks
• To apply CNN architectures of deep neural networks
• To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
• To apply autoencoders and generative models for suitable applications.

UNIT I  INTRODUCTION
Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction-Evolution of Neural Networks-Basic Models of Artificial Neural Network- Important Terminologies of ANNs-Supervised Learning Network.

UNIT II  ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS  6
UNIT III  THIRD-GENERATION NEURAL NETWORKS  

UNIT IV  DEEP FEEDFORWARD NETWORKS  

UNIT V  RECURRENT NEURAL NETWORKS  

LAB EXPERIMENTS:  
1. Implement simple vector addition in TensorFlow.  
2. Implement a regression model in Keras.  
4. Implement a Feed-Forward Network in TensorFlow/Keras.  
5. Implement an Image Classifier using CNN in TensorFlow/Keras.  
6. Improve the Deep learning model by fine tuning hyper parameters.  
7. Implement a Transfer Learning concept in Image Classification.  
8. Using a pre trained model on Keras for Transfer Learning  
9. Perform Sentiment Analysis using RNN  
10. Implement an LSTM based Autoencoder in TensorFlow/Keras.  
11. Image generation using GAN  

Additional Experiments:  
12. Train a Deep learning model to classify a given image using pre trained model  
13. Recommendation system from sales data using Deep Learning  
14. Implement Object Detection using CNN  
15. Implement any simple Reinforcement Algorithm for an NLP problem  

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will be able to:
CO1: Apply Convolution Neural Network for image processing.
CO2: Understand the basics of associative memory and unsupervised learning networks.
CO3: Apply CNN and its variants for suitable applications.
CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
CO5: Apply autoencoders and generative models for suitable applications.
TEXT BOOKS:

REFERENCES:
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018

CO’s- PO’s & PSO’s MAPPING

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CCW332 DIGITAL MARKETING  L T P C
2 0 2 3

COURSE OBJECTIVES:
- The primary objective of this module is to examine and explore the role and importance of digital marketing in today’s rapidly changing business environment.
- It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

UNIT I INTRODUCTION TO ONLINE MARKET
Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.
UNIT II SEARCH ENGINE OPTIMISATION 6

UNIT III E-MAIL MARKETING 6
E-Mail Marketing - Types of E-Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile - Measuring and maximizing email campaign effectiveness. Mobile Marketing - Mobile Inventory/channels - Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns - Profiling and targeting

UNIT IV SOCIAL MEDIA MARKETING 6

UNIT V DIGITAL TRANSFORMATION 6
Digital Transformation & Channel Attribution - Analytics - Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis - Recent trends in Digital marketing.

PRACTICAL EXERCISES: 30 PERIODS
1. Subscribe to a weekly/quarterly newsletter and analyze how its content and structure aid with the branding of the company and how it aids its potential customer segments.
2. Perform keyword search for a skincare hospital website based on search volume and competition using Google keyword planner tool.
3. Demonstrate how to use the Google WebMasters Indexing API
4. Discuss an interesting case study regarding how an insurance company manages leads.
5. Discuss negative and positive impacts and ethical implications of using social media for political advertising.
6. Discuss how Predictive analytics is impacting marketing automation

COURSE OUTCOMES:
CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
CO3: To know the key elements of a digital marketing strategy.
CO4: To study how the effectiveness of a digital marketing campaign can be measured
CO5: To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

TOTAL: 60 PERIODS

TEXT BOOKS
1. Fundamentals of Digital Marketing by Puneet Singh Bhatia; Publisher: Pearson Education;
7. Pulizzi, J. Beginner’s Guide to Digital Marketing, Mcgraw Hill Education

**CO’s- PO’s & PSO’s MAPPING**

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**OPEN ELECTIVE II**

**OIE352 RESOURCE MANAGEMENT TECHNIQUES**

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**COURSE OBJECTIVES:**
- Learn to formulate linear programming problems and solve LPP using simple algorithm
- Learn to solve networking problems
- Learn to formulate and solve integer programming problems
- Learn to solve Non Linear programming problems
- Learn to understand and solve project management problems

**UNIT I LINEAR PROGRAMMING**


**UNIT II DUALITY AND NETWORKS**


**UNIT III INTEGER PROGRAMMING**

Cutting plan algorithm – Branch and bound methods, Multistage (Dynamic) programming.

**UNIT IV CLASSICAL OPTIMISATION THEORY:**


**UNIT V OBJECT SCHEDULING**

Network diagram representation – Critical path method – Time charts and resource leveling – PERT.
TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon Completion of the course, the students should be able to:
CO1 : Understand to formulate linear programming problems and solve LPP using simple algorithm
CO2 : Understand to solve networking problems
CO3 : Understand to formulate and solve integer programming problems
CO4 : Understand to solve Non Linear programming problems
CO5 : Understand to understand and solve project management problems

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TEXT BOOK:

REFERENCES:

OMG351 FINTECH REGULATION L T P C
3 0 0 3

COURSE OBJECTIVES:
1. To learn about Laws and Regulation
2. To acquire the knowledge of Regulations of Fintech firm and their role in Market

UNIT I INTRODUCTION 9
The Role of the Regulators, Equal Treatment and Competition, Need for a regulatory assessment of Fintech, India Regulations, The Risks to Consider, Regtech and SupTech, The rise of TechFins, Regulatory sandboxes, compliance and whistleblowing.

UNIT II INNOVATION AND REGULATION 9

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UNIT III  CROWDFUNDING AND DIGITAL ASSETS  9

UNIT IV  MARKETPLACE LENDING AND MOBILE PAYMENTS  9

UNIT V  ANTI-MONEY LAUNDERING AND CYBERSECURITY  9
Reporting requirements under the Bank Secrecy Act, Patriot Act, Penalties for violating the BSA, Virtual currencies and the Bank Secrecy Act, Cybersecurity Frameworks, Cybersecurity Act of 2015, Contractual and Self Regulatory obligations.

REFERENCES
6. Lee Reiners, FinTech Law and Policy, 2018

OFD351  HOLISTIC NUTRITION  L T P C  3 0 0 3

UNIT I  NUTRITION AND HEALTH  9
Introduction to the principles of nutrition; Basics of nutrition including; micronutrients (vitamins and minerals), the energy-yielding nutrients (Carbohydrates, Lipids and Proteins), metabolism, digestion, absorption and energy balance. Lipids: their functions, classification, dietary requirements, digestion & absorption, metabolism and links to the major fatal diseases, heart disease and cancer.

UNIT II  AYURVEDA – MIND/BODY HEALING  9
Philosophy of Holistic Nutrition with spiritual and psychological approaches towards attaining optimal health; Principles and practical applications of Ayurveda, the oldest healing system in the world. Three forces – Vata, Pitta and Kapha, that combine in each being into a distinct constitution. Practical dietary and lifestyle recommendations for different constitutions will also be explored in real case studies.
UNIT III NUTRITION AND ENVIRONMENT

Based on an underlying philosophy that environments maintain and promote health and that individuals have a right to self-determination and self-knowledge, Nutrition principles which promote health and prevent disease. Safety of our food supply, naturally occurring and environmental toxins in foods, microbes and food poisoning.

UNIT IV COMPARATIVE DIETS

Evaluating principles of food dynamics, nutrient proportions, holistic individuality, the law of opposites, food combining, and more. Therapeutic benefits and limitations of several alternative diet approaches, including: modern diets (intermittent fasting, macrobiotics), food combining (colour-therapy/rainbow diet), high protein diets (Ketogenic, Paleo), Vegetarian approaches (plant-based/vegetarian/vegan variations, fruitarian, raw food), as well as cleansing and detoxification diets (caffeine, alcohol, and nicotine detoxes, juice fasts).

UNIT V PREVENTIVE HEALTH CARE

Proper nutrition protection against, reverse and/or retard many ailments including: osteoporosis, diabetes, atherosclerosis and high blood pressure, arthritis, cancer, anemia, kidney disease and colon cancer. Current research developments on phytochemicals, antioxidants and nutraceuticals will be explored.

COURSE OUTCOMES

CO1 Discuss the role of essential nutrients in physical, mental and emotional wellness
CO2 Discuss the role of deficiencies in essential nutrients in the disease process
CO3 Explain how the standard American diet relates to the disease process
CO4 Identify five contemporary eating “styles” and lists the pros and cons of each
CO5 Discuss the concept of whole foods nutrition and its relationship to wellness

TEXTBOOKS


REFERENCES

1. Modern Nutrition in Health & Disease by Young & Shils.

AI3021 IT IN AGRICULTURAL SYSTEM

COURSE OBJECTIVES:

- To introduce the students to areas of agricultural systems in which IT and computers play a major role.
- To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.
UNIT I  PRECISION FARMING 9
Precision agriculture and agricultural management – Ground based sensors, Remote sensing, GPS, GIS and mapping software, Yield mapping systems, Crop production modeling.

UNIT II  ENVIRONMENT CONTROL SYSTEMS 9
Artificial light systems, management of crop growth in greenhouses, simulation of $\text{CO}_2$ consumption in greenhouses, on-line measurement of plant growth in the greenhouse, models of plant production and expert systems in horticulture.

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

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

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

TOTAL: 45 PERIODS

TEXTBOOKS:

REFERENCES:

COURSE OUTCOME:
CO1: The students shall be able to understand the applications of IT in remote sensing applications such as Drones etc.
CO2: The students will be able to get a clear understanding of how a greenhouse can be automated and its advantages.
CO3: The students will be able to apply IT principles and concepts for management of field operations.
CO4: The students will get an understanding about weather models, their inputs and applications.
CO5: The students will get an understanding of how IT can be used for e-governance in agriculture.
## CO’s-PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>Course Outcome</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
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<td>Knowledge of Engineering Sciences</td>
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<td>Problem Analysis</td>
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<td>Design/ Development of Solutions</td>
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<td>Investigations</td>
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<td>Modern Tool Usage</td>
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<td>Individual and Team work</td>
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<td>PSO1</td>
<td>To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<td>PSO2</td>
<td>To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

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### OEI352 INTRODUCTION TO CONTROL ENGINEERING

**LT P C**

3 0 0 3

**COURSE OBJECTIVES:**

- To introduce the control system components and transfer function model with their graphical representation
- To understand the analysis of system in time domain along with steady state error.
- To introduce frequency response analysis of systems.
- To accord basic knowledge in design of compensators.
• To introduce the state space models.

UNIT – I  MATHEMATICAL MODELLING  9
Introduction – transfer function – simple electrical, mechanical, pneumatic, hydraulic and thermal systems–analogies

UNIT -II  FEEDBACK CONTROL SYSTEMS  9
Control system components - Block diagram representation of control systems, Reduction of block diagrams, Signal flow graphs, Output to input ratios

UNIT - III TIME DOMAIN ANALYSIS  9
Response of systems to different inputs viz., Step impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit.

UNIT - IV STABILITY ANALYSIS  9
Necessary and sufficient conditions, Routh-Hurwitz criteria of stability, Rootlocus and Bodetechniques, Concept and construction, frequency response.

UNIT - V STATE SPACE TECHNIQUE  9
State vectors–state space models–Digital Controllers–design aspects.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)  5

1. Explore various controllers presently used in industries.
2. Develop control structures for industrial processes.
3. Implement the controllers for various transfer functions of industrial systems.
4. Using software tools for practical exposures to the controllers used in industries by undergoing training.
5. Realisation of various stability criterion techniques for economical operation of process.

COURSE OUTCOMES:

CO1  To represent and develop systems in different forms using the knowledge gained (L5).
CO2  To analyses the system in time and frequency domain (L4).
CO3  Ability to Derive Transfer function Model of Electrical and Mechanical Systems. (L2)
CO4  Ability to Obtain the transfer Function by the Reduction of Block diagram & Signal flow graph (L3)
CO5  To analyses the stability of physical systems(L4).
CO6  To acquire and analyse knowledge in State variable model for MIMO systems(L1)

TEXT BOOKS:
REFERENCES:

List of Open Source Software/ Learning website:
1. https://nptel.ac.in/courses/112107240
2. https://onlinecourses.nptel.ac.in/noc20_me25/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee90/preview

<table>
<thead>
<tr>
<th>CO's- PO's &amp; PSO's MAPPING</th>
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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.

OPY351 PHARMACEUTICAL NANOTECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES:
- The goal of this course is to provide an insight into the fundamentals of nanotechnology in biomedical and Pharmaceutical research. It will also guide the students to understand how nanomaterials can be used for a diversity of analytical and medicinal rationales.

UNIT I NANOSTRUCTURES
Preparation, properties and characterization - Self-assembling nanostructure - vesicular and micellar polymerization-nanofilms - Metal Nanoparticles- lipid nanoparticles- nanoemulsion - Molecular nanomaterials: dendrimers, etc.,

UNIT II NANOTECHNOLOGY IN BIOMEDICAL INDUSTRY
UNIT III  NANOTECHNOLOGY IN CANCER THERAPY

UNIT IV  NANOTECHNOLOGY IN COSMETICS

UNIT V  NANOTOXICITY
NanoToxicology- introduction, dose relationship- Hazard Classification-Risk assessment and management - factors affecting nano toxicity- Dermal Effects of Nanomaterials, Pulmonary, Neuro and Cardiovascular effects of Nanoparticles - Gene–Cellular and molecular Interactions of Nanomaterials.

TOTAL:45 PERIODS

COURSE OUTCOMES:
The student will be able to
CO1: Identify the process for the preparation and characterization of the different nanostructured materials.
CO2: Apply the nanotechnology in biomedical discipline with related to drug delivery and disease diagnosis
CO3: Develop the process, experiments and apply in identifying in a societal and global context.
CO4: Design and develop the process with suitable equipment for the preparation of nanomaterials in developing cosmetic products.
CO5: Understand the ethical principles to confirm the safety of the nano products with respect to risk assessment and its management.
CO6: Have the knowledge about nanotechnology products and its different applications in a societal and global context.

TEXT BOOKS:

REFERENCES:
CO’s-PO’s & PSO’s MAPPING

<table>
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<tr>
<th>Course Outcome Statements</th>
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1 - low, 2 - medium, 3 - high, '-' - no correlation
(1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.)

OAE351                   AVIATION MANAGEMENT  L T P C
                                   3 0 0 3

COURSE OBJECTIVES:
- To acquire solid background of managerial skills in aviation management
- To develop personality to face business difficulties.
- To control multicultural conditions.
- To identify the relevant analytical and logical skills to deal with problems in the airline industry.
- To learn the concepts of performing well in teams, professionalism, and the knowledge acquired in the field of airport planning, airport security, passengers forecasting, aerodromes work etc

UNIT I       INTRODUCTION
9
History of aviation – organisation, global, social & ethical environment – history of Aviation in India – major players in the airline industry - swot analysis of the different Airline companies in India – market potential of airline industry in India – new airport Development plans – current challenges in the airline industry - competition in the Airline industry – domestic and international from an Indian perspective

UNIT II      AIRPORT INFRASTRUCTURE AND MANAGEMENT
8
Airport planning – terminal planning design and operation – airport operations – Airport functions – organisation structure in an airline - airport authority of India - Comparison of global and Indian airport management – role of AAI -airline privatisation - full Privatisation - gradual privatisation – partial privatization
UNIT III  AIR TRANSPORT SERVICES
Various airport services - international air transport services – Indian scenario – an Overview of airports in Delhi, Mumbai, Hyderabad and Bangalore – the role of private Operators – airport development fees, rates, tariffs

UNIT IV  INSTITUTIONAL FRAMEWORK
Role of DGCA - slot allocation – methodology followed by AFC and DGCA -management of Bilaterals – economic regulations

UNIT V  CONTROLLING
Role of air traffic control - airspace and navigational aids – control process – case Studies in airline industry – Mumbai Delhi airport privatisation – Navi Mumbai airport Tendering process – 6 cases in the airline industry

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

COURSE OUTCOMES:
CO1: To interpret business difficulties.
CO2: To Dissect multicultural conditions.
CO3: To identify and apply the relevant analytical and logical skills to deal with problems in the airline industry.
CO4: To Develop well in teams, professionalism etc.
CO5: To apply the knowledge acquired in the field of airport planning, airport security, passengers forecasting, aerodromes work etc.

CCS342  DEVOPS
L T P C
2 0 2 3

COURSE OBJECTIVES:
- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems
UNIT I  INTRODUCTION TO DEVOPS  6
Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II  COMPILE AND BUILD USING mAVEN & GRADLE  6
Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global), Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT III  CONTINUOUS INTEGRATION USING JENKINS  6
Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV  CONFIGURATION MANAGEMENT USING ANSIBLE  6
Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V  BUILDING DEVOPS PIPELINES USING AZURE  6
Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

COURSE OUTCOMES:
  CO1: Understand different actions performed through Version control tools like Git.
  CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.
  CO3: Ability to Perform Automated Continuous Deployment
  CO4: Ability to do configuration management using Ansible
  CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps

30 PERIODS 30 PERIODS

PRACTICAL EXERCISES:
1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud
4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle
8. Install Ansible and configure ansible roles and to write playbooks

TOTAL: 60 PERIODS

TEXT BOOKS
REFERENCES
2. by Mitesh Soni

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

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

CCS361 ROBOTIC PROCESS AUTOMATION

COURSE OBJECTIVES:
- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION


UNIT II AUTOMATION PROCESS ACTIVITIES

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

217
UNIT III  APP INTEGRATION, RECORDING AND SCRAPING  6
App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV  EXCEPTION HANDLING AND CODE MANAGEMENT  6

UNIT V  DEPLOYMENT AND MAINTENANCE  6
Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

PRACTICAL EXERCISES:

1. Create a Sequence to obtain user inputs display them using a message box;
2. Create a Flowchart to navigate to a desired page based on a condition;
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments
6. Also implement Automation using System Trigger
7. Automate login to (web)Email account
8. Recording mouse and keyboard actions.
9. Scraping data from website and writing to CSV
10. Implement Error Handling in RPA platform
11. Web Scraping
12. Email Query Processing

TOTAL: 30 PERIODS
30 PERIODS

TEXT BOOKS:

REFERENCES:
1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
**OPEN ELCTIVE 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

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.

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

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

REFERENCE BOOKS:

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

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

REFERENCES


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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT- IV

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

TOTAL 45 : PERIODS

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
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT – II SOLAR ENERGY

UNIT – III WIND ENERGY

UNIT – IV BIO-ENERGY
Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration

UNIT – V OCEAN AND GEOTHERMAL ENERGY

TOTAL: 45 PERIODS

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

CO1: Discuss the Indian and global energy scenario.

CO2: Describe the various solar energy technologies and its applications.

CO3: Explain the various wind energy technologies.

CO4: Explore the various bio-energy technologies.

CO5: Discuss the ocean and geothermal technologies.

TEXT BOOKS:

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CO’s-PO’s & PSO’s MAPPING

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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 rubber] - Case studies

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

UNIT III  APPLIED DESIGN THINKING TOOLS
Concept of Minimum Usable Prototype [MUP] - MUP challenge brief - Designing & Crafting the value proposition - Designing and Testing Value Proposition; Design a compelling value proposition; Process, tools and techniques of Value Proposition Design

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

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

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

TEXT BOOKS
1. Steve Blank, (2013), The four steps to epiphany: Successful strategies for products that win, Wiley.
3. Proposition Design: How to Create Products and Services Customers Want, Wiley

REFERENCES
1. https://www.ideou.com/pages/design-thinking#process
4. https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e
6. https://blog.forgeforward.in/star_tup-failure-is-like-true-lie-7812cdfe9b85

MF3003 REVERSE ENGINEERING LT P C 3 0 0 3

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

UNIT I INTRODUCTION & GEOMETRIC FORM 9 Hours

UNIT II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION 9 Hours

UNIT III DATA PROCESSING 9 Hours
UNIT IV 3D SCANNING AND MODELLING 9 Hours

UNIT V INDUSTRIAL APPLICATIONS 9 Hours

TOTAL : 45 PERIODS

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

CO1: Apply the fundamental concepts and principles of reverse engineering in product design and development.

CO2: Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.

CO3: Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.

CO4: Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.

CO5: Analyze the various legal aspect

CO6: Applications of reverse engineering in product design and development.

TEXT BOOKS:

REFERENCES:

OPR351 SUSTAINABLE MANUFACTURING L T P C
3 0 0 3

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

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

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

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

UNIT – V  TRENDS IN SUSTAINABLE OPERATIONS

TOTAL: 45 PERIODS

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

TEXT BOOKS:
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AU3791 ELECTRIC AND HYBRID VEHICLES L T P C

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

UNIT I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES


UNIT II ENERGY SOURCES


UNIT III MOTORS AND DRIVES

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the student will be able to
CO1: Understand the operation and architecture of electric and hybrid vehicles
CO2: Identify various energy source options like battery and fuel cell
CO3: Select suitable electric motor for applications in hybrid and electric vehicles.
CO4: Explain the role of power electronics in hybrid and electric vehicles
CO5: Analyze the energy and design requirement for hybrid and electric vehicles.

TEXT BOOKS:

REFERENCES:

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OAS352 SPACE ENGINEERING

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  9
Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations -thrust/power available and thrust/power required.

UNIT IV  AIRCRAFT STABILITY AND STRUCTURAL THEORY  10

UNIT V  SPACE APPLICATIONS  10
History of space research - spacecraft trajectories and basic orbital manoeuvres - six orbital elements - Kepler’s laws of orbits - Newton’s law of gravitation.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCE:

OIM351  INDUSTRIAL MANAGEMENT  L T P C
3 0 0 3

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

UNIT I  INTRODUCTION

UNIT II  FUNCTIONS OF MANAGEMENT

UNIT III  ORGANIZATIONAL BEHAVIOUR

UNIT IV  GROUPDYNAMICS

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

TOTAL: 45 PERIODS

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

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OIE354 QUALITY ENGINEERING L T P C

COURSE OBJECTIVES
- Developing a clear knowledge in the basics of various quality concepts.
- Facilitating the students in understanding the application of control charts and its techniques.
- Developing the special control procedures for service and process-oriented industries.
- Analyzing and understanding the process capability study.
- Developing the acceptance sampling procedures for incoming raw material.

UNIT I INTRODUCTION 9

UNIT II CONTROL CHARTS 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 STATISTICAL PROCESS CONTROL 9
Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.
UNIT V  ACCEPTANCESAMPLING  9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students will be able to:

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

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

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

COURSE OBJECTIVES

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

UNIT I  INHERENT SAFETY CONCEPTS  9

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

UNIT II  PLANT LOCATIONS  9

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

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:

CO’s- PO’s & PSO’s MAPPING

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OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equip themselves to locate a flaw in various materials, products.
- Applying the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application

UNIT I INTRODUCTION TO NDT & VISUAL TESTING
Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.

UNIT II LIQUID PENETRANT & MAGNETIC PARTICLE TESTING
Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developers and cleaners, Methods & Interpretation.
Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation of test indications.

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY
Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.
UNIT IV  ULTRASONIC TESTING & AET

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

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

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

TEXT BOOKS:

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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

- Selecting sensors to develop mechatronics systems.
- Explaining the architecture and timing diagram of microprocessor, and also interpret and develop programs.
- Designing appropriate interfacing circuits to connect I/O devices with microprocessor.
- Applying PLC as a controller in mechatronics system.
- Designing and develop the apt mechatronics system for an application.

UNIT – I INTRODUCTION AND SENSORS

UNIT – II 8085 MICROPROCESSOR

UNIT – III PROGRAMMABLE PERIPHERAL INTERFACE

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

UNIT – V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

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

CO1: Select sensors to develop mechatronics systems.
CO2: Explain the architecture and timing diagram of microprocessor, and also interpret and develop programs.
CO3: Design appropriate interfacing circuits to connect I/O devices with microprocessor.
CO 4: Apply PLC as a controller in mechatronics system.
CO 5: Design and develop the apt mechatronics system for an application.

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TEXT BOOKS

REFERENCES

ORA351 FOUNDATION OF ROBOTICS

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

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

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

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

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:
**CO’s-PO’s & PSO’s MAPPING**

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**REFERENCES:**

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**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**
Balloon flight-ornithopter-Early Airplanes by Wright Brothers, biplanes and monoplanes, Developments in aerodynamics, materials, structures and propulsion over the years.

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

**UNIT III**  
**BASICS OF AERODYNAMICS**
UNIT IV  BASICS OF AIRCRAFT STRUCTURES  

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

TOTAL : 45 PERIODS

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

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

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

UNIT I  REMOTE SENSING AND ELECTROMAGNETIC RADIATION  

UNIT II  EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL  
Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows - Energy

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

UNIT IV SENSING TECHNIQUES 9

UNIT V DATA PRODUCTS AND INTERPRETATION 9
Photographic and digital products – Types, levels and open source satellite data products — selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

TOTAL:45 PERIODS

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

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

TEXTBOOKS:

REFERENCES:
CO’s-PO’s & PSO’s MAPPING

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OAI351 URBAN AGRICULTURE L T P C

COURSE OBJECTIVES:
- To introduce the students the principles of agricultural crop production and the production practices of crops in modern ways.
- To delineate the role of agricultural engineers in relation to various crop production practices.

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

UNIT II VERTICAL FARMING

UNIT III SOIL LESS CULTIVATION
Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyard gardens- tactical gardens- street landscaping- forest gardening, greenhouses, urban beekeeping
UNIT IV MODERN CONCEPTS
Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops

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

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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<td>PO3 Design/ Development of Solutions</td>
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<td>PO4 Conduct Investigations of Complex Problems</td>
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</table>
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

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

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  9

UNIT V WATER DISTRIBUTION AND SUPPLY  9
Requirements of water distribution – Components – Selection of pipe material – Service reservoirs - Functions – Network design – Economics - Computer applications – Appurtenances – Leak
detection - Principles of design of water supply in buildings – House service connection –
Fixtures and fittings, systems of plumbing and types of plumbing.

TOTAL: 45 PERIODS

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

TEXTBOOKS :
private limited, New Delhi, 2016.

REFERENCES :
1. Fair. G.M., Geyer.J.C., "Water Supply and Wastewater Disposal", John Wiley and Sons,
1954.
New Delhi, 1998.

CO’s- PO’s & PSO’s MAPPING

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

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

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

UNIT I  ROTATING POWER CONVERTERS  9

UNIT II  STATIC POWER CONVERTERS  9
Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.

UNIT III  CONTROL OF DC AND AC MOTOR DRIVES  9
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives

UNIT IV  HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS  9

UNIT V  MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES  9
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power spilt 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.

CO’s-PO’s & PSO’s MAPPING

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OEI353 INTRODUCTION TO PLC PROGRAMMING

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

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

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

UNIT III PLC PROGRAMMING
Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions
UNIT IV  COMMUNICATION OF PLC AND SCADA  
Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

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

TOTAL:45 PERIODS

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

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

TEXT BOOKS:
1. Frank Petruzella, Programmable Logic Controllers, Tata Mc-Grav Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication

REFERENCES:
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles andApplications, Pearson publication

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

CO’s-PO’s & PSO’s MAPPING

<table>
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<tr>
<th>PO</th>
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250
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
Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional
nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice-
clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction
methods, thermal analysis method, BET analysis method.

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

TOTAL : 45 PERIODS

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

TEXT BOOKS

REFERENCES

CO’s-PO’s & PSO’s MAPPING

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<th>Course Outcomes</th>
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<td>understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications</td>
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<td>acquire knowledge about the different types of nano material synthesis</td>
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<td>describes about the shape, size, structure of composite nanomaterials and their interference</td>
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<td>understand the different characterization techniques for nanomaterials</td>
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<td>develop a deeper knowledge in the application of nanomaterials in different fields</td>
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Overall CO: 3 2 2 1 3 3 1 1 1 1 1 1 1 3 2 1

1 - low, 2 - medium, 3 - high, ‘-’ - no correlation
COURSE OBJECTIVE:
- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I  INTRODUCTION

UNIT II  MOLECULAR SELF ASSEMBLY

UNIT III  BIO-INSPRIRED MATERIALS

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

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

TOTAL: 45 PERIODS

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

TEXT BOOK:

REFERENCE:
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:
COURSE OBJECTIVE:

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

UNIT I PROCESSING OF FOOD AND ITS IMPORTANCE

Source of food - plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of the course the students are expected to

CO1 Be aware of the different methods applied to processing foods.

CO2 Be able to understand the significance of food processing and the role of food and beverage industries in the supply of foods.

TEXT BOOKS/REFERENCES:


OPY352 IPR FOR PHARMA INDUSTRY L T P C 3 0 0 3

COURSE OBJECTIVES:

- To provide the basic fundamental knowledge of different forms of Intellectual Property Rights in national and international level.
- To provide the significance of the Intellectual Property Rights about the patents, copyrights, industrial design, plant and geographical indications.
- This paper is to study significance of the amended patent act on pharma industry.

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

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

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

UNIT IV ENFORCEMENT AND PRACTICAL ASPECTS OF IPR 9

UNIT V INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY 9

TOTAL:45 PERIODS

TEXT BOOKS:

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

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

CO’s-PO’s & PSO’s MAPPING

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

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

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
- CO: 2 Concept of Flame proof & flame retardancy, waterproof and water repellent, Antimicrobial finishes.
- CO: 3 Concept of Soil Release, Anti Pilling, UV Protection and Antistatic finishes.
- CO: 4 Concept of Mechanical finishing.
- CO: 5 Basics of Micro encapsulation techniques, Nano finish, Plasma Treatment.

TEXT BOOKS:

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

OTT352 INDUSTRIAL ENGINEERING FOR GARMENT INDUSTRY

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

**UNIT II WORK STUDY**

9
Definition, Purpose, Basic procedure and techniques of work-study.

**Work environment** – Lighting, Ventilation, Climatic condition on productivity. Temperature control, humidity control, noise control measures. Safety and ergonomics on work station and work environment

**Material Handling** – Objectives, Classification and characteristics of material handling equipments, Specialized material handling equipments.

**UNIT III METHOD STUDY**

9
Definition, Objectives, Procedure, Process charts and symbols. Various charts – Charts indicating process sequence: Outline process chart, flow process chart (man type, material type and equipment type); Charts using time scale – multiple activity chart. Diagrams indicating movement – flow diagram, string diagram, cycle graph, chrono cycle graph, travel chart

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

**UNIT IV WORK MEASUREMENT**

9
Definition, purpose, procedure, equipments, techniques. Time study - Definition, basics of time study- equipments. Time study forms, Stop watch procedure. Predetermined motion time standards (PMTS). Time Study rating, calculation of standard time, Performance rating – relaxation and other allowances. Calculation of SAM for different garments, GSD.

**UNIT V WORK STUDY APPLICATION**

9
Application of work study techniques in cutting, stitching and packing in garment industry. Workaids in sewing, Pitch diagram, Line balancing, Capacity planning, scientific method of training.

**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**

259

CO’s-PO’s & PSO’s MAPPING:

<table>
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1 - low, 2 - medium, 3 - high, '.' - no correlation

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

OTT353 BASIC OF TEXTILE MANUFACTURE  L T P C
3 0 0 3

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

UNIT I NATURAL FIBRES
Introduction: Definition of staple fibre, filament; Classification of natural and man-made fibres, essential and desirable properties of fibres. Production and cultivation of Natural Fibers: Cultivation of cotton, production of silk (sericulture), wool and jute – physical and chemical structure of these fibres.
UNIT II REGENERATED AND SYNTHETIC FIBRES
Production sequence of regenerated and modified cellulosic fibres: viscose rayon, Acetate Rayon, high wet modulus and high tenacity fibres; synthetic fibres – chemical structure, fibre forming polymers, production principles.

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

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

UNIT V BASICS OF KNITTING AND NONWOVEN

TOTAL : 45 PERIODS

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

TEXTBOOKS

REFERENCES:

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

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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 L T P C
3 0 0 3

COURSE OBJECTIVES:
At the end of the course, the student is expected to
- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I INTRODUCTION 9
Energy - Power – Past & Present scenario of World; National Energy consumption Data –
Environmental aspects associated with energy utilization – Energy Auditing: Need, Types,
Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS 9
Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors,
Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy
Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of
Encon in Illumination.

UNIT III THERMAL SYSTEMS 9
Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon
measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam
Utilization, Insulators & Refractories

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

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

TOTAL: 45 PERIODS

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
Introduction to plastic processing – Principles of plastic processing: processing of plastics vs. metals and ceramics. Factors influencing the efficiency of plastics processing: molecular weight, viscosity and rheology. Difference in approach for thermoplastic and thermoset processing.
Additives for plastics compounding and processing: antioxidants, light stabilizers, UV stabilizers, lubricants, impact modifiers, flame retardants, antistatic agents, stabilizers and plasticizers.
Compounding: plastic compounding techniques, plasticization, pelletization.

UNIT II EXTRUSION 9
UNIT III INJECTION MOLDING
Injection molding – Principles and processing outline, machinery, accessories and functions, specifications, process variables, mould cycle. Types of clamping: hydraulic and toggle mechanisms. Start-up and shut down procedures-Cylinder nozzles- Press capacity projected area -Shot weight Basic theoretical concepts and their relationship to processing - Interaction of moulding process aspect effects in quoted variables. Basic mould types. Reciprocating vs. plunger type injection moulding. Thermoplastic vs. thermosetting injection moulding. Injection moulding vs. other plastic processing techniques. State-of-the art injection moulding techniques - Introduction to trouble shooting

UNIT IV COMPRESSION AND TRANSFER MOLDING
Compression moulding – Basic principles of compression and transfer moulding-Meaning of terms- Bulk factor and flow properties, moulding materials, process variables and process cycle, 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

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
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

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

UNIT III  LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

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

UNIT V  LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

TOTAL: 45 PERIODS

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

TEXT BOOKS:
REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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

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

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

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

UNIT II  AMPLIFIERS  9
Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT III  MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER  9
Cascode amplifier, Differential amplifier – Common mode and Difference mode analysis – Tuned amplifiers – Gain and frequency response – Neutralization methods.

UNIT IV  FEEDBACK AMPLIFIERS AND OSCILLATORS  9

268
UNIT V  POWER AMPLIFIERS AND DC/DC CONVERTERS

Power amplifiers- class A-Class B-Class AB-Class C-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1: Explain the structure and working operation of basic electronic devices.
CO2: Design and analyze amplifiers.
CO3: Analyze frequency response of BJT and MOSFET amplifiers
CO4: Design and analyze feedback amplifiers and oscillator principles.
CO5: Design and analyze power amplifiers and supply circuits

TEXT BOOKS:

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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

OMA352 OPERATIONS RESEARCH

COURSE OBJECTIVES:
This course will help the students to
- determine the optimum solution for Linear programming problems.
- study the Transportation and assignment models and various techniques to solve them.
- acquire the knowledge of optimality, formulation and computation of integer programming problems.
- acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
determine the optimum solution for non-linear programming problems.

UNIT I  LINEAR PROGRAMMING  9

UNIT II  TRANSPORTATION AND ASSIGNMENT PROBLEMS  9

UNIT III INTEGER PROGRAMMING  9

UNIT IV DYNAMIC PROGRAMMING PROBLEMS  9

UNIT V NON-LINEAR PROGRAMMING PROBLEMS  9

TOTAL:45 PERIODS

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 L T P C 3 0 0 3

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

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

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

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

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

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

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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OMA354 LINEAR ALGEBRA L T P C 3 0 0 3

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

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9
UNIT II VECTOR SPACES 9
Vector spaces over Real and Complex fields - Subspace – Linear space - Linear independence and dependence - Basis and dimension.

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

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

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9

TOTAL : 45 PERIODS

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

TEXT BOOKS

REFERENCES

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273
COURSE OBJECTIVE:
- To impart knowledge about the basics of lean principles, tools and techniques, and implementation in the construction industry.

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

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

UNIT III CORE CONCEPTS IN LEAN 9
Concepts in lean thinking - Principles of lean construction - Variability and its impact - Traditional construction and lean construction - Traditional project delivery - Lean construction and workflow reliability - Work structuring - Production control.

UNIT IV LEAN TOOLS AND TECHNIQUES 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:

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

COURSE OBJECTIVE:
- Enable the Non-biological student’s to understand about the basics of life science and their pro and cons for living organisms.

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

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

UNIT III PATHOGENIC MICROBES 9
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengu, Malaria, Diarrhea, Tuberculosis, Typhoid, Covid, HIV.

UNIT IV BENEFICIAL MICROBES 9
Applications of microbes – Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.

UNIT V PRODUCTS FROM MICROBES 9
Fermented products – Fermented Beverages, Curd, Cheese, Mushroom, Agricultural products – Biopesticide, Biofertilizers, Vermi compost, Pharmaceutical products - Antibiotics, Vaccines

TOTAL: 45 PERIODS

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

TEXT BOOKS

OBT353 
BASICS OF BIOMOLECULES

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

UNIT I 
CARBOHYDRATES
Introduction to carbohydrate, classification, properties of monosaccharide, structural aspects of monosaccharides. Introduction to disaccharide (lactose, maltose, sucrose) and polysaccharide (Heparin, starch, and glycogen) biological function of carbohydrate.

UNIT II 
LIPID AND FATTY ACIDS
Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipids, sphingolipid and glycerolipid. Biological function of lipid. Fatty acid, Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.

UNIT III 
AMINO ACIDS AND PROTEIN.

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

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
   W.H.Freeman and Company 2017

REFERENCES

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

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

UNIT I  INTRODUCTION TO CELL  9
Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution,
Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria,cyanobacteria,
mycoplasma and prions.

UNIT II  CELL ORGANELLES  9
Molecular organisation, biogenesis and functin Mitochondria, endoplasmic reticulam, golgi
apparatus, plastids, chloroplast, leucoplast, centrosome, lysosome, ribosome, peroxisome,
Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.

UNIT III  BIO-MEMBRANE TRANSPORT  9
Physiochemical properties of cell membranes. Molecular constitute of membranes, asymmetrical
organisation of lipids and proteins. Solute transport across membrane’s-fick’s law, simple diffusion,
passive-facilitated diffusion, active transport- primary and secondary, group translocation, transport
ATPases, membrane transport in bacteria and animals. Transportmechanism- mobile carriers and
pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell respiration.

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

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

OPEN ELECTIVE IV

OHS352  PROJECT REPORT WRITING  L T P C
3 0 0 3

COURSE OBJECTIVE
The Course will enable Learners to,

• Understand the essentials of project writing.
• Perceive the difference between general writing and technical writing
• Assimilate the fundamental features of report writing.
• Understand the essential differences that exist between general and technical writing.
• Learn the structure of a technical and project report.

UNIT I

UNIT II
UNIT III
Structure of the Project Report: (Part 1) Framing a Title – Content – Acknowledgement – Funding Details - Abstract – Introduction – Aim of the Study – Background - Writing the research question - Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework.

UNIT IV

UNIT V

TOTAL: 45 PERIODS

COURSE OUTCOMES
By the end of the course, learners will be able to
CO1: Write effective project reports.
CO2: Use statistical tools with confidence.
CO3: Explain the purpose and 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.

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

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

REFERENCES
COURSE OBJECTIVE:

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

UNIT I  ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM  9

UNIT II  INTERPOLATION  9
Central difference: Stirling and Bessel's interpolation formulae; Piecewise spline interpolation: Piecewise linear, piecewise quadratic and cubic spline; Least square approximation for continuous data (upto 3rd degree).

UNIT III  NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS  9

UNIT IV  FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS  9
Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes - Leibmann's iterative methods - Dirichlet's and Neumann conditions – Laplace equation in polar coordinates: Finite difference schemes.

UNIT V  FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: demonstrate the understandings of common numerical methods for nonlinear equations, system of linear equations and eigenvalue problems;
CO2: understand the interpolation theory;
CO3: understand the concepts of numerical methods for ordinary differential equations;
CO4: demonstrate the understandings of common numerical methods for elliptic equations;
CO5: understand the concepts of numerical methods for time dependent partial differential equations.

TEXT BOOKS:
REFERENCES:

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OMA356 RANDOM PROCESSES L T P C

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

281
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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COURSE OBJECTIVES:

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

UNIT I RANDOM PROCESSES

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

UNIT II MARKOVIAN QUEUEING MODELS

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

UNIT III ADVANCED QUEUEING MODELS

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

UNIT IV SYSTEM RELIABILITY

Reliability and hazard functions- Exponential, Normal, Weibull and Gamma failure distribution –

UNIT V MAINTAINABILITY AND AVAILABILITY

Maintainability and Availability functions – Frequency of failures – Two Unit parallel system with
repair – k out of m systems.

TOTAL: 45 PERIODS

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


Delhi,2010.
REFERENCES

CO’s-PO’s & PSO’s MAPPING

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OMG354 PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS

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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

9

UNIT V CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT

9

COURSE OUTCOMES:
Upon completion of this course the learners will be able :
CO 1 To understand the basics and functions of Production and Operation Management for business owners.
CO 2 To learn about the Production & Operation Systems.
CO 3 To acquaint on the Production & Operations Planning Techniques followed by entrepreneurs in Industries.
CO 4 To known about the Production & Operations Management Processes in organisations.
CO 5 To comprehend the techniques of controlling , Production and Operations in industries.

REFERENCES
UNIT II PREPARING FOR MULTIVARIATE ANALYSIS
Conceptualization of research model with variables, collection of data — Approaches for dealing with missing data — Testing the assumptions of multivariate analysis.

UNIT III MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS
Multiple Linear Regression Analysis — Inferences from the estimated regression function — Validation of the model. - Approaches to factor analysis — interpretation of results.

UNIT IV LATENT VARIABLE TECHNIQUES
Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES
Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

COURSE OUTCOMES:
CO1: Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.
CO2: Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
CO3: Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
CO4: Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
CO5: Make better business decisions by using advanced techniques in data analytics.

REFERENCES:

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  9

UNIT II  VAT POLYMERIZATION AND MATERIAL EXTRUSION  9

UNIT III  POWDER BED FUSION AND BINDER JETTING  9

UNIT IV  MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION  9

UNIT V  SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY  9
Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

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  L  T  P  C
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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  9

UNIT – II  MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS  9
Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT – III  ESSENTIALS OF NPD  9
RFQ (Request of Quotation) Processing – Feasibility Studies & reporting – CFT (Cross Function Team)

UNIT – IV CRITERIONS OF NPD

New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

UNIT – V REPORTING & FORWARD-THINKING OF NPD

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

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

CO1: Discuss fundamental concepts and customer specific requirements of the New Product development

CO2: Discuss the Material specification standards, analysis and fabrication, manufacturing process.

CO3: Develop Feasibility Studies & reporting of New Product development

CO4: Analyzing the New product qualification and Market Survey on similar products of new product development

CO5: Develop Reverse Engineering. Cloud points generation, converting cloud data to 3D model

TEXT BOOKS:

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

REFERENCES:

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

CO’s-PO’s & PSO’s MAPPING

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

UNIT I   UI/UX

UNIT II   APP DEVELOPMENT
SDLC - Introduction to App Development - Types of Apps - web Development - understanding Stack - Frontend - backend - Working with Databases - Introduction to API - Introduction to Cloud services - Cloud environment Setup - Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III   INDUSTRIAL DESIGN
Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV   MECHANICAL RAPID PROTOTYPING
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V   ELECTRONIC RAPID PROTOTYPING
Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, learners will be able to:
CO1: Create quick UI/UX prototypes for customer needs
CO2: Develop web application to test product traction / product feature
CO3: Develop 3D models for prototyping various product ideas
CO4: Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

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

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

UNIT I INTRODUCTION TO MICROSYSYEMNS 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 MICROSYSYEMNS: 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
Precision machining processes for macro components - Diamond turning, fixed and free abrasive processes, finishing processes.

UNIT V METROLOGY FOR MICRO SYSTEMS
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 processes
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

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

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

UNIT – II INTRODUCTION TO PROJECT MANAGEMENT
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts
UNIT – III  PROJECT EXECUTION AND COSTING CONCEPTS  
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing

UNIT – IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  

UNIT – V  QUANTITATIVE techniques FOR COST MANAGEMENT  
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.  
TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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

COURSE OBJECTIVES:
• The objective of this course is to make the students to understand the working and characteristics of different types of batteries and their management.
UNIT I  ADVANCED BATTERIES 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
SOC Estimation- Definition, importance, single cell Vs series batteries SOC. Estimation Methods-

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.

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.
CO5: Approach different BMS architectures during real world usage.

TEXT BOOKS

REFERENCE BOOKS
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet
COURSE OBJECTIVES:
- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I  INTRODUCTION TO MEASUREMENTS AND SENSORS  9

UNIT II  VARIABLE RESISTANCE AND INDUCTANCE SENSORS  9
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III  VARIABLE AND OTHER SPECIAL SENSORS  9
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers- Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV  AUTOMOTIVE ACTUATORS  9

UNIT V  AUTOMATIC TEMPERATURE CONTROL ACTUATORS  9
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL =45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: List common types of sensor and actuators used in vehicles.
CO2: Design measuring equipment’s for the measurement of pressure force, temperature and flow.
CO3: Generate new ideas in designing the sensors and actuators for automotive application
CO4: Understand the operation of the sensors, actuators and electronic control.
CO5: Design temperature control actuators for vehicles.

TEXT BOOKS:

REFERENCES:

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
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II SELECTION OF ROCKET PROPULSION SYSTEMS
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III ENGINE SYSTEMS, CONTROLS, AND INTEGRATION

UNIT IV THRUST VECTOR CONTROL
TVC Mechanisms with a Single Nozzle – TVC with Multiple Thrust Chambers or Nozzles – Testing – Integration with Vehicle – SITVC method – other jet control methods - exhaust plume problems in space environment

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
CO1: Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
CO2: Apply knowledge in selecting the appropriate rocket propulsion systems.
CO3: Interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
CO4: Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
CO5: Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.

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

UNIT II OPERATIONS AND MARKETING MANAGEMENT
Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering (BPR) - Statistical Quality Control: Control Charts for Variables and Attributes (simple Problems) and Acceptance Sampling, Objectives of Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix, and Marketing Strategies based on Product Life Cycle.

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

UNIT IV PROJECT MANAGEMENT
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).
MISSION, GOALS, OBJECTIVES, POLICY, STRATEGY, PROGRAMMES, ELEMENTS OF CORPORATE PLANNING PROCESS, ENVIRONMENTAL SCANNING, VALUE CHAIN ANALYSIS, SWOT ANALYSIS, STEPS IN STRATEGY FORMULATION AND IMPLEMENTATION, GENERIC STRATEGY ALTERNATIVES, BENCHMARKING AND BALANCED SCORE CARDS AS CONTEMPORARY BUSINESS STRATEGIES.

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

CO1: Plan an organizational structure for a given context in the organization to carry out production operations through work-study.

CO2: Survey the markets, customers and competition better and price the given product appropriately.

CO3: Ensure quality for a given product or service.

CO4: Plan, schedule and control projects through PERT and CPM.

CO5: Evaluate strategy for a business or service organization.

CO’S-PO’S & PSO’S MAPPING

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TEXTBOOKS:

REFERENCES:

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 9
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain Management
UNIT II  FORECASTING, CAPACITY AND FACILITY DESIGN  9

UNIT III  DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS  9

UNIT IV  MATERIALS MANAGEMENT  9

UNIT V  SCHEDULING AND PROJECT MANAGEMENT  9
Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers – nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling – Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.

CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.

CO3: The students will be able to Formulate and Assess Aggregate Planning strategies and Material Requirement Plan.

CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.

CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

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TEXT BOOKS
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

Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000, OSHA, Process Safety Management (PSM) as per OSHA, PSM principles, OHSAS – 18001, EPA Standards, Performance measurements to determine effectiveness of PSM. Importance of Industrial safety, role of safety department,

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

COURSE OUTCOMES:

Students able to
CO1: Explain and apply human factors engineering concepts in both evaluation of existing systems and design of new systems
CO2: Specify designs that avoid occupation related injuries
CO3: Define and apply the principles of work design, motion economy, and work environment design.
CO4: Identify the basic human sensory, cognitive, and physical capabilities and limitations with respect to human-machine system performance.
CO5: Acknowledge the impact of workplace design and environment on productivity

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2,

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303
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
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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1: Understand various types of dielectric materials, their properties in various conditions.
CO2: Evaluate magnetic materials and their behavior.
CO3: Evaluate semiconductor materials and technologies.
CO4: Select suitable materials for electrical engineering applications.
CO5: Identify right material for optical and optoelectronic applications

TEXT BOOKS:

REFERENCE BOOKS:

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OML353  NANOMATERIALS AND APPLICATIONS  L T P C
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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:

- Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- Gaining knowledge on dimensionality effects on different properties of nanomaterials
- Getting acquainted with the different processing techniques employed for fabricating nanomaterials
- Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
- Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.

UNIT I  NANOMATERIALS
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III PROCESSING
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV STRUCTURAL CHARACTERISTICS
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis
UNIT V  APPLICATIONS
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
CO1: Evaluate nanomaterials and understand the different types of nanomaterials
CO2: Recognise the effects of dimensionality of materials on the properties
CO3: Process different nanomaterials and use them in engineering applications
CO4: Use appropriate techniques for characterising nanomaterials
CO5: Identify and use different nanomaterials for applications in different engineering fields.

TEXT BOOKS:

REFERENCES:

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

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

OMR352 HYDRAULICS AND PNEUMATICS

COURSE OBJECTIVES:
1. To knowledge on fluid power principles and working of hydraulic pumps
2. To obtain the knowledge in hydraulic actuators and control components
3. To understand the basics in hydraulic circuits and systems
4. To obtain the knowledge in pneumatic and electro pneumatic systems
5. To apply the concepts to solve the trouble shooting
UNIT – I  FLUID POWER PRINCIPLES AND HYDRAULIC PUMPS  

UNIT – II  HYDRAULIC ACTUATORS AND CONTROL COMPONENTS  

UNIT – III  HYDRAULIC CIRCUITS AND SYSTEMS  
Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT – IV  PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS  

UNIT – V  TROUBLE SHOOTING AND APPLICATIONS  

TOTAL: 45 PERIODS

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

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

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TEXT BOOKS

REFERENCES

OMR353          SENSORS          L T P C
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COURSE OBJECTIVES:
1. To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
2. To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
3. To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
4. To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
5. To familiarize students with different signal conditioning circuits design and data acquisition system.

UNIT – I          SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES    9

UNIT – II          DISPLACEMENT, PROXIMITY AND RANGING SENSORS    9
UNIT – III  FORCE, MAGNETIC AND HEADING SENSORS  9

UNIT – IV  OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS  9

UNIT – V  SIGNAL CONDITIONING  9

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors. They can also analyze the sensor response.
CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.
CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.
CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.
CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

CO’s-PO’s & PSO’s MAPPING

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TEXT BOOKS

REFERENCES

### ORA352 CONCEPTS IN MOBILE ROBOTS

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

#### UNIT – I INTRODUCTION TO MOBILE ROBOTICS


#### UNIT – II KINEMATICS


#### UNIT – III PERCEPTION


#### UNIT – IV LOCALIZATION


#### UNIT – V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS


**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Evaluate the appropriate mobile robots for the desired application.
CO2: Create the kinematics for given wheeled and legged robot.
CO3: Analyse the sensors for the intelligence of mobile robotics.
CO4: Create the localization strategies and mapping technique for mobile robot.
CO5: Create the collaborative mobile robotics for planning, navigation and intelligence for desired applications.

TEXTBOOK

REFERENCES:

MV3501 MARINE PROPULSION L T P C
3 0 0 3

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

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

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

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

UNIT IV BASICS OF PROPELLER
Propeller dimension, Propeller and its types – fixed propeller, control pitch propeller, kort nozzle,
ducted propeller, voith schneider, Parts of propeller, 3 blade - 5 blade - 6 blade propellers and its
advantages, propeller boss hub, crown nut, propeller skew, pitch of propeller - Thrust creation by

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Explain the basics of propulsion system and ship dynamic movements
CO2: Familiarize with various components assisting ship stabilization.
CO3: Demonstrate the performance of the ship.
CO4: Classify the Propeller and its types, Materials etc.
CO5: Categories the Rudder and its types, design criteria of rudder.

TEXT BOOKS:
1. GP. Ghose, “Basic Ship propulsion”,2015

REFERENCES BOOKS:

CO’s-PO’s & PSO’s MAPPING

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

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

UNIT II TYPES OF SHIP 10
General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships – Oil
tankers- Bulk carriers - Liquefied Natural Gas carriers - Liquefied Petroleum Gascarriers - Chemical
tankers - Passenger ships

UNIT III SHIPBUILDING MATERIALS 9
Types of Steels used in Shipbuilding - High tensile steels, Corrosion resistant steels, Steel
sandwich panels, Steel castings, Steel forgings - Other shipbuilding materials, Aluminium alloys,
Aluminium alloy sandwich panels, Fire protection especially for Aluminium Alloys, Fiber Reinforced
Composites

UNIT IV MARINE PROPELLER AND RUDDER 8
Types of rudder, construction of Rudder-Types of Propeller, Propeller material-Cavitations and its
effects on propeller

UNIT V GOVERNING BODIES FOR SHIPPING INDUSTRY 9
Role of IMO (International Maritime Organization), SOLAS (International Convention for the
Safety of Life at Sea), MARPOL (International Convention for the Prevention of Pollution from
Ships) , MLC (Maritime Labour Convention), STCW 2010 (International Convention on Standards
of Training, Certification and Watch keeping for Seafarers), Classification societies Administration
authorities

COURSE OUTCOMES:
Upon completion of this course, students would
CO1: Acquire Knowledge on floatation of ships
CO2: Acquire Knowledge on features of various ships
CO3: Acquire Knowledge of Shipbuilding Materials
CO4: Acquire Knowledge to identify the different types of marine propeller
and rudder
CO5: Understand the Roles and responsibilities of governing bodies

TEXT BOOKS:
USA,2015

TOTAL: 45 PERIODS
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
1. Understand the role of Marine machinery systems
2. Be familiar with Marine propulsion machinery system
3. Acquaint with Marine Auxiliary machinery system
4. Have acquired basics of Marine Auxiliary boiler system
5. Be aware of ship propellers and steering system

UNIT I ELEMENTARY KNOWLEDGE ON MARINE MACHINERY SYSTEMS
Marine Engineering Terminologies, Parts of Ship, Introduction to Machinery systems on board ships – Propulsion Machinery system, Electricity Generator system, Steering gear system, Air compressors & Air reservoirs, Fuel oil and Lubricating Oil Purifiers, Marine Boiler systems

UNIT II MARINE PROPULSION MACHINERY SYSTEM
Two stroke Large Marine slow speed Diesel Engine – General Construction, Basic knowledge of Air starting and reversing mechanism, Cylinder lubrication oil system, Main lubricating oil system and cooling water system

UNIT III MARINE AUXILIARY MACHINERY SYSTEM
Four stroke medium speed Diesel engine – General Construction, Inline, V-type arrangement of engine, Difference between slow speed and medium speed engines – advantages, limitations and applications

UNIT IV MARINE BOILER SYSTEM
Types of Boiler – Difference between Water tube boiler and Fire tube boiler, Need for boiler on board ships, Uses of steam, Advantages of using steam as working medium, Boiler mountings and accessories – importance of mountings, need for accessories

UNIT V SHIP PROPELLERS AND STEERING MECHANISM
Importance of Propellor and Steering gear, Types of propellers - Fixed pitch propellers, Controllable pitch propellers, Water jet propellers, Steering gear systems - 2-Ram and 4 Ram steering gear, Electric steering gear

COURSE OUTCOMES:
At the end of the course, students should able to,
CO1: Distinguish the role of various marine machinery systems
CO2: Relate the components of marine propulsion machinery system
CO3: Explain the importance of marine auxiliary machinery system
CO4: Acquire knowledge of marine boiler system
CO5: Understand the importance of ship 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  L  T  P  C
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COURSE OBJECTIVES:
1. To understand the basics of drone concepts
2. To learn and understand the fundamentals of design, fabrication and programming of drone
3. To impart the knowledge of an flying and operation of drone
4. To know about the various applications of drone
5. To understand the safety risks and guidelines of fly safely

UNIT – I INTRODUCTION TO DRONE TECHNOLOGY
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT – II DRONE DESIGN, FABRICATION AND PROGRAMMING
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT – III DRONE FLYING AND OPERATION
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications

UNIT – IV DRONE COMMERCIAL APPLICATIONS
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing
UNIT – V FUTURE DRONES AND SAFETY

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Create the programs for various drones

CO’s-PO’s & PSO’s MAPPING

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS

REFERENCES

OGI352 GEOGRAPHICAL INFORMATION SYSTEM L T P C 3 0 0 3

COURSE OBJECTIVES:
- To impart the knowledge on basic components, data preparation and implementation of Geographical Information System.
UNIT I  FUNDAMENTALS OF GIS

UNIT II  SPATIAL DATA MODELS

UNIT III  DATA INPUT AND TOPOLOGY

UNIT IV  DATA QUALITY AND STANDARDS
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V  DATA MANAGEMENT AND OUTPUT
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.

TOTAL:45 PERIODS

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

CO1  Have basic idea about the fundamentals of GIS.
CO2  Understand the types of data models.
CO3  Get knowledge about data input and topology
CO4  Gain knowledge on data quality and standards
CO5  Understand data management functions and data output

TEXTBOOKS:

REFERENCES:
### CO’s-PO’s & PSO’s MAPPING: GEOGRAPHICAL INFORMATION SYSTEM

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<td>PO12</td>
<td>Life-long Learning</td>
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<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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1 - low, 2 - medium, 3 - high, '-' - no correlation

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**OAI352 AGRICULTURE ENTREPRENEURSHIP DEVELOPMENT**

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**COURSE OBJECTIVES**

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

**UNIT I ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT**

Entrepreneur Development(ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics- Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.

**UNIT II AGRIPRNEURSHIP IN GLOBAL ARENA: LEGAL PERSPECTIVE**

Importance of agribusiness in Indian economy - International trade-WTO agreements- Provisions related to agreements in agricultural and food commodities - Agreements on Agriculture (AOA)- Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS).
UNIT III ENTREPRENEURSHIP MANAGEMENT: FINANCIAL PERSPECTIVE 

UNIT IV ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE 
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.

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

<table>
<thead>
<tr>
<th>PO/PSO</th>
<th>CO1</th>
<th>CO2</th>
<th>CO3</th>
<th>CO4</th>
<th>CO5</th>
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<td>PO1 Engineering Knowledge</td>
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<td>PO2 Problem Analysis</td>
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<td>PO3 Design/ Development of Solutions</td>
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<td>PO4 Conduct Investigations of Complex Problems</td>
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<td>PO5 Modern Tool Usage</td>
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<td>PO6 The Engineer and Society</td>
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<td>PO7 Environment and sustainability</td>
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<td>PO9 Individual and team work:</td>
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<td>PO11 Project management and finance</td>
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<tr>
<td>PSO1 To make expertise in design and engineering problem solving approach in agriculture with proper knowledge and skill</td>
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<td>PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

OEN352 BIODIVERSITY CONSERVATION

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  9
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III  MICROBIAL DIVERSITY  9
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis

UNIT IV  MEGA DIVERSITY  9
Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio- economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNIT V  CONSERVATIONS OF BIODIVERSITY  9
In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

COURSE OUTCOMES
Upon successful completion of this course, students will:
CO1: An insight into the structure and function of diversity for ecosystem stability.
CO2: Understand the concept of animal diversity and taxonomy
CO3: Understand socio-economic issues pertaining to biodiversity
CO4: An understanding of biodiversity in community resource management.
CO5: Student can apply fundamental knowledge of biodiversity conservation to solve problems associated with infrastructure development.
CO’s- PO’s & PSO’s MAPPING

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

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

OEE353 INTRODUCTION TO CONTROL SYSTEMS

COURSE OBJECTIVES

- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems.
- To analyze the stability of linear systems in frequency domain and time domain.
- To develop linear models mainly state variable model and transfer function model.

UNIT I MATHEMATICAL MODELS OF PHYSICAL SYSTEMS

Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction – Signal flow graphs.

UNIT II TIME RESPONSE ANALYSIS & ROOTLOCUSTEchnique


UNIT III FREQUENCY RESPONSE ANALYSIS

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

UNIT IV STABILITY CONCEPTS & ANALYSIS


UNIT V STATE VARIABLE ANALYSIS

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

TOTAL : 45 PERIODS

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

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

OEI354 INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS LT P C 3 0 03

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

UNIT I INTRODUCTION
UNIT II         AUTOMATION COMPONENTS  9
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH
measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power
MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III       COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS  9
Role of computers in measurement and control, Elements of computer aided measurement and
control, man-machine interface, computer aided process control hardware, process related
interfaces, Communication and networking, Industrial communication systems, Data transfer
techniques, Computer aided process control software, Computer based data acquisition system,
Internet of things (IoT) for plant automation.

UNIT IV        PROGRAMMABLE LOGIC CONTROLLERS  9
Programmable controllers, Programmable logic controllers, Analog digital input and output
modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and
networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation,
Application of PLC to process control industries.

UNIT V         DISTRIBUTED CONTROL SYSTEM  9
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer
Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL:45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content
Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)  5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function
   Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1  Design a signal conditioning circuits for various application (L3).
CO2  Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3  Understand the basics and Importance of communication buses in applied automation
     Engineering (L2).
CO4  Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic
     Instructions Studied for Ladder Logic and Function Block.(L3)
CO5  Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:
   2006.
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

<table>
<thead>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

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

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.

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.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES

CO’s-PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>Course Outcomes</th>
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<th>Students will excel as professionals in the various fields of energy engineering</th>
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<td>Compare different renewable energy technologies and choose the most appropriate based on local conditions.</td>
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<td>CO4</td>
<td>Explain the technological basis for harnessing renewable energy sources.</td>
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<td>Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level</td>
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OVERALL CO  

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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, Fischer-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V  EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS

COURSE OUTCOME:
- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena

TEXT BOOK:

REFERENCE:

OFD354  FUNDAMENTALS OF FOOD ENGINEERING  L T P C
3 0 0 3

COURSE OBJECTIVES
The course aims to
- acquaint and equip the students with different techniques of measurement of engineering properties.
- make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum,
osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger's, Kick's and Bond's equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT V
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment: plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electrodialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.

TEXTBOOKS:
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.

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
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 electrototopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT IV ROLE IN HEALTH AND DISEASE

The health benefit of - Soy protein, Spirulina, Tea, Olive oil, plant sterols, Broccoli, omega3 fatty acid and eicosanoids. Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and 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
COURSE OUTCOME - NUTRACEUTICALS

<table>
<thead>
<tr>
<th>CO</th>
<th>Description</th>
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<tbody>
<tr>
<td>CO 1</td>
<td>acquire knowledge about the Nutraceuticals and functional foods, their classification and benefits.</td>
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<tr>
<td>CO 2</td>
<td>acquire knowledge of phytochemicals, zoochemicals and microbes in food, plants, animals and microbes</td>
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<td>CO 3</td>
<td>attain the knowledge of the manufacturing practices of selected nutraceutical components and formulation considerations of functional foods.</td>
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<td>CO 4</td>
<td>distinguish the various In vitro and In vivo assessment of Antioxidant activity of compounds from plant sources.</td>
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<td>CO 5</td>
<td>gain information about the health benefits of various functional foods and nutraceuticals in the prevention and treatment of various lifestyle diseases.</td>
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<td>CO 6</td>
<td>Attain the knowledge of the regulatory and safety issues of nutraceuticals at national and international level.</td>
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CO’s-PO’s & PSO’s MAPPING

<table>
<thead>
<tr>
<th>NUTRACEUTICALS</th>
<th>Course outcome</th>
<th>PO1</th>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

OTT354 BASICS OF DYEING AND PRINTING

COURSE OBJECTIVE:
- To enable the students to learn about the basics of Pretreatment, dyeing, printing and machinery in textile processing.
UNIT I INTRODUCTION
Impurities present in different fibres, Inspection of grey goods and lot preparation. Shearing,

UNIT II PRE TREATMENT

UNIT III DYEING

UNIT IV PRINTING
Definition of printing – Difference between printing and dying- Classification thickeners – Requirements to be good thickener, printing paste Preparation - different styles of printing.

UNIT V MACHINERIES

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

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
2. Dr. N N Mahapatra., “Textile dyeing”, Wood head publishing India, 2018
4. Bleaching & Mercerizing – BTRA Silver Jubilee Monograph series

CO’s-PO’s & PSO’s MAPPING
1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
<table>
<thead>
<tr>
<th>Course Outcomes</th>
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<td>Statement</td>
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<tr>
<td>CO1</td>
<td>Classification of fibres and production of natural fibres</td>
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<td>CO2</td>
<td>Regenerated and synthetic fibres</td>
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<td>CO3</td>
<td>Yarn spinning</td>
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<td>CO4</td>
<td>Weaving</td>
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<td>CO5</td>
<td>Knitting and nonwoven</td>
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1 - low, 2 - medium, 3 - high, '-' - no correlation

**FT3201**

**FIBRE SCIENCE**

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**COURSE OBJECTIVES**

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

**UNIT I**

**INTRODUCTION TO TEXTILE FIBRES**

Definition of various forms of textile fibres - staple fibre, filament, bicomponent fibres. Classification of Natural and Man-made fibres, essential and desirable properties of Fibres. Production and cultivation of Natural Fibers: Cotton, Silk, Wool - Physical and chemical structure of the above fibres.

**UNIT II**

**REGENERATED FIBRES**

Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel, Tencel

**UNIT III**

**SYNTHETIC FIBRES**

Production Sequence of Synthetic Fibers: polymer-Polyester, Nylon, Acrylic and polypropylene. Mineral fibres: fibre glass , carbon. Introduction to spin finishes and texturization
UNIT IV SPECIALITY FIBRES
Properties and end uses of high tenacity and high modulus fibres, high temperature and flame retardant fibres, Chemical resistant fibres

UNIT V FUNCTIONAL SPECIALITY FIBRES
Properties and end uses: Fibres for medical application – Biodegradable fibres based on PLA, Super absorbent fibres elastomeric fibres, ultra-fine fibres, electrospun nano fibres, metallic fibres – Gold and Silver coated.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1: Understand the process sequence of various fibres
CO2: Understand the properties of various fibres

TEXT BOOKS:

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  9
Different types of seams and stitches; single needle lock stitch machine – mechanism and accessories; needle – functions, special needles, needlepoint

UNIT III  COMPONENTS AND TRIMS USED IN GARMENT  9
Sewing thread-construction, material, thread size, packages, accessories – labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons

UNIT IV  GARMENT INSPECTION AND DIMENSIONAL CHANGES  9
Raw material, in process and final inspection; needle cutting; sewability of fabrics; strength properties of apparel; dimensional changes in apparel due to laundering, dry-cleaning, steaming and pressing.

UNIT V  GARMENT PRESSING, PACKING AND CARE LABELING  9
Garment pressing – categories and equipment, packing; care labelling of apparels

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to Understand
CO1: Pattern making, marker planning, cutting
CO2: Types of seams, stitches and functions of needles
CO3: Components and trims used in garment
CO4: Garment inspection and dimensional changes
CO5: Garment pressing, packing and care labelling

TEXT BOOKS:

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the student is expected to be able to:
CO1: Describe, with example, the common work-related diseases and accidents in occupational setting
CO2: Name essential members of the Occupational Health team
CO3: What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES

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

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV BASICS OF MASS TRANSFER

UNIT V MASS TRANSFER OPERATIONS
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction).Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method.Drying- drying operations, batch and continuous drying. Conceptual numerical.
COURSE OUTCOMES:
At the end of the course the student will be able to:
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.

TEXTBOOK(S)
2. Fluid Mechanics K L Kumar S Chand & Company Ltd 2008

REFERENCE BOOKS
2. Unit Operations of Chemical Engineering, Vol I &II Chattopadhyaya Khanna Publishers, Delhi-6 1996

COURSE OBJECTIVES
- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
- Understand the basics as well as the advanced applications of various plastic materials in the industry
- To understand the preparation methods of thermosetting materials
- Select suitable specialty plastics for different end applications

UNIT I INTRODUCTION TO PLASTIC MATERIALS
Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)

UNIT II ENGINEERING THERMOPLASTICS AND APPLICATIONS
Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)
UNIT III THERMOSETTING PLASTICS
Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV MISCELLANEOUS PLASTICS FOR END APPLICATIONS
Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications

UNIT V PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS
Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: To study the importance, advantages and classification of plastic materials
CO2: Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
CO3: To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
CO4: Know the manufacture, properties and uses of thermosetting resins based on polyester, epoxy, silicone and PU
CO5: To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES

OCT353 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**  9

**UNIT II  MECHANICAL PROPERTIES**  9
Mechanical properties: Tensile, compression, flexural, shear, tear strength, hardness, impact strength, resilience, abrasion resistance, creep and stress relaxation, compression set, dynamic fatigue, ageing properties, Basic concepts of stress and strain, short term tests: Viscoelastic behavior (simple models: Kelvin model for creep and stress relaxation, Maxwell-Voigt model, strain recovery and dynamic response), Effect of structure and composition on mechanical properties, Behavior of reinforced polymers

**UNIT III  THERMAL RHEOLOGICAL PROPERTIES**  9
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

**UNIT IV  ELECTRICAL AND OPTICAL PROPERTIES**  9
Electrical properties: volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

**UNIT V  ENVIRONMENTAL AND CHEMICAL RESISTANCE**  9

TOTAL : 45 PERIODS

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

**REFERENCES**

OCE354     BASICS OF INTEGRATED WATER RESOURCES MANAGEMENT     L T P C

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.

CO4 Illustrate the recent trends in water management.

CO5 Understand the implementation hitches and the institutional frameworks.
TEXT BOOKS

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

OEC353 VLSI DESIGN L T P C 3 0 0 3

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 9
MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor DC transfer Characteristics, small signal analysis of MOSFET.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES 9

UNIT IV INTERCONNECT, MEMORY ARCHITECTURE 9
Interconnect Parameters – Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS 9
Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon successful completion of the course the student will be able to
CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combinational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.

TEXTBOOKS

REFERENCES

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

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

UNIT I BIOLOGICAL TREATMENT PROCESS

UNIT II WASTE BIOMASS AND ITS VALUE ADDITION
Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

UNIT III BIOCONVERSION OF WASTES TO ENERGY 9
Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies

UNIT IV CHEMICALS AND ENZYME PRODUCTION FROM WASTES 9
Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases - Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

UNIT V BIOCOMPOSTING OF ORGANIC WASTES 9
Overview of composting process - Benefits of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should be able
CO1: To learn the various methods biological treatment
CO2: To know the details of waste biomass and its value addition
CO3: To develop the bioconversion processes to convert wastes to energy
CO4: To synthesize the chemicals and enzyme from wastes
CO5: To produce the biocompost from wastes
CO6: To apply the theoretical knowledge for the development of value added products

TEXT BOOKS

REFERENCE BOOKS
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

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

UNIT III
CARDIOVASCULAR DISEASES

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

UNIT IV
DIABETES AND OBESITY

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V
RESPIRATORY DISEASES

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

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

UNIT I
PUBLIC HEALTH

UNIT II  CLINICAL DISEASES  9
Communicable diseases: Chickenpox / Shingles, COVID-19, Tuberculosis, Hepatitis B, Hepatitis C, HIV / AIDS, Influenza, Swine flu. Non Communicable diseases: Diabetes mellitus, atherosclerosis, fatty liver, Obesity, Cancer

UNIT III  VACCINOLOGY  9
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment.

UNIT IV  OUTPATIENT & IN PATIENT SERVICES  9
Radiotherapy, Nuclear medicine, surgical units, OT Medical units, G & Obs. units Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation, Neurology, Gastroenterology, Endoscopy, Pulmonology, Cardiology.

UNIT V  BASICS OF IMAGING MODALITIES  9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

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

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

UNIT I INTRODUCTION TO FINANCIAL MANAGEMENT  9
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.
UNIT II. SOURCES OF FINANCE
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:

UNIT IV FINANCING AND DIVIDEND DECISION

UNIT V WORKING CAPITAL DECISION

TEXT BOOKS

REFERENCES
2. Prasanna Chandra, Financial Management,

CMG332 FUNDAMENTALS OF INVESTMENT LT P C 3 0 0 3

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

UNIT1: 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 2: FIXED INCOME SECURITIES
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default-risk and credit rating.

UNIT 3: 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 4: PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

UNIT 5: INVESTOR PROTECTION
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism.

REFERENCES

CMG333   BANKING, FINANCIAL SERVICES AND INSURANCE

COURSE OBJECTIVES
- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM
Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector – RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY
UNIT IV FINANCIAL SERVICES

UNIT V INSURANCE

REFERENCES:

CMG334 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS

UNIT I INTRODUCTION TO BLOCKCHAIN
Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY

UNIT III Ethereum
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV WEB3 AND HYPERLEDGE

TOTAL : 45 PERIODS
UNIT V EMERGING TRENDS

REFERENCE
2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

TOTAL: 45 PERIODS

REFERENCE
5. IIBF, Digital Banking, Taxmann Publication, 2016

CMG336 INTRODUCTION TO FINTECH LT P C 3 0 0 3

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

UNIT I INTRODUCTION
Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT II PAYMENT INDUSTRY
Fintech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, Fintech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III INSURANCE INDUSTRY

UNIT IV FINTECH AROUND THE GLOBE
UNIT V FUTURE OF FINTECH

How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

REFERENCES

4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

VERTICAL 2: ENTREPRENEURSHIP

CMG337 FOUNDATIONS OF ENTREPRENEURSHIP

COURSE OBJECTIVES

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businesses.
- To empower the learners to run a Technology driven business efficiently and effectively.

UNIT I INTRODUCTION TO ENTREPRENEURSHIP

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT II BUSINESS OWNERSHIP & ENVIRONMENT

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristicicis of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship – Success Stories of Technopreneurs - Case Studies

UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP

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

TEXT BOOKS:

REFERENCES:
4) David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
7) Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship
COURSE OBJECTIVES

- To develop and strengthen the Leadership qualities and motivation of learners.
- To impart the Leadership skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of Team Building in managing Technology oriented businesses.
- To empower the learners to build robust teams for running and leading a business efficiently and effectively.

UNIT I INTRODUCTION TO MANAGING TEAMS

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTS) - Multicultural Teams.

UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS

Team-based Organisations - Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III INTRODUCTION TO LEADERSHIP

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership - Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT IV LEADERSHIP IN ORGANISATIONS


UNIT V LEADERSHIP EFFECTIVENESS


TOTAL 45 : PERIODS

COURSE OUTCOMES:

Upon completion of this course, the student should be able to:
CO 1 Learn the basics of managing teams for business.
CO 2 Understand developing effective teams for business management.
CO 3 Understand the fundamentals of leadership for running a business.
CO 4 Learn about the importance of leadership for business development.
CO 5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs."
REFERENCES:

CMG339 CREATIVITY & 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
Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities- Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment-Creative Technology- Creative Personality and Motivation.

UNIT II CREATIVE INTELLIGENCE
Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training--Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

UNIT III INNOVATION

UNIT IV INNOVATION AND ENTREPRENEURSHIP

UNIT V INNOVATIVE BUSINESS MODELS

TOTAL 45 : PERIODS

358
COURSE OUTCOMES
Upon completion of this course, the student should be able to:
CO 1  Learn the basics of creativity for developing Entrepreneurship
CO 2  Understand the importance of creative intelligence for business growth
CO 3  Understand the advances through Innovation in Industries
CO 4  Learn about applications of innovation in building successful ventures
CO 5  Acquaint with developing innovative business models to run the business efficiently and effectively

Suggested Readings:
Creativity and Inovation in Entrepreneurship, Kankha, Sultan Chand
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

CMG340      PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS

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

UNIT I INTRODUCTION TO MARKETING MANAGEMENT

UNIT II MARKETING ENVIRONMENT

UNIT III PRODUCT AND PRICING MANAGEMENT
Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions -
UNIT IV  PROMOTION  AND DISTRIBUTION MANAGEMENT

Introduction to Promotion – Marketing Channels - Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP) - Logistics Management- Introduction to Retailing and Wholesaling.

UNIT V  CONTEMPORARY ISSUES IN MARKETING MANAGEMENT


TOTAL 45 : PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to :
CO 1 Have the awareness of marketing management process
CO 2 Understand the marketing environment
CO 3 Acquaint about product and pricing strategies
CO 4 Knowledge of promotion and distribution in marketing management.
CO 5 Comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCES:

CMG341 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS

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

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Person nel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

UNIT II  HUMAN RESOURCE PLANNING

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation-Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III  RECRUITMENT AND SELECTION

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources - eRecruitment - Selection Process - Selection techniques - eSelection- Interview Types- Employee Engagement.

UNIT IV  TRAINING AND EMPLOYEE DEVELOPMENT


UNIT V  CONTROLLING HUMAN RESOURCES


TOTAL 45 : PERIODS

COURSE OUTCOMES

Upon completion of this course the learners will be able:

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

REFERENCES

COURSE OBJECTIVES
- To develop the basics of business venture financing.
- To impart the knowledge essential for entrepreneurs for financing new ventures.
- To acquaint the learners with the sources of debt and equity financing.
- To empower the learners towards fund raising for new ventures effectively.

UNIT I ESSENTIALS OF NEW BUSINESS VENTURE

UNIT II INTRODUCTION TO VENTURE FINANCING

UNIT III SOURCES OF DEBT FINANCING

UNIT IV SOURCES OF EQUITY FINANCING
Own Capital, Unsecured Loan - Government Subsidies , Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.

UNIT V METHODS OF FUND RAISING FOR NEW VENTURES

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

REFERENCES:
1) Principles of Corporate Finance by Brealey and Myers et al.,12TH ed, McGraw Hill Education (India) Private Limited, 2018

VERTICAL 3: PUBLIC ADMINISTRATION

CMG343 PRINCIPLES OF PUBLIC ADMINISTRATION

UNIT-I
1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration

UNIT-II
1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT-III
1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT-IV
1. Bureaucratic Approach: Max Weber
2. Human Relations Approach : Elton Mayo
3. Ecological Approach : Riggs

UNIT-V
1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers

TOTAL: 45 PERIODS
REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

CMG344 CONSTITUTION OF INDIA

UNIT-I
1. Constitutional Development Since 1909 to 1947
2. Making of the Constitution
3. Constituent Assembly

UNIT-II
1. Fundamental Rights
2. Fundamental Duties
3. Directive Principles of State Policy

UNIT-III
1. President
2. Parliament
3. Supreme Court

UNIT-IV
1. Governor
2. State Legislature
3. High Court

UNIT-V
1. Secularism
2. Social Justice
3. Minority Safeguards

REFERENCES:
3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi
UNIT-I
1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

UNIT-II
1. Generalist Vs Specialist
2. Civil Servants’ Relationship with Political Executive
3. Integrity in Administration.

UNIT-III
1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

UNIT-IV
1. All India Services
2. Service Conditions
3. State Public Service Commission

UNIT-V
1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

REFERENCES:
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations

TOTAL: 45 PERIODS
UNIT II
Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

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

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

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

REFERENCES:
1. Crozier M : The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis : Organization Theory (MAC)

TOTAL: 45 PERIODS
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

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

COURSE OBJECTIVE:
- To learn the applications of statistics in business decision making.
UNIT I INTRODUCTION
Basic definitions and rules for probability, Baye’s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETRIC TESTS
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS

UNIT V CORRELATION AND REGRESSION

TOTAL: 45 PERIODS

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

REFERENCES:

CMG350   DATAMINING FOR BUSINESS INTELLIGENCE   L T P C
3 0 0 3

COURSE OBJECTIVES:
- To know how to derive meaning form huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.
UNIT I INTRODUCTION
Data mining, Text mining, Web mining, Data ware house.

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

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

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Learn to apply various data mining techniques into various areas of different domains.
CO2: Be able to interact competently on the topic of data mining for business intelligence.
CO3: Apply various prediction techniques.
CO4: Learn about supervised and unsupervised learning technique.
CO5: Develop and implement machine learning algorithms

REFERENCES:
1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
7. G. K. Gupta, Introduction to Data mining with Case Studies, Prentice hall of India, 2011
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011
CMG351  HUMAN RESOURCE ANALYTICS  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I - INTRODUCTION TO HR ANALYTICS  9
People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business – HR metrics and KPIs.

UNIT II - HR ANALYTICS I: RECRUITMENT  9
Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

UNIT III - HR ANALYTICS - TRAINING AND DEVELOPMENT  9
Training & Development Metrics: Percentage of employees trained - Internally and externally trained - Training hours and cost per employee - ROI.

UNIT IV - HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION  9
Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover-grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V - HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT  9
Workforce Diversity and Development Metrics: Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

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

REFERENCES:

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS L T P C 3 0 0 3

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

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

UNIT II - COMMUNITY BUILDING AND MANAGEMENT
History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages-Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT III - SOCIAL MEDIA POLICIES AND MEASUREMENTS
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV - WEB ANALYTICS
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

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

TOTAL: 45 PERIODS

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
COURSE OBJECTIVE:

- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I - INTRODUCTION

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

UNIT II - WAREHOUSING DECISIONS

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III - INVENTORY MANAGEMENT

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV - TRANSPORTATION NETWORK MODELS


UNIT V - MCDM MODELS

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

TOTAL: 45 PERIODS

COURSE OUTCOME:

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

REFERENCES:

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

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

UNIT II - FINANCIAL MARKET ANALYSIS 9
Estimation and prediction of risk and return ( bond investment and stock investment) –Time series-examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III - PORTFOLIO ANALYSIS 9
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV - TECHNICAL ANALYSIS 9

UNIT V - CREDIT RISK ANALYSIS 9
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

COURSE OUTCOME
- 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  9

UNIT II  SUSTAINABLE INFRASTRUCTURE PLANNING  9

UNIT III  SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES  9

UNIT IV  SUSTAINABLE CONSTRUCTION MATERIALS  9
Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS


TOTAL: 45 PERIODS

COURSE OUTCOME:
On completion of the course, the student is expected to be able to
CO1 Understand the environment sustainability goals at global and Indian scenario.
CO2 Understand risks in development of projects and suggest mitigation measures.
CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:
5. New Building Materials and Construction World magazine
7. Munier N, "Introduction to Sustainability", Springer2005
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- SUSTAINABLE AGRICULTURE PRACTICES

<table>
<thead>
<tr>
<th>CO’s</th>
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1 – Low; 2 – Medium; 3 – High; ‘- “– No correlation
COURSE OBJECTIVES

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT-I  INTRODUCTION TO BIOMATERIALS  9

UNIT-II  BIO POLYMERS  9
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  9
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  9
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  9

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 3 0 0 3

COURSE OBJECTIVES
- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT-I SUSTAINABLE ENERGY SOURCES
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT-II ELECTROCHEMICAL DEVICES
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O₂ battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO₂, LiFePO₄, LiMn₂O₄) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)
UNIT-III FUEL CELLS


UNIT-IV PHOTOVOLTAICS


UNIT-V SUPERCAPACITORS

Supercapacitor – types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS

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 OBJECTIVE:
- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics - atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES
Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT V GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5 – To understand advanced technology in green synthesis
TEXT BOOKS

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

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

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
COURSE OUTCOMES
After completion of this course, the students will know

<table>
<thead>
<tr>
<th>CO1</th>
<th>Basic concepts of environmental standards and monitoring.</th>
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<tr>
<td>CO2</td>
<td>the ambient air quality and water quality standards;</td>
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<td>CO3</td>
<td>the various instrumental methods and their principles for environmental monitoring</td>
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<td>CO4</td>
<td>The significance of environmental standards in monitoring quality and sustainability of the environment.</td>
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<td>CO5</td>
<td>the various ways of raising environmental awareness among the people.</td>
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<tr>
<td>CO6</td>
<td>Know the standard research methods that are used worldwide for monitoring the environment.</td>
</tr>
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</table>

TEXTBOOKS
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc

REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

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

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
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1 - low, 2 - medium, 3 - high, '-' - no correlation
COURSE OBJECTIVES:
1. To create awareness on the energy scenario of India with respect to world
2. To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
3. Familiarisation on the concept of sustainable development and its benefits
4. Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development
5. Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

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

UNIT III SUSTAINABLE DEVELOPMENT

UNIT IV RENEWABLE ENERGY TECHNOLOGY

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Understand the world and Indian energy scenario
CO2: Analyse energy projects, its impact on environment and suggest control strategies
CO3: Recognise the need of Sustainable development and its impact on human resource development
CO4: Apply renewable energy technologies for sustainable development
CO5: Fathom Energy policies and planning for sustainable development.

REFERENCES:
7. https://www.niti.gov.in/verticals/energy

CES338 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT L T P C 3 0 0 3

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

UNIT I ENERGY AND ENVIRONMENT 9
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING 9
Need and types of energy audit. Energy management (audit) approach understanding energy costs, benchmarking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters, Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVATION IN ELECTRICAL UTILITIES 9
Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V SUSTAINABLE DEVELOPMENT 9

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Understand the prevailing energy scenario
CO2: Familiarise on energy audits and its relevance
CO3: Apply the concept of energy audit on thermal utilities
CO4: Employ relevant techniques for energy improvement in electrical utilities
CO5: Understand Sustainable development and its impact on human resource development

REFERENCES: