ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM (CBCS)

B. TECH. FASHION TECHNOLOGY

PROGRAM EDUCATIONAL OBJECTIVES:

Bachelor of Fashion Technology curriculum is designed to prepare the undergraduates to
1. Have attitude and knowledge for the successful professional and technical career
2. Have strong foundation in basic sciences, engineering, management, mathematics and computational platforms
3. Have knowledge on the theory and practices in the field of textile based garment manufacturing technology, fashion industry and allied areas
4. Engross in life-long learning to keep themselves abreast of new developments, and practice and inspire high ethical values and technical standards

PROGRAM OUTCOMES:

The Fashion Technology Graduates will have the ability to

1. Apply knowledge of mathematics, sciences, engineering, textile and fashion technology to get solution for the technological problems in fashion and garment industry
2. Identify, formulate, review literature and critically analyze the technological problems in the textile and fashion industry to reach substantiated conclusion
3. Design and develop the solutions to the technological and managerial problems in fashion and garment industry with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
4. 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 to the technological problems in fashion and textile based garment industry
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for managing garment manufacturing companies with an understanding of the limitations

6. Apply reasoning gained through the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the profession

7. Understand the impact of the developed solutions in societal and environmental contexts, and demonstrate the knowledge for sustainable development

8. Understand ethical and professional responsibilities

9. Function effectively as an individual, and as a member or leader in diverse teams in the profession

10. Communicate effectively on complex engineering activities with the engineering community and with society at large. Able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

PROGRAM SPECIFIC OUTCOMES:

The Fashion Technology Graduates will have the ability to

1. Understand and apply fundamental and the technical knowledge for managing textile based garment and fashion industries.

2. Be a successful entrepreneur and execute fashion business in the area of garment design, development and manufacture.

3. Design and develop novel products and manufacturing processes in fashion and Garment fields.
## PEO’s – PO’s & PSO’s MAPPING

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TOTAL 16, 10 = 27, 22

$ Skill Based Course

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TOTAL 17, 16 = 34, 26

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

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$ Skill Based Course

### Semester IV

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

*Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester.
### SEMESTER V

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

*Four weeks industrial training/internship carries two credits. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

### SEMESTER VI

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

**Four weeks industrial training/internship carries two credit. Industrial training/Internship during VI Semester Summer Vacation will be evaluated in VII semester

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

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

**SEMIESTER 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.

**SEMIESTER VIII/VII**

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

* 15 weeks of continuous Internship in an organization carries 10 credits.

**TOTAL CREDITS: 164**
## Elective – Management Courses

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### Mandatory Courses I*

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* Mandatory Courses are offered as Non–Credit Courses

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

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<td>Garment Manufacturing</td>
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<td>Operation research in Apparel Industry</td>
<td>Technology of nonwoven</td>
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<tr>
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<td>Clothing Fit and comfort</td>
<td>Lean manufacturing</td>
<td>Enterprise Resource Planning in Apparel industry</td>
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<td>Smart Textiles and Garments</td>
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<tr>
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<tr>
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Registration of Professional Elective Courses from Verticals:

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

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OPEN ELECTIVES

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

OPEN ELECTIVE I AND II
(EMERGING TECHNOLOGIES)

To be offered other than Faculty of Information and Communication Engineering

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Enrollment for B.E. / B. Tech. (Honours) / Minor degree (Optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech. (Honours) 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 ADDITIONS TO ALL THE VERTICALS OF OTHER PROGRAMMES)**

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<th>Vertical II Entrepreneurship</th>
<th>Vertical III Public Administration</th>
<th>Vertical IV Business Data Analytics</th>
<th>Vertical V Environment and Sustainability</th>
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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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IP3151  INDUCTION PROGRAMME
This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

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

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

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

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

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

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

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

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

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

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

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

(viii) Familiarization to Dept./Branch & Innovations
They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

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

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

References:
Guide to Induction program from AICTE

HS3152 PROFESSIONAL ENGLISH I

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

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

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: 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
• To use appropriate words in a professional context
• To gain understanding of basic grammatical structures and use them in right context.
- To read and interpret information presented in tables, charts and other graphic forms
- To write definitions, descriptions, narrations and essays on various topics

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

**REFERENCE BOOKS:**

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

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

**MA3151**

**MATRICES AND CALCULUS**

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

UNIT I MATRICES

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
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia

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 ].

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PH3151 ENGINEERING PHYSICS

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

UNIT I MECHANICS
Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M.I –moment of inertia of continuous bodies

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

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

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

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

TOTAL: 45 PERIODS

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

CY3151 ENGINEERING CHEMISTRY

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

UNIT III PHASE RULE AND COMPOSITES 9
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.

UNIT IV FUELS AND COMBUSTION 9
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon footprint.

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9
Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion battery; Electric vehicles; working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

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 application in energy sectors.

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GE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING

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

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING

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

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

UNIT IV  LISTS, TUPLES, DICTIONARIES  9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V  FILES, MODULES, PACKAGES  9
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/
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8. 1 - low, 2 - medium, 3 - high, ‘-’ - no correlation

GE3152  

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3 - no correlation
UNIT I  LANGUAGE AND LITERATURE
minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. 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)
2. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) –
GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

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

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

TEXT BOOKS:

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

COs- PO’s & PSO’s MAPPING

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

BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY : (Any Seven Experiments)

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

**LIST OF EXPERIMENTS**

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

**TOTAL: 30 PERIODS**

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

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

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

**CHEMISTRY LABORATORY:** (Any seven experiments )

**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

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

TOTAL : 30 PERIODS

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

TEXT BOOKS :

CO-PO & PSO MAPPING

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• 1-low, 2-medium, 3-high, ´-´- no correlation
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

LEARNING OUTCOMES:

At the end of the course, learners will be able
- To listen to and comprehend general as well as complex academic texts information
- To listen to and understand different points of view in a discussion
- To speak fluently and accurately in formal and informal communicative contexts
- To describe products and processes and explain their uses and purposes clearly and accurately

TOTAL: 30 PERIODS
- To express their opinions effectively in both formal and informal discussions

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

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

**HS3252**

**PROFESSIONAL ENGLISH -II**

**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**

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**

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**

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

Reading – Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report
Grammar – Reported Speech, Modals
Vocabulary – Conjunctions, use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals;
Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

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

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

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.
**CO-PO & PSO MAPPING**

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

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### MA3251

**STATISTICS AND NUMERICAL METHODS**

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**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.

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**UNIT II**

**DESIGN OF EXPERIMENTS**

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

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**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

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

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

TEXT BOOKS:

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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 9
Definition of various forms of textile fibres - staple fibre, filament, bicomponent fibres. Classification of Natural and Man-made fibres, essential and desirable properties of Fibres. Production and cultivation of Natural Fibers: Cotton, Silk, Wool -Physical and chemical structure of the above fibres.

UNIT II REGENERATED FIBRES 9
Production Sequence of Regenerated Cellulosic fibres: Viscose Rayon, Acetate rayon – High wet modulus fibres: Modal and Lyocel , Tencel

UNIT III SYNTHETIC FIBRES 9
Production Sequence of Synthetic Fibers: polymer-Polyester, Nylon, Acrylic and polypropylene. Mineral fibres: fibre glass , carbon . Introduction to spin finishes and texturization

UNIT IV SPECIALITY FIBRES 9
Properties and end uses of high tenacity and high modulus fibres, high temperature and flame retardant fibres, Chemical resistant fibres

UNIT V FUNCTIONAL SPECIALITY FIBRES 9
Properties and end uses : Fibres for medical application – Biodegradable fibres based on PLA, Super absorbent fibres elastomeric fibres, ultra-fine fibres, electrospun nano fibres, metallic fibres – Gold and Silver coated.

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- Understand the process sequence of various fibres
- Understand the properties of various fibres

TEXT BOOKS:

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

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

UNIT II MAGNETIC CIRCUITS AND ELECTRICAL INSTALLATIONS 9
Magnetic circuits-definitions-MMF, flux, reluctance, magnetic field intensity, flux density, fringing, self and mutual inductances-simple problems.
Domestic wiring , types of wires and cables, earthing ,protective devices- switch fuse unit-Miniature circuit breaker-moulded case circuit breaker-earth leakage circuit breaker, safety precautions and First Aid

UNIT III ELECTRICAL MACHINES 9

UNIT IV ANALOG ELECTRONICS 9

UNIT V SENSORS AND TRANSDUCERS 9
Sensors, solenoids, pneumatic controls with electrical actuator, mechatronics, types of valves and its applications, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, hall effect, photo sensors,Strain gauge, LVDT, differential pressure transducer,optical and digital transducers, Smart sensors, Thermal Imagers.

COURSE OUTCOMES:
After completing this course, the students will be able to
CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestic wiring and protective devices
CO3: Explain the working principle and applications of electrical machines

TOTAL : 45 PERIODS
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the types and operating principles of sensors and transducers

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

REFERENCES:

CO’s, PO’s & PSO’s MAPPING

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GE3251 ENGINEERING GRAPHICS

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

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications — Use of drafting instruments — BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.
UNIT I  PLANE CURVES  6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics —
Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of
cycloid — construction of involutes of square and circle — Drawing of tangents and normal to
the above curves.

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

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

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF
SURFACES  6+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the
one of the principal planes and perpendicular to the other — obtaining true shape of section.
Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders
and cones.
Practicing three dimensional modeling of simple objects by CAD Software(Not for
examination)

UNIT V  ISOMETRIC AND PERSPECTIVE PROJECTIONS  6+12
Principles of isometric projection — isometric scale —Isometric projections of simple solids
and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in
simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and
cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD
Software(Not for examination)

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

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

TEXT BOOKS:
REFERENCES:

Publication of Bureau of Indian Standards:

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

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Low (1); Medium (2); High (3)
OBJECTIVES:
The course aims to

- Gain proper understanding on spectroscopic and surface analytical techniques.
- Impart knowledge to students on the chemistry of surface and interfaces.
- Make students well versed on the chemical analysis of oils, fats, soaps & lubricants.
- Firmly establish a sound understanding on the student’s mind about chemicals and auxiliaries.
- Familiarize students with the identification and characteristics of dyes and their applications.

UNIT I   SPECTROSCOPIC TECHNIQUES
Spectroscopy: Electromagnetic spectrum - absorption of radiation electronic, vibrational and rotational transitions. Width and intensities of spectral lines. Flame photometer, Atomic absorption spectroscopy, UV-Vis, IR spectroscopy, Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) - principles, instrumentation (Block diagram) and applications.

UNIT II   CHEMISTRY OF INTERFACES

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

UNIT IV   OILS, FATS, SOAPS & LUBRICANTS
Chemical constitution, Chemical analysis of oils and fats acid, saponification and iodine values, Definitions, determinations and significance. Definition, mechanism of lubrication, preparation of petrolubes, desirable characteristics viscosity, viscosity index, carbon residue, oxidation stability, flash and fire points, cloud and pour points, aniline point. Semisoluid lubricant greases, preparation of sodium, lithium, calcium and axle greases and uses, consistency test and drop point test. Solid lubricants graphite and molybdenum disulphide.

UNIT V   CHEMICALS AND AUXILIARIES
Estimation of available chlorine in hypochlorite bleach liquor. Determination of strength of hydrogen peroxide. Colorants Theory of colour and constitution: chromophore and auxochromes, bathochromic and hypsochromic shift, classification of dyes based on application and composition. Chemistry of azo dye – synthesis of Methyl red, Methyl orange, Congo red, phenolphthalein, fluorescein and eosin

COURSE OUTCOMES:
At the end of the course, the students will be able to:
CO1: Understand and apply spectroscopic techniques for the analysis of engineering materials for their end use applications.

CO2: Make use of the applications of adsorption in detergency, wetting, spreading, foaming, de-foaming, and water repellence and separation processes.

CO3: Analyse and estimate oils, fats, lubricants and soap for their intended applications.

CO4: Distinguish and demonstrate the role of different types of chemicals and auxiliaries.

CO5: Realize the chemical structures, properties and relationships of different types of dyes and their applications

TEXTBOOKS:

REFERENCES:
TEXT-CUM-REFERENCE BOOKS

1. **Social Life of Tamils** (Dr.K.K.Pillay) A joint publication of TNTB & 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. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. 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)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

TOTAL : 15 PERIODS
UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

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

UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

TEXT-CUM-REFERENCE BOOKS
1. குறிப்பிட்டு ஜோதிர்லிங்கம் - முதல்தமிழ் பாடச்செய்தி - 0.0.0. பிரமதா (பொறியியல்: குறிப்பிட்டு பாடல்கள் மற்றும் கலை மற்றும் பாடச்செய்திகள் குறிப்பிடு).
2. குறிப்பிட்டு குறிப்பிட்டு - முதல்தமிழ் தொழ். குறிப்பிடு. (பொறியியல்: பிரமதா).
3. தமிழ் – பொறியியல் தொழில்நுட்பம் தகவல்கள் தகவுச் சாதனை (பொறியியல்: தகவுச் சாதனை)
4. பாரம்பரியா - அளவறிக்கை சாதனை (பொறியியல்: அளவறிக்கை சாதனை)
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).
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**NCC GENERAL**

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

**NATIONAL INTEGRATION AND AWARENESS**

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

**PERSONALITY DEVELOPMENT**

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

**LEADERSHIP**

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

**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**

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

**NCC Credit Course Level 1**

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**NCC GENERAL**

- **NCC 1** Aims, Objectives & Organization of NCC 1
- **NCC 2** Incentives 2

57
NCC 3  Duties of NCC Cadet  1
NCC 4  NCC Camps: Types & Conduct  2

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

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

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

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

TOTAL : 30 PERIODS

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

NCC GENERAL  6
NCC 1  Aims, Objectives & Organization of NCC  1
NCC 2  Incentives  2
NCC 3  Duties of NCC Cadet  1
NCC 4  NCC Camps: Types & Conduct  2

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

PERSONALITY DEVELOPMENT  7

TOTAL PERIODS: 30
PD 1  Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  2
PD 2  Communication Skills  3
PD 3  Group Discussion: Stress & Emotions  2

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

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

TOTAL : 30 PERIODS

GE3271  ENGINEERING PRACTICES LABORATORY  L T P C  0 0 4 2

COURSE OBJECTIVES:
• 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 commonhousehold wood work.
• Wiring various electrical joints in common household electrical wire work.
• Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
• Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I  CIVIL ENGINEERING PRACTICES  15

PLUMBING WORK:

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

WOOD WORK:

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

Wood Work Study:

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

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III  MECHANICAL ENGINEERING PRACTICES  15

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

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

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

SHEET METAL WORK:
 a) Making of a square tray

FOUNDRY WORK:
 a) Demonstrating basic foundry operations.

PART IV  ELECTRONIC ENGINEERING PRACTICES  15

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

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

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

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

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

CO3: Weld various joints in steel plates using arc welding work; Machine various simple 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.

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

BE3272 BASIC ELECTRICAL, ELECTRONICS AND INSTRUMENTATION L T P C
ENGINEERING LABORATORY 0 0 4 2

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

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

TOTAL: 60 PERIODS

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

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

CO2: Analyze experimentally the load characteristics of electrical machines

CO3: Analyze the characteristics of basic electronic devices
CO4: Use LVDT to measure displacement

CO’s, PO’s & PSO’s MAPPING

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OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

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

UNIT II
12 Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures-talking about travel problems-making arrangements-describing arrangements-discussing 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:
LEARNING OUTCOMES
At the end of the course, learners will be able
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions.
- Write emails, letters and effective job applications.
- Write critical reports to convey data and information with clarity and precision.
- Give appropriate instructions and recommendations for safe execution of tasks.

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

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**CO-PO & PSO MAPPING**

**MA3357 PROBABILITY AND STATISTICAL METHODS**

**COURSE OBJECTIVES:**
- To develop Probability techniques in manufacturing and quality evaluation process.
- To familiarize the students with two dimensional random variables.
- To familiarize the student with Differential Equations.
- To make the students to understand various techniques of Correlation and Time series Analysis.
- To acquaint the student with mathematical tools needed in evaluating Statistical quality control and to apply in the textile manufacturing industry.

**UNIT I PROBABILITY AND RANDOM VARIABLES**

**UNIT II TWO DIMENSIONAL RANDOM VARIABLES**
Join distributions – Marginal distributions and conditional distributions –Moments - Covariance - Transforms of random variables – Central limit theorem.
UNIT III DIFFERENTIAL EQUATIONS 9+3

UNIT IV CORRELATION, REGRESSION, INDEX NUMBERS AND TIMES SERIES ANALYSIS 9+3
Correlation analysis, estimation of regression line. Time series analysis: Variations in time series, trend analysis, cyclical variations, seasonal variations and irregular variations. Index Numbers – Laspeyre’s, Paasche’s and Fisher’s Ideal Index.

UNIT V STATISTICAL QUALITY CONTROL 9+3
Control charts for measurements (X and R chart) – Control charts for attributes (p,C and np) charts – Tolerance limits – acceptance Sampling.

TOTAL PERIODS: 60

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1: Use the Probability techniques for solving practical problems.
CO2: Apply two dimensional random variable tools in solving various problems.
CO3: Able to solve differential Equations by applying various techniques.
CO4: Apply different methods of Correlation, Regression, Index Numbers and Times series analysis in solving practical problems.
CO5: Apply statistical techniques in solving manufacturing and management related problems

TEXTBOOKS:

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FT3301  CHARACTERISTICS OF TEXTILE FIBRES  

OBJECTIVES
To enable the students to understand the physical characteristics of textile fibres

UNIT I  STRUCTURE AND INVESTIGATION TECHNIQUES OF FIBRES  9
Classification of fibres; study of morphological structures of fibers; Transmission and Scanning electron microscopes-principle; construction and working; X-ray diffraction techniques – estimation of crystallinity; Infrared radiation and dichroism techniques

UNIT II  MOISTURE ABSORPTION CHARACTERISTICS  9
Theories of moisture sorption; moisture absorption behavior of natural and man-made fibres; influence of fibre structure, humidity and temperature on the moisture absorption; conditioning of fibres –mechanism of conditioning and factors influencing conditioning .moisture diffusion in fibres; heat of sorption – factors influencing heat of sorption - measurement of heat of sorption

UNIT III  TENSILE AND ELONGATION CHARACTERISTICS OF FIBRES  9
Tensile characteristics –study of strength, elongation, work of rupture, initial modulus, work factor and yield point – determination of yield point. stress-strain relations of natural and manmade fibres - influence of fibre structure, humidity and temperature on tensile characteristics. time effects- study of creep phenomena.

UNIT IV  ELASTIC RECOVERY BEHAVIOUR OF FIBRES  9
Elastic recovery and its relation to stress and strain of fibres; mechanical conditioning of fibres and its influence on elastic recovery .load cycling and extension cycling-their effect on elastic recovery. introduction about torsional and flexural rigidity of fibers
UNIT V  OPTICAL, FRICTIONAL, AND THERMAL CHARACTERISTICS

Reflection and lustre - objective and subjective methods of measurement - refractive index and its measurement - friction - its measurement, comparison of fibres, directional friction in wool - friction, thermal transitions of fibres - thermal conductivity, thermal expansion and contraction, Tg, melting; static electricity in textile fibres

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student shall

CO1 Investigate and identify fibers based on their morphological structure
CO2 Identify the factors influencing moisture and heat sorption behavior of fibres
CO3 Identify the factors influencing tensile and elongation behavior of fibres
CO4 Understand the elastic recovery behaviour of fibres
CO5 Understand and measure the optical, frictional, and thermal characteristics of fibres

TEXTBOOKS


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<td>Identify the factors influencing moisture and heat sorption behavior of fibres</td>
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<td>Identify the factors influencing tensile and elongation behavior of fibres</td>
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<td>Understand the elastic recovery behaviour of fibres</td>
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<td>CO5</td>
<td>Understand and measure the optical, frictional, and thermal characteristics of fibres</td>
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OBJECTIVE:
To enable the students to understand various processes involved in conversion of fibre to yarn by various spinning system and other modern spinning systems.

UNIT I  YARN SPINNING  10
Linear density systems for textile materials; – objectives, types, working principle of Ginning , blow room , Carding , drawing machine , roving machine, Ring spinning

UNIT II  COMBED YARN PRODUCTION PROCESS  4
Comber preparation – objectives, principles of sliver lap ribbon lap and super lap formers; comber- principle of combing, sequence of combing operation.

UNIT III  OUTLINE & PASSAGE FLOW OF OPEN END SPINNING  6
Principles of yarn formation and material flow – rotor, friction, air-jet and air vortex spinning machines ; core, wrap spinning system, comparison of yarn properties

UNIT IV  OUTLINE & PASSAGE FLOW OF SEWING THREAD AND SPECIALITY YARNS:  5

UNIT V  OUTLINE & PASSAGE FLOW OF SPECIALITY SPINNING  5
Melt spinning, Dry spinning, Sol gel spinning, Hollow spinning, specialized non-circular cross section fibres, spinning for - nonwovens, Optical fibres, thermotropic liquid-crystal polymers, Electro spinning.

OUTCOMES:
Upon completion of this course, the student shall
- Infer the short staple spinning process and machineries
- Infer the combing process to produce combed cotton yarn
- Outline the process of open-end spinning.
- Apply the spinning concepts in fancy yarns and product diversifications.
- Outline the process of specialty spinning

TEXT BOOKS:
1. Lawrence C.A. Advances in Yarn Spinning Technology, Woodhead publishing, 2010
4. Bin Ding, Xianfeng Wang and Jianyong Yu, Electrospinning: Nanofabrication and Applications, Woodhead publishing, 2019
REFERENCES:
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
- To teach preparatory processes, primary and secondary mechanisms auxiliary, additional mechanisms of shuttle looms; weft insertion principles of shuttle less looms
- To teach knitting process, principles of weft and warp knitting machines,
- To teach principles involved in the manufacturing of nonwoven fabric

UNIT I
Basics of Woven Fabrics: Different kinds of fabrics, Woven fabrics, Warp, Weft, Weaving; Preparatory processes for single and folded yarn
Yarn Winding Machines: Objectives, yarn passage in Cone Winding machine and Pirn Winding machine.
Warping Machines: Objectives, warp passage in Back beam warping machine and Sectional warping machine.
Sizing and Gaiting: Objects of sizing, sizing ingredients and its function; Drawing-in, Denting, and Knotting or Piecing; Gaiting

UNIT II
Basic Concepts of Loom: Loom, Parts of Loom, Path of Warp in loom; Motions of Weaving –Primary, Secondary, and Auxiliary motions; Types of looms, Loom speed and Efficiency
Primary Mechanisms: Basic working principles of Tappet Shedding, Cone over Picking, Cone under Picking, Side lever Under Picking, Crank Beat-up, Timings of Primary Motions
Secondary Mechanisms: Negative Let-off mechanism, Positive Seven wheels Take-up mechanism.
Objectives of Auxiliary Motions: Temple, Brake/Starting handle, Warp stop, Warp protecting, Weft stop, Drop box

UNIT III
Other Shedding Devices: Basic working principles Climax Dobby and Single lift single cylinder Jacquard
Shuttle less looms: Basic principles of weft insertion by Projectile, Single Rapier, Double Rapier, Air jet, water jet; Multi-phase weaving; Principles 3D fabric weaving
Defects and Inspection: Woven fabric Defects, Causes and Remedies; Fabric inspection, 4-points system, Classification of defects, Inspection procedure

UNIT IV
Classification of knitting processes – weft knit and warp knit; yarn quality requirements for knitting; principles of knitting; types of knitting needles – Bearded, Latch &Compound needle; Weft knitting machines: Principles of Flat knitting machine and Circular knitting machine, - Circular bearded needle single-jersey fabric machine, Revolving cylinder latch needle machine, Circular garment length machine
Warp knitting machines: needle bar, sinker bar, guide bar –pattern wheel –chain link-Warp knitting fundamentals- Knitting cycle for warp knitting- closed lap and open lap stitches – Raschel, compound needle and Tricot knitting machines- Comparison of raschel and tricot knitting machines
UNIT V

Web preparation for nonwovens – Principle, machines, processes for web preparation by dry laid, wet laid and air laid; web preparation by polymeric solution, Spun bonding and Melt blown process.

Bonding of nonwoven: Bonding methods- principles, machine; processes for mechanical, thermal, chemical bonding; Finishes, Properties and uses of nonwoven fabrics

OUTCOMES:

Upon completion of this course, the student shall be able to

CO1: Describe the objectives and principles of winding, warping machines and the objectives of sizing

CO2: Explain the basic concepts of loom and the working principle of primary, secondary, and auxiliary mechanisms of power loom

CO3: Explain the working principle of dobby, jacquard, and shuttle less looms; Describe the fabric defects, causes and remedies, procedure for fabric inspection

CO4: Describe the classification of knitted fabrics and explain the working principle of warp and weft knitting machines

CO5: Explain the principles involved in web preparation, bonding and finishing of nonwoven fabrics

TEXT BOOKS:


REFERENCES:


### Course Articulation Matrix:

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<td>CO3</td>
<td>Explain the working principle of dobby, jacquard, and shuttle less looms; Describe the fabric defects, causes and remedies, procedure for fabric inspection</td>
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<td>CO4</td>
<td>Describe the classification of knitted fabrics and explain the working principle of warp and weft knitting machines</td>
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<td>CO5</td>
<td>Explain the principle involved in web preparation, bonding and finishing of nonwoven fabrics</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:

- Structures of basic, simple and compound weaves
- Structures of pile and leno structures; graphing for spot and jacquard figuring
- Different weft knit and warp knit structures

UNIT I
Basic Weaves: Plain, Twill, Sateen, Warp Rib, Weft Rib, Mat; Draft and peg-plan of these weaves
Simple Weaves: Wavy Twill, Herring Bone, Diamond, Diaper; Ordinary Honey comb, Brighton Honey comb, Mock-leno, Huck-a-back, Crepe; Colour and weave effect; Draft and peg-plan of basic and simple weaves

UNIT II
Compound Weaves: Basic construction of – Plain face Bedford cord, Plain face welt, Twill face Warp Backed, Weft Backed structures; Plain face Extra Warp, Extra Weft structures produced by heald; Twill face self-stitched Double Cloth, Interchanging plain double cloth;

UNIT III
Pile Weaves and Leno: Basic construction of - Warp pile-Velvet, Terry Pile, Weft Pile- Velveteen and Corduroy; Basic Leno structure
Dobby and Jacquard Design: Spot Figure graphing, Steps involved in graphing for figured fabrics, Basics of computer Aided Graph Designing.
Characteristics, Commercial names and end uses of the fabrics woven with different weaves of the course

UNIT IV
Weft knit structures: Representation and characteristics of weft knit fabric structures -Single jersey, Rib, Purl, Interlock. Derivatives of single and double jersey structures: Accordion type of fabrics, plaited fabrics, 2X2 rib structure, half cardigan, full cardigan, eight lock, Ponte-di-Roma, Ottoman rib, Bourrelet, Texi- pique, Pin-tuck, Milano rib, French pique, Swiss pique.

UNIT V
Warp knit structures: Representation and characteristics of warp knit fabric structures. Point Paper, Chain-Link Notation, single fabrics, Chain stitch, Tricot lap, Full tricot, Lock Knit, Reverse Lock Knit, satin, Loop raided fabrics, Queen's cord, Sharkskin, Blind lap, open work effects, Marquisette, sand- flair net, Hexagonal net.
Characteristics, Commercial names and end uses of the fabrics/garments woven with different weft and warp knit structures

OUTCOMES:

Upon completion of this course, the student shall be able to

- Design and describe the construction of basic weaves and simple weaves
- Design and describe the construction of compound weaves
- Design and describe the construction of pile weaves, jacquard designs, and define the commercial names of woven fabrics
- Design and describe the weft knit structures
- Design and describe the warp knit structures and define the commercial names of knitted fabrics

TEXTBOOKS
REFERENCES
<table>
<thead>
<tr>
<th>Course Outcomes</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Design and describe the construction of basic weaves and simple weaves</td>
<td>PO 1 PO 2 PO 3 PO 4 PO 5 PO 6 PO 7 PO 8 PO 9 PO 10 PO 11 PO 12 PS O 1 PS O 2 PS O 3</td>
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<td>CO2</td>
<td>Design and describe the construction of compound weaves</td>
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<tr>
<td>CO3</td>
<td>Design and describe the construction of pile weaves, jacquard designs, and define the commercial names of woven fabrics</td>
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<td>3 2 2 1 2 - - - 1 2 2 3 - 2</td>
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<tr>
<td>CO4</td>
<td>Design and describe the weft knit structures</td>
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<tr>
<td>CO5</td>
<td>Design and describe the warp knit structures and define the commercial names of woven fabrics</td>
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OBJECTIVES:
- To introduce briefly the basic concepts of fashion and design to the students.
- To acquaint the student with the history of fashion, its elements, traditional costumes of various cultures of the world.

UNIT I
Development of Figured Motif; Forms – Natural, Geometrical, Artificial, and Abstract; Bases – Diamond, Ogee, and Diagonal; Arrangement – Plain, Twill, and Sateen; Principles – Half Drop Straight, and Half Drop Reverse.
Garment design – Classification - structural, decorative and functional.

UNIT II
Elements of Design – line, shape, form, size, colour, texture and pattern;
Principles of design – Harmony, Balance, Rhythm, Emphasis and Proportion; introducing elements and principles of design in apparels.
Colour – definition; dimensions of colour-hue, value and intensity; colour harmonies, warm and cool colours; advancing and receding colours; colour theories – Prang colour system and Munsell colour system.

UNIT III
Fashion fundamentals – definition, tangibles and intangibles of fashion; fashion life cycle; factors influencing fashion; fashion adoption theories.
Fashion terminology - street fashion, recurring fashion, mass fashion, fashion trend, fashion shows, style, chic, boutique, Haute Couture; role of a fashion designer.

UNIT IV
History of world costumes – principle garments and textiles of Egyptian, Greek, medieval English, Renaissance French costumes
History of Indian costumes – Ancient garments during the Mauryan and Guptha period
Traditional Indian costumes - Tamil Nadu, Kerala, Gujarat, Rajasthan, Bengal, Manipur, Jammu & Kashmir, Manipur, Orissa, Maharashtra

UNIT V

OUTCOMES:
Upon the completion of this course, the students shall understand the
- Development of textile designs and garment designs
- Adapt elements & principles of design in context to Textiles and Apparels
- Basic concepts of fashion fundamental and terminology
- Identify the traditional world costumes and textiles of India.
- Summarize the traditional Indian textiles, embroideries and printing

TEXT BOOKS:
1. Vandana Bhenderi, “Costume, Textiles and Jewellery of India – Traditions in Rajasthan”,

REFERENCES:
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<td>CO1</td>
<td>Development of textile designs and garment designs</td>
<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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<tr>
<td>CO2</td>
<td>Adapt elements &amp; principles of design in context to Textiles and Apparels</td>
<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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<tr>
<td>CO3</td>
<td>Basic concepts of fashion fundamental and terminology</td>
<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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<tr>
<td>CO4</td>
<td>Identify the traditional world costumes and textiles of India.</td>
<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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<tr>
<td>CO5</td>
<td>Summarize the traditional Indian textiles, embroideries and printing</td>
<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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<td>PO1 3 PO2 2 PO3 2 PO4 1 PO5 2 PO6 - PO7 - PO8 - PO9 1 PO10 2 PO11 2 PSO 3 - PO12 2</td>
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</table>
OBJECTIVE:

- To train the students in analyzing the cloth to identify construction parameters and structure of woven, knitted and nonwoven fabrics.

Analysis of construction details of the following fabric structure

1. Plain and its derivatives
2. Twill and its derivatives
3. Satin & Sateen (Regular and irregular)
4. Honeycomb (ordinary and Brighton)
5. Huck-a-back & Mock-leno
6. Extra warp and extra weft figuring
7. Pile fabrics (warp and weft)
8. Bedford cord & Backed fabrics
9. Gauze and Leno
10. Double cloth
11. Crepe
12. Tapestry
13. Basic Weft knitted structures
14. Basic Warp knitted structure
15. Basic Non Wovens structures

OUTCOMES:

Upon completion of the laboratory course, the student will be able

- Identify the constructional parameters of woven fabric
- Construct design, draft and peg plan for woven fabrics
- Analyze the construction of Weft and warp knitted structures
- Analyze the structure of nonwoven fabrics
- Analysis of the non-woven structures

TOTAL: 60 PERIODS
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<td>Overall CO</td>
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</table>
COURSE OBJECTIVES
- To train the students in fashion illustration

LIST OF EXPERIMENTS
2. Object Drawing and Shading concepts.
3. Drape of fabrics and shading with different mediums.
4. Preparing swatches for dimensions of colour, different colour theories and harmonies.
5. Rendering prints and textures with various fabric constructions (wovens, non-wovens and knit).
6. Drawing different Silhouettes and garment components - sleeves, collars, necklines, cuffs, skirts, pants.
7. Human Anatomy- Figure basics, Constant proportions, Shapes and parts of human body. Study of different postures- Head- Face, Hand, Leg.
8. Normal Drawing - Eight head theory. Fashion Figure Drawing - Drawing croqui figures-stick, geometric, flesh - 8 ½ and 10 head figures.
10. Drawing croqui figures using template, model, imagination and photograph.
11. Create a mood board based on a selected theme.
12. Develop garments on croqui figures (Male and female) deriving inspirations from the developed mood board.

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able
- To develop motifs, draw objects and shade them
- To illustrate fabric drapes and shading with different color mediums.
- To illustrate different fabric swatches and garment components
- To understand human anatomy and illustrate basic figures
- To create a mood board based on a selected theme and develop garment designs
<table>
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<tr>
<td>CO1</td>
<td>To develop motifs, draw objects and shade them</td>
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<td>CO2</td>
<td>To illustrate fabric drapes and shading with different color mediums.</td>
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<td>CO3</td>
<td>To illustrate different fabric swatches and garment components</td>
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<tr>
<td>CO4</td>
<td>To understand human anatomy and illustrate basic figures</td>
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<tr>
<td>CO5</td>
<td>To create a mood board based on a selected theme and develop garment designs</td>
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OBJECTIVES:
   To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
   • To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
   • To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
   • To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

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

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

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

FT3401 APPAREL PRODUCTION MACHINERY

COURSE OBJECTIVES
- To impart knowledge on the machineries and equipments used for garment production latest developments in the garment production machineries.

UNIT I SPREADING MACHINES

UNIT II CUTTING MACHINES

UNIT III SEWING MACHINES

UNIT IV MULTI THREAD SEWING MACHINES

UNIT V SPECIALISED SEWING MACHINES
Special sewing machines – Button hole and button sewing machines. Parts and their Functions. Threading diagram. Rib cutting machine-Zig zag and feed off the arm machine Parts and their functions. Threading diagram; automation in sewing machine; Functions and merits of
computerized sewing machines; usage of special attachments and tools for operation simplifications. Maintenance & safety measures of machines

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would have knowledge on
- Different types of fabric laying methods, spreading machines and its control methods
- Different types of cutting machines and its control methods
- Sewing machine and its basic parts, functions and its safety measures
- Different types of multi thread sewing machines and its purpose
- Special sewing machines, its purpose and control measures

TEXT BOOKS:

REFERENCES:
2. Laing R.M. and Webster J, "Stitches and Seams," The Textile Institute, Manchester, 1999
<table>
<thead>
<tr>
<th>Course Outcomes</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Different types of fabric laying methods, spreading machines and its control methods</td>
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<td>CO2</td>
<td>Different types of cutting machines and its control methods</td>
<td>P O1  P O2  P O3  P O4  P O5  P O6  P O7  P O8  P O9  P O10  P O11  P O12  PS O1  PS O2  PS O3</td>
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<tr>
<td>CO3</td>
<td>Sewing machine and its basic parts, functions and its safety measures</td>
<td>P O1  P O2  P O3  P O4  P O5  P O6  P O7  P O8  P O9  P O10  P O11  P O12  PS O1  PS O2  PS O3</td>
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<tr>
<td>CO4</td>
<td>Different types of multi thread sewing machines and its purpose</td>
<td>P O1  P O2  P O3  P O4  P O5  P O6  P O7  P O8  P O9  P O10  P O11  P O12  PS O1  PS O2  PS O3</td>
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<tr>
<td>CO5</td>
<td>Special sewing machines, its purpose and control measures</td>
<td>P O1  P O2  P O3  P O4  P O5  P O6  P O7  P O8  P O9  P O10  P O11  P O12  PS O1  PS O2  PS O3</td>
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OBJECTIVE:
- To impart knowledge on quality evaluation of fabrics and garments

UNIT I CONSTRUCTION CHARACTERISTICS & SAMPLING TECHNIQUES 9
Basic fabric particulars – Measurement of ends and picks per inch, count of warp and weft, thickness and areal density (GSM), moisture regain and moisture content, warp and weft crimp; cover factor calculation


UNIT II MECHANICAL PROPERTIES 5
Tensile strength measurement – ravelled strip test and grab test – mechanical and electronic measuring systems. Tear strength – importance – measuring systems. Bursting strength and its measurement. Ballistic impact strength, Universal tensile tester; standards

UNIT III SERVICEABILITY PROPERTIES 13
Fabric stiffness – principle of measurement of flexural rigidity; Drapeability – measurement of drape coefficient; Crease recovery measurement techniques. Wrinkle recovery assessment using standard grades; Principle and functioning of air permeability testers, water repellency, contact angle, fabric abrasion and pilling tester and fabric shrinkage testing; standards and norms
Colour fastness testing – Washing, Rubbing, Light, Perspiration fastness.

UNIT IV LOW STRESS CHARACTERISTICS 9
Low stress mechanical properties - Kawabata Evaluation System; FAST; Fabric bending, Shear compression and decompression; surface roughness and friction tensile behaviour;

UNIT V FABRIC AND GARMENT INSPECTION 9
Fabric inspection – 4-point system, 10 point system, classification of fabric defects, independent product quality certification, acceptable quality level, Seam strength and seam slippage testing. Peel bond strength testing; Button, Zipper strength testing, Apparel dimensional stability – spirality.
Inspection of garments and garment defects - sewing, pressing, finishing and packaging defects.

OUTCOMES:
Upon completion of the course, the student will know
- CO1: Identification of construction characteristics and sampling methods
- CO2: Evaluation of mechanical characteristics
- CO3: Evaluation of serviceable properties
- CO4: Evaluation of low stress mechanical characteristics
- CO5: Fabric and garment inspection
- CO6: Practical testing of yarn and fabrics

TEXT BOOKS:


REFERENCES:

TOTAL: 30 PERIODS

LIST OF EXPERIMENTS:
Determination of
1. Yarn Count and Lea Strength
2. Single / Ply Yarn Twist
3. Yarn Appearance Grade
4. Fabric Abrasion Resistance and pilling
5. Fabric Tensile Strength
6. Color Fastness to Rubbing - Crock meter
7. Fabric Stiffness and Crease Recovery Angle
10. Colorfastness to perspiration.
11. Shrinkage of woven and knitted fabrics.
12. Seam Strength, Seam Slippage, zipper strength, button pull strength
13. Peel bond strength of fusible interlinings
14. Wickability and wettability of fabric
15. Spirality and Course length of Knitted fabrics
### Course Articulation Matrix:

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<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Identification of fabric construction characteristics and understand various sampling methods</td>
<td>PO 1</td>
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<td>3</td>
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<tr>
<td>CO2</td>
<td>Evaluation of mechanical characteristics</td>
<td>3</td>
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<tr>
<td>CO3</td>
<td>Evaluation of apparel comfort and accessories characteristics</td>
<td>3</td>
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<tr>
<td>CO4</td>
<td>Evaluation of low stress and thermal characteristics</td>
<td>3</td>
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<tr>
<td>CO5</td>
<td>Evaluation of fabric and garment inspection</td>
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<td>Overall CO</td>
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</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and substantial (High) respectively.
OBJECTIVES:
To enable the students to learn fundamentals of garment manufacture

UNIT I  APPAREL INDUSTRY PROCESS FLOW  9
Introduction to Indian apparel industry. Structure of an apparel industry-work flow, Pre production planning; types of samples and sample approval; Technical pack, Specification sheet – preparation, analysis and approval. Preparation of proto pattern and developing production pattern.

UNIT II  RAW MATERIAL SELECTION  9
Types and applications of garment accessories and trims – Labels, linings, inter-linnings, waddings, lace, braid, elastic, hook and loop fastners, shoulder pads, eyelets, zip fastners, buttons, rivets. Characteristics of sewing threads, types, construction and seam performance. Stitch types and uses; seam types and uses; Stitches and seam defects.

UNIT III  PATTERN LAYOUT PLANNING  9

UNIT IV  PRODUCTION SYSTEMS  9
Production systems- individual system; Factory production system- Progressive Bundle System, Unit Production System, Modular Production System. Quality control in swing section, assembly of garment components and operational break down.

UNIT V  APPAREL FINISHING PROCESS  9
Fusing requirements and process; stain removal process and machine, ironing and pressing process and machines. Packaging – types, functions and suitable machines– types of packaging forms.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students shall be able to
- Understand the structure of apparel industry and production planning
- Define and classify the types of accessories, trims, stitches, seams
- Explain Inspection, spreading and cutting processes
- Discuss the production systems followed in apparel manufacturing
- Explain apparel finishing process and packaging

TEXT BOOKS:
REFERENCES:

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<td>P O 1  P O 2  P O 3  P O 4  P O 5  P O 6  P O 7  P O 8  P O 9  P O10  P O11  P O12  PSO 1  PSO 2  PSO3</td>
</tr>
<tr>
<td>CO1</td>
<td>Understanding the structure of apparel industry and production planning</td>
</tr>
<tr>
<td>CO2</td>
<td>Define and Classify the types accessories, trims, stitches, seams</td>
</tr>
<tr>
<td>CO3</td>
<td>Acquire knowledge on Inspection, spreading and cutting process</td>
</tr>
<tr>
<td>CO4</td>
<td>Discuss the production systems</td>
</tr>
<tr>
<td>CO5</td>
<td>Understanding apparel finishing process and packaging</td>
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<td>Overall CO</td>
<td>3  3  2  2  3  -  -  -  -  1  -  -  3  2  2</td>
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</table>
COURSE OBJECTIVES

- To enhance the fundamental knowledge in human anthropometrics from the scientific and technological viewpoint
- To equip students with comprehensive pattern making skills

UNIT I STUDY OF BODY MEASUREMENTS AND SIZING SYSTEMS 6

UNIT II BASICS OF PATTERN MAKING 15
Introduction to pattern making and methods. Functions of pattern making tools, Preparing and Measuring the Form, Pattern making terminologies, Development of pattern - Drafting and draping methods - Basic men’s block - bodice, sleeves trousers, and women’s block - bodice, sleeves, trousers, skirt.

UNIT III PATTERN ALTERATIONS AND GRADING 6
Pattern alteration for fit, Factors affecting the pattern making process. Grading process, grade rules, and types of grading system.

UNIT IV TECHNIQUES OF PATTERN MAKING 9

UNIT V PATTERNS FOR COLLARS AND SLEEVES 9
Collar classification and terms, basic shirt collar, Peter Pan collar, sailor collar, mandarin collar, built-up neck lines, Cows, Sleeve cap, sleeve cuffs, puff, petal, lantern and leg-of-mutton sleeves.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1: Understand Anthropometry concepts and important body measurements
CO2: Prepare patterns for basic blocks using drafting and draping techniques
CO3: Develop grading and in pattern alteration
CO4: Apply dart manipulation techniques to design, variation in garment components
CO5: Prepare patterns for basic collar and sleeve components

TEXT BOOKS:

REFERENCES:
2. Gerry Cooklin, “Master Patterns and Grading for Men’s Outsize”, Blackwell Scientific
International Publications, 2005
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<td>Understand Anthropometry related concepts and important body measurements</td>
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<td>CO2</td>
<td>Prepare patterns for basic blocks using drafting and draping techniques</td>
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<tr>
<td>CO3</td>
<td>Develop knowledge on the techniques involved in grading and in pattern alteration</td>
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<tr>
<td>CO4</td>
<td>Apply dart manipulation techniques to design, variation in garment components</td>
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<td>CO5</td>
<td>Prepare patterns for basic collar and sleeve components</td>
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OBJECTIVES:
To enable the students to learn about pre-treatments involved in the wet processing of textiles, dyeing and printing of textiles

UNIT I PREPARATORY PROCESSES

UNIT II DYEING

UNIT III PRINTING:

UNIT IV FINISHING

UNIT V COMPUTER COLOR MATCHING CONCEPTS
Color; Electromagnetic spectrum - visible range, measurement of color strength - color matching - theory and applications. Spectrophotometer and color matching systems. Quality control using color matching systems, color difference - pass / fail system and shade sorting

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to

- CO1 Explain the preparatory process in chemical processing
- CO2 Explain the classes, machines, stages, and application of dyes
- CO3 Discuss about the ingredients, types and machines and faults in printing
- CO4 Understand the various methods and application of finishing
- CO5 Understand the measurement of strength of colour and colour difference

TEXT BOOKS:

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<td>Understand the preparatory process in chemical processing</td>
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<td>CO2</td>
<td>Explain the classes, machines, stages, and application of dyes</td>
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<td>CO3</td>
<td>Discuss about the ingredients, types and machines and faults of printing</td>
<td>PO 1 PO 2 PO 3 PO 4 PO 5 PO 6 PO 7 PO 8 PO 9 PO1 0 PO1 1 PO1 2 PSO 1 PSO 2 PSO 3</td>
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<td>CO4</td>
<td>Understand the various methods and application of finishing</td>
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<td>CO5</td>
<td>Understand the measurement of strength of colour and colour difference</td>
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<td>PO 1 PO 2 PO 3 PO 4 PO 5 PO 6 PO 7 PO 8 PO 9 PO1 0 PO1 1 PO1 2 PSO 1 PSO 2 PSO 3</td>
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OBJECTIVES:

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

UNIT I ENVIRO\NMENT AND BIODIVERSITY


UNIT II ENVIRONMENTAL POLLUTION


UNIT III RENEWABLE SOURCES OF ENERGY.

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

UNIT IV SUSTAINABILITY AND MANAGEMENT

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

UNIT V SUSTAINABILITY PRACTICES


OUTCOMES:

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

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

REFERENCE BOOKS:
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<td>DM 3</td>
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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**
COURSE OBJECTIVES
• To train the students in CAD used for designing of garments.

LIST OF EXPERIMENTS
1. Introduction to tools and workspace of image editing software & vector software
2. Development of motifs suitable for printed textile and woven textile
3. Development of woven fabrics designs – plain, twill, satin and denim
4. Development of technical diagrams – T-shirt and trousers
5. Illustration of Kid’s romper (all over print)
6. Illustration of Kid’s frock (lace)
7. Illustration of Men’s T-shirt with a chest print design
8. Illustration of Men’s Basic formal shirt (checks and plaids)
9. Illustration of Men’s Basic trouser (solid combos)
10. Illustration of Women’s long dress (all over print)
11. Illustration of children’s school uniform.
12. Illustration of Women’s maternity wear with functionality.

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon completion of this course the student will be able
• To develop textile print design
• To develop fabric design
• To develop technical drawings
• To illustrate different kid’s garments
• To illustrate different men’s and women's garments
<table>
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<th>Statement</th>
<th>Program Outcome</th>
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<td>To develop textile print design</td>
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<tr>
<td>CO2</td>
<td>To develop fabric design</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>To develop technical drawings</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>To illustrate different kid’s garments</td>
<td>1</td>
</tr>
<tr>
<td>CO5</td>
<td>To illustrate different men’s and women’s garments</td>
<td>1</td>
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<tr>
<td>Overall CO</td>
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</tbody>
</table>
COURSE OBJECTIVES
- To train the students in pattern making of apparels.
- To train the students in fundamentals of garment construction.

LIST OF EQUIPMENTS
1. Measuring the dress form kid’s, male and female.
2. Drafting and grading the basic pattern set for kid’s top, male shirt and female top.
3. Drafting and grading the basic pattern set for kid’s bottom, male trouser and female skirt & trouser
4. Techniques of pattern making (slash and spread, pivoted technique)
5. Developing basic patterns using Draping methods – Bodice, Bodice with dart variations, Sleeve
6. Developing patterns using Draping methods – Skirt, Cowl Necklines
7. Developing patterns using Draping methods – Men’s trousers
8. Preparing samples for stitches – slip basting, slip stitch, running, back, overcasting, hemming, even basting,
9. Preparing samples for seams and seam finishes – Plain seam, double top stitch seam, lapped seam, slot seam, French seam, flat felt seam, pinked finish, edge stitched finish.
10. Preparing samples for Fullness - Darts, Tucks, Pleats, Gathers
11. Preparing samples for Necklines – Bias facing, Bias Binding and Fitted facing

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon completion of this practical course, the student would have practical experience on
- To take basic body measurements and then drafting and grading of basic patterns
- To learn the different techniques of pattern making and prepare different patterns
- To prepare patterns using the draping techniques
- To prepare samples for seams and stitches
- To prepare samples for fullness, necklines and plackets
<table>
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<th>Course Outcomes</th>
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<td>To take basic body measurements and then drafting and grading of basic patterns</td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3</td>
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<tr>
<td>CO2</td>
<td>To learn the different techniques of pattern making and prepare different patterns</td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3</td>
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<tr>
<td>CO3</td>
<td>To prepare patterns using the draping techniques</td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3</td>
</tr>
<tr>
<td>CO4</td>
<td>To prepare samples for seams and stitches</td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3</td>
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<td>CO5</td>
<td>To prepare samples for fullness, necklines and plackets</td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3</td>
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<tr>
<td>Overall CO</td>
<td></td>
<td>PO1 2 3 2 2 - - - 2 - - 2 3 3 3 3 3 3</td>
</tr>
</tbody>
</table>
OBJECTIVES:

- To train the students in pre-treatment, dyeing and printing of textile materials

LIST OF EXPERIMENTS

1. Identification of fibres
2. Analysis of blend composition in the yarn of the fabric
5. Degumming of silk.
6. Identification of dyes
8. Dyeing of silk yarn / fabric with acid dyes
10. Dyeing of polyester and cotton blend
15. Analysis and interpretation of spectrophotometer data for dyed fabrics

TOTAL: 45 PERIODS

COURSE OUTCOMES

At the end of this practical course, the students would be able to

- Investigate and identify fibers and dyes
- Do bleaching, dyeing and printing process
- Estimate and apply chemicals and dyes for processing the textile materials
- Apply the different types of finishes for the chemical processing
- Evaluate fastness properties of dyed materials.
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<tr>
<td>CO2</td>
<td>Do bleaching, dyeing and printing process</td>
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<td>Estimate and apply chemicals and dyes for processing the textile materials</td>
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<tr>
<td>CO4</td>
<td>Apply the different types of finishes for the chemical processing</td>
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<td>Evaluate fastness properties of dyed materials.</td>
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OBJECTIVES:
To enable the students to
- Get connected with industry/ laboratory/research institute
- Get practical knowledge on production process in the industry and develop skills to solve related problems
- Develop skills to carry out research in the research institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No.of. Weeks: 04

OUTCOMES:
On completion of the course, the student will know about
CO1: Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute
CO2: Analysis of industrial / research problems and their solutions
CO3: Documenting of material specifications, machine and process parameters, testing parameters and results
CO4: Preparing of Technical report and presentation

FT3501 GARMENT CONSTRUCTION

COURSE OBJECTIVES
- To impart knowledge on drafting and constructing for garment components
- To impart knowledge on Men, Women's and Children wear.

UNIT I PATTERN AND CONSTRUCTION OF GARMENT COMPONENTS 9
Pocket classification, outside pockets, inserted pocket and side-seam pocket. Pointed, Slit opening and Wing collar plackets, waist band, pleats, flares, gathers, Facing patterns for cutout necklines and armholes.

UNIT II PATTERN AND CONSTRUCTION OF CHILDREN’S WEAR 9
Fabric selection, drafting procedure, operation breakdown of garment assembly - Kids Top and bottom apparel awears Rompers, Creeper, and Jumpsuit

UNIT III PATTERN AND CONSTRUCTION OF MEN’S WEAR 9
Fabric selection, drafting procedure, operation breakdown of garment assembly -Shirt, T-shirt, Pant derivatives, Jean, Jacket, Inner wear- Vests, Briefs

UNIT IV PATTERN AND CONSTRUCTION OF WOMEN’S TOPS 9
Fabric selection, drafting procedure, operation breakdown of garment assembly -Kimono, Raglan foundation, princess line foundation, Bias cut dresses Tunic, Tank Tops, Sports top’s, Capri

UNIT V PATTERN AND CONSTRUCTION OF WOMEN’S BOTTOMS AND INTIMATE APPAREL 9
Fabric selection, drafting procedure, operation breakdown of garment assembly -Trousers variations skirt variations, leggings, panties, brassier and camisoles, petticoat
COURSE OUTCOMES
Upon completion of this course, the student would be able to
- Patterns and construction for garment components
- Patterns and construction for kid’s wear
- Patterns and construction for men Wear
- Patterns and construction for Women’s wear

TEXT BOOKS:

REFERENCES:
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COURSE OBJECTIVES

- To enable the students to understand the production planning in garment industry
- To emphasis on the improved methods of material control in apparel production
- To acquaint students with quality concepts for implementing quality in apparel production

UNIT I
Process control parameters in garment manufacturing, concepts of concurrent engineering, reverse engineering of standard garments, production planning and time and action calendar, sampling stages, steps between prototypes to production, product data management and understanding specification sheets

UNIT II
Basic principles of the lay planning process; automation of lay planning process and cutting room operations; influence of fabric design on marker making process, marker utilization, bundle distributions, Current practices in cutting room - cut piece distribution and tracking

UNIT III
Practices followed for style changeover - Operation break down and production sequence, line balancing, identification of bottle necks and critical operations, operation wise machinery allocation – basic shirts, trousers, skirts; usage of special attachments and tools for operation simplifications, production grid and flow chart,

UNIT IV
Material management - Manufacturing Resources Planning (MRP), just in time production system (JIT), Kanban system, Optimised production technology (OPT), Economic order Quantity (EOQ), ABC, VED analysis in inventory control

UNIT V
Final audit /inspection - finishing and packing; packing - ratio packing, solid packing, short shipment, excess shipment, calculation of volumetric weight, carton and other packing requirements; concept of AQL

COURSE OUTCOMES
Upon completion of this course, the student would know

- Process control in garment manufacture
- Production planning, line balancing
- Lay planning process
- Material management techniques and
- Quality control in garment manufacture

TEXT BOOKS:
REFERENCES:

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COURSE OBJECTIVES

To train the students in garment construction.

LIST OF EXPERIMENTS
1. Preparing Samples for Sleeves – Plain, Puff at Both Sides, Raglan, Kimono
2. Preparing samples for collars – Peter Pan Collar, Standing collar, Full Shirt Collar, Shawl Collar.
3. Preparing samples for pockets – Patch Pocket, Bound Pocket and Front Hip Pocket
4. Study of overlock and flatlock machines
5. Study of SNLS and zig-zag embroidery machines
6. Designing and developing pattern for Baby set- Top, Bottom
7. Construction of Baby set- Top and Bottom
8. Designing and developing pattern for Rompers
9. Construction of Rompers
10. Designing and Developing Pattern for Ladies Skirt and Top
11. Grading Ladies Skirt and Top
12. Construction of Ladies Skirt and Top

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- Develop samples in various special machines.
- Develop various garment components.
- Develop various children’s garments and basic women’s garments.

TOTAL: 60 PERIODS
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COURSE OBJECTIVES
To train the students in CAD used for designing, pattern making and marker planning of garments

LIST OF EXPERIMENTS:
1) Digitize and develop graded patterns for a Baby frock using a one way fabric of 38” and 42” width.
2) Digitize and develop graded patterns for a kid’s Rompers using a two-way fabric of 38” and 42” width.
3) Develop graded patterns and marker plan for a Ladies top with fabric of 44” and 52” width. Calculate the fabric consumption.
4) Develop pattern and marker plan for a Men’s Basic T shirt of 48” fabric width. Calculate the fabric consumption. Develop a cut order plan
5) Develop graded patterns and marker plan for Men’s Formal Trouser using fabric of 60” and 72” width. Calculate the fabric consumption.
6) Develop graded patterns and marker plan for a Ladies Skirt using plaid fabric of 38” and 60” width.
7) Develop graded patterns for a Men’s Full arm shirt.
8) Develop marker plan and cut order plan for a Men’s Full arm shirt using fabric of 60” and 72” width. Calculate the fabric consumption.
9) Develop graded patterns and marker plan for Salwar using fabric of 60” and 72” width. Calculate the fabric consumption.
10) Develop graded patterns and marker plan for Kameez using fabric of 60” and 72” width. Calculate the fabric consumption.
11) Develop graded patterns and marker plan for a Men’s vest using fabric of 38” and 42” width. Calculate the marker efficiency and fabric consumption. Develop a specification sheet and cut order plan for the vest

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon completion of this course the student will have practical experience
CO1: to digitize and develop graded patterns for kid’s wear
CO2: to digitize and develop graded patterns for men’s wear
CO3: to digitize and develop graded patterns for women’s wear
CO4: to prepare marker planning
CO5: to calculate fabric consumption and to develop cut order plan
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**PROGRESS THROUGH KNOWLEDGE**

119
COURSE OBJECTIVES

- To acquaint the students with the concepts of Fashion business, design merchandising, sourcing and export documentation

UNIT I  FASHION INDUSTRY OVERVIEW

Segments of the fashion industry – history and categories, influence of the customer; different generations and motivations behind the changes. Apparel business practices; business operations of domestic and export oriented of Indian apparel industries, consumer buying behavior, Market segmentation, market positioning.

UNIT II  MARKETING FOR APPAREL AND TEXTILE PRODUCTS

Uniqueness of apparel market, core concepts and orientation towards market place, strategies and planning, market research and forecast, customers, consumer markets and business markets, market segments and brand building, brand positioning and competition, programmatic marketing; digital and autonomous interventions, conversational interfaces - Artificial intelligence chat bots

UNIT III  DESIGN MERCHANDISING

Concepts of merchandising, apparel product lines, dimensions of product change, determination and development of product line and product range; creative design of garments and accessories, new product development and seasons of sale, costing, coordination and communication with the production house and export house

UNIT IV  SOURCING

Understanding the basics of sourcing, sourcing strategy and best sourcing practice in apparel and textile businesses, supply chain and demand chain, sourcing negotiations, global co-ordination in sourcing, materials management and quality in sourcing, quick response, ERP, supplier partnership in sourcing, JIT technology, made to fit.

UNIT V  EXPORT DOCUMENTATION AND POLICIES

Government policies, guide lines for apparel export and domestic trade, tax structures and government incentives in apparel trade; export documents and its purposes, banking activities, Letter of credit, logistics and shipping, foreign exchange regulation, export risk management and insurance; export finance, Special economic zones.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student would be able to

CO1: Explain the international apparel business and role of Asian countries in the apparel and fashion trade
CO2: Apply the concepts of marketing in the apparel industry
CO3: Explain the concepts of merchandising and new product development
CO4: Explain the apparel product dynamics in a market and relate it along the value chain.
CO5: Understand Export documentation and policies

TEXT BOOKS:

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<td>Explain the concepts of merchandising and new product development</td>
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FT3692 INDUSTRIAL ENGINEERING IN GARMENT MANUFACTURING

COURSE OBJECTIVES:
- To enable the students to learn about basics of industrial engineering
- To provide knowledge on different tools of industrial engineering and its application in apparel industry

UNIT I
Industrial Engineering - evolution, functions, role of industrial engineer; productivity concepts, causes for low productivity in apparel industry, suggestions for productivity improvement; basic work content, added work content, reduction of work content and ineffective time, work study-introduction and procedure.

UNIT II
Methods study - introduction, techniques of recording; method analysis techniques; principles of motion economy; method study in garment manufacture; ergonomics - importance, workplace design, fatigue

UNIT III
Work measurement – introduction; time study – equipment and procedure; standard data; predetermined time standards; work sampling techniques; incentive wage system; work measurement applied to garment industry- calculation of SAM

UNIT IV
Site selection for textile industry; plant layout - types of layouts suitable for textile industry, methods to construct layout; line balancing

UNIT V
Statistical Process Control – data collection; concept of AQL, control charts in quality control; process capability

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- CO1: Understand the basics of industrial engineering and productivity concepts
- CO2: Method study and its techniques
- CO3: Apply work measurement
- CO4: Understand the concepts of layout and line balancing
- CO5: Interpret the result using statistical process control

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
Course Articulation Matrix:

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
### Personaity Development
- **PD 3**: Group Discussion: Team Work, 2 periods
- **PD 4**: Career Counselling, SSB Procedure & Interview Skills, 3 periods
- **PD 5**: Public Speaking, 4 periods

### Border & Coastal Areas
- **BCA 2**: Security Setup and Border/Coastal management in the area, 2 periods
- **BCA 3**: Security Challenges & Role of cadets in Border management, 2 periods

### Armed Forces
- **AF 2**: Modes of Entry to Army, CAPF, Police, 3 periods

### Communication
- **C 1**: Introduction to Communication & Latest Trends, 3 periods

### Infantry
- **INF 1**: Organisation of Infantry Battalion & its weapons, 3 periods

### Military History
- **MH 1**: Biographies of Renowned Generals, 4 periods
- **MH 2**: War Heroes - PVC Awardees, 4 periods
- **MH 3**: Study of Battles - Indo Pak War 1965, 1971 & Kargil, 9 periods
- **MH 4**: War Movies, 6 periods

**TOTAL: 45 Periods**

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### Personality Development
- **PD 3**: Group Discussion: Team Work, 2 periods
- **PD 4**: Career Counselling, SSB Procedure & Interview Skills, 3 periods
- **PD 5**: Public Speaking, 4 periods

### Border & Coastal Areas
- **BCA 2**: Security Setup and Border/Coastal management in the area, 2 periods
- **BCA 3**: Security Challenges & Role of cadets in Border management, 2 periods

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

### Naval Communication
- **NC 1**: Introduction to Naval Communications, 1 period
- **NC 2**: Semaphore, 1 period

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

### Seamanship
- **MH 1**: Introduction to Anchor Work, 2 periods
- **MH 2**: Rigging Capsule, 6 periods
- **MH 3**: Boatwork - Parts of Boat, 2 periods
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COURSE OBJECTIVES

- To train the students in garment construction.

LIST OF EXPERIMENTS

1. Study of feed-of the arm machine and elastic attachment machine
2. Study of button holing and button fixing machine
3. Designing and Developing Pattern for Ladies Salwar and Ladies Kameez
4. Construction of Ladies Salwar
5. Construction of Ladies Kameez
6. Designing and Developing Pattern for Men's Formal Shirt
7. Construction of Men's Formal Shirt
8. Designing and Developing Pattern for Men's Formal Trousers
9. Grading Men's Formal Trousers
10. Construction of Men's Formal Trousers
11. Designing and Developing Pattern for Knitted Basic T-shirt
12. Construction of Knitted Basic T-shirt

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student would be able to

- CO1: Develop samples in various special machines.
- CO2: design and development of patterns for women’s wear
- CO3: design and development of patterns for men’s wear
- CO4: construction process for women’s wear
- CO5: construction process for men’s wear
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</table>
COURSE OBJECTIVES
- To train the students in portfolio preparation.

LIST OF EXPERIMENTS
The following have to be prepared:
Design Research
Forecast board/Inspiration Board
Conceptualization
Theme board/ Trend Board
Client profile.
Color board
Look Board
Sourcing Board – Fabrics
Sourcing Board – Trims
Pattern (doodle) development board
Fashion design presentation board – 8 nos.
Product development - One men’s wear,
Product development - one women’s wear

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1: design research process and conceptualization
CO2: prepare theme/inspiration and mood board
CO3: prepare client, color and look board
CO4: prepare fabrics, trims and design board
CO5: develop product for men’s and women’s wear

TOTAL: 45 PERIODS
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<td>To learn how to prepare theme/inspiration and mood board</td>
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<td>CO3</td>
<td>To learn how to prepare client, color and look board</td>
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<td>CO4</td>
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<tr>
<td>CO5</td>
<td>To learn how to develop product for men's and women's wear</td>
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<td>Overall CO</td>
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OBJECTIVES:
To enable the students to
- Get connected with industry/ laboratory/research institute
- Get practical knowledge on production process in the industry and develop skills to solve related problems
- Develop skills to carry out research in the research institutes/laboratories

The students individually undergo training in reputed firms/ research institutes / laboratories for the specified duration. After the completion of training, a detailed report should be submitted within ten days from the commencement of next semester. The students will be evaluated as per the Regulations.

No.of. Weeks: 04

OUTCOMES:
On completion of the course, the student will know about
CO1: Plant layout, machinery, organizational structure and production processes in the firm or research facilities in the laboratory/research institute
CO2: Analysis of industrial / research problems and their solutions
CO3: Documenting of material specifications, machine and process parameters, testing parameters and results
CO4: Preparing of Technical report and presentation

OBJECTIVES:
To impart knowledge to the students on
- Demand and supply analysis
- Inflation and government policies
- Textile costing fundamentals and determining cost of textile products.

UNIT I  BASIC CONCEPTS OF ECONOMICS AND MARKET  9
Definition, scope of economics; fundamental concepts; demand, supply, equilibrium; theory of production, cost; forms of market; concepts of revenue; pricing in perfect and imperfect competition.

UNIT I  INFLATION AND GOVERNMENT POLICY  9
Inflation - causes, effect, control; Inflation Vs Unemployment, Philips curve; Government policies, Fiscal and Monitoring Policy, planning - economic growth and public welfare.

UNIT III  COSTING AND COST SHEET PREPARATION  9
Costing - concepts; costing types; different methods of costing, standard costing, analysis of variance; classification of costs; preparation of cost sheet; cost profit volume analysis, breakeven analysis

UNIT IV  COSTING OF FABRICS AND APPARELS  9
Costing of fabrics; costing of apparel – accounting of prime costs and overhead costs, allocation of overheads; tax structure
UNIT V FOREIGN EXCHANGE MANAGEMENT AND BUDGETING

Foreign exchange rates; foreign exchange management – risks, strategies to reduce risk; Budget, types of budgets, budgeting and control in apparel industry

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student would have acquired knowledge on
CO1: Fashion market and marketing environment
CO2: Fashion, Fad, style and its application
CO3: Applied illusions and its Physical effects
CO4: Fashion marketing research, fashion forecasting and marketing mix
CO5: Fashion Products and its importance in Fashion Industry & new Product Development

TEXTBOOKS

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<td>costing concepts, types of cost and preparation of cost sheet</td>
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</table>
COURSE DESCRIPTION
This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

COURSE OBJECTIVES:
- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students’ minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES
Reading Text: Excerpts from John Stuart Mills’ On Liberty

UNIT II SECULAR VALUES
Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani

UNIT III SCIENTIFIC VALUES
Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

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

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

TOTAL: 30 PERIODS

REFERENCES:
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.

FT3711 APPAREL PRODUCT ENGINEERING LABORATORY

Objective: To enable the students to test and analyze the given apparel product that include identification of fibre, yarn and fabric specifications and method of production of same

List of experiments
Reverse engineering of apparel products with an emphasis on
Identification of apparel construction methods and parameters
Identification of fabric specifications, materials used and related tests
Identification of coloring of product and related tests
Identification of sources for procurement of materials and (or, whichever is applicable) machineries required to produce the apparel
Estimating approximate cost of product
–Three each for a student

Outcomes:
Upon the completion of this course the student will be able to
CO1: Identify the method construction and materials used in the product
CO2: Carryout confirmative tests to identify specifications of materials used
CO3: Suggest the production process required to make the product
CO4: Identify the sources for material procurement
CO5: Estimate the cost of product
## Course Articulation Matrix

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<td>Identify the materials used in the product</td>
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<tr>
<td>CO2</td>
<td>Carry out confirmative tests to identify specifications of materials used</td>
<td>3    3    3    3    2    1    1    -    2    2    2    2    3    2    3</td>
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<td>CO3</td>
<td>Suggest the production process required to make the product</td>
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<td>Identify the sources for material procurement</td>
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<td>CO5</td>
<td>Estimate the cost of product</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
To train the students in

- Identifying problem and developing the structured methodology to solve the identified problem in the industry or research problem at research institution or college.
- Conducting experiments, analyze and discuss the test results, and make conclusions.
- Preparing project reports and presentation

The students shall individually / or as group work on a specific topic approved by the Department. The student can select any topic which is relevant to his/her specialization of the programme. The student should continue the work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work, results and discussion, conclusion and references should be prepared as per the format prescribed by the University and submitted to the Head of the department. The students will be evaluated based on the report and viva-voce examination by a panel of examiners as per the Regulations.

OUTCOMES:
At the end of the project, the student will be able to
CO1: Formulate and analyze problem / create a new product/ process.
CO2: Design and conduct experiments to find solution
CO3: Analyze the results and provide solution for the identified problem, prepare project report and make presentation

TOTAL: 300 PERIODS
COURSE OBJECTIVES

- To impart knowledge on principles marketing, marketing research. Domestic and international market.

UNIT I
Fashion market and marketing environment – market research – evaluating the collections - Fashion consumer – Consumer influence on market.

UNIT II
Fashion, Fad, style – Application – Society Fashion and individual fashion – their Coordination - wardrobe.

UNIT III
Applied illusions – Physical effects - Overall height - over all weight – Covering body defects by design – Visual design in Dress in Australia - Brazil – Germany - India – Japan - Nigeria.

UNIT IV
Fashion marketing research – Purpose of research - research design & data sources – Sampling methods – data Collection – Forecasting Fashion – Market Segmentation - marketing mix.

UNIT V

COURSE OUTCOMES

Upon completion of this course, the student would be able to understand

- CO1: understand the fashion market and marketing environment
- CO2: understand what is Fashion, Fad, style and its application
- CO3: understand the Applied illusions and its Physical effects
- CO4: understand what fashion marketing research is, how to do fashion forecasting and what is marketing mix
- CO5: impart knowledge in Fashion Products and its importance in Fashion Industry & new Product Development

TOTAL: 45 PERIODS

TEXT BOOKS:

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</table>
COURSE OBJECTIVES

- Define and appreciate the significance and role of visual merchandising in a retail environment, in order to effectively present the merchandise to the consumers

UNIT I  FUNDAMENTALS OF VISUAL MERCHANDISING  9

UNIT II  ELEMENTS OF VISUAL PRESENTATION  9
Overview of the various elements – Color, lighting, line and composition, graphics and signage, store exteriors and interiors, sensory stimulants like scent, sound etc. Application of color schemes and color psychology to create mood in garment display

UNIT III  MANNEQUINS AND FIXTURES  9

UNIT IV  STORE INTERIORS AND POINTS OF DISPLAY  9
Focal points, island displays, risers and platforms, the runway the catwalk, counters and display cases, museum cases, demonstration cubes, ledges, shadow boxes, enclosed displays, fascia, walls. Point of purchase display, industrial display, fashion shows, trade organizations and sources. Display techniques

UNIT V  STORE PLANNING AND EXECUTION OF A VISUAL PRESENTATION  9
Store layout planning-grid, racetrack, free form and their direction of flow. Floor plans and reading of floor plans – Plan-o-gram- definition, purpose and planning -theme, ensemble, racks, shelves, bins etc. Assortment planning- Assortment planning, optimize apparel assortments Display calendar and planning a display, scheduling the promotion, budgeting and safety factors in visual merchandising.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student would be able to

CO1: Classify various elements of Visual presentation and understand their significance in visually presenting a display
CO2: Analyze and identify the best suitable environment for merchandise including interior, exterior and point of displays
CO3: Appraise on various techniques used in presenting merchandise
CO4: Plan on optimizing the merchandise and retail space to customers
CO5: Summarize the various features available in a computer controlled visual merchandising

TEXT BOOKS:
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<th>Course Outcomes</th>
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<td>CO1</td>
<td>Classify various elements of Visual presentation and understand their significance in visually presenting a display</td>
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<td>Analyze and identify the best suitable environment for merchandise including interior, exterior and point of displays</td>
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<td>CO3</td>
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<td>CO4</td>
<td>Plan on optimizing the merchandise and retail space to customers</td>
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<tr>
<td>CO5</td>
<td>Summarize the various features available in a computer controlled visual merchandising</td>
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</table>
OBJECTIVES:
To impart knowledge on traditional textiles produced in various regions of India

UNIT I  INTRODUCTION  9

UNIT II  NORTHERN TRADITIONAL TEXTILES  9

UNIT III  SOUTHERN TRADITIONAL TEXTILES  9

UNIT IV  EASTERN TRADITIONAL TEXTILES  9

UNIT V  WESTERN TEXTILES  9
Traditional woven textiles of Western states of India – Maheshwari sarees of Madhya Pradesh, Patola, Bandhini and Amrus. Traditional embroideries of Western India – Sindhi embroidery – Kutch, Ari Bharath, Kanbi Bharath, Mochi Bharath, Shisha embroidery. Traditional costumes of Western states of India – Rajasthan, Gujjrat, Maharastra, Madhya Pradesh, Chhattisgarh and Goa.

COURSE OUTCOMES:
Upon completion of this course, the student would be able to
CO1: understand the evolution of clothing
CO2: Identify and appreciate the various traditional textiles and costumes of Northern India
CO3: Identify and appreciate the various traditional textiles and costumes of Southern India
CO4: Identify and appreciate the various traditional textiles and costumes of Eastern India
CO5: Identify and appreciate the various traditional textiles and costumes of Western India

REFERENCES
6. Costumes and textiles of Royal India – Ritu Kumar Published by Christie’s Books.
7. Impressions – a classic collection of Indian textiles design (with cd) Prakash. K
8. Traditional Embroideries of India Shailaja D. Naik
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COURSE OBJECTIVES
To enable the students to
- Gain knowledge on the fundamentals of retailing
- Understand the importance of effective location for retailing
- Understand the importance of atmospherics and space management of retail outlets

UNIT I
Retailing, current global and Indian retail scenario in garment and fashion, key drivers of Indian apparel retail business, growth of organised apparel retail in India; understanding the Indian retail economics, foreign direct investment in Indian apparel retail.

UNIT II
Operational excellence, customer service strategies, pricing strategies, inventory levels and merchandise availability as a strategy, case studies on Indian and International retail stores, retail business formats, retail management information system

UNIT III
Objectives of store planning, location, design, retail image mix, layout plan for retail stores. Buying, mark-up and mark-down in merchandise management, private labels; apparel franchising- types, Key success factors

UNIT IV
Product management, brand management and retailing, merchandise management, model stock plan, constraining factors, types of suppliers and selection criteria, category management, merchandise management planning in retail segments. OTB Planning, sample plan.

UNIT V
An introduction to fashion e-commerce, apparel and fashion e-business, s-commerce vs. ebusiness, economic forces – advantages – myths – e-business models, design, develop and management of e-business, web and social networking, mobile commerce - business applications, classifications, and models, payments, security and legal requirements

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- CO1: Gained knowledge on Indian and global retailing
- CO2: Understood the retail business formats and strategies
- CO3: Understood the importance of effective location for retailing
- CO4: Acquired Knowledge on management of merchandise
- CO5: Ability to outline the benefits of E-commerce business and E marketing

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CFT331  APPAREL BRAND MANAGEMENT  L T P C  3 0 0 3

COURSE OBJECTIVES

• To introduce students to the concept of brand, brand building, branding strategies and legal issues in brand management

UNIT I  9
Product – definition, types; product line, product mix; new product development; estimating market and sales potential, sales forecasting

UNIT II  13
Brand – definition, evolution, importance; product vs brand; terminologies used in branding; branding – meaning, creation, challenges; brand design – understanding consumer, competition, components, brand identity - brand naming, logos, characters, slogans, tools to maintain identity, illustrations from apparel industry

UNIT III  9
Brand Building: brand insistence model; advertising – definition, objectives, modes, economic and ethics; non traditional marketing approach

UNIT IV  9
Branding strategies; brand extension, brand revitalization, brand repositioning, brand recall, brand elimination, brand imitation

UNIT V  5
Brand equity measurement systems; legal issues in brand management; global branding

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student would be able to

CO1: Apply knowledge on product and sales
CO2: Understand the concept of brand and brand identity
CO3: Apply skills for brand building and advertising
CO4: Demonstrate the branding strategies and Extension strategies
CO5: Understand global branding and legal issues

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COURSE OBJECTIVES

- To introduce the fashion online business and E-Marketing
- To acquaint the students with online enabling technologies

UNIT I INTRODUCTION
Fashion and marketing, evolution of digital fashion marketing, marketing channels, digital marketing strategy, building online, social media evolution, fashion marketing communication environment. History of e-commerce, e-commerce vs e-business, unique features of ecommerce technology, commercial use of the internet, growth of the internet mobile and web, e-commerce opportunities for industries.

UNIT II FASHION ONLINE AND MARKETING
Website, search engine, email marketing, online advertising, search and display advertising, online branding, finding an audience, analytics, creating website, traditional approach to promotion, marketing communities. Marketing communities environment, fashion advertising and sales promotion, public relations, personal selling, visual marketing, new directions in marketing, various types of promotion and advertising, strategies.

UNIT III E-COMMERCE BUSINESS
Social networking and facebook, Types of e-commerce: business to consumer (B2C), Business to Business (B2B), Consumer to Consumer (C2C), Consumer to Business (C2B), Mobile E-Commerce, Social E-Commerce, Local E-Commerce; e-commerce technology, concepts, approaches.

UNIT IV ENABLING TECHNOLOGIES
Internet, Mobile internet access, wireless internet, internet access, web, hypertext markups, emails, messaging, search engine, online forum, cookies, streaming media, online social networks, blogs, wikis, mobile applications. E-Security- Networks and website security, risks, site hack, security and e-mail, firewall concept, phishing, dimensions of good e-commerce security.

UNIT V E-MARKETING
Uniqueness of web, satisfying the requirements of website visitors, e-marketing value chain, maintaining a website, online video store, online payment, online marketing, advertising, market research, customer relationship applications, effectiveness of e-advertising, elements of branding, marketing strategy on web.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to:

CO1: Outline of digital fashion marketing and features of E commerce technology
CO2: Understand E-commerce business and E marketing
CO3: Explain social media and digital marketing techniques
CO4: Explain strategic decisions using online technology
CO5: outline the importance of online marketing and E advertising

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COURSE OBJECTIVES
To enable the students to
- Acquire knowledge on Fashion concept and able to classify apparel products.
- Understand Development of Visualization and communication design on to manufacturability.

UNIT I  DEVELOPING FASHION CONCEPT FOR APPAREL 9

UNIT II  FUNCTIONAL APPAREL DESIGN AND ENGINEERING 9
Introduction to apparel design & its types – aesthetic, functional, exploratory, incremental. Requirements for functional clothing design and engineering- physiological, biomechanical, ergonomic, psychological requirements. Process involved in functional clothing design – material selection, clothing design and evaluation for functionality.

UNIT III  LINE DEVELOPMENT AND PRESENTATION 9
Creative design - Develop designs, Create prototype. Line adoption – Determining styles and balancing assortments. Technical design – perfect styling and fit, engineer production patterns, samples, costing and grade patterns. Presentation: Review for adoption, line review, line / style release.

UNIT IV  ANALYSIS OF PRODUCT DEVELOPMENT 9

UNIT V  PROTO DEVELOPMENT 9
Fabric Sourcing and Selection. Analysis of functional and aesthetic characteristics of fabrics and trims - Co-ordinating with availability, ability to enhance product aesthetics and functionality and cost. Visualization and Communication design into manufacturability. Overview to E-proto development and rapid proto development

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- CO1: Develop Fashion Concept for Apparel
- CO2: Understand Functional Apparel Design and Engineering
- CO3: Understand Line Development and Presentation
- CO4: Analyse of Product Development
- CO5: Develop Garment Prototype

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OBJECTIVES
To enable the students to learn about the
- Important characteristics of the fabric responsible for its comfort properties and
- Different phenomena which take place in the fabric related to the comfort properties of the fabric

UNIT I
Comfort – types and definition; human clothing system, comfort perception and preferences.
Neuro-physiological comfort-basis of sensory perceptions; measurement techniques - mechanical stimuli and thermal stimuli.

UNIT II
Thermo physiological comfort – thermoregulatory mechanisms of the human body -
Thermoregulation through clothing system - Thermal comfort of clothing - Measurement of thermal transmission characteristics.
Moisture regulations - Liquid water transfer: wicking and water absorption - Principles of moisture vapour transfer - Condensation of moisture vapour - Evaluation of moisture vapour transmission -
Moisture sensation in clothing

UNIT III
Methods of sizing for mass production of clothing for men, women. Mass customization-sizing technologies and application.

UNIT IV

UNIT V

TOTAL: 45 HOURS

OUTCOMES
Upon completion of this course, the student shall be able to explain
CO1: Comfort of fabric and measurement
CO2: Thermo physiological comfort requirements of human and the role of clothing
CO3: Sizing of garments and Mass customization
CO4: Objective and subjective evaluation of fit
CO5: Fabric drape and fit

TEXT BOOKS:
REFERENCES:
5. Editors of Creative publishing," The Perfect Fit- classic guide to alter patterns", Creative publishing international, USA, 2005.
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OBJECTIVES
To enable the students to learn about the
- Different trims, components and fashion accessories used in apparel industry to enhance value addition.

UNIT I
Garment components and trimmings – labels and motifs, linings, interlining wadding, lace, braid and elastic, seam binding and tape, shoulder pads, eyelets and laces, zip fasteners, buttons – tack buttons, snap fastener and rivets; buckles, frag closures, belts, ribbons, fringe, emblems and sequins, decorative and functional trimmings; performance properties of components and trims.

UNIT II
Hook and loop fastening (Velcro), Zippers – anatomy of zipper, types, function of zipper, position of slider, standards on zipper, selection of zipper, application of zipper, shortening of zipper; evaluation of quality of accessories.

UNIT III
Embroideries - basic embroidery stitches – chain stitch, button hole stitch, herringbone stitch, feather stitch, lazy daisy, double knot stitch, interlacing stitch, stem stitch, French knot stitch, types of embroidery machines, limitations of hand embroidery; kaustic embroidery; kasida, kathiwar; Sind; chickankari; zardosi; tribal embroideries.

UNIT IV
Fashion accessories – footwear, handbags, gloves, hats, scarves, hosiery, jewelry, watches; testing of zippers, elastic waist band testing, fusible interlinings; safety issues for different accessories in children garment.

UNIT V
Printing – introduction; different methods – block printing, roller, screen, discharge, resist and pigment; styles of printing - batik, tie and dye, patch work, appliqué work, bead work.

TOTAL: 45 PERIODS

OUTCOMES
At the end of the course, the students would be able to explain
- CO1: different types of garment components and trims
- CO2 –different types of Zippers
- CO3 –Embroideries - Indian and tribal
- CO4 – Fashion accessories
- CO5 –Different types of printing

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OBJECTIVE
To enable the students to learn techniques and machinery for dyeing and finishing of garments and to impart knowledge on different garment care techniques.

UNIT I
9

UNIT II
13
Principles of laundering; Laundry equipment and reagents – soaps – detergents – cleaning action of soaps, Modern and industrial cleaning agents. Finishing- Optical brightening, stiffening, softening, crease resistant and crease retentive finish, anti-static, anti-bacterial, UV protection, water proofing, flame proofing, soil release finish, mildew and moth proofing; silicone finishing.

UNIT III
9

UNIT IV
9
Stain removal – characteristics of stain and method of stain removal-blood, tea, rust, oil/grease, colour matter, chemicals. Different methods of washing.

UNIT V
9

OUTCOME
Upon completion of this course, the student shall have the knowledge of:
- CO1: Garment dyeing and wash treatments
- CO2: Finishing of fabrics for special end uses
- CO3: Garment finishing room equipment
- CO4: Stain removal
- CO5: Garment care

TEXT BOOKS:

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OBJECTIVES
To enable the students to learn about
- Various kinds of materials used as home textiles
- Recent developments in home furnishing, floor covering and other home textile products
- Finishes and Evaluation required for home textiles.

UNIT I INTRODUCTION
Concepts of Home textiles and its market scenario, consumer expectation from home textiles; fibers and fabrics used - Woven, nonwoven and knits; manufacturing concepts - damask, brocade, organdie, chiffon, oxford, tapestry

UNIT II HOME FURNISHING
Living room furnishings – types, fabric selection and design concepts; bed room furnishings- types, fabric selection and design concepts; advances in the production of different types of bed linen, bed sheets, blankets, blanket covers, comforts, comfort covers, bed spreads, mattress and mattress covers, pads, pillows; kitchen furnishing - fabric selection and finishing for dish cloth, hand towels, aprons, mittens and runners

UNIT III FLOOR COVERING AND DRAPES
Recent developments in manufacturing of floor coverings - hard floor coverings, resilient floor coverings; soft floor coverings – carpets and rugs, laying procedure, maintenance and care; cushion and pads; factors affecting the selection of floor covering; advances in home decoration - draperies – choice of fabrics ,curtains, finishing of draperies- tucks and pleats; types of drapery rods, hooks, tape rings and pins.

UNIT IV FINISHES USED IN HOME TEXTILES
Introduction, thermal draperies, protection against unpleasant odour, antimicrobial finish, moisture management finish, flame retardant finish, towel finishing; sensory perception technology; insect and mite repellent finish, antistatic finish; temperature regulated beddings

UNIT V EVALUATION OF HOME TEXTILES
Test methods - towels, rugs; flammability standards for curtains, test methods for pot holders and woven mittens; labelling and care instructions of home textiles

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student shall be able to understand
- CO 1 - Different types of materials used as home textiles
- CO 2 - Selection of fabric and design for living room, bed room and kitchen furnishings
- CO 3 - Selection of floor coverings and draperies
- CO 4 - Finishes used for various home textile products
- CO 5 - Evaluation of home textile products

TEXTBOOKS:

REFERENCES:
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVE:
- To enable the students to learn about design and production of different garments from knitted fabric

UNIT I INTRODUCTION
Introduction to knitted materials types and features; grain, support and shape trims, linings and interlinings; requirements for sewing knitted fabrics; compression garments

UNIT II CHILDREN’S WEAR
Construction of Children’s wear - stitches, seams, sewing and special machine selection and assembly operations; Rompers, Creeper, Jumpsuit, legging and skirts

UNIT III WOMEN’S WEAR
Women’s wear construction- stitches, seams, sewing and special machine selection and assembly operations – Tunic, Tank Tops, Sports top’s, Capri, Legging

UNIT IV MEN’S WEAR
Construction and assembly of men’s wear - stitches, seams, sewing and special machine selection and assembly operations; T-Shirts, Polo Shirts, Raglon, Kimono Tee’s, Cap’s, Active wear, Sweat shirts, Hooded and non-hooded jackets

UNIT V INTIMATE APPARELS
Construction of Intimate apparels of men’s and women’s- assembly of men’s wear - stitches, seams, sewing and special machine selection and assembly operations; Vests, Briefs, women’s Hipster, panties, bikini, thong, brassier and trunks

OUTCOME:
Upon completion of the course, the students can explain
CO 1 - Different types of knitted materials and their application
CO 2 – Selection of stitches, seams and machine for the construction of children’s wear
CO 3 - Selection of stitches, seams and machine for the construction of women’s wear
CO 4 - Selection of stitches, seams and machine for the construction of men’s wear
CO 5 - Selection of stitches, seams and machine for the construction of intimate apparels

TOTAL: 45 PERIODS

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OBJECTIVES
• To impart knowledge on automations in fabric inspection, spreading and cutting, material handling and the production systems automation

UNIT I  INTRODUCTION
Introduction to Automations in Manufacturing; Global scenario of Automation- Requirements and Fundamentals; Various automation systems and Technologies in Apparel Manufacturing; Prerequisites for adopting automation in Garment Manufacturing; Advantages and Challenges faced during and after adoption of automation; Case studies.

UNIT II  AUTOMATIONS IN FABRIC INSPECTION

UNIT III  AUTOMATIONS IN CUTTING AND SPREADING
Role of automations in spreading and cutting in garment manufacturing; Automated spreading methods and machines; Automatic Fabric pattern matching; Automations in Cutting methods and systems, automated laser cutting; Advanced technologies for fusing cut components.

UNIT IV  AUTOMATIONS IN MATERIAL HANDLING AND PRODUCTION SYSTEMS
Automations in material handling; Gripping Technologies for textile material handling; ETON systems; Strategies and key principles for automation in garment production systems, USA principle; Case studies on commercialized automated production systems in Apparel Industry for material handling.

UNIT V  AUTOMATIONS IN SEWING OPERATIONS
Automation and Robotics for sewing; 3D sewing operations using sewing automats; Sewing preparatory machines with automatic control system; Applications of sewing automats for various garment constructions; Challenges associated with sewing operations automation.

OUTCOMES:
Upon completion of this course, the student would acquire knowledge on automation in
  CO1: Apparel industry and its importance
  CO2: Fabric inspection
  CO3: Cutting and spreading
  CO4: Material handling and production systems
  CO5: Sewing operations

TEXT BOOKS:

REFERENCES:
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
COURSE OBJECTIVES
To impart knowledge to the students on
- concepts and tools in lean manufacture
- application of lean concepts and tools in manufacturing process
- Six Sigma concepts for product and process control.

UNIT I  INTRODUCTION TO LEAN MANUFACTURING  9
Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing –
Basic elements of lean manufacturing – Introduction to LM Tools. Cellular Manufacturing – Types
of Layout, Principles of Cell layout, Implementation.

UNIT II  JIT, TPM, 5S CONCEPTS  9
JIT – Principles of JIT and Implementation of Kanban. Application of KANBAN Cards for
production planning and control for traceability and identification. Continuous Improvement –
application of KAIZEN in reducing rejections. TPM – Pillars of TPM, Principles and implementation
of TPM. 5S Principles and implementation – Value stream mapping – Procedure and principles.

UNIT III  LEAN CONCEPTS IN INVENTORY CONTROL  9
Lean concepts applied in transparent flow of information and production between processes and
customers. Takt Time – Calculation of time for producing exactly quantity required. Reduction of
inventory using simple Economic Order Quantity (EOQ) and Batch Production Models.

UNIT IV  TQM Tools and Techniques:  13
The seven traditional tools of quality, New management tools, and Six sigma: Concepts,
methodology, applications to manufacturing, service sector including IT, Bench marking, Reason
to bench mark, Bench marking process, FMEA, Stages, and Types. Quality circles, Quality
Function Deployment (QFD), Taguchi quality loss function, Concepts, improvement needs, Cost of
Quality, Performance measures

UNIT V  SIX SIGMA  5
Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six
Sigma implementation

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of this course, the student would be able to
- CO1: Understand the principles and elements of lean manufacture
- CO2: Gain skill on JIT, TPM and 5S principles
- CO3: Comprehend application of lean concepts and tools in inventory and production control
- CO4: Understand TQM Tools and Techniques
- CO5: Understand the application of Six Sigma concepts for manufacturing and process control

TEXT BOOKS:
1. Askin Ronald G; Goldberg Jeffrey B, “Design and Analysis of Lean Production Systems”,
   JohnWiley & Sons Inc, 2003

REFERENCES:
   Goldberg,John Wiley & Sons, 2003
2. Gopalakrishnan N, “Simplified Lean Manufacture: Elements, Rules, Tools and
   Implementation”,Prentice Hall of India Learning Pvt. Ltd., 2010
6. Tapan Bose “Total Quality Management”, Pearson Education
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
COURSE OBJECTIVES:
- To provide an insight on the fundamentals of supply chain networks, tools and techniques.

UNIT I  INTRODUCTION
Role of Logistics and Supply Chain Management: Scope and Importance- Evolution of Supply Chain–Decision Phases in Supply Chain - Competitive and Supply chain Strategies–Drivers of Supply Chain Performance and Obstacles.

UNIT II  SUPPLY CHAIN NETWORK DESIGN

UNIT III  LOGISTICS IN SUPPLY CHAIN
Role of transportation in supply chain–factors affecting transportation decision–Design option for transportation network–Tailored transportation – Routing and scheduling in transportation.

UNIT IV  SOURCING AND COORDINATION IN SUPPLY CHAIN
Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration-sourcing planning and analysis-supply chain co-ordination-Bull whip effect–Effect of lack of co-ordination in supply chain and obstacles–Building strategic partnerships and trust within a supply chain.

UNIT V  SUPPLY CHAIN AND INFORMATION TECHNOLOGY
The role IT in supply chain-The supply chain IT frame work Customer Relationship Management–Internal supply chain management–supplier relationship management–future of IT in supply chain–E-Business in supply chain.

COURSE OUTCOMES
Upon completion of this course, the student would be able to
CO1: Gain knowledge on basics of Supply chain Management
CO2: Understand the framework and scope of supply chain networks and functions
CO3: Understand the importance of logistics in supply chain
CO4: Acquire skills on sourcing and coordination in supply chain
CO5: Comprehend the knowledge on role of information technology in supply chain

TEXT BOOKS:

REFERENCES:
## Course Articulation Matrix:

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<td>Understand the framework and scope of supply chain networks and functions</td>
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<td>Understand the importance of logistics in supply chain</td>
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<td>Acquire skills on sourcing and coordination in supply chain</td>
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<td>Comprehend the knowledge on role of information technology in supply chain</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
COURSE OBJECTIVES:

- To impart knowledge on the concepts of social compliance
- To provide insight on compliance norms for apparel manufacture and industry
- To impart knowledge on concepts of ethical trading and international compliance for apparel Business

UNIT I  SCOPE AND NEED OF SOCIAL COMPLIANCE  

UNIT II  GENERAL NORMS ON LABOUR AND SAFETY  
Conventions on discrimination, forced labour, child labour- Direction and risk in the supply chain. ILO convention on child labour, worst Form of child labour, Hazardous child labour, Environment and climate, health and safety–safety norms and measures to been forced for safe working Environment., working hours–norms, remuneration-minimum wages Conventions on Acquired Immune Deficiency Syndrome (AIDS) and Gender.

UNIT III  HEALTH AND ENVIRONMENT COMPLIANCE  

UNIT IV  WAGE COMPLIANCE  
Freedom of association, collective bargaining agreements (C87,C98–ILO) compensation–norms applicable in India. Working hours–code of conduct.

UNIT V  ETHICAL TRADING AND INTERNATIONAL COMPLIANCE  

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of this course, the student would be able to

CO1: Explain the concepts of social compliance and its importance in the apparel industry  
CO2: Know the general norms on labour and safety  
CO3: Interpret health and environment compliance in apparel industry  
CO4: Interpret wage compliance norms for the industry  
CO5: Relate and practice concepts of ethical trading and international compliance for apparel Business

TEXT BOOKS:

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<td>Interpret health and environment compliance in apparel industry</td>
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<td>Interpret compliance norms for apparel manufacture and industry</td>
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<td>Relate and practice concepts of ethical trading and international compliance for apparel Business</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To impart knowledge on
- Advancements in apparel designing and garment sizing
- Seamless and stitch less garments
- Applications of AI in apparel industry and of automations in apparel industry

UNIT I  APPLICATIONS OF CAD IN GARMENT INDUSTRY  9
Computer aided garment design using three dimensional body models, computerized made-to-measure systems, technological advances in fabric designing, embroidery designing; consumer based virtual pattern and garment panels designing.

UNIT II  ADVANCEMENTS IN GARMENT SIZING AND FABRIC DRAPE  9
Apparel sizing and garment fit - key issues, technological advancements in virtual fitting; digital body measurement techniques, virtual measurements, AI powered body measuring; 3D body scanning types- light based, laser based, sound wave and microwave-based systems; modelling fabric and garment drape- geometrical and physical, 2D and 3D garment drape modelling

UNIT III  TECHNOLOGICAL ADVANCEMENTS IN SEWING GARMENTS  13
Seamless technologies: seamless techniques and seamless knitting machine, 3D seamless knitting, application of seamless garments; advancements in technologies for fabric joining, seam sealing, welding technology, bonding, methods of joining fabrics to accessories; applications, advantages and disadvantages

UNIT IV  ARTIFICIAL INTELLIGENCE IN APPAREL INDUSTRY  5
Introduction to AI – Neural networks (NN), fuzzy logic (FL), genetic algorithm (GA), evolution strategy (ES), artificial immune system (AIS) and multiagent system (MAS); application of AI in garment designing, production planning, manufacturing, inspection, supply chain and retail. Challenges and future trends

UNIT V  ADVANCEMENTS IN GARMENT MANUFACTURING  9
Automations in material handling - gripping technologies, conveyor systems and digital tracking; automation in sewing machines – under bed trimmers, bobbin changers; automation in pressing and fusing; automation in garment inspection and packing

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students would have knowledge on
CO1: Advancements in apparel designing using CAD
CO2: Developments in garment sizing and fabric draping
CO3: Alternative techniques to stitches and seams
CO4: Applications of AI in apparel industry
CO5: Automations in garment manufacturing process

TEXTBOOKS:

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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES
To impart knowledge on
- Role and importance of computer in apparel industry.
- CAD in textile and apparel product design.
- Computer controlled 3D garment design, modelling techniques, size and fit

UNIT I INTRODUCTION
Introduction to terminology – CAM, CAD, CIM, EDI, CAA, Block Chain, Artificial System, Expert System, E-Prototyping, Rapid Prototyping; techniques for 3D garment design - sketch-based garment design, surface flattening for virtual garments; Online garment shopping system: problems and solutions.

UNIT II COMPUTER AIDED TEXTILE DESIGN SOFTWARE
Features and modules of Textile designing software – image editing, woven, knits, embroidery; digital printing technology for textiles and apparel; computerized colour matching

UNIT III COMPUTER AIDED GARMENT DESIGN SOFTWARE
Application of computers in each stage of apparel design - market research, fashion trend forecasting, fashion and garment designing - Illustration software, pattern making, grading, marker making, laying & spreading, fabric defect checking, cutting, ticketing and assembling, production planning, production systems, customisation, warehouse, ERP and MIS, retail and EXIM procedures.

UNIT IV SIZE AND FIT
Importance and development of Size Chart, key issues affecting apparel size and fit, objective evaluation of clothing fit; types of body scanning – light based, laser based, microwave based, advantage and disadvantage of body scanning; tools and features of virtual garmenting software used to evaluate clothing fit.

UNIT V 3D TECHNOLOGIES FOR VIRTUAL APPAREL AND TEXTILE DESIGN
Model development, Simulation of garment appearance based on fabric construction, technologies of human body modelling in 3D, development of the body surface, animation, generic vs. individualized body models, applications of 3D human body modelling, virtual try on technologies in apparel Retailing.

OUTCOMES:
Upon completion of this course, students would have acquired knowledge on,
- CO1: Computer based systems and techniques used in apparel manufacturing
- CO2: Features available in different textile design software
- CO3: Features available in different garment design and production software
- CO4: 3D body scanning technologies to develop size charts and evaluate clothing fit
- CO5: 3D modelling and virtual garmenting features for apparel and textile product design using CAD

TEXT BOOKS:
REFERENCES:
### Course Articulation Matrix:

| Course Outcomes | Statement                                                                 | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|-----------------|---------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
| CO1             | Computer based systems and techniques used in apparel manufacturing       | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |
| CO2             | Features available in different textile design software                   | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |
| CO3             | Features available in different garment design and production software    | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |
| CO4             | 3D body scanning technologies to develop size charts and evaluate clothing fit | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |
| CO5             | 3D modelling and virtual garmenting features for apparel and textile product design using CAD | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |
| Overall CO      |                                                                           | 2   | 2   | 3   | 1   | 3   | -   | -   | 1   | 2   | -    | 2    | 2    | 3    | 3    | 2    |

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
To enable the students to learn about
- Various operations research (OR) methods that can be applied in the apparel industry
- Expressing of problems arising in the textile industry in appropriate Operations Research formats
- Methods of solving such Operations Research problems

UNIT I
Introduction – History of Operations Research, Scope of Operation Research, applications and limitations; Linear programming problem – construction, solution by graphical method, the Simplex method and its extension by the Big M method; integer programming – introduction; application of the LP technique in the field of apparel technology

UNIT II
Transportation problem – construction, initial basic feasible solution – North West Corner rule, lowest cost entry method, Vogel’s Approximation Method; the optimality test – Modified Distribution method, stepping stone method; transshipment problem

UNIT III
The Assignment problem – construction, solution by Hungarian method, application in the apparel industry; sequencing problems from apparel industry; Decisions theory - decisions under assumed certainty, decision under risk, decision under uncertainty, illustrations from apparel industry

UNIT IV
Replacement analysis; inventory control – ABC, VED analysis, EOQ – application in apparel industry, simulation-introduction, Monte Carlo method

UNIT V
Project planning and control models: CPM, PERT – network representation, determining critical path, project duration; crashing of project duration; resource leveling

COURSE OUTCOMES
Upon completion of the course, the students will be able to
CO1: Design Operations Research problems from the cases arising in the apparel Industry and determine solution for linear programming problems
CO2: Construct and solve transportation problems
CO3: Construct and solve assignment problems and understand decision making under different conditions.
CO4: Carryout replacement analysis and inventory control
CO5: Construct and solve project scheduling by PERT and CPM techniques and resource leveling

TEXTBOOKS
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<td>CO1</td>
<td>Design Operations Research problems from the cases arising in the apparel industry and determine solution for linear programming problems</td>
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<td>Construct and solve transportation problems</td>
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<td>CO3</td>
<td>Construct and solve assignment problems and understand decision making under different conditions.</td>
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<td>CO4</td>
<td>Carryout replacement analysis and inventory control</td>
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<td>CO5</td>
<td>Construct and solve project scheduling by PERT and CPM techniques and resource leveling</td>
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
- To impart knowledge on enterprise resource planning and implementation in apparel industry.
- To impart knowledge on management information system, its function and characteristics.

UNIT I
Enterprise Resource Planning - principle, framework, application and suitability in garment production

UNIT II
Client/Server architecture; technology choices; SCM, CRM – concepts, Business Process Reengineering, Data ware Housing, Data mining, ERP system packages.

UNIT III
ERP implementation strategies – organizational and social issues, data safety & security, ERP implementation in a garment production facility

UNIT IV
Management Information System – report for different levels of management, decision making; application in garment industry.

UNIT V
Information – requirements, properties and scope, information economics, types and characteristics.

OUTCOMES:
Upon completion of this course, students shall able to know about,
CO1: Benefits and application procedure of ERP in apparel industry
CO2: Various components used in ERP and its modules
CO3: Implementation and execution process of ERP in apparel industry
CO4: Integration of MIS and its ability of managing activities
CO5: Interpretation of information’s and its impacts in apparel industry

TOTAL: 45 PERIODS

TEXT BOOKS:

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INTERNATIONAL TEXTILE AND APPAREL BUSINESS MANAGEMENT

OBJECTIVE:
- To give the students an exposure on international market for textile products, regulations with respect to export and import of textiles.

UNIT I
International markets for yarns, fabrics; international market for cotton, silk, jute, wool and other fibres; yarns and fabrics; export and import of textiles by India – current status, promotional activities

UNIT II
International markets for carpets and home textiles – product types, market potential and statistics, India - current status and promotional activities, role of export promotional councils

UNIT III
International markets for woven piece goods, knitted garments, leather garments; statistics of international apparel market and trade; export incentives, role of AEPC, CII, FIEO, Textile Committee

UNIT IV
Marketing – strategies, global brand building; logistics & SCM; role of export finances & EXIM banking, Letter of credit, ECGC, Indian council of arbitration, FERA; impact of foreign trade on Indian economy; foreign exchange – Regulation, risk management

UNIT V
Exim policy - customs act, acts relating to export/import of textile and apparel; Indian customs formalities - export documentation for excisable goods, import documentation, clearance of import goods; concepts - 100% export oriented units, export processing zones, special economic zones; duty drawback procedure; import/export incentives; licenses; case study

OUTCOMES:
Upon completion of this course, the student will be able to,
- CO1: Explain the international market for fibre, yarn and woven fabric
- CO2: Discuss the international market for carpets and home textiles
- CO3: Explain the international market for woven, knitted and leather garments
- CO4: Describe the marketing strategies and export finance
- CO5: Discuss the Indian EXIM policies and procedure

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES
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<td>Discuss the international market for carpets and home textiles</td>
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<td>CO3</td>
<td>Explain the international market for woven, knitted and leather garments</td>
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<td>Describe the marketing strategies and export finance</td>
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<td>CO5</td>
<td>Discuss the Indian EXIM policies and procedure</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substant
CFT332 ENTREPRENEURSHIP IN APPAREL MANUFACTURE L T P C 3 0 0 3

OBJECTIVE:
- The course provides an understanding of the scope of entrepreneurship in apparel, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits.

UNIT I ENTREPRENEURSHIP

UNIT II MOTIVATION
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, self Rating, Business Game, Thematic Apperception Test – Stress management, Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS

UNIT IV FINANCING AND ACCOUNTING

UNIT V SUPPORT TO ENTREPRENEURS

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course, the students will have confidence and entrepreneurial skills essential for the successful launch and scaling-up of an enterprise. They would know
- About entrepreneurship
- Motivation for entrepreneurs
- The processes involved in setting up a business
- Financing and tax implications
- Types of supports available for the entrepreneurs

TEXT BOOKS:

REFERENCES:
Course Articulation Matrix:

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<tr>
<th>Course Outcomes</th>
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<tr>
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<tr>
<td>CO1</td>
<td>About entrepreneurship</td>
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<tr>
<td>CO2</td>
<td>Motivation for entrepreneurs</td>
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<td>CO3</td>
<td>The processes involved in setting up a business</td>
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</tr>
<tr>
<td>CO4</td>
<td>Financing and tax implications</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>Types of supports available for the entrepreneurs</td>
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
The general goal of this course is to provide an introduction to sustainability management in textile and apparel organization. This sustainability course is also focused on corporate sustainability strategy.

UNIT I INTRODUCTION TO SUSTAINABILITY MANAGEMENT

UNIT II SUSTAINABILITY OPERATING SYSTEM IN AN ORGANIZATION
SOS basics, critical elements of an SOS, structural elements support SOS, SOS Standards, Sustainability-related Management system for apparel industries, SOS Process Schedule.

UNIT III STRATEGIC PLANNING FOR A SUSTAINABILITY OPERATING SYSTEM

UNIT IV ENVIRONMENTAL POLICY AND SUSTAINABILITY MANAGEMENT
Framework for Understanding Environmental Policy - Values Dimension, Political Dimension, Science and Technology dimension in apparel industries, Policy Design Dimension and implementation in apparel firm, Green supply chain management for apparel products.

UNIT V SUSTAINABILITY REPORTING

TOTAL: 45 PERIODS

OUTCOMES
After the completion of the course, the students would know
CO1: the process of sustainability and its procedures
CO2: Implementation criteria’s of sustainability in apparel industries
CO3: Planning and policy decision for sustainable strategic approach
CO4: Correlation between ecology and sustainability management
CO5: Reporting and auditing of sustainability management system

TEXT BOOKS
2. Dr. P. Kandhavadivu “Sustainability In Fashion And Apparels” Woodhead Publishing 2018

REFERENCES
1. Claudia E. Henninger (Editor), Panayiota J. Alevizou (Editor), Helen Goworek (Editor) Sustainability in Fashion: A Cradle to Upcycle Approach Palgrave Macmillan; 1st ed. 2017 edition
2. Tsan-Ming Choi (Editor), T. C. Edwin Cheng Sustainable Fashion Supply Chain Management: From Sourcing to Retailing: Springer; Softcover reprint of the original 1st ed. 2015 edition
### Course Articulation Matrix:

<table>
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<tr>
<th>Course Outcomes</th>
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<td>CO1</td>
<td>Understanding the process of sustainability and its procedures</td>
<td>PO 1 PO 2 PO 3 PO 4 PO 5 PO 6 PO 7 PO 8 PO 9 PO 10 PO 11 PO 12 PSO 1 PSO 2 PSO 3</td>
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<td>CO2</td>
<td>Implementation criteria's of sustainability in apparel industries</td>
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<tr>
<td>CO3</td>
<td>Planning and policy decision for sustainable strategic approach</td>
<td>2 2 2 3 3 3 3 3 3 - - - - 2 3 2</td>
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<tr>
<td>CO4</td>
<td>Correlation between ecology and sustainability management</td>
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<tr>
<td>CO5</td>
<td>Reporting and auditing of sustainability management system</td>
<td>2 2 2 3 3 3 3 3 3 - - - - 2 3 2</td>
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<td>Overall CO</td>
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<td>2 2 2 3 3 3 3 3 3 - - - - 2 3 2</td>
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</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVE
To enable the students understand various aspects of human resources management and different acts related to personnel management

UNIT I
Human resource development systems - Indian society in transition, understanding the concepts of HRD past, present and future, strategies adopted, structure, objectives and working of the HRD system in India and abroad, role of HR managers in textile and apparel industries.

UNIT II
Human resource planning objectives of planning on the macro level, demand forecasting of HR planning, MIS in HR planning, future skill mapping, human resource outsourcing, recruitment and processes involved in textile and apparel industries, induction; training objectives, methods, carrier planning, performance and potential appraisal.

UNIT III
Job analysis, description, evaluation, enrichment; performance measurement - objectives, methods, multi-skill development, motivation; organized labour, understanding groups, development, cohesion, alienation, groupwork, behaviour and managing international workforce.

UNIT IV
Compensation, wage policy, industrial pay structure, types, components, laws and methods of payment; methods of wage fixation in textile, mill and apparel units; laws governing employee benefits and welfare, incentives, overtime, bonus, cost to the company.

UNIT V
Different Acts governing labour welfare and employment; employee discipline - disciplinary actions, procedures, suspension, dismissal, and trendemment, rollover, trade unions, collective bargaining, industrial democracy and workers participation in management, related case studies.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students shall be able to understand
- Role of HR managers and HRD system in India
- Recruitment and training in textile industry
- Job analysis, managing organized labour and international labour
- Compensation, wage policy
- Government Acts related to labor management

TEXTBOOKS:

REFERENCES:
Course Articulation Matrix:

| Course Outcomes | Statement                                                                 | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PSO 3 |
|-----------------|---------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
| CO1             | Role of HR managers and HRD system in India                               | 2    | 2    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | 3     | -     |
| CO2             | Recruitment and training in textile industry                              | 2    | 2    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | 3     | -     |
| CO3             | Job analysis, managing organized labour and international labour         | 2    | 2    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | 3     | -     |
| CO4             | Compensation, wage policy                                                | 2    | 2    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | 3     | -     |
| CO5             | Government Acts related to labour management                            | 3    | -    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | -     | -     |
| Overall CO      |                                                                           | 2    | 2    | 2    | -    | -    | -    | 2    | 3    | 2    | 2     | -     | 2     | 3     | -     |

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

- To enable the students to learn about the fundamentals of bonded fabrics and different method of web formation and bonding

UNIT I WEB FORMATION
Definitions and classification of bonded fabrics; web formation – dry and wet method of production, fibre requirements; web laying – types, influence on web structure and nonwoven properties; quality control of web

UNIT II MECHANICAL BONDING
Bonded fabric production by mechanical bonding - needling, stitching, water-jet consolidation; factors influencing the properties; applications

UNIT III CHEMICAL AND THERMAL BONDING
Chemical bonding – binder polymers and bonding technologies; thermal bonding technologies; factors influencing the properties; applications

UNIT IV POLYMER-LAIDED WEB AND FABRIC FORMATION
Manufacture of spun bonded fabrics, fibre orientation in spun bonded fabrics and characterization of filament arrangement; manufacture of melt blown fabrics – fibre formation and attenuation; effect of processing parameters on fabric characteristics; applications

UNIT V FINISHING AND CHARACTERIZATION OF BONDED FABRICS
Dry and wet finishing; characterization – tensile, tear, bursting, thickness, abrasion, puncture, permeability, porosity; safety measures to be taken at the nonwoven industry

TOTAL: 45 PERIODS

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

CO1: Explain the basics of nonwoven web formation techniques
CO2: Discuss the mechanical bonding technique to produce nonwovens
CO3: Explain the chemical and thermal bonding methods to produce nonwovens and their end uses
CO4: Discuss the production of spun bonded and melt blown nonwoven fabrics.
CO5: Explain the finishing and characterization of bonded fabrics

TEXTBOOKS

REFERENCES
**Course Articulation Matrix:**

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<tr>
<th>Course Outcomes</th>
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<td>Explain the basics of nonwoven web formation techniques</td>
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<td>Discuss the mechanical bonding technique to produce nonwovens</td>
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<td>CO3</td>
<td>Explain the chemical and thermal bonding methods to produce nonwovens and their end uses</td>
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<td>CO4</td>
<td>Discuss the production of spun bonded and melt blown nonwoven fabrics</td>
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<td>Explain the finishing and characterization of bonded fabrics</td>
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</table>

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

- To introduce about basic elements required for protective garments
- To impart the conceptual knowledge about the chemical finishes required for protective garments
- To understand the different application areas of protective garments
- To understand the implicit knowledge of protective garment construction
- To analyse and evaluate the protective garments codes of standards

UNIT I  FIBRES, YARNS AND FABRICS FOR PROTECTIVE GARMENTS
Selection of fibres - suitability and properties of fibres for various protective clothing, chemical composition and physical structure, characteristics and working of various fibres according to different end uses like thermal protection, ballistic protection, anti-microbial protection, protection against cold. Yarn and fabric (knitted, woven and Non-woven) parameters, their methods of production, effect of structure on their performance; use of composite materials in yarn and fabric formation used for protective end uses.

UNIT II  CHEMICAL FINISHES FOR PROTECTIVE GARMENTS
Use of coated fabrics - different types of finishes like fire retardant finishes, water repellent finishes, anti-microbial finishes; chemical finishes against radiation and chemicals – method of application of those finishes; machines and techniques used for such applications; protective finishes for health care garments.

UNIT III  PROTECTIVE GARMENTS IN OTHER APPLICATIONS
Protective fabrics used in the medical field and in hygiene; military combat clothing; protective fabrics against biological and chemical warfare; textiles for high visibility.

UNIT IV  GARMENT CONSTRUCTION
Garment construction - method of construction of garments according to various protective end uses like protection against thermal, water, cold, chemical, UV radiation, ballistic and antimicrobial protection; use of inter lining and composites;

UNIT V  EVALUATION OF PROTECTIVE GARMENTS
Evaluation of protective fabrics - desirable properties of protective textiles, method of testing for thermal protective performance, water, cold, abrasion and wear resistance; evaluation of resistance in to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; evaluation of antiballistic, personal protective garments ASTM standards for protective garments.

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the students would have knowledge on:
- Basic elements required for protective garments
- Chemical finishes required for protective garments
- Application area of protective garments
- Protective garment construction
- Evaluation and standards for protective garments
TEXTBOOKS

REFERENCES
### Course Articulation Matrix:

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<tr>
<th>CO</th>
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<td>Draw up the basic elements required for protective garments</td>
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<td>Basic knowledge on chemical finishes required for protective garments</td>
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<td>Impart knowledge on application area of protective garments</td>
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<td>Information about protective garment construction</td>
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<td>Condition of knowing the codes of standards for protective garments</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
COURSE OBJECTIVES

- To acquaint students on the design, material, accessories and sewing aspects of intimate garments

UNIT I CLASSIFICATION AND RAW MATERIAL REQUIREMENTS FOR INTIMATE APPAREL 5
Intimate apparels – Definition, classification, materials-fiber, fabric and accessories; physical and physiological requirements of intimate apparels

UNIT II DESIGN ELEMENTS FOR INTIMATE APPAREL 13
Design analysis, measurements, pattern drafting of men’s intimate apparel – Long johns, tanktop, tanga, boy shorts, knickers, bikini underwear, thong, boxer briefs, boxer shorts and jock strap.

UNIT III MEASUREMENTS AND PATTERN CONSTRUCTION 13
Design analysis, measurements, pattern drafting of women’s intimate apparel – waist petticoats, panties, camisoles, tube top, shape wear, bikini and bra.

UNIT IV ACCESSORIES INVOLVED IN INTIMATE APPAREL 5
Intimate apparel accessories - Bra wire, hook and eye tape, ring and slider, buckle, plastic bone, elastics and sewing threads

UNIT V SEWING AND VALUE ADDITION OF INTIMATE APPAREL 9
Sewing of intimate apparels - seams, stitches, machines; lamination; moulding and welding technique.

TOTAL: 45 PERIODS

Course Outcomes
Upon completion of this course, the students will have the skills essential to:
CO1 - Select fibres and fabric for intimates
CO2 - Design and draft pattern for men’s intimate apparel
CO3 - Design and draft pattern for women’s intimate apparel
CO4 - Select required accessories
CO5 - Know about seams, stitches and seamless technology to develop intimates

TEXT BOOKS

REFERENCES
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<td>Basic knowledge on design elements of intimate garments</td>
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<td>Impart knowledge on pattern measurements of intimate garments</td>
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<tr>
<td>CO.4</td>
<td>Information about accessories required for intimate garments</td>
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<tr>
<td>CO.5</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES

- To enable the students to understand the concept and construction of smart fabrics and interactive garments

UNIT I POLYMERS FOR SMART TEXTILES

An overview on smart textiles, electrically active polymers materials, application of non-ionic polymer gel and elastomers for artificial muscles; heat storage and thermo regulated polymers, thermally sensitive materials, cross linked polymers as multifunctional and multi-use intelligent material; mechanical properties of fibre Bragg gratings, optical responses of FBG (Fibre Bragg Grating) sensors under deformation; smart textile composites integrated with optic sensors

UNIT II CHARACTERIZATION

Morphological characterisation, electrical characterization- surface and volume resistance, electromechanical characterization- change in resistance with elongation and compression, gauge factor, impedance value measurement, repeatability study, effect of environment

UNIT III ADAPTIVE AND RESPONSIVE TEXTILES

Pre-treatment of fabrics for smart textiles applications, adaptive and responsive textile structures, intelligent polymers for biomedical applications

UNIT IV SMART FABRICS

Smart fabrics – passive, active, very smart; classification of smart materials, concept of wearable computing, structure of fabrics used for integrating different electronic sensors

UNIT V DESIGN OF SMART INTERACTIVE GARMENTS

Requirements, selection of material and sensors, garment construction for smart interactive garments - military applications, hospital and patient care, sports and fitness activities; smart home textiles

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students shall have the knowledge on

CO1: Requirement of polymers used in smart textiles and their properties
CO2: Characterization of electrically active material
CO3: Adaptive and responsive textiles
CO4: Smart fabrics
CO5: Design of smart interactive garments

TEXTBOOKS

REFERENCES
## Course Articulation Matrix:

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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
- To impart knowledge on requirements of sports textiles, coated and laminated sports textiles, sports garment designing and evaluation

UNIT I SPORTSWEAR - PHYSIOLOGICAL COMFORT
Sportswear – introduction, types; textiles in sportswear; sportswear - comfort and protection from injury, functional requirements; wear comfort of sportswear, measurement of physiological comfort; heat exchange mechanism and heat balance, water resistance, water vapour transfer, condensation problem in waterproof breathable fabrics for sportswear.

UNIT II COATED AND LAMINATED TEXTILES IN SPORTSWEAR
Sports products from coated and laminated fabrics; fibre and fabric preparation for coated fabrics; transfer, rotary screen, micro porous coating; determination of coating add-on; lamination in sportswear; finishes for sportswear- mechanism, chemistry and application.

UNIT III SPORTS GARMENT DESIGNING
Design of sports garments – selection of fibre, yarn and fabrics for different types of sports, construction of sports garments; advancements in textile materials for active wears

UNIT III OTHER SPORTS PRODUCTS DESIGNING
Design of sports foot wear, protective gears, glove – components, design features, selection of material, construction.

UNIT V EVALUATION OF SPORTS TEXTILES
Standards and test methods for sports textiles, testing of coated and laminated sportswear fabrics

COURSE OUTCOMES
At the end of the course the students would be able
CO1: Explain physiological comfort requirement of sports textile products
CO2: Explain development and application of coated and laminated textiles as sports textiles.
CO3: Design sports garments
CO4: Design sports footwear, glove and protective gears.
CO5: Explain evaluating of sportswear

TEXT BOOKS

REFERENCES
3. A.K.Sen, Coated Textiles: Principal and Applications, Technomic Publication, Lancaster,
Course Articulation Matrix:

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COURSE OBJECTIVES
To enable the students, understand the different types of biomaterials and biomedical application of different textile structures

UNIT I  METERIALS IN BIO MEDICAL APPLICATION  13
Metals, ceramics, polymers used for bio medical applications – manufacture, features and limitations; super absorbent polymers, cell- biomaterial interaction

UNIT II  WOUND DRESSING BANDAGES AND NON IMPLANTABLES  9
Non-implantable materials: wound dressing - requirements of wound dressing, types, properties and applications; bandages - types, evaluation and applications; design and manufacture of wound dressings and bandages

UNIT III  IMPLANTABLE TEXTILES  9
Implantable biomedical devices: vascular grafts, sutures - types, properties and applications; extra-corporeal devices; scaffolds for tissue engineering: development and characterization

UNIT IV  HEALTH CARE AND HYGIENE TEXTILES  9
Healthcare and hygiene products: surgical gowns, masks, respirators, wipes, napkins, antibacterial, antidour texts design and manufacture of above products

UNIT V  STANDARDS IN MEDICAL TEXTILES  5
Standards; safety, legal and ethical issues involved in conducting trials with medical textile materials; disposal of medical textile products

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the students would know about
CO.1   medical textiles and its base material
CO.2   wound dressing and bandage textiles and manufacture
CO.3   implantable textiles
CO.4   healthcare and hygiene textiles and manufacture
CO.5   evaluation methods in medical textiles

TEXTBOOKS

REFERENCES
## Course Articulation Matrix:

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GE3751  PRINCIPLES OF MANAGEMENT  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS  9

UNIT II  PLANNING  9

UNIT III  ORGANISING  9

UNIT IV  DIRECTING  9

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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**TABLE 1**: CO’s, PO’s and PSO’s

**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**


**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**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation-Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM:

TOTAL: 45 PERIODS

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

TEXT BOOK:

REFERENCES:

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

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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 9

UNIT III PRICING 9
Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

MAPPING OF COS AND POS:

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219
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

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT

UNIT II HUMAN RESOURCE PLANNING

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

UNIT IV EMPLOYEE COMPENSATION

UNIT V PERFORMANCE EVALUATION AND CONTROL

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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GE3755 KNOWLEDGE MANAGEMENT

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

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

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING

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

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Understand the process of 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.

CO’s- PO’s & PSO’s MAPPING

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TEXT BOOK:

REFERENCE:

GE3792 INDUSTRIAL MANAGEMENT

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-Mouton, 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.

TEXTBOOKS:

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MANDATORY COURSES I

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

COURSE OUTLINE

UNIT I CONCEPTS
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.
UNIT II  FEMINIST THEORY
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

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

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

UNIT V  GENDER AND REPRESENTATION
Advertising and popular visual media.

Gender and Representation in Alternative Media.
Gender and social media.

TOTAL: 45 PERIODS

MX3082  ELEMENTS OF LITERATURE

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) Figurative language.
   c) Plot character and perspective.

3. Elements of poetry
   a) Emotions and imaginations.
   b) Figurative language.
   c) (Simile, metaphor, conceit, symbol, pun and irony).
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.
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.

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**MX3084**

**DISASTER RISK REDUCTION AND MANAGEMENT**

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

**UNIT I**

**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, programmes 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:
1 Taimpo (2016), Disaster Management and Preparedness, CRC Publications

REFERENCES

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

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

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 handle 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.

Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease - cancer - diabetes - chronic pulmonary diseases - risk factors - tobacco - alcohol - unhealthy diet - lack of physical activities.


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

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

UNIT II DIET

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


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

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

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

**UNIT III** ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH 4+4

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

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

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

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

**UNIT IV** MENTAL WELLNESS 3+4

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


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

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

**UNIT V** YOGA 2+12

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

**TOTAL : 45 PERIODS**

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

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

UNIT-I CONCEPTS AND PERSPECTIVES
Meaning of History
Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation versus evidence, concept of historical inevitability, Historical Positivism.
Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.
UNIT-II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA
Introduction to the works of D.D. Kosambi, 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)

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.
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)

Essential elements of Indian civilization. (3 lectures)

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.

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TOTAL: 45 PERIODS

OUTCOME:

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

MX3088 STATE, NATION BUILDING AND POLITICS IN INDIA

OBJECTIVE:

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

TOPICS:

Understanding the need and role of State and politics.
Development of Nation-State, sovereignty, sovereignty in a globalized world.


1857 and the national awakening.


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

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

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

UNIT II STANDARDS AND REGULATIONS

UNIT III SAFETY ACTIVITIES

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

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

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

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

REFERENCES
5. Society of Safety Engineers, USA

ONLINE RESOURCES
<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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<td>CO1</td>
<td>Understand the basic concept of safety.</td>
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<td>Obtain knowledge of Statutory Regulations and standards.</td>
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<td>Know about the safety Activities of the Working Place.</td>
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<td>CO4</td>
<td>Analyze on the impact of Occupational Exposures and their Remedies</td>
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<td>Obtain knowledge of Risk Assessment Techniques.</td>
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OBJECTIVES:
The main objectives of this course are to:
1. Understand the importance, principles, and search methods of AI
2. Provide knowledge on predicate logic and Prolog.
3. Introduce machine learning fundamentals
4. Study of supervised learning algorithms.
5. Study about unsupervised learning algorithms.

UNIT I INTELLIGENT AGENT AND UNINFORMED SEARCH

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

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

UNIT IV SUPERVISED LEARNING

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

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

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

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

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

TOTAL PERIODS: 60

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

REFERENCES

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

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

UNIT I INTRODUCTION TO INTERNET OF THINGS 5

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

UNIT IV  OPEN PLATFORMS AND PROGRAMMING  

UNIT V  IOT APPLICATIONS  
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance – Home Automation – Smart Agriculture

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

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

TOTAL PERIODS: 60

TEXTBOOKS

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

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

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

UNIT II DATA MANIPULATION

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

UNIT IV DATA VISUALIZATION

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

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

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

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

TOTAL PERIODS: 60

TEXT BOOKS

REFERENCES

CCS333 AUGMENTED REALITY/VIRTUAL REALITY

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

UNIT I INTRODUCTION

UNIT II VR MODELING

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

UNIT IV APPLICATIONS 6

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

PRACTICAL EXERCISES: 30 PERIODS

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

TOTAL PERIODS: 60

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

TEXTBOOKS:
1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
Course Description:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

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

UNIT I 9

UNIT II 9

UNIT III 9

UNIT IV 9

UNIT V 9

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

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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:

REFERENCEBOOKS:

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

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

UNIT I  INTRODUCTION

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

UNIT II  LEAN MANAGEMENT

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

UNIT III  CORE CONCEPTS IN LEAN


UNIT IV  LEAN TOOLS AND TECHNIQUES


UNIT V  LEAN IMPLEMENTATION IN CONSTRUCTION INDUSTRY

Lean construction implementation- Enabling lean through information technology - Lean in design - Design Structure - BIM (Building Information Modelling) - IPD (Integrated Project Delivery) – Sustainability through lean construction approach.

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:

5. Salem, O., Solomon, J., Genaidy, A. and Luegring, M., Site implementation and Assessment of Lean Construction Techniques, Lean Construction Journal, 2005

OMG352 NGOS AND SUSTAINABLE DEVELOPMENT L T P C
3 0 0 3

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

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

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

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

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

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

TOTAL 45 : PERIODS

OUTCOMES
Upon completion of this course, the student will:
CO1 Have a thorough grounding on the issues and challenges being faced in attaining sustainable development
CO2 have a knowledge on the role of NGOs towards sustainable development
CO 3 present strategies for NGOs in attaining sustainable development
CO 4 recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment
CO 5 understand the environmental legislations

REFERENCE BOOKS

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

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

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

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

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

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

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

CME365 RENEWABLE ENERGY TECHNOLOGIES
L T P C
3 0 0 3

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

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

UNIT – II  SOLAR ENERGY

UNIT – III  WIND ENERGY

UNIT – IV  BIO-ENERGY

UNIT – V  OCEAN AND GEOTHERMAL ENERGY

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

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

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

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

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

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

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

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

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

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

**REFERENCES**
1. https://www.ideou.com/pages/design-thinking#process
3. https://blog.forgeforward.in/product-innovation-rubric-adf5ebdf0d356
4. https://blog.forgeforward.in/evaluating-product-innovations-e8178e58b86e
6. https://blog.forgeforward.in/star-tup-failure-is-like-true-lie-7812cffe9b85

**MF3003 REVERSE ENGINEERING**

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

**UNIT I INTRODUCTION & GEOMETRIC FORM**

**UNIT II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION**
UNIT III  DATA PROCESSING  9 Hours

UNIT IV  3D SCANNING AND MODELLING  9 Hours

UNIT V  INDUSTRIAL APPLICATIONS  9 Hours

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

OPR351  SUSTAINABLE MANUFACTURING  L T P C
3 0 0 3

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

UNIT – I  ECONOMIC SUSTAINABILITY

UNIT – II  SOCIAL AND ENVIRONMENTAL SUSTAINABILITY

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

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

UNIT – V  TRENDS IN SUSTAINABLE OPERATIONS

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
AU3791 ELECTRIC AND HYBRID VEHICLES

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

UNIT I DESIGN CONSIDERATIONS FOR ELECTRIC VEHICLES


UNIT II ENERGY SOURCES


UNIT III MOTORS AND DRIVES

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

UNIT IV POWER CONVERTERS AND CONTROLLERS

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

UNIT V HYBRID AND ELECTRIC VEHICLES

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

TOTAL: 45 PERIODS

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

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OAS352 SPACE ENGINEERING

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

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

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

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

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

TEXT BOOKS:

REFERENCE:

OIM351  INDUSTRIAL MANAGEMENT  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION  9

UNIT II  FUNCTIONS OF MANAGEMENT  9
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
3 0 0 3

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 thespecialcontrolproceduresfor 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
Quality Dimensions–Quality definitions–Inspection–Quality control–Quality Assurance–
Quality planning–Quality costs–Economics of quality–Quality loss function

UNIT II  CONTROLCHARTS  9
Chance and assignable causes of process variation, statistical basis of the control chart,
control charts for variables–X̅, 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, X̅ chart with a linear trend, chart for moving averages and ranges, cumulative-sum and
exponentially weighted moving average control charts.

UNIT IV  STATISTICALPROCESSCONTROL  9
Process stability, process capability analysis using a Histogram or probability plots and
control chart.Gauge capability studies, setting specification limits.

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

TOTAL: 45 PERIODS

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

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

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

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

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

UNIT V WORKING AT HEIGHTS 9

TOTAL : 45 PERIODS

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

TEXT BOOKS

REFERENCES:
OML351 INTRODUCTION TO NON-DESTRUCTIVE TESTING L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Understanding the basic importance of NDT in quality assurance.
- Imbibing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying apply the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application

UNIT I INTRODUCTION TO NDT & VISUAL TESTING 9
Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.

UNIT II LIQUID PENETRANT & MAGNETIC PARTICLE TESTING 9
Liquid Penetrant Inspection: principle, applications, advantages and limitations, dyes, developers and cleaners, Methods & Interpretation. Magnetic Particle Inspection: Principles, applications, magnetization methods, magnetic particles, Testing Procedure, demagnetization, advantages and limitations, – Interpretation and evaluation of test indications.

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY 9
spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.

UNIT IV ULTRASONIC TESTING & AET

Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique. Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration.


UNIT V RADIOGRAPHY TESTING

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

TOTAL: 45 PERIODS

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

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

UNIT – I INTRODUCTION AND SENSORS

UNIT – II 8085 MICROPROCESSOR

UNIT – III PROGRAMMABLE PERIPHERAL INTERFACE

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

UNIT – V ACTUATORS AND MECHATRONICS SYSTEM DESIGN

TOTAL: 45 PERIODS

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

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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 9

UNIT – II ROBOT KINEMATICS 9
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 9

UNIT – IV SENSORS IN ROBOTICS 9
Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and
compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT – V PROGRAMMING AND APPLICATIONS OF ROBOT

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

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

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Mapping of COs with POs and PSOs

TEXT BOOKS:

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

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

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

UNIT III  BASICS OF AERODYNAMICS  9
Aerofoils, Mach number, Maneuvers.

UNIT IV  BASICS OF AIRCRAFT STRUCTURES  9

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

TOTAL : 45 PERIODS

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

TEXT BOOKS

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

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

UNIT IV SENSING TECHNIQUES

UNIT V DATA PRODUCTS AND INTERPRETATION

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

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OAI351 URBAN AGRICULTURE L T P C 3 0 0 3

OBJECTIVES:
- To introduce the students the principles of agricultural crop production and the production practices of crops in modern ways.
- To delineate the role of agricultural engineers in relation to various crop production practices.

UNIT I INTRODUCTION 9
Benefits of urban agriculture- economic benefits, environmental benefits, social and cultural benefits, educational, skill-building and job training benefits, health, nutrition and food accessibility benefits.

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

UNIT IV MODERN CONCEPTS 9
Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation concepts suitable for roof top gardening, rain hose system, Green house, polyhouse and shade net system of crop production on roof tops

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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| OEN351 | DRINKING WATER SUPPLY AND TREATMENT | L | T | P | C |
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**OBJECTIVE:**
- To equip the students with the principles and design of water treatment units and distribution system.

**UNIT I SOURCES OF WATER**

**UNIT II CONVEYANCE FROM THE SOURCE**

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

**UNIT IV ADVANCED WATER TREATMENT**

**UNIT V WATER DISTRIBUTION AND SUPPLY**

**TOTAL: 45 PERIODS**

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

TEXTBOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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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
Magnetic circuits- DC machine and AC machine – Working principle of Generator and Motor- DC and AC - Voltage and torque equations – Characteristics and applications. Working
principle of special machines like: Brushless DC motor, Switched reluctance motor and PMSM.

UNIT II    STATIC POWER CONVERTERS

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

UNIT III   CONTROL OF DC AND AC MOTOR DRIVES

Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motorizing and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives

UNIT IV    HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS


UNIT V     MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES

Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power 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.

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

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

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

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

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

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

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

TOTAL:45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)  5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Communication Network Used for PLC/SCADA.
COURSE OUTCOMES:
CO1 Know the basic requirement of a PLC input/output devices and architecture. (L1)
CO2 Ability to apply Basics Instruction Sets used for ladder Logic and Function Block Programming. (L2)
CO3 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block. (L3)
CO4 Able to develop a PLC logic for a specific application on real world problem. (L5)
CO5 Ability to Understand the Concepts of Communication used for PLC/SCADA. (L1)

TEXT BOOKS:
1. Frank Petruzulla, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication

REFERENCES:
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles and Applications, Pearson publication

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

MAPPING COURSE OUTCOMES WITH PROGRAMME OUTCOMES

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

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 9
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 9

UNIT III TRADITIONAL FOOD PATTERNS 9
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 9
Commercial production of traditional breads, snacks, ready-to-eat foods and instant mixes, frozen foods – types marketed, turnover; role of SHGs, SMES industries, national and multinational companies; commercial production and packaging of traditional beverages such as tender coconut water, neera, lassi, buttermilk, dahi. Commercial production of intermediate foods – ginger and garlic pastes, tamarind pastes, masalas (spice mixes), idli and dosa batters.

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

TOTAL: 45 PERIODS

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

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

UNIT II METHODS OF FOOD HANDLING AND STORAGE 9
Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT III LARGE-SCALE FOOD PROCESSING 12
Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS/REFERENCES:

OPY352 IPR FOR PHARMA INDUSTRY L T P C 3 0 0 3

COURSE OBJECTIVES:
- To provide the basic fundamental knowledge of different forms of Intellectual Property Rights in national and international level.
- To provide the significance of the Intellectual Property Rights about the patents, copyrights, industrial design, plant and geographical indications.
- This paper is to study significance of the amended patent act on pharma industry.
UNIT I  INTRODUCTION- INTELLECTUAL PROPERTY RIGHTS  9
Introduction, Types of Intellectual Property Rights - patents, plant varieties protection, geographical indicators, copyright, trademark, trade secrets.

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

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

UNIT IV  ENFORCEMENT AND PRACTICAL ASPECTS OF IPR  9

UNIT V  INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY  9

TOTAL:45 PERIODS

TEXT BOOKS:

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

Course Outcome
The student will be able to
C1 Understand and differentiate the categories of intellectual property rights.
C2 Describe about patents and procedure for obtaining patents.
C3 Distinguish plant variety, traditional knowledge and geographical indications under IPR.
C4 Provide the information about the different enforcements and practical aspects involved in protection of IPR.
C5  Provide different organizations role and responsibilities in the protection of IPR in the international level.

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

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OCH351  NANO TECHNOLOGY  L T P C  3 0 0 3

UNIT I  INTRODUCTION  8
General definition and size effects—important nano structured materials and nano particles—importance of nano materials—Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials—surface area - band gap energy and applications. Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials- Nano catalysis.

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

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

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

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

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

TEXT BOOKS

REFERENCES

Course articulation matrix

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<td>CO2</td>
<td>acquire knowledge about the different types of nano material synthesis</td>
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<td>CO3</td>
<td>describes about the shape, size, structure of composite nano materials and their interference</td>
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<td>CO4</td>
<td>understand the different characterization techniques for nanomaterials</td>
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<td>CO5</td>
<td>develop a deeper knowledge in the application of nanomaterials in different fields</td>
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276
OBJECTIVE:
- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I INTRODUCTION 9

UNIT II MOLECULAR SELF ASSEMBLY 9

UNIT III BIO-INSPIRED MATERIALS 9

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

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

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:

OBJECTIVE:
The course is aimed to
Gain knowledge about petroleum refining process and production of petrochemical products.
UNIT I ORIGIN, FORMATION AND REFINING OF CRUDE OIL


UNIT II CRACKING

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

UNIT III REFORMING AND HYDROTREATING


UNIT IV INTRODUCTION TO PETROCHEMICALS

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

UNIT V PRODUCTION OF PETROCHEMICALS

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

TOTAL: 45 PERIODS

OUTCOMES:

On the completion of the course students are expected to

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

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

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

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

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

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

TEXT BOOKS


REFERENCES

OBJECTIVES:
At the end of the course, the student is expected to
- understand and analyse the energy data of industries
- carry out energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I  INTRODUCTION 9

UNIT II  ELECTRICAL SYSTEMS 9

UNIT III  THERMAL SYSTEMS 9

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

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

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students can able to analyze the energy data of industries.
CO1: Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.
CO2: Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.
CO3: Skills on combustion thermodynamics and kinetics.
CO4: Apply calculation and design tube still heaters.
CO5: Studied different heat treatment furnace.
CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

REFERENCES:

OPT351 BASICS OF PLASTICS PROCESSING

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

UNIT II EXTRUSION

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 HOURS: 45

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

REFERENCES

OEC351 SIGNALS AND SYSTEMS

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

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids-Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - 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
Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS

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

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS

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

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

UNIT II AMPLIFIERS
- Load line, operating point, biasing methods for BJT and MOSFET, BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response –Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

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

UNIT IV FEEDBACK AMPLIFIERS AND OSCILLATORS

UNIT V POWER AMPLIFIERS AND DC/DC CONVERTERS
- Power amplifiers- class A-Class B-Class AB-Class C-Temperature Effect- Class AB Power amplifier using MOSFET –DC/DC convertors – Buck, Boost, Buck-Boost analysis and design.

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:
CBM348 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

OBJECTIVES:

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

UNIT I BASICS OF PRODUCT DEVELOPMENT


UNIT II REQUIREMENTS AND SYSTEM DESIGN


UNIT III DESIGN AND TESTING


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

UNIT V  BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

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

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

REFERENCES:

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CBM333  ASSISTIVE TECHNOLOGY

OBJECTIVES:
The student should be made to:
- To know the hardware requirement various assistive devices
- To understand the prosthetic and orthotic devices
- To know the developments in assistive technology
UNIT I  CARDIAC ASSIST DEVICES  9
Cardiac functions and parameters, principle of External counter pulsation techniques, intra aortic balloon pump, Auxillary ventricle and schematic for temporary bypass of left ventricle, prosthetic heart valves, cardiac pacemaker.

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

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

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

UNIT V  RECENT TRENDS  9
Transcutaneous electrical nerve stimulator, bio-feedback, assistive devices in drug delivery

TOTAL: 45 PERIODS

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

TEXT BOOKS

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

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

UNIT I  LINEAR PROGRAMMING  9

UNIT II  TRANSPORTATION AND ASSIGNMENT PROBLEMS  9

UNIT III  INTEGER PROGRAMMING  9

UNIT IV  DYNAMIC PROGRAMMING PROBLEMS  9

UNIT V  NON-LINEAR PROGRAMMING PROBLEMS  9

TOTAL:45 PERIODS

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

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OMA353 ALGEBRA AND NUMBER THEORY

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

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

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

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

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

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

TOTAL: 45 PERIODS

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

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OMA354 LINEAR ALGEBRA

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

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS

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

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

UNIT IV INNER PRODUCT SPACES
Inner product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidt orthonormalization process - Least square approximation.
UNIT V    EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION  9
Eigen value Problems : Power method, Jacobi rotation method - Singular value decomposition –
QR decomposition.

TOTAL : 45 PERIODS

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

TEXT BOOKS

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

COURSE OBJECTIVE:
- Enable the Non-biological student's to understand about the basics of life science and their pro and cons for living organisms.

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

UNIT II    MICROBIAL TECHNIQUES  9
Sterilization – types – physical and chemical sterilization, Decontamination, Preservation methods, fermentation, Cultivation and growth of microbes, Diagnostic methods.
UNIT III PATHOGENIC MICROBES
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengue, Malaria, Diarrhea, Tuberculosis, Typhoid, Covid, HIV.

UNIT IV BENEFICIAL MICROBES
Applications of microbes – Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.

UNIT V PRODUCTS FROM MICROBES
Fermented products – Fermented Beverages, Curd, Cheese, Mushroom, Agricultural products – Biopesticide, Biofertilizers, Vermicompost, Pharmaceutical products - Antibiotics, Vaccines

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

TEXT BOOKS

OBT353 BASICS OF BIOMOLECULES

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 glycerollipid. 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  9
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA &
amp; RNA Structure of Nitrogen bases in DNA and RNA along with the nomenclature- DNA double
helix (Watson and crick) model, types of DNA, RNA.

UNIT V  VITAMINS AND HORMONES  9
Different types of vitamins, their diverse biochemical functions and deficiency related diseases.
Overview of hormones. Hormone mediated signaling. Mechanism of action of steroid hormones,
epinephrine, glucagons and insulin.Role of vitamins and hormones in metabolism; Hormonal
disorders; Therapeutic uses of vitamins and hormones.

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

TOTAL: 45 PERIODS

TEXT BOOKS
W.H.Freeman and Company 2017

REFERENCES

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

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

UNIT-I  INTRODUCTION TO CELL  9
Cell, cell wall and Extracellular Matrix (ECM), composition, cellular dimensions, Evolution,
Organisation, differentiation of prokaryotic and Eukaryotic cells, Virus, bacteria, cyanobacteria,
mycoplasma and prions.

UNIT II  CELL ORGANELLES  9
Molecular organisation, biogenesis and function Mitochondria, endoplasmic reticulam, golgi
apparatus, plastids, chloroplast, leuoplast, 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. Transport mechanism- mobile
carriers and pores mechanisms. Transport by vesicle formation, endocytosis, exocytosis, cell
respiration.
UNIT IV  CELL CYCLE
Cell cycle- Cell division by mitosis and meiosis, Comparision of meiosis and mitosis, regulation of cell cycle, cell lysis, Cytokinesis, Cell signaling, Cell communication, Cell adhesion and Cell junction, cell cycle checkpoints.

UNIT V  CENTRAL DOGMA

TOTAL: 45 PERIODS

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

TEXTBOOKS:

REFERENCES:

OPEN ELECTIVE IV

OHS352  PROJECT REPORT WRITING

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

UNIT I

UNIT II

UNIT III
Structure of the Project Report: (Part 1) Framing a Title – Content – Acknowledgement – Funding Details -Abstract – Introduction – Aim of the Study – Background - Writing the research question -
Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework.

UNIT IV

UNIT V

TOTAL:45 PERIODS

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

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

REFERENCES

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

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

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

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

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

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

TOTAL: 45 PERIODS

OUTCOMES
- On completion of the course, the student will be able to apply appropriate management techniques towards managing the water resources.
  CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
  CO2 Discuss on the different water uses; how it is impacted and ways to tackle these impacts.
  CO3 Explain the economic aspects of water and choose the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
  CO4 Illustrate the recent trends in water management.
  CO5 Understand the implementation hitches and the institutional frameworks.

TEXT BOOKS

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

OMA355  ADVANCED NUMERICAL METHODS  L T P C
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
Parabolic equations: Explicit and implicit finite difference methods - Weighted average approximation - Dirichlet's and Neumann conditions - First order hyperbolic equations - Method of characteristics - Different explicit and implicit methods; Wave equation: Explicit scheme - Stability of above schemes.

TOTAL : 45 PERIODS

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

UNIT I RANDOM VARIABLES

UNIT II RANDOM PROCESSES

UNIT III SPECIAL RANDOM PROCESSES

UNIT IV CORRELATION AND SPECTRAL DENSITIES

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

TOTAL: 45 PERIODS

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

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OMA357 QUEUING AND RELIABILITY MODELLING

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

UNIT I RANDOM PROCESSES

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

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

UNIT IV SYSTEM RELIABILITY

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

TOTAL: 45 PERIODS

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

**TEXT BOOKS**

**REFERENCES**

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**OMG354** PRODUCTION AND OPERATIONS MANAGEMENT FOR ENTREPRENEURS

**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 1** 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
Process selection with PLC phases - Process simulation tools - Work Study - Significance - Methods, evolution of normal/standard time - Job design and rating - Value Analysis - Plant Layout: meaning - characters - Plant location techniques - Types- MRP and Layout Design - Optimisation and Theory of Constraints (TOC) - Critical Chain Project Management (CCPM) - REL (Relationship) Chart - Assembly line balancing - Plant design optimisation - Forecasting methods.

UNIT V  CONTROLLING PRODUCTION & OPERATIONS MANAGEMENT  9

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

OMG355  MULTIVARIATE DATA ANALYSIS  9

OBJECTIVE:
- To know various multivariate data analysis techniques for business research.

UNIT I  INTRODUCTION  9
Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation.

UNIT II  PREPARING FOR MULTIVARIATE ANALYSIS  9
Conceptualization of research model with variables, collection of data — Approaches for dealing with missing data – Testing the assumptions of multivariate analysis.

UNIT III  MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS  9
Multiple Linear Regression Analysis – Inferences from the estimated regression function – Validation of the model - Approaches to factor analysis – interpretation of results.
UNIT IV  LATENT VARIABLE TECHNIQUES  9
Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation
models, Longitudinal studies.

UNIT V  ADVANCED MULTIVARIATE TECHNIQUES  9
Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

TOTAL: 45 PERIODS

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

REFERENCES:
1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data
   Hall, New Delhi, 2005.
4. David R Anderson, Dennis J Seveency, and Thomas A Williams, Statistics for Business and
   Economics, Thompson, Singapore, 2002

OME352  ADDITIVE MANUFACTURING  L  T  P  C
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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
Overview - Need - Development of Additive Manufacturing (AM) Technology: Rapid Prototyping-
Rapid Tooling - Rapid Manufacturing - Additive Manufacturing. AM Process Chain - ASTM/ISO
52900 Classification - Benefits - AM Unique Capabilities - AM File formats: STL, AMF Applications:
Building Printing, Bio Printing, Food Printing, Electronics Printing, Automobile, Aerospace,
Healthcare. Business Opportunities in AM.

UNIT II  VAT POLYMERIZATION AND MATERIAL EXTRUSION  9
Photo polymerization: Stereolithography Apparatus (SLA)- Materials -Process - top down and
bottom up approach - Advantages - Limitations - Applications. Digital Light Processing (DLP) -
Process - Advantages - Applications.
Material Extrusion: Fused Deposition Modeling (FDM) - Process-Materials -Applications and
Limitations.
UNIT III  
POWDER BED FUSION AND BINDER JETTING


UNIT IV  
MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION


UNIT V  
SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY


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

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COURSE OBJECTIVES

1. To introduce the fundamental concepts of the new product development

2. To develop material specifications, analysis and process.
3. To Learn the Feasibility Studies & reporting of new product development.
4. To study the New product qualification and Market Survey on similar products of new product development

To learn Reverse Engineering. Cloud points generation, converting cloud data to 3D model

UNIT – I  FUNDAMENTALS OF NPD

UNIT – II  MATERIAL SPECIFICATIONS, ANALYSIS & PROCESS
Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT – III  ESSENTIALS OF NPD

UNIT – IV  CRITERIONS OF NPD
New product qualification for Dimensions, Mechanical & Physical Properties, Internal Soundness proving through X-Ray, Radiography, Ultrasonic Testing, MPT, etc. Agreement with customer for testing frequencies. Market Survey on similar products, Risk analysis, validating samples with simulation results, Lesson Learned & Horizontal deployment in NPD.

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

TOTAL : 45 PERIODS

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

TEXT BOOKS:
1. Product Development – Sten Jonsson
2. Product Design & Development – Karl T. Ulrich, Maria C. Young, Steven D. Eppinger
REFERENCES:
1. Revolutionizing Product Development – Steven C Wheelwright & Kim B. Clark
2. Change by Design
5. Product Design & Value Engineering – Dr. M.A. Bulsara & Dr. H.R. Thakkar

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OME355 INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES

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

UNIT I UI/UX

UNIT II APP DEVELOPMENT
SDLC - Introduction to App Development - Types of Apps - web Development - understanding Stack - Frontend - backend - Working with Databases - Introduction to API - Introduction to Cloud services - Cloud environment Setup - Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III INDUSTRIAL DESIGN
Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV MECHANICAL RAPID PROTOTYPING
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V ELECTRONIC RAPID PROTOTYPING
Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA
COURSE OUTCOMES
At the end of the course, learners will be able to:
- Create quick UI/UX prototypes for customer needs
- Develop web application to test product traction / product feature
- Develop 3D models for prototyping various product ideas
- Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

MF3010 MICRO AND PRECISION ENGINEERING

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 systems

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

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

UNIT III INTRODUCTION TO PRECISION ENGINEERING
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
- Select suitable precision machine tools and operate
- Apply the macro and micro components for fabrication of micro systems.
- Apply suitable machining process
- Able to work with miniature models of existing machine tools/robots and other instruments.
- Apply metrology for micro system

TEXT BOOKS:

REFERENCES:

OMF354 COST MANAGEMENT OF ENGINEERING PROJECTS

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

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

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

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

UNIT – IV COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL
UNIT – V  QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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

UNIT IV  BATTERY STATE ESTIMATION  9

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

TOTAL =45 PERIODS

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

TEXT BOOKS

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

AU3008   SENSORS AND ACTUATORS

COURSE OBJECTIVES:
- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I   INTRODUCTION TO MEASUREMENTS AND SENSORS

UNIT II   VARIABLE RESISTANCE AND INDUTANCE SENSORS
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers- EI pick up and LVDT

UNIT III   VARIABLE AND OTHER SPECIAL SENSORS
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV   AUTOMOTIVE ACTUATORS
Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings
for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

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.

COURSE OUTCOMES:
At the end of the course, the student will be able to
1. List common types of sensor and actuators used in vehicles.
2. Design measuring equipment's for the measurement of pressure force, temperature and flow.
3. Generate new ideas in designing the sensors and actuators for automotive application
4. Understand the operation of these sensors, actuators and electronic control.
5. Design temperature control actuators for vehicles.

TEXT BOOKS:

REFERENCES:

OBJECTIVES:
- To interpret the missile space stations, space vs earth environment.
- To explain the life support systems, mission logistics and planning.
- To deploy the skills effectively in the understanding of space vehicle configuration design.
- To explain Engine system and support of space vehicle
- To interpret nose cone configuration of space vehicle

UNIT I  FUNDAMENTAL ASPECTS  9
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II  SELECTION OF ROCKET PROPULSION SYSTEMS  9
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III  ENGINE SYSTEMS, CONTROLS, AND INTEGRATION  9

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

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

OIM352  MANAGEMENT SCIENCE
COURSE OBJECTIVES:
Of this course are
1. To introduce fundamental concepts of management and organization to students.
2. To impart knowledge to students on various aspects of marketing, quality control and marketing strategies.
3. To make students familiarize with the concepts of human resources management.
4. To acquaint students with the concepts of project management and cost analysis.
5. 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

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

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

UNIT V  STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES

9

TOTAL: 45 PERIODS

OURSE OUTCOMES:

Upon completion of the course, Students will be able to
CO1: Plan an organizational structure for a given context in the organisation to carry out production operation 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 organisation.

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REFERENCES:

OIM353  PRODUCTION PLANNING AND CONTROL

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COURSE OBJECTIVES:
- To understand the concept of production planning and control act work study,
- To apply the concept of product planning,

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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).

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OIE353 OPERATIONS MANAGEMENT

COURSE OBJECTIVES:
- Recognize and appreciate the concept of Production and Operations Management in creating and enhancing a firm’s competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations Management (both manufacturing and service).
- Relate the interdependence of the operations function with the other key functional areas of a firm.
- Teach analytical skills and problem-solving tools to the analysis of the operations problems.
- Apply scheduling and Lean Concepts for improving System Performance.

UNIT I INTRODUCTION TO OPERATIONS MANAGEMENT
Operations Management – Nature, Importance, historical development, transformation processes, differences between services and goods, a system perspective, functions, challenges, current priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain Management

UNIT II FORECASTING, CAPACITY AND FACILITY DESIGN

UNIT III DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS

UNIT IV MATERIALS MANAGEMENT

UNIT V SCHEDULING AND PROJECT MANAGEMENT

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 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

REFERENCES
1. Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
2. Compare and contrast the roles of environmental and biological monitoring in work health and safety.
3. Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.
4. Discuss how personal protective equipment can be used to reduce risks associated with workplace exposures.
5. Provide high-level advice on managing and controlling noise and noise-related hazards.

UNIT I INTRODUCTION AND SCOPE

UNIT II MONITORING FOR SAFETY, HEALTH & ENVIRONMENT

UNIT III OCCUPATIONAL HEALTH AND ENVIRONMENTAL SAFETY EDUCATION

UNIT IV OCCUPATIONAL SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT

UNIT-V INDUSTRIAL HAZARDS

COURSE OUTCOMES:
Students able to
CO1: Explain and apply human factors engineering concepts in both evaluation of existing systems and design of new systems.
CO2: Specify designs that avoid occupation related injuries.
CO3: Define and apply the principles of work design, motion economy, and work environment design.
CO4: Identify the basic human sensory, cognitive, and physical capabilities and limitations with respect to human-machine system performance.
CO5: Acknowledge the impact of workplace design and environment on productivity.

TEXT BOOKS:
REFERENCES:

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OSF353 CHEMICAL PROCESS SAFETY

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
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
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
Design principles -Process design development -types of designs, feasibility survey, preliminary design, Flow diagrams, piping and instrumentation diagram, batch versus continuous operation,
factors in equipment scale up and design, equipment specifications - reliability and safety in designing - inherent safety - engineered safety - safety during startup and shutdown - non destructive testing methods - pressure and leak testing - emergency safety devices - scrubbers and flares- new concepts in safety design and operation- Pressure vessel testing standards- Inspection techniques for boilers and reaction vessels.

UNIT IV SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS 9
Properties of chemicals - Material Safety Data Sheets - the various properties and formats used - methods available for property determination. Operational activities and hazards - standards operating procedures - safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems - effects of pressure, temperature, Flow rate and humidity on operations - corrosion and control measures- condition monitoring - control valves - safety valves - pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

UNIT V SAFETY AND ANALYSIS 9
Safety vs reliability- quantification of basic events, system safety quantification, Human error analysis, Accident investigation and analysis, OSHAS 18001 and OSHMS.

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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COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Understanding the importance of various materials used in electrical, electronics and magnetic applications
2. Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
3. Gaining knowledge on the selection of suitable materials for the given application
4. Knowing the fundamental concepts in Semiconducting materials
5. Getting equipped with the materials used in optical and optoelectronic applications.

UNIT – I DIELECTRIC MATERIALS
Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics. Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT – II MAGNETIC MATERIALS
Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT – III SEMICONDUCTOR MATERIALS
Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT – IV MATERIALS FOR ELECTRICAL APPLICATIONS
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
1. Understand various types of dielectric materials, their properties in various conditions.
2. Evaluate magnetic materials and their behavior.
3. Evaluate semiconductor materials and technologies.
4. Select suitable materials for electrical engineering applications.
5. Identify right material for optical and optoelectronic applications

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OML353   NANOMATERIALS AND APPLICATIONS

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

- Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
- Gaining knowledge on dimensionality effects on different properties of nanomaterials
- Getting acquainted with the different processing techniques employed for fabricating nanomaterials
- Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
- Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.

UNIT I   NANOMATERIALS
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II   THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III  PROCESSING
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV   STRUCTURAL CHARACTERISTICS
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis
UNIT V  APPLICATIONS
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
1. Evaluate nanomaterials and understand the different types of nanomaterials
2. Recognise the effects of dimensionality of materials on the properties
3. Process different nanomaterials and use them in engineering applications
4. Use appropriate techniques for characterising nanomaterials
5. Identify and use different nanomaterials for applications in different engineering fields.

TEXT BOOKS:

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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
Performance, Selection criteria of Linear and Rotary – Fixed and Variable displacement pumps – Problems.

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

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

UNIT – I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES

UNIT – II DISPLACEMENT, PROXIMITY AND RANGING SENSORS

UNIT – III FORCE, MAGNETIC AND HEADING SENSORS

UNIT – IV OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS

UNIT – V SIGNAL CONDITIONING

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Understand various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors. They can also analyze the sensor response.

CO2: Analyze and select suitable sensor for displacement, proximity and range measurement.

CO3: Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.

CO4: Analyze and Select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.

CO5: Select and design suitable signal conditioning circuit with proper compensation and linearizing element based on sensor output signal.

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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 mobilerobotics in task planning, navigation and intelligence.

UNIT – I INTRODUCTION TO MOBILE ROBOTICS
Introduction – Locomotion of the Robots – Key Issues on Locomotion – Legged Mobile Roots –
Configurations and Stability – Wheeled Mobile Robots – Design Space and Mobility Issues – Unmanned Aerial and Underwater Vehicles

UNIT – II  KINEMATICS

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  9
law of floatation - Basics principle of propulsion- Earlier methods of propulsion- ship propulsion
machinery- boiler, Marine steam engine, diesel engine, ship power transmission system, ship
dynamic structure, Marine propulsion equipment - shaft tunnel, Intermediate shaft and bearing,
stem tube, stern tube sealing etc. degree of freedom, Modern propelling methods- water jet
propulsion , screw propulsion.

UNIT II  SHIPS MOVEMENTS AND SHIP STABILIZATION  9
Thrust augmented devices, Ship hull, modern ship propulsion design, bow thruster – Advantages,
various methods to stabilize the ship- passive and active stabilizer, fin stabilizer, bilge keel -
stabilizing and securing ship in port- effect of tides on ship – effect of river water and sea water
sailing vessel, Load line and load line of marking- draught markings.

UNIT III  SHIPS SPEED AND ITS PERFORMANCE  9
Ship propulsion factors, factors affecting ships speed, various velocities of ship, hull drag, effects
of fouling on ships hull, ship wake, relation between powers, Fuel consumption of ship, cavitations
- effects of cavitations, ship turning radius.

UNIT IV  BASICS OF PROPELLER  9
Propeller dimension, Propeller and its types – fixed propeller, control pitch propeller, kort nozzle,
ducted propeller, voith schneider, Parts of propeller, 3 blade - 5 blade - 6 blade propellers and its
advantages, propeller boss hub, crown nut, propeller skew, pitch of propeller - Thrust creation by

UNIT V  BASICS OF RUDDER  9
Rudder dimension, Area of rudder and its design, Rudder arrangements, Rudder fittings - Rudder
pintle - Rudder types- Balanced rudder, semi balanced rudder, Spade rudder, merits and demerits
of various types of rudders, Propeller and rudder interaction, Rudder stopper, movement of
rudders, Basic construction of Rudder

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students should be able to:
CO1: Explain the basics of propulsion system and ship dynamic movements
CO2: Familiarize with various components assisting ship stabilization.
CO3: Demonstrate the performance of the ship.
CO4: Classify the Propeller and its types, Materials etc.
CO5: Categories the Rudder and its types, design criteria of rudder.

TEXT BOOKS:
1. GP. Ghose, “Basic Ship propulsion”,2015

REFERENCES BOOKS:
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OMV351 MARINE MERCHANT VESSELS LT P C 3 0 0 3

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

UNIT I  INTRODUCTION TO HYDROSTATICS  9

UNIT II  TYPES OF SHIP  10
General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships – Oil tankers- Bulk carriers - Liquefied Natural Gas carriers - Liquefied Petroleum Gas carriers - Chemical tankers - Passenger ships

UNIT III  SHIPBUILDING MATERIALS  9
Types of Steels used in Shipbuilding - High tensile steels, Corrosion resistant steels, Steel sandwich panels, Steel castings, Steel forgings - Other shipbuilding materials, Aluminium alloys, Aluminium alloy sandwich panels, Fire protection especially for Aluminium Alloys, Fiber Reinforced Composites

UNIT IV  MARINE PROPELLER AND RUDDER  8
Types of rudder, construction of Rudder-Types of Propeller, Propeller material-Cavitations and its effects on propeller

UNIT V  GOVERNING BODIES FOR SHIPPING INDUSTRY  9
Role of IMO (International Maritime Organization), SOLAS (International Convention for the Safety of Life at Sea), MARPOL (International Convention for the Prevention of Pollution from Ships), MLC (Maritime Labour Convention), STCW 2010 (International Convention on Standards of Training, Certification and Watch keeping for Seafarers), Classification societies Administration authorities

OUTCOMES:
Upon completion of this course, students would
1. Acquire Knowledge on floatation of ships
2. Acquire Knowledge on features of various ships
3. Acquire Knowledge of Shipbuilding Materials
4. Acquire Knowledge to identify the different types of marine propeller

TOTAL: 45 PERIODS

326
5. Understand the Roles and responsibilities of governing bodies

TEXT BOOKS:
2. Dr.DA Taylor, “Merchant Ship Naval Architecture” I. Mar EST publications, 2006

REFERENCES:
2. MARPOL Consolidated Edition, Bhandakar Publications, 2018

OMV352 ELEMENTS OF MARINE ENGINEERING

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

OUTCOMES:
At the end of the course, students should able to,
1. Distinguish the role of various marine machinery systems

TOTAL: 45 PERIODS
2. Relate the components of marine propulsion machinery system
3. Explain the importance of marine auxiliary machinery system
4. Acquire knowledge of marine boiler system
5. Understand the importance of ship propellers and steering system

TEXT BOOKS:

REFERENCES:
1. Alan L.Rowen, “Introduction to Practical Marine Engineering, Volume 1&2, The Institute of Marine Engineers (India), Mumbai, 2006
2. A.S.Tambwekar, “Naval Architecture and Ship Construction”, The Institute of Marine Engineers (India), Mumbai, 2015

CRA332 DRONE TECHNOLOGIES

COURSE OBJECTIVES:
1. To understand the basics of drone concepts
2. To learn and understand the fundaments 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
Dron Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT – II DRONE DESIGN, FABRICATION AND PROGRAMMING
Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT – III DRONE FLYING AND OPERATION
Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity -Removable storage devices- Linked mobile devices and applications

UNIT – IV DRONE COMMERCIAL APPLICATIONS
Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

UNIT – V FUTURE DRONES AND SAFETY
The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms
COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Create the programs for various drones

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<td>CO/PO &amp; PSO Average</td>
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</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS

REFERENCES

OGI352 GEOGRAPHICAL INFORMATION SYSTEM

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
models.

UNIT III DATA INPUT AND TOPOLOGY 9

UNIT IV DATA QUALITY AND STANDARDS 9
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V DATA MANAGEMENT AND OUTPUT 9
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.

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 – PO – PSO MAPPING: GEOGRAPHIC INFORMATION SYSTEM

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<td>Knowledge of Geoinformatics discipline</td>
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TOTAL:45 PERIODS

330
OBJECTIVES

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

UNIT I  ENTREPRENEURIAL ENVIRONMENT IN INDIAN CONTEXT  9
Entrepreneur Development (ED): Concept of entrepreneur and entrepreneurship assessing overall business environment in Indian economy- Entrepreneurial and managerial characteristics- Entrepreneurship development programmers (EDP)-Generation incubation and commercialization of ideas and innovations- Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment.

UNIT II  AGRIPRENEURSHIP IN GLOBAL ARENA: LEGAL PERSPECTIVE  9
Importance of agribusiness in Indian economy - International trade-WTO agreements- Provisions related to agreements in agricultural and food commodities - Agreements on Agriculture (AOA)-Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS).

UNIT III  ENTREPRENEURSHIP MANAGEMENT: FINANCIAL PERSPECTIVE  9

UNIT IV  ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE  9
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political system and their implications for decision making by individual entrepreneurs- Economic system and its implication for decision making by individual entrepreneurs.

UNIT V  ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT  9
Social responsibility of business. Morals and ethics in enterprise management- SWOT analysis-Government schemes and incentives for promotions of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors- Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) - overview of agricultural engineering industry, characteristics of Indian farm machinery industry.
COURSE OUTCOMES
1. Judge about agricultural finance, banking and cooperation
2. Evaluate basic concepts, principles and functions of financial management
3. Improve the skills on basic banking and insurance schemes available to customers
4. Analyze various financial data for efficient farm management
5. Identify the financial institutions

TEXT BOOKS

REFERENCES

CO-PO MAPPING

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TOTAL: 45 PERIODS
OBJECTIVE:
The identification of different aspects of biological diversity and conservation techniques.

UNIT I  INTRODUCTION  9
Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II  INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY  9
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III  MICROBIAL DIVERSITY  9
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa); Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis

UNIT IV  MEGA DIVERSITY  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:

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

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

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.

<table>
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OEI354 INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS

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

UNIT I INTRODUCTION

UNIT II AUTOMATION COMPONENTS
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

335
UNIT IV  PROGRAMMABLE LOGIC CONTROLLERS
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V  DISTRIBUTED CONTROL SYSTEM
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) 5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1 Design a signal conditioning circuits for various application (L3).
CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:

REFERENCES:

List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063

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

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OBJECTIVES
The course aims to

- acquaint and equip the students with different techniques of measurement of engineering properties.
- make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger’s, Kick’s and Bond’s equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for lo.w- or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT V
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electrodialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration

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

CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.

TEXTBOOKS:

OFD355 FOOD SAFETY AND QUALITY REGULATIONS L T P C

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 10
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 8
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 9
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 9
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
4. Microbiological safety of Food by Hobbs BC, 1973

OBJECTIVES:
- To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
- To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electropotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT IV ROLE IN HEALTH AND DISEASE
The health benefit of - Soy protein, Spirulina, Tea, Olive oil, plant sterols, Broccoli, omega3 fatty acid and eicosanoids. Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT V SAFETY ISSUES
Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues International and national.
TEXT BOOKS:
3. WEBB, PP, Dietary Supplements and Functional Foods Blackwell Publishing Ltd (United Kingdom), 2006

REFERENCES:
1. Asian Functional Foods (Nutraceutical Science and Technology) by John Shi (Editor), Fereidoon Shahidi (Editor), Chi-Tang Ho (Editor), CRC Publications, Taylor & Francis, 2007

COURSE OUTCOME - NUTRACEUTICALS

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

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UNIT I  INTRODUCTION
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II  CONVENTIONAL ENERGY
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
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV  BIOMASS ENERGY
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V  ENERGY CONSERVATION
Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

OUTCOMES:
On completion of the course, the students will be able to
CO1: Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.
CO2: Students will excel as professionals in the various fields of energy engineering
CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.
CO4: Explain the technological basis for harnessing renewable energy sources.
CO5: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

TEXT BOOKS

REFERENCES
## Course articulation matrix

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

### OCH354 SURFACE SCIENCE

**OBJECTIVE:**
- To enable the students to analyze properties of a surfaces and correlate them to structure, chemistry, and physics and surface modification technique.

**UNIT I SURFACE STRUCTURE AND EXPERIMENTAL PROBES**
9
Relevance of surface science to Chemical and Electrochemical Engineering, Heterogeneous Catalysis and Nanoscience; Surface structure and reconstructions, absorbate structure, Band and Vibrational structure, Importance of UHV techniques, Electronic probes and molecular beams, Scanning probes and diffraction, Qualitative introduction to electronic and vibrational spectroscopy

**UNIT II ADSORPTION, DYNAMICS, THERMODYNAMICS AND KINETICS AT SURFACES**
9
Interactions at the surface, Physisorption, Chemisorption, Diffusion, dynamics and reactions of atoms/molecules on surfaces, Generic reaction mechanism on surfaces, Adsorption isotherms, Kinetics of adsorption, Use of temperature desorption methods
UNIT III LIQUID INTERFACES 9
Structure and Thermodynamics of liquid-solid interface, Self-assembled monolayers, Electrified interfaces, Charge transfer at the liquid-solid interfaces, Photoelectrochemical processes, Gratzel cells

UNIT IV HETEROGENEOUS CATALYSIS 9
Characterization of heterogeneous catalytic processes, Microscopic kinetics to catalysis, Overview of important heterogeneous catalytic processes: Haber-Bosch, Fisher-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES 9

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena.

TEXT BOOK:

REFERENCE:

OPE353 INDUSTRIAL SAFETY L T P C
3 0 0 3

OBJECTIVES:
- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings.
- Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards.

UNIT I INTRODUCTION 9
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 9
UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS

UNIT IV HAZARDS AND RISK MANAGEMENT

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT

TOTAL: 45 PERIODS

OUTCOMES:
After completion of this course, the student is expected to be able to:
- Describe, with example, the common work-related diseases and accidents in occupational setting
- Name essential members of the Occupational Health team
- What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES

OBJECTIVES:
- To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I FLUID MECHANICS CONCEPTS
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton's Law of viscosity. Fluid statics-Pascal's law, Hydrostatic equilibrium, Barometric equation and pressure measurement(problems),Basic equations of fluid flow - Continuity equation, Euler’s equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numericals.

UNIT II FLOW MEASUREMENTS & MECHANICAL OPERATIONS

UNIT III CONDUCTIVE & CONVECTIVE HEAT TRANSFER
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders: Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no
derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV  BASICS OF MASS TRANSFER  9

UNIT V  MASS TRANSFER OPERATIONS  9
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction). Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method. Drying- drying operations, batch and continuous drying. Conceptual numerical.

TOTAL: 45 PERIODS

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

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

OPT352  PLASTIC MATERIALS FOR ENGINEERS  3 0 0 3

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  9
Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)
UNIT II  ENGINEERING THERMOPLASTICS AND APPLICATIONS  9
Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)

UNIT III  THERMOSETTING PLASTICS  9
Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV  MISCELLANEOUS PLASTICS FOR END APPLICATIONS  9
Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications

UNIT V  PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS  9
Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL : 45 PERIODS

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

REFERENCES

OPT353  PROPERTIES AND TESTING OF PLASTICS  L T P C
3 0 0 3

COURSE OBJECTIVES
- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
• To study about the environmental effects and prevent polymer degradation.

UNIT I  INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS  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 HOURS: 45

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

REFERENCES
OBJECTIVES:

● Understand the fundamentals of IC technology components and their characteristics.
● Understand combinational logic circuits and design principles.
● Understand sequential logic circuits and clocking strategies.
● Understand Interconnects and Memory Architecture.
● Understand the design of arithmetic building blocks

UNIT I MOS TRANSISTOR PRINCIPLES

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor DC transfer Characteristics ,small signal analysis of MOSFET.

UNIT II COMBINATIONAL LOGIC CIRCUITS


UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES


UNIT IV INTERCONNECT, MEMORY ARCHITECTURE

Interconnect Parameters – Capacitance, Resistance, and Inductance, Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks.

UNIT V DESIGN OF ARITHMETIC BUILDING BLOCKS

Arithmetic Building Blocks: Data Paths, Adders-Ripple Carry Adder, Carry-Bypass Adder, Carry Select Adder, Carry-Look Ahead Adder, Multipliers, Barrel Shifter, power and speed tradeoffs.

TOTAL: 45 PERIODS

OUTCOMES:
Upon successful completion of the course the student will be able to

CO1: Understand the working principle and characteristics of MOSFET
CO2: Design Combinational Logic Circuits
CO3: Design Sequential Logic Circuits and Clocking systems
CO4: Understand Memory architecture and interconnects
CO5: Design of arithmetic building blocks.

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**CBM370 WEARABLE DEVICES**

**OBJECTIVES:**

The student should be made to:

- To know the hardware requirement of wearable systems
- To understand the communication and security aspects in the wearable devices
- To know the applications of wearable devices in the field of medicine

**UNIT I**

**INTRODUCTION TO WEARABLE SYSTEMS AND SENSORS**


**UNIT II**

**SIGNAL PROCESSING AND ENERGY HARVESTING FOR WEARABLE DEVICES**

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

**UNIT III**

**WIRELESS HEALTH SYSTEMS**


**UNIT IV**

**SMART TEXTILE**


**UNIT V**

**APPLICATIONS OF WEARABLE SYSTEMS**

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

**OUTCOMES:**

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

CO1: Describe the concepts of wearable system.
CO2: Explain the energy harvestings in wearable device.
CO3: Use the concepts of BAN in health care.
CO4: Illustrate the concept of smart textile

**TOTAL PERIODS:** 45
CO5: Compare the various wearable devices in healthcare system

**TEXT BOOKS**

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**CBM356 MEDICAL INFORMATICS L T P C 3 0 0 3**

**Preamble:**
1. To study the applications of information technology in health care management.
2. This course provides knowledge on resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.

**UNIT I INTRODUCTION TO MEDICAL INFORMATICS**
Introduction - Structure of Medical Informatics - Internet and Medicine - Security issues, Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics, Bioinformatics

**UNIT II COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING**
Automated clinical laboratories - Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging - Nuclear medicine, Ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

**UNIT III COMPUTERISED PATIENT RECORD**
Introduction - Conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology - Application server provider, Clinical information system, Computerized prescriptions for patients.

**UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING**
Neuro computers and Artificial Neural Networks application, Expert system - General model of CMD, Computer-assisted decision support system - Production rule system cognitive model,
semantic networks, decisions analysis in clinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V  RECENT TRENDS IN MEDICAL INFORMATICS  9
Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and health- Medical education and healthcare information, computer assisted instruction in medicine.

TOTAL : 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

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

UNIT I  BIOLOGICAL TREATMENT PROCESS  9

UNIT II  WASTE BIOMASS AND ITS VALUE ADDITION  9
Types of waste biomass – Solid waste management - Nature of biomass feedstock – Biobased economy/process – Value addition of waste biomass – Biotransformation of biomass – Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

UNIT III  BIOCONVERSION OF WASTES TO ENERGY  9
Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies
UNIT IV CHEMICALS AND ENZYME PRODUCTION FROM WASTES
Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases – Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

UNIT V BIOCOMPOSTING OF ORGANIC WASTES
Overview of composting process - Benefits of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

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

TEXT BOOKS

REFERENCE BOOKS

OBT356 LIFESTYLE DISEASES

UNIT I INTRODUCTION
Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER
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

352
UNIT V RESPIRATORY DISEASES 9
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking –
Diagnosis - Pulmonary function testing

TOTAL: 45 PERIODS

TEXT BOOKS:
Publications, 2003

REFERENCES:

TEXT BOOKS:
1. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John
Publishers
3. The Vaccine Book (2nd Ed.), Rafi Ahmed, Roy M. Anderson et. al.Editor(s): Barry R.
REFERENCE BOOKS

VERTICAL 1: FINTECH AND BLOCK CHAIN

CMG331 FINANCIAL MANAGEMENT LT P C 3 0 0 3

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

UNIT I INTRODUCTION TO FINANCIAL MANGEMENT 9
Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

UNIT II SOURCES OF FINANCE 9
Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III INVESTMENT DECISIONS: 9

UNIT IV FINANCING AND DIVIDEND DECISION 9

UNIT V WORKING CAPITAL DECISION 9

TOTAL : 45 PERIODS

TEXT BOOKS

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

UNIT I  THE INVESTMENT ENVIRONMENT  9
The investment decision process, Types of Investments – Commodities, Real Estate and Financial Assets, the Indian securities market, the market participants and trading of securities, securitization, security market indices, sources of financial information, Concept of return and risk, Impact of Taxes and Inflation on returns.

UNIT II  FIXED INCOME SECURITIES  9
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, default risk and credit rating.

UNIT III  APPROACHES TO EQUITY ANALYSIS  9
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalization models, and price-earnings multiple approach to equity valuation.

UNIT IV  PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES  9
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India.

UNIT V  INVESTOR PROTECTION  9
Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism.

TOTAL : 45 PERIODS

REFERENCES

OBJECTIVES
- Understand the Banking system in India.
- Grasp how banks raise their sources and how they deploy it.
- Understand the development in banking technology.
- Understand the financial services in India.
- Understand the insurance Industry in India.

UNIT I  INTRODUCTION TO INDIAN BANKING SYSTEM  9
Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector – RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.
UNIT II MANAGING BANK FUNDS/ PRODUCTS

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY

UNIT IV FINANCIAL SERVICES

UNIT V INSURANCE

REFERENCES:

CMG334 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS
UNIT I INTRODUCTION TO BLOCKCHAIN
Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY

UNIT III ETHEREUM
Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV WEB3 AND HYPERLEDGE

UNIT V EMERGING TRENDS

TOTAL : 45 PERIODS

REFERENCE
2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

CMG335 FINTECH PERSONAL FINANCE AND PAYMENTS

UNIT I CURRENCY EXCHANGE AND PAYMENT

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE
A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering

UNIT III INSURETECH
InsurTech Introduction , Business model disruption AI/ML in InsurTech ● IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services

UNIT IV PEER TO PEER LENDING
P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding Crowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations

UNIT V REGULATORY ISSUES

TOTAL : 45 PERIODS

REFERENCE
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
COURSE OBJECTIVES

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businessess.
- To empower the learners to run a Technology driven business efficiently and effectively.

UNIT I INTRODUCTION TO ENTREPRENEURSHIP
Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs - Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.

UNIT II BUSINESS OWNERSHIP & ENVIRONMENT

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP
Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characteristics of a technopreneur - Impacts of Technopreneurship on Society – Economy- Job Opportunities in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP
Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -- Success Stories of Technopreneurs - Case Studies

UNIT V EMERGING TRENDS IN ENTREPRENEURSHIP

TOTAL : 45 PERIODS

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

TEXT BOOKS:
2) Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning,

REFERENCES:
5) JumpStart: A Technopreneurship Fable, Dennis Posadas, (Singapore: Pearson Prentice Hall, 2009
6) Basics of Technopreneurship: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
7) Journal articles pertaining to Entrepreneurship
8) CMG338 TEAM BUILDING & LEADERSHIP MANAGEMENT FOR BUSINESS L T P C 3 0 0 3

COURSE OBJECTIVES
- To develop and strengthen the Leadership qualities and motivation of learners.
- To impart the Leadership skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of Team Building in managing Technology oriented businesses.
- To empower the learners to build robust teams for running and leading a business efficiently and effectively

UNIT I INTRODUCTION TO MANAGING TEAMS
Introduction to Team - Team Dynamics - Team Formation – Stages of Team Development - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) - Multicultural Teams.

UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS
Team-based Organisations - Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III INTRODUCTION TO LEADERSHIP
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
Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

**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**

**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

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

Suggested Readings:
Creativity and Innovation in Entrepreneurship, Kankha, Sultan Chand
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

CMG340 PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS L T P C
3 0 0 3

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

UNIT I INTRODUCTION TO MARKETING MANAGEMENT 9

UNIT II MARKETING ENVIRONMENT 9

UNIT III PRODUCT AND PRICING MANAGEMENT 9
UNIT IV  PROMOTION AND DISTRIBUTUION MANAGEMENT  9

UNIT V  CONTEMPORARY ISSUES IN MARKETING MANAGEMENT  9

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

REFERENCES:

CMG341  HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS  L  T  P  C  3  0  0  0  3

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

UNIT I  INTRODUCTION TO HRM  9

UNIT II  HUMAN RESOURCE PLANNING  9
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends
UNIT III RECRUITMENT AND SELECTION
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

OUTOMES:
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 acquaintance 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

CMG342 FINANCING NEW BUSINESS VENTURES

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
Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments –
Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit
Facilities - Cash Credit - Over Draft.

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
Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing
Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds -
Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends

TOTAL 45 : PERIODS

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
  2) Prasanna Chandra, Projects : Planning ,Analysis,Selection ,Financing,Implementation and
  4) Metrick, Andrew; Yasuda, Ayako. Venture Capital And The Finance Of Innovation. Venture
     Capital And The Finance Of Innovation, 2nd Edition, Andrew Metrick And Ayako Yasuda,
  7) Gompers, Paul Alan; Lerner, Joshua. The Money Of Invention: How Venture Capital
  8) Camp, Justin J. Venture Capital Due Diligence: A Guide To Making Smart Investment
 10) Lerner, Josh; Leamon, Ann; Hardymon, Felda. Venture Capital, Private Equity, And The

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

365
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.
3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi

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<td><strong>UNIT-I</strong></td>
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<td>1. Meaning, Scope and Importance of Personnel Administration</td>
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<td>2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems</td>
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<td><strong>UNIT-II</strong></td>
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<td>1. Generalist Vs Specialist</td>
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<td>2. Civil Servants' Relationship with Political Executive</td>
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<td>3. Integrity in Administration</td>
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<td><strong>UNIT-III</strong></td>
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<td>1. Recruitment: Direct Recruitment and Recruitment from Within</td>
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<td>2. Training: Kinds of Training</td>
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<td>3. Promotion</td>
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<td><strong>UNIT-IV</strong></td>
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<td>1. All India Services</td>
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<td>2. Service Conditions</td>
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<td>3. State Public Service Commission</td>
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<td><strong>UNIT-V</strong></td>
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<td>1. Employer Employee Relations</td>
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<td>2. Wage and Salary Administration</td>
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<td>3. Allowances and Benefits</td>
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**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

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<td>Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration</td>
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<td><strong>UNIT II</strong></td>
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<td>Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory</td>
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<td><strong>UNIT III</strong></td>
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<td>Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.</td>
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UNIT IV
Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making

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

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

TOTAL: 45 PERIODS

CMG347 INDIAN ADMINISTRATIVE SYSTEM
UNIT I
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV
Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V
Corruption – Ombudsman, Lok Pal & Lok Ayuktha

TOTAL: 45 PERIODS

REFERENCES:
1. S.R. Maheswari : Indian Administration
2. Khera. S.S : Administration in India
3. Ramesh K. Arora : Indian Public Administration
4. T.N. Chaturvedi : State administration in India
5. Basu, D.D : Introduction to the Constitution of India

CMG348 PUBLIC POLICY ADMINISTRATION
UNIT I

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

UNIT-IV
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT-V
Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

REFERENCES:
4. Pradeep Saxena : Public Policy Administration and Development

VERTICAL 4: BUSINESS DATA ANALYTICS

CMG349  STATISTICS FOR MANAGEMENT  L T P C  3 0 0 3

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

UNIT I  INTRODUCTION  9
Basic definitions and rules for probability, Baye’s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II  SAMPLING DISTRIBUTION AND ESTIMATION  9
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III  TESTING OF HYPOTHESIS - PARAMETRIC TESTS  9
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV  NON-PARAMETRIC TESTS  9

UNIT V  CORRELATION AND REGRESSION  9

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

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

UNIT I INTRODUCTION
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

OUTCOMES:
1. Learn to apply various data mining techniques into various areas of different domains.
2. Be able to interact competently on the topic of data mining for business intelligence.
3. Apply various prediction techniques.
4. Learn about supervised and unsupervised learning technique.
5. Develop and implement machine learning algorithms

REFERENCES:
1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.

370
**CMG351**  
**HUMAN RESOURCE ANALYTICS**  
**L T P C**  
**3 0 0 3**

**OBJECTIVE:**
- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

**UNIT I - INTRODUCTION TO HR ANALYTICS**  
People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business - HR metrics and KPIs.

**UNIT II - HR ANALYTICS I: RECRUITMENT**  
Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

**UNIT III - HR ANALYTICS - TRAINING AND DEVELOPMENT**  
Training & Development Metrics: Percentage of employees trained - Internally and externally trained - Training hours and cost per employee - ROI.

**UNIT IV - HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION**  
Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover - grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

**UNIT V - HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT**  
Workforce Diversity and Development Metrics: Employees per manager - Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

**TOTAL: 45 PERIODS**

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

**REFERENCES:**

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS

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

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

UNIT II COMMUNITY BUILDING AND MANAGEMENT 9
History and Evolution of Social Media - Understanding Science of Social Media - Goals for using Social Media - Social Media Audience and Influencers - Digital PR - Promoting Social Media Pages - Linking Social Media Accounts - The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS 9
Social Media Policies - Etiquette, Privacy - ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS 9
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

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

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

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CMG353  OPERATION AND SUPPLY CHAIN ANALYTICS  L T P C 3 0 0 3

OBJECTIVE:
- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I  INTRODUCTION  9
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

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

UNIT III  INVENTORY MANAGEMENT  9
Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV  TRANSPORTATION NETWORK MODELS  9

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

TOTAL: 45 PERIODS

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

REFERENCES:

CMG354  FINANCIAL ANALYTICS  L T P C 3 0 0 3

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

UNIT I  CORPORATE FINANCE ANALYSIS  9
Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.
UNIT II  FINANCIAL MARKET ANALYSIS  9
Estimation and prediction of risk and return ( bond investment and stock investment) – Time series- examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III  PORTFOLIO ANALYSIS  9
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV  TECHNICAL ANALYSIS  9

UNIT V  CREDIT RISK ANALYSIS  9
Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

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

REFERENCES:

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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

OBJECTIVE:
➢ To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I  SUSTAINABLE DEVELOPMENT GOALS  9

UNIT II  SUSTAINABLE INFRASTRUCTURE PLANNING  9
Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES


UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS


UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS


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

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CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT L T P C 3 0 0 3

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 9
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 9
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 9
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

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 – PO Mapping - SUSTAINABLE AGRICULTURE PRACTICES

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CES333 SUSTAINABLE BIOMATERIALS L T P C

OBJECTIVES

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
• To introduce the students about metals as biomaterials and their usage as implants
• To make the students understand the significance of bionanomaterials and its applications.

UNIT I  INTRODUCTION TO BIOMATERIALS

UNIT II  BIO POLYMERS
Molecular structure of polymers -Molecular weight - Types of polymerization techniques—Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials - Polyethylene -Poly(methylmethacrylate) (PMMA)-Poly(lactic acid) (PLA) and polyglycolic acid (PGA) - Polycaprolactone (PCL) - Other biodegradable polymers -Polyurethane- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III  BIO CERAMICS AND BIOCOMPOSITES
General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites-Polymer Matrix Composite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)—glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV  METALS AS BIOMATERIALS
Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V  NANOBIOATERIALS

TOTAL : 45 PERIODS

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

REFERENCES
CES334 MATERIALS FOR ENERGY SUSTAINABILITY L T P C 3 0 0 3

OBJECTIVES

- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell
- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I SUSTAINABLE ENERGY SOURCES 9
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO2, LiFePO4, LiMn2O4) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III FUEL CELLS 9

UNIT IV PHOTOVOLTAICS 9
phthalocyanine and perylenetetracarboxylicbis - benzine – fullerenes - boron subphthalocyanine-tin (II) phthalocyanine

UNIT V  SUPERCAPACITORS  9
Supercapacitor – types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS

OUTCOMES

• Students will acquire knowledge about energy sustainability.
• Students understand the principles of different electrochemical devices.
• Students learn about the working of fuel cells and their application.
• Students will learn about various Photovoltaic applications and the materials used.
• The students gain knowledge on different types of supercapacitors and the performance of various materials

REFERENCES

5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

CES335  GREEN TECHNOLOGY  L T P C
            3 0 0 3

COURSE OBJECTIVE:

• To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
• To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I  PRINCIPLES OF GREEN CHEMISTRY  9
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  9
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES
Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT V GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS

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

OBJECTIVES:
- to understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I ENVIRONMENTAL MONITORING AND STANDARDS

UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS
UNIT III  
ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING  
Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods - Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV  
ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT  

UNIT V  
AUTOMATED DATA ACQUISITION AND PROCESSING  
Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks - Sensors and transducers - classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

COURSE OUTCOMES  
After completion of this course, the students will know

CO1 Basic concepts of environmental standards and monitoring.
CO2 the ambient air quality and water quality standards;
CO3 the various instrumental methods and their principles for environmental monitoring
CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 the various ways of raising environmental awareness among the people.
CO6 Know the standard research methods that are used worldwide for monitoring the environment.

TEXTBOOKS
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc

REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

Course Articulation Matrix

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<th>Course Outcomes</th>
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TOTAL: 45 PERIODS

382
COURSE OBJECTIVES:
1. To create awareness on the energy scenario of India with respect to the world
2. To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
3. Familiarisation on the concept of sustainable development and its benefits
4. Recognise the potential of renewable energy sources and its conversion technologies for attaining sustainable development
5. Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO 9
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT 9
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT 9

UNIT IV RENEWABLE ENERGY TECHNOLOGY 9

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

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

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

UNIT I ENERGY AND ENVIRONMENT 
Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING
Need and types of energy audit. Energy management (audit) approach-understanding energy costs, 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
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVATION IN ELECTRICAL UTILITIES
Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V SUSTAINABLE DEVELOPMENT

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

REFERENCES: