ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED COLLEGES
REGULATIONS 2021

B. TECH. HANDLOOM AND TEXTILE TECHNOLOGY

CHOICE BASED CREDIT SYSTEM (CBCS)

PROGRAM EDUCATIONAL OBJECTIVES:
Bachelor of Handloom and Textile 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 handloom and textile manufacturing technology 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 Handloom and Textile Technology Graduates will have the ability to
1. Apply knowledge of mathematics, sciences, engineering and textile technology to get solution for the technological problems in handloom and textile industry
2. Identify, formulate, review literature and critically analyze the technological problems in the handloom and textile industry to reach substantiated conclusion
3. Design and develop the solutions to the technological and managerial problems in handloom and textile 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 handloom and textile industry
5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools for managing handloom and textile 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 Handloom and Textile Technology Graduates will have the ability to
1. Understand and apply fundamental and the technical knowledge for managing handloom and textile manufacturing industry
2. Be a successful entrepreneur and designer in handloom fabrics and textile clothing.
3. Design and develop novel products and manufacturing processes in handloom and textile fields
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**PROFESSIONAL ELECTIVES [PEC]**

<p>| Process and Quality Control in Spinning | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | - | - | - | 2 | 3 | 2 | 2 |
| Process and Quality Control in Fabric Manufacture | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 1 | - | - | - | 2 | 3 | 2 | 2 |
| Theory of Drafting and Twisting | 3 | 3 | 3 | 2 | 2 | - | - | - | - | - | - | 1 | 3 | 1 | 2 |
| Production and application of sewing threads | 3 | 3 | 1 | 1 | 1 | - | - | - | - | - | - | 1 | 3 | 1 | 2 |
| Textile Chemicals and Auxiliaries | 2 | 2 | 2 | 2 | - | 2 | 2 | 2 | - | 2 | 2 | - | 2 | 2 | 2 |
| Garment Production Machinery | 2.5 | 7 | 2.2 | 8 | 1.14 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 3 | 3 |
| Industrial Engineering in Garment Industry | 1.2 | 2 | 3 | 3 | 2 | 1 | 1.2 | 2 | 2 | 1 | 2.4 | 2 | 1 | 1 | - |
| Pattern Engineering | 2 | 2 | 2 | - | 2 | - | - | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 1 |
| Apparel Marketing and Merchandising | - | 1 | 2.6 | 2 | 2 | 1 | 2.4 | 2 | 1.2 | 1 | - | 2 | 2 | 2 |
| Apparel Product Development Laboratory | 1.33 | - | - | - | - | - | 1 | 1.3 | 3 | 1.3 | 3 | 1.3 | 3 | 1 | 3 | 2 |
| Basic Sewing and Pattern Making Laboratory | - | - | - | - | 1 | - | - | 1 | 1 | - | 1 | 2 | 1 |
| Apparel Costing | 3 | 2 | - | - | 1 | - | - | - | - | 2 | 1 | 3 | 2 | 1 |
| Operations Research in Textile Industry | 3 | 2 | 2 | 3 | 3 | - | - | - | - | 1 | 2 | 1 | 3 | 3 | 2 |
| Supply Chain Management | 1 | 1 | 2 | 2 | 2 | - | - | - | 2 | 2 | 2 | 1 | 2 | 2 | 1 |
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1-Low, 2-Medium, 3-High, "-"—no correlation
## ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED COLLEGES
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM (CBCS)
B. TECH. HANDLOOM AND TEXTILE TECHNOLOGY
CURRICULUM AND SYLLABI FOR FOR I TO VIII SEMESTERS

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$^\dagger$ Skill Based Course

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$^\dagger$ 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.

$^\dagger$ Skill Based Course

8
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<sup>#</sup> 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.

<sup>1*</sup> Two weeks industrial training/internship carries one credit. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester.
### SEMESTER V

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<tr>
<th>S. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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**THEORY**

**PRACTICALS**

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**TOTAL 18 0 7 25 19.5**

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

*Two weeks industrial training/internship carries one credit. Industrial training/internship during IV Semester Summer Vacation will be evaluated in V semester

### SEMESTER VI

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**PRACTICALS**

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**TOTAL 21 0 6 27 21**

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

## Two weeks industrial training/internship carries one 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.
## SEMESTER VII/VIII

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<td>1.</td>
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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.
**Open Elective – II shall be chosen from the emerging technologies.
***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes
* Elective- Management shall be chosen from the Elective Management courses
## SEMESTER VIII/VII

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<tr>
<th>S. NO.</th>
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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: 166**

## ELECTIVE – MANAGEMENT COURSES

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### MANDATORY COURSES I*

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* Mandatory Courses are offered as Non-Credit Courses

### MANDATORY COURSES II*

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<tr>
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<td>MX3085</td>
<td>Well Being with Traditional Practices - Yoga, Ayurveda and Siddha</td>
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* Mandatory Courses are offered as Non-Credit Courses
# Professional Elective Courses: Verticals

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<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
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<tbody>
<tr>
<td>Spinning, Weaving and chemical processing</td>
<td>Garment Production Machinery</td>
<td>Operations Research in Textile Industry</td>
<td>Technical Textiles</td>
<td>Characterization of Textile Polymers</td>
</tr>
<tr>
<td>Process and Quality Control in Spinning</td>
<td>Industrial Engineering in Garment Industry</td>
<td>Supply Chain Management</td>
<td>Medical Textiles</td>
<td>Clothing Comfort</td>
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<tr>
<td>Process and Quality Control in Fabric Manufacture</td>
<td>Pattern Making</td>
<td>Apparel Costing</td>
<td>Home Textiles</td>
<td>Textile Reinforced Composites</td>
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<tr>
<td>Theory of Drafting and Twisting</td>
<td>Apparel Marketing and Merchandising</td>
<td>Textile and Apparel EXIM Management</td>
<td>Smart Textiles</td>
<td>High Performance Fibres</td>
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<tr>
<td>Structural Mechanics of Yarns and Fabrics</td>
<td>Basic Sewing and Pattern Making Laboratory</td>
<td>Management of Textile Effluents</td>
<td>Coated Textiles</td>
<td>Advances in Textile Printing and Finishes</td>
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<tr>
<td>Textile Chemicals and Auxiliaries</td>
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Registration of Professional Elective Courses from Verticals:

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

### VERTICAL 1: SPINNING, WEAVING AND CHEMICAL PROCESSING

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### VERTICAL 2: GARMENT MANUFACTURING

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## VERTICAL 3: MANAGEMENT OF TEXTILE INDUSTRIES

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## VERTICAL 4: TECHNICAL TEXTILES

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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)

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
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<tr>
<td>Fintech and Block Chain</td>
<td>Foundations of Entrepreneurship</td>
<td>Principles of Public Administration</td>
<td>Statistics For Management</td>
<td>Sustainable infrastructure Development</td>
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<td>Fundamentals of Investment</td>
<td>Team Building &amp; Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining For Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
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<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity &amp; Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
</tr>
<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management For Business</td>
<td>Administrative Theories</td>
<td>Marketing And Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
</tr>
<tr>
<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurs</td>
<td>Indian Administrative System</td>
<td>Operation And Supply Chain Analytics</td>
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<td>Introduction to Fintech</td>
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<td>Public Policy Administration</td>
<td>Financial Analytics</td>
<td>Environmental Quality Monitoring and Analysis</td>
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<td>Integrated Energy Planning for Sustainable Development</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>Energy Efficiency for Sustainable Development</td>
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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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<th>TOTAL CONTACT PERIODS</th>
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<td>4.</td>
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**VERTICAL 2: ENTREPRENEURSHIP**

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### VERTICAL 3: PUBLIC ADMINISTRATION

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### VERTICAL 4: BUSINESS DATA ANALYTICS

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### VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

References:
Guide to Induction program from AICTE

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

MA3151 MATRICES AND CALCULUS

UNIT I MATRICES

UNIT II DIFFERENTIAL CALCULUS

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

UNIT V MULTIPLE INTEGRALS 9+3
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

TOTAL: 60 PERIODS

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

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

REFERENCES :
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 9


UNIT II ELECTROMAGNETIC WAVES 9

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

UNIT III OSCILLATIONS, OPTICS AND LASERS 9


UNIT IV BASIC QUANTUM MECHANICS 9

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

UNIT V APPLIED QUANTUM MECHANICS 9

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

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.

TOTAL : 45 PERIODS
TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer-Verlag,

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.

CY3151 ENGINEERING CHEMISTRY

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

UNIT I WATER AND ITS TREATMENT

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

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

UNIT IV  FUELS AND COMBUSTION  9

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

TOTAL: 45 PERIODS

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.

TEXT BOOKS:
REFERENCES:

CO-PO & PSO MAPPING

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

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
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/

COs- PO’s & PSO’s MAPPING

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1 - low, 2 - medium, 3 - high, '-' - no correlation
TEXT-CUM-REFERENCE BOOKS

1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

TOTAL : 15 PERIODS
6. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K. K. Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

GE3152  HERITAGE OF TAMILS  L T P C
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UNIT I  LANGUAGE AND LITERATURE  3

UNIT II  HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE  3
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veena1, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

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

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

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. காவிரிக் தமிழ் - மக்கள் பல்கலைக் கழகம் – தமிழ் பள்ளி பதிப்பு (கல்லூரியில் காவிரிக் தமிழ் பதிப்பு பல்கலைக் கழகம்).
2. காவிரிக் தமிழ் - மக்கள் பல்கலைக் கழகம் (தமிழ் பள்ளி பதிப்பு).
GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY

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

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

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)

2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).

3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)

4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)

5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)

6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

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/

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PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:

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

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 Na$_2$CO$_3$ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
   - Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
13. Preparation of nanoparticles (TiO$_2$/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:

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

39
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 progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

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

TOTAL : 30 PERIODS

LEARNING OUTCOMES:
At the end of the course, learners will be able
- 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
- 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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- 1-low, 2-medium, 3-high, ‘-’- no correlation
- **Note:** The average value of this course to be used for program articulation matrix.

**HS3252**

**PROFESSIONAL ENGLISH -II**

**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**
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.

TOTAL : 30 PERIODS

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

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

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

TOTAL: 60 PERIODS

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.
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PH3257 PHYSICS FOR TEXTILE TECHNOLOGISTS

COURSE OBJECTIVES:
• To make the students effectively to understand the basics of crystallography and crystal imperfections.
• To enable the students to get knowledge on ferrous and nonferrous alloys.
• To impart knowledge on the basics of ceramics, composites and nanomaterials.
• To learn about mechanical properties of materials.
• To introduce the concept of light - matter interactions and electro-optical effects.

UNIT I CRYSTALLOGRAPHY

UNIT II FERROUS AND NONFERROUS ALLOYS
The Fe-Fe3C phase diagram: phases, invariant reactions, development of microstructure in eutectoid, hypoeutectoid and hypereutectoid alloys—influence of other alloying elements in the Fe-
UNIT III CERAMICS, COMPOSITES AND NANO MATERIALS 9

UNIT IV MECHANICAL PROPERTIES 9

UNIT V OPTICAL PROPERTIES OF MATERIALS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students should be able to
CO1 : Understand the basics of crystallography and its importance in materials properties
CO2 : Understand the basics of crystallography and crystal imperfections.
CO3 : Get knowledge on ferrous and nonferrous alloys.
CO4 : Acquire knowledge on the basics of ceramics, composites and nano-materials
CO5 : Learn about the concept of light - matter interactions and electro-optical effects.

TEXT BOOKS:
3. Safa O. Kasap, Optoelectronics and Photonics, Dorling Kindersley India, 2009

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

After completing this course, the students will be able to

CO1: Compute the electric circuit parameters for simple problems
CO2: Explain the concepts of domestics wiring and protective devices
CO3: Explain the working principle and applications of electrical machines
CO4: Analyze the characteristics of analog electronic devices
CO5: Explain the types and operating principles of sensors and transducers
TEXT BOOKS:
3. S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019
4. James A Svoboda, Richard C. Dorf, Dorf’s Introduction to Electric Circuits, Wiley, 2018

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GE3251 ENGINEERING GRAPHICS
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids.
5. Drawing isometric and perspective projections of simple solids.

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

UNIT I PLANE CURVES
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 BOOK:

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)

CY3252 CHEMISTRY FOR TEXTILE TECHNOLOGISTS

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. Semisolid 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 auxochrome, 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

TOTAL :  45 PERIODS

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. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)
3. Social Life of Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)

TOTAL: 15 PERIODS
(Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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<td>DESIGN AND CONSTRUCTION TECHNOLOGY</td>
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<td>Designing and Structural construction House &amp; 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.</td>
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<td>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.</td>
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TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. இந்தியாவின் இராணுவ வலிமை - அரசியல் வளிமை - தேசிய பெருநிலை (தமிழில்: இந்தியாவின் இராணுவ வலிமை - அரசியல் வளிமை - தேசிய பெருநிலை)
2. கொடி விளையாட்டின் விளையாட்டு - விளையாட்டு விளையாட்டின் விளையாட்டு (தமிழில்: கொடி விளையாட்டின் விளையாட்டு)
3. தமிழின் விளையாட்டு விளையாட்டு - விளையாட்டு விளையாட்டு விளையாட்டின் விளையாட்டு (தமிழில்: தமிழின் விளையாட்டு விளையாட்டு)
4. புணர்கூட்டி - புணர்கூட்டி விளையாட்டின் விளையாட்டு (தமிழில்: புணர்கூட்டி - புணர்கூட்டி விளையாட்டின் விளையாட்டு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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NCC Credit Course Level 1*
NX3251 (ARMY WING) NCC Credit Course Level - I

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TOTAL : 30 PERIODS
### NCC Credit Course Level 1*

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

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**NCC GENERAL**  
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- **NCC 2**  Incentives  
- **NCC 3**  Duties of NCC Cadet  
- **NCC 4**  NCC Camps: Types & Conduct  

4

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

7

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

5

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

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TOTAL : 30 PERIODS

### NCC Credit Course Level 1*

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

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

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

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**PERSONALITY DEVELOPMENT**  

54
PD 1  Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  2
PD 2  Communication Skills  3
PD 3  Group Discussion: Stress & Emotions  2

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

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

TOTAL : 30 PERIODS

GE3271  ENGINEERING PRACTICES LABORATORY  LT 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 common household wood work.
- Wiring various electrical joints in common household electrical wire work.
- Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
- Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I  CIVIL ENGINEERING PRACTICES  15

PLUMBING WORK:

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/quadac)
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

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.

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
ENGINEERING LABORATORY

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

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

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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TOTAL: 60 PERIODS
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: job application( Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

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.
CO-PO & PSO MAPPING

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

**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**


**UNIT IV  CORRELATION, REGRESSION, INDEX NUMBERS AND TIMES SERIES ANALYSIS**

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**

Control charts for measurements (X and R chart ) – Control charts for attributes ( p,C and np) charts – Tolerance limits – acceptance Sampling.

**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

TEXT BOOKS:

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HT3301 HANDLOOM WEAVING TECHNOLOGY

OBJECTIVES:
- To enable the students to understand the principles of mechanisms of handloom weaving such as primary, secondary and auxiliary motions, preparatory processes, yarn packages etc.,
- To enable the students to perform calculations of yarn count, reed count and heald count
- To enable the students to gain the knowledge of the principles of working of various handloom dobbies

UNIT I WEAVING PREPARATORY PROCESS
Yarn packages - hanks, cones, cheeses, and spools - Characteristics and use; Essential characteristic of warp and weft, Objectives of winding and warping, peg warping, vertical warping and sectional warping; objectives and importance of sizing of cotton yarn, ingredients used in size
mixture for handloom industry and their functions, various forms of sizing- hank sizing and street warp sizing; Characteristics of ideal sizing, common defects during sizing- causes and remedies.

UNIT II SHEDDING AND PICKING MECHANISM
Evolution of handlooms, Various parts of a handloom and their functions, types of handlooms- Throw shuttle handloom, Fly shuttle pit loom and frame loom; Relationship between type of handloom and the product, passage of warp in frame loom; motions of a handloom; definitions of primary, secondary & auxiliary, motions; Types of shed formations- centre closed shed, bottom closed shed, top closed shed, open shed and semi open shed - advantages, disadvantages and shedding devices; shedding mechanism of a handloom using treadles and heald reversing motions – roller system, pulley reversing system and jack and lam rod system

UNIT III BEAT-UP AND SECONDARY MECHANISM
Picking mechanism of a handloom, types of shuttles – throw shuttle, fly shuttle and roller shuttle, design and suitability; beat-up- open shed beat-up, closed shed beat up and crossed shed beat-up in handlooms, different types of reed – bamboo reed, steel reed and all metal steel reed, suitability for various fabrics; let off motion in handlooms – ratchet wheel and pawl, rope and weight, rope-lever and weight motions; take up motion in handloom – poker rod, ratchet wheel & pawl; auxiliary motions of a handloom – temple motion and terry motion; handloom dobbies – lattice dobbey, barrel dobbey and vertical dobbey

UNIT IV YARN NUMBERING SYSTEM
Introduction to numbering of yarns; indirect system of numbering of yarns – New English cotton, New French, metric, worsted, woollen Yorkshire Skein, linen, spun yarn, Direct system of numbering of yarns – Denier metric, flax/ jute/ hemp, Universal system of yarn numbering – Tex and its derivatives - millitex, kilotex; Determination of conversion factors, Conversion of count of yarn -indirect to indirect, direct to direct, indirect to direct, direct to indirect systems.

UNIT V YARN COUNT CALCULATION
Determination of Equivalent/Resultant count of folded yarns with and without contraction during twisting, costing of folded yarn, Average count of warp. Read Count - dents per linear space and groups of dents per linear space models, Stockport System of Reed count - relation between reed counts, number of ends per dent, ends per inch, cloth width, reed width and total number of ends, heald count calculations.

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Describe the yarn packages and the process of winding, warping and sizing
CO2: Explain the various parts, motions and shedding mechanism of handloom
CO3: Explain the various types of picking, beat up, let off and take up mechanism
CO4: Describe the direct and indirect yarn numbering systems
CO5: Explain the average count, reed count, heald count and its calculations

TEXT BOOKS:

REFERENCES:
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<td>Explain the various parts, motions and shedding mechanism of handloom</td>
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<td>Explain the various types of picking, beat up, let off and take up mechanism</td>
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<td>CO4</td>
<td>Describe the direct and indirect yarn numbering systems</td>
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<td>CO5</td>
<td>Explain the average count, reed count, heald count and its calculations</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 expose the students to the yarn numbering system used to specify textile yarns.
- To enable the students to understand the processes involved in the production of yarn from fibres.
- To enable the students to understand the machinery used for the production of yarns using short staple spinning system.

UNIT I  INTRODUCTION TO SPINNING  9
Sequence of spinning machinery for producing carded, combed and blended yarns in short staple and long staple spinning system; yarn numbering systems- direct, indirect and conversions; influence of characteristics of raw material – fibre fineness, length, strength, elongation, stiffness, fibre friction, cleanliness on spinning performance; spinnability

UNIT II  GINNING AND BLOWROOM  9
Description and working of different types of gins; selection of right type of gins; ginning performance on yarn quality; objectives, principle and description of opening, cleaning and blending machines used in blowroom; chute feed; cleaning efficiency, production calculations.

UNIT III  CARDING  9
Objectives and principle of carding; detailed study of flat card; autolevelling; card clothing and its maintenance; drives and production calculation

UNIT IV  COMBING  9
Objectives of comber preparatory; detailed study of sliver lap, ribbon lap and super lap formers; objectives and principle of combing; sequence of combing operation; combing efficiency and production calculation.

UNIT V  DRAWING AND ROVING  9
Tasks of drawing machine; drafting systems used in modern drawing machines; autolevelling; draft and production calculation; objectives of roving machine; working of roving machine; bobbin builder mechanism – mechanical and electro-mechanical; draft, twist and production calculations.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to,
CO1: Explain the staple yarn spinning processes and fibre characteristics.
CO2: Explain the ginning and blow room process and carryout calculations.
CO3: Describe the objective, principle and working of carding machine and carryout production calculations..
CO4: Explain the preparatory for comber and combing process and carryout production calculation.
CO5: Explain the process of drawing, roving and carryout draft, twist and production calculations.

TEXT BOOKS:
REFERENCES:
5. Lord P.R., “Yarn Production: Science, Technology and Economics “, The Textile Institute, Manchester, 1999
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<td>Describe the objective, principle and working of carding machine and carryout production calculations.</td>
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<td>CO5</td>
<td>Explain the process of drawing, roving and carryout draft, twist and production calculations.</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
TT3351   PREPARATORY PROCESS FOR WOVEN FABRIC MANUFACTURE   L T P C
3 0 2 4

OBJECTIVES:
- The main objective of this course is to enable the students to understand the preparatory processes involved in the production of fabrics.

UNIT I       WINDING  13
Objects of winding; principles of cheese and cone winding machines; drum and precision winding; uniform build of yarn package; types of drums – half accelerated and fully accelerated drums; control of balloons; Classification of yarn faults and its removal; concepts in yarn clearing – mechanical, optical and electronic clearers; knotters and splicers, weft winding; study of modern automatic winders.

UNIT II      PROCESS CONTROL IN WINDING  5
Faults in wound packages, their causes and remedies; winding synthetic and blended yarns; winding for colouration; quality of knots and splices; winding performance; productivity; maintenance; quality control; material handling.

UNIT III     WARPPING AND SIZING  18
Objectives of warping, material flow in beam warping and creels used in warping machines; sectional warping machines. Sizing objectives of sizing; sizing materials and recipe used for different types of fibers; size preparation equipment; sizing machines; sizing filament yarns; concept of single end sizing, combined dyeing and sizing. Control concepts in modern sizing; energy conservation in sizing; Sizing defects and production calculations.

UNIT IV      PROCESS CONTROL IN WARPPING AND SIZING  5
Process control in warping (production calculation, machine and labor productivity, control of end breaks, quality and hard waste in warping); Control systems used in sizing machine.

UNIT V       DRAWING- IN  4
Need for drawing-in operation; manual and automatic drawing- in, leasing, knotting and pinning machines; selection and care of reeds, healds and drop pins, control of cross ends and extra ends and calculations.

TOTAL: 75 PERIODS (45L + 30P)

LIST OF EXPERIMENTS:
1. Analysis of Yarn faults
2. Control of production, package density, yarn faults in cone / cheese winding machine
3. Study of pirn winding
4. Study of warping machine
5. Study of sectional warping machine
6. Study of drawing – in, denting and tying

OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Explain the types of winding, yarn faults and automatic winding
CO2: Elucidate winding package faults and winding performance
CO3: Discuss the types of warping and sizing process
CO4: Describe the process control in warping and sizing
CO5: Explain the manual and automatic drawing in process
CO6: Analyse yarn faults and control of faults in cone / cheese finding
CO7: Understand the preparatory process of fabric manufacturing by practice.
TEXT BOOKS:

REFERENCES:
Course Marticulation Matrix:

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<td>Explain the types of winding, yarn faults and automatic winding</td>
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<td>Elucidate winding package faults and winding performance</td>
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<td>Discuss the types of warping and sizing process</td>
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<td>Describe the process control in warping and sizing</td>
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<td>CO5</td>
<td>Explain the manual and automatic drawing in process</td>
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<td>CO6</td>
<td>Analyse yarn faults and control of faults in cone / cheese Winding</td>
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<td>CO7</td>
<td>Understand the preparatory process of fabric manufacturing by practice</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVES:
The main objective of this course is to enable the students to understand the
- Structure and morphology of textile fibres
- Structure investigation techniques
- Physical characteristics of textile fibres

UNIT I STRUCTURE OF FIBRES
Classification of fibres; study of morphological structures of fibres; physical properties of fibres;
order and disorder in fibre structure; molecular conformations – planar zig-zag, helical, lamellar,
and sperulite conformations

UNIT II STRUCTURE INVESTIGATION TECHNIQUES
Transmission and Scanning electron microscopes - principle; construction and working; X-ray
diffraction techniques – estimation of crystallinity; Infrared radiation and dichroism techniques;
chemical element and group identification by transmittance and optical density methods, molecular
orientation estimation

UNIT III MOISTURE ABSORPTION CHARACTERISTICS
Theories of moisture sorption; moisture absorption behaviour 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 – integral and differential, their relation; factors influencing heat of sorption
measurement of heat of sorption

UNIT IV MECHANICAL PROPERTIES OF FIBRES
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 effect study
of creep phenomena. 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 fibres

UNIT V OPTICAL, FRICTIONAL AND THERMAL CHARACTERISTICS
Reflexion and lustre-objective and subjective methods of measurement - refractive index and its
measurement - birefringence, factors influencing birefringence - absorption and dichroism friction –
static, limiting and kinetic friction, its measurement, comparison of fibres, directional friction in wool
– friction. thermal transitions of fibres - thermal conductivity, thermal expansion and contraction, Tg
and Tm; static electricity in textile fibres

TOTAL: 75 (45 L+30 P)

LIST OF EXPERIMENTS
1. Identification of natural, regenerated and synthetic fibres
2. Determination of denier of synthetic fibres
3. Determination of moisture regain and moisture content of fibres
4. Determination of wax content and spin finish of natural and synthetic fibres
5. Identification of fibres and determination of the blend proportion of
   a. Cotton/ regenerated cellulose
   b. Polyester/ protein fibres
   c. Cellulose/polyester fibres
   d. Cotton/ viscose/polyester
OUTCOME:
Upon completion of this course, the student shall be able to
CO1: Explain the structure and properties of fibres
CO2: Identify the method of investigation of structure of fibres
CO3: Compare and understand moisture absorption behaviour of various fibres
CO4: Demonstrate the tensile and elongation properties of fibres
CO5: Interpret the optical, thermal and frictional characteristics of fibres
CO6: Identify the fibres using, solubility, burning and microscopic test.
CO7: Determine the linear density and moisture properties of fibres

TEXTBOOKS

REFERENCES
### Course Articulation Matrix:

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<tr>
<td>CO4</td>
<td>Demonstrate the tensile and elongation properties of fibres</td>
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<tr>
<td>CO5</td>
<td>Interpret the optical, thermal and frictional characteristics of fibres</td>
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<tr>
<td>CO6</td>
<td>Identify the fibres using, solubility, burning and microscopic test.</td>
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<tr>
<td>CO7</td>
<td>Determine the linear density and moisture properties of fibres</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 about the natural fibre production, polymer rheology and the laws, and various spinning techniques of manufactured fibre production
- To expose the students to post spinning and development in the spinning process

UNIT I  NATURAL FIBERS  12

UNIT II  MELT SPINNING  9
Newtonian and non-newtonian fluids, Melt instabilities; Melt Spinning- Polymer Selection and Preparation, equipment, properties and applications of polyester, polyamide and polypropylene fibers.

UNIT III  SOLUTION SPINNING  9
Solution spinning- Polymer Selection and Preparation, equipment, properties and applications of acrylic, polyurethane and regenerated cellulose fibres.

UNIT IV  POST SPINNING OPERATIONS  9
Neck drawing, drawing systems, influence of drawing on structure and properties of fibres; Types of heat setting, influencing parameters on heat setting, influence of heat setting on fibre behavior; Spin finish composition and application; texturising.

UNIT V  DEVELOPMENTS IN FIBER SPINNING  6
Liquid crystal spinning; Gel spinning; Profile fibres and hollow fibres; Speciality fibres: polylactic acid and chitosan fibres preparation properties and applications.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student shall be able to
CO1: Recognize the cultivation and production of natural fibres
CO2: Explain the polymer rheology and polymer process parameters involved in melt spinning.
CO3: Demonstrate the various spinning techniques of polymers parameter involved in spinning synthetic yarn
CO4: Infer the need of various post spinning operations
CO5: Describe the advances in the spinning process

TEXT BOOKS:

REFERENCES:
### Course Articulation Matrix:

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<tr>
<th>Course Outcomes</th>
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<th>PSO1</th>
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<td>CO1</td>
<td>Recognize the cultivation and production of natural fibres</td>
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<td>CO2</td>
<td>Explain the polymer rheology and polymer process parameters involved in melt spinning</td>
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<td>CO3</td>
<td>Demonstrate the various spinning techniques of polymers parameter involved in spinning synthetic yarn</td>
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<tr>
<td>CO4</td>
<td>Infer the need of various post spinning operations</td>
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<td>CO5</td>
<td>Describe the advances in the spinning process</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 enable the students to learn passage of materials for ginning, cleaning machines and carding.
- To enable the students to learn passage of materials for drawing and roving machines.
- To enable the students to learn bobbin building and process parameters roving bobbins.

LIST OF EXPERIMENTS:
1. Construction details of Ginning machine, material passage and ginning out turn calculations
2. Construction details of blowroom machines material passage and production calculations
3. Determine the process parameters of 100% cotton material, running of blowroom machines to produce lap and running of carding machines to produce sliver
4. Construction details of carding machine, material passage and production calculations
5. Wire point specifications and various settings in a carding machine
6. Construction details of drawing machine, material passage, draft and production calculations
7. Study of construction details of comber preparatory machines, draft, and production calculations of those machines
8. Study of construction details of comber machines, combing cycle and production calculations
9. Construction details of roving machine, material passage, draft and production calculations
10. Study of bobbin builder mechanism in roving machine.
11. Study of roving frame bobbin stretch variation and to determine the count variation within bobbin, between bobbin and between front and back row bobbins.
12. Determine process parameters of drawing and roving machines to produce roving bobbins.
13. Handling of accessories – Tachometer, top roller load measuring devices, pressure gauge, roller eccentricity measuring gauge, leaf gauge, vernier caliber for roller settings, shore hardness tester etc.,

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Discuss the ginning, cleaning machine’s material passage and carryout production calculations.
CO2: Explain the carding, drawing and roving machine’s material passage and carryout production calculations.
CO3: Understand the process parameters in the blow room, carding machine draw frame and roving machines.

TOTAL: 45 PERIODS
## Course Articulation Matrix:

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<th>PSO1</th>
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<td>CO1.</td>
<td>Discuss the ginning, cleaning machine’s material passage and carryout production calculations.</td>
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<td>Explain the carding, drawing and roving machine’s material passage and carryout production calculations.</td>
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<tr>
<td>CO3.</td>
<td>Understand the process parameters in the blow room, carding machine draw frame and roving machines</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 practically train the students
- On various process and technology of handloom weaving.
- Develop plain and twill weave fabrics.
- Develop mock-leno, honeycomb and huck-a-back weave fabrics.

LIST OF EXPERIMENTS:
1. Drawing sketches of different parts of handlooms with specifications and joining threads by piecing and knotting
2. Practice of Drawing–in, denting and gaiting up
3. Practice of winding of yarn on double flanged bobbins and pirns using charka
4. Practice of warping process on peg warping frame
5. Practice of warping process on sectional warping machine
6. Study of weave, peg/tie-up plan and loom setting on multi treadle frame loom
7. Development of fabric samples using Plain and its derivatives
8. Development of fabric samples using twill weave and its derivatives
10. Development of fabric samples using Honeycomb weave

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Explain the parts and specifications of handloom.
CO2: Describe the winding, warping process, drawing – in, denting,
CO3: Develop the derivatives of plain, twill weave fabrics, Mock –leno and honey comb weave fabrics and Huck –a back weave fabrics.

TOTAL: 30 PERIODS
### Course Articulation Matrix:

<table>
<thead>
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<th>PSO1</th>
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</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Explain the parts and specifications of handloom</td>
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<tr>
<td>CO2</td>
<td>Describe the winding, warping, drawing – in, denting</td>
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<tr>
<td>CO3</td>
<td>Develop the derivatives of plain, twill weave fabrics, Mock – leno and honey comb weave fabrics and Huck – a back weave 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
OBJECTIVES:
- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered.
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

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

**10 Hours**

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

**10 Hours**

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

**10 Hours**
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.

TT3454 TECHNOLOGY OF YARN SPINNING L T P C
3 0 2 4

OBJECTIVES:
- To enable the students to learn ring spinning and condensed spinning process.
- To enable the students to understand the yarn pllying, twisting, types fancy yarn and
method of production.
- To enable the students to learn rotor, friction, air jet, vortex, core and wrap spun yarn
production methods.
- To enable the students to learn material passage, draft and production calculation of ring
and rotor spinning.
- To enable the students to learn process parameters and production of ring and rotor spun
yarn

UNIT I RING SPINNING
Principle of yarn formation in ring spinning machines; working of ring spinning machine; cop
building; design features of important elements used in ring spinning machine; draft, twist and
production calculations in ring spinning machine; end breakage rate – causes and remedies yarn
faults- causes and remedies

UNIT II CONDENSED YARN SPINNING
Condensed yarn spinning – principle, different methods, properties; comparison with ring spun
yarn

UNIT III YARN PLYING
Merits of pllying of yarns; methods followed for pllying – TFO, ring twisting; selection of twist level
for pllying; calculation of resultant count of plied yarns; types of fancy yarns, method of production

UNIT IV ROTOR SPINNING
Principle of open-end spinning; principle of yarn production by rotor spinning system; design
features of important elements used in rotor spinning; structure and properties of rotor yarn

UNIT V OTHER SPINNING SYSTEMS
Friction, single and two nozzle air jet and air vortex spinning methods – principle of yarn
production, raw material used, structure, properties and applications; principle of yarn production
by electrostatic, self-twist, core, wrap, integrated compound spinning systems.

TOTAL: 75 PERIODS (45L + 30P)

LIST OF EXPERIMENTS:
1. Construction details of Ring spinning machine, material passage, draft and production
calculations
2. Study of bobbin builder mechanism in ring spinning machine
3. Study of ring spinning machine and to calculate draft and twist. To determine yarn twist variation when the yarn wind at minimum and maximum diameters of bobbin
4. Construction details of rotor spinning machine, material passage, draft and production calculations.
5. Production of yarn in ring spinning machine
6. Production of yarn in rotor spinning machine
7. Study and analysis of MIS report of spinning Mill.
8. Study and analysis of spectrogram, V-L curve, and evenness test results.

OUTCOMES:
Upon the completion of this course, the student will be able to
CO1: Discuss the yarn formation, draft, twist and production calculation in ring spinning.
CO2: Explain the principle, properties and different methods of condensed yarn spinning.
CO3: Describe the yarn plying and production methods of fancy yarn.
CO4: Explain the principle, properties and different methods of rotor spinning.
CO5: Explain the friction, air jet, vortex, self twist, core and wrap yarn production methods.
CO6: Describe the material passage and carryout twist, draft and production calculation of ring
CO7: Determine the process parameters of ring and rotor spinning machines.

TEXT BOOKS:

REFERENCES:
2. Lord P.R., “Yarn Production: Science, Technology and Economics”, The Textile Institute, Manchester, 1999
### Course Articulation Matrix:

<table>
<thead>
<tr>
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<td>Discuss the yarn formation, draft, twist and production calculation in ring spinning.</td>
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<tr>
<td>CO2</td>
<td>Explain the principle, properties and different methods of condensed yarn spinning.</td>
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<tr>
<td>CO3</td>
<td>Describe the yarn plying and production methods of fancy yarn.</td>
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<td>CO4</td>
<td>Explain the principle, properties and different methods of rotor spinning.</td>
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<tr>
<td>CO5</td>
<td>Explain the friction, air jet, vortex, self twist, core and wrap yarn production methods</td>
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<td>CO6</td>
<td>Describe the material passage and carryout twist, draft and production calculation of ring and rotor spinning machines</td>
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<td>CO7</td>
<td>Determine the process parameters of ring and rotor spinning machines.</td>
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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 understand various functions of weaving machine and process control

UNIT I — INTRODUCTION TO WEAVING
Yarns quality requirements for high speed automatic shuttle looms and shuttle less loom; warp and weft preparation for high speed looms; Principle of weaving, passage of material, motions in loom – primary, secondary and auxiliary motions, plain power loom driving, timing of motions.

UNIT II — SHEDDING MOTIONS
Shed geometry and shedding requirement. Types of shed. Shedding mechanisms – positive and negative. Principles of tappet, dobbi and jacquard shedding mechanisms, reversing mechanisms-limitations of various shedding mechanisms; Conventional and modern dobbi and jacquard mechanism.

UNIT III — WEFT INSERTION AND BEAT UP
Shuttle picking and checking mechanisms, shuttle flight and timing; Weft feeder – types, Principles of weft insertions in shuttle less looms; mechanism of weft insertion by projectile, rapier loom and jet – air and water. Multi-Phase weaving systems; Kinematics of sley, sley eccentricity; beat up mechanism in modern looms;

UNIT IV — SECONDARY AND AUXILARY MOTIONS
Take up and let – off motions used in plain power looms; cloth formation, weaving condition – factors and control; warp protector and warp and weft stop motion; plain power loom accessories. Automatic weft replenishment in shuttle looms – pim changing and shuttle changing looms; mechanisms involved in automatic pim changing – feelers, cutters, design of shuttle, three try motions; multi shuttle looms- box changing principle, Automatic pim changing in multi shuttle loom. Weft arrival control and automation in shuttle less looms; selvedges in shuttle less looms; quick style change;

UNIT V — PROCESS CONTROL & SPECIAL WEAVING PROCESSES
Techno economics of shuttle less loom weft insertion systems; loom monitoring and control Loom stoppages and efficiency; fabric defects and value loss; fabric shrinkage in the loom – causes and control; fabric engineering. Filament weaving – Silk & Texturised yarns. Principles and mechanisms in weaving Pile fabrics, tapes and triaxial fabrics

OUTCOMES:
Upon completion of this course the student will be able to,
CO1: Explain the primary, secondary and auxiliary motions of loom
CO2: Discuss the types of shedding mechanisms
CO3: Explain the types of weft insertion and beat up mechanisms
CO4: Describe the let – off, take – up and shuttle changing mechanism
CO5: Discuss the process control in weaving and special weaving processes

TOTAL: 45 PERIODS

TEXT BOOKS:
REFERENCES:
## Course Articulation Matrix:

<table>
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<tr>
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<td>Explain the types of weft insertion and beat up mechanism</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 make the students understand fundamentals of knitting, types of knitting processes in detail, the functioning of components of knitting machine and knitted fabric structures.

UNIT I  INTRODUCTION  5
Reasons for the growth of the knitting industry; comparison of fabric properties - woven, knits and bonded fabrics; classification of knitting processes – weft knit & warp knit; yarn quality requirements for knitting; preparation of staple yarns for weft and warp knitting

UNIT II  FUNDAMENTALS OF KNITTING  9
General definitions and principles of knitting; types of knitting needles – Bearded, Latch & Compound needle; elements of knitted loop structure

UNIT III  WEFT KNITTING  13
Basic weft knitted structures and their production - plain, rib, interlock and purl; fundamentals of formation of knit, tuck and float stitches; factors affecting the formation of loop; effect of loop length and shape on fabric properties; analysis of various types of weft knitted structures; weft knitted fabric geometry; basic principles and elements of flat knitting machines; different types of flat knitting machines- manual, mechanical and computer controlled; production of various weft knitted structures using flat knitting machines;

UNIT IV  WEFT KNITTING MACHINE  9
Construction, characteristics and working of circular knitting machines used for the production of basic structures; production of derivatives of weft knitted structures; needle control in circular knitting machines; quality control in knitted fabric production; production calculation; safety measures to be taken at knitting industry; process control in weft knitting

UNIT V  WARP KNITTING  9
Basic principles; elements of warp knitted loop – open loop, closed loop; warp knitting elements chain link, chain links for simple patterns, guide bar movement mechanism; Tricot and Rachel warp knitting machines; principles of double needle bar patterning, terry pile fabric production; let off system; run in value based on the lapping diagram; take up system; theoretical concepts of warp knitted loop configuration; uses of warp knitted fabrics in technical applications.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the student will be able to
CO1: Classify the knitting process and understand the yarn requirements for knitting process
CO2: Explain the types of knitting needle and elements of knitting
CO3: Discuss the weft knit structures
CO4: Explain the working of weft knitting machines and its types
CO5: Discuss the principle, elements and types of warp knitting machines

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 pre-treatment processes and the machineries involved in the wet processing and dyeing of textiles fabrics.

UNIT I PREPARATORY PROCESS 9
Pretreatments-process Sequence; singeing and desizing of natural and synthetic fibres and its blends; heat setting; Scouring, bleaching and mercerization of cotton, bio-scouring of cotton; carbonization, scouring and bleaching of wool; degumming and bleaching of silk

UNIT II PROCESSING MACHINERIES 9
Loose stock machine; hank and package processing machines; singeing machines; stretching devices; shearing and raising machines; kiers; mangles; jigger; winch; jet and soft flow machines J – Box ; yarn mercerizer, chain and chainless mercerizes; washing ranges, hydro extractors; detwisters; dryers; stenters

UNIT III THEORY OF DYEING 9
Dyeing equilibrium; dye-fibre interaction; adsorption isotherm; dye affinity; heat of dyeing; half dyeing time. Basic characteristics of dyes and pigments; classification of dyes and principle of application of dyes.

UNIT IV DYEING 9
Technology of application of direct, reactive, vat, disperse, acid and basic dyes.

UNIT V COLOUR SCIENCE 9
Theories of colour measurement, Beer–Lambert’s law and Kubelka-Munk theory and their application in colour assessment and colour matching; whiteness and yellowness indices.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course the student will be able to
CO1: Demonstrate the scouring and bleaching of textile fabrics
CO2: Describe the functions of chemical processing machineries
CO3: Explain the theory, classification and application of dyes
CO4: Explain application of dye for various fibres
CO5: Explain the theory and measurement of color

TEXT BOOKS

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<td>Explain the theory, classification and application of dyes</td>
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<td>CO4</td>
<td>Explain application of dye for various fibres</td>
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<td>Explain the theory and measurement of color</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 construction and classification woven fabrics.
- Understand the concept of design elements and features of basic weaves.
- Construct the different kinds of basic weave structures.
- Develop toweling, fancy weaves and color and weave effect.

UNIT 1  INTRODUCTION TO TEXTILE DESIGNING
Classification of textile fabrics; classification of woven fabrics - simple, compound and complex; fundamental aspects of woven fabrics-count of graph paper, Methods of representing design on graph paper; Principle of Design, draft, denting, lifting & tie-up plans. Types of draft - straight draft, skipped draft, pointed draft, herring bone draft, mixed draft etc. Plain weave - ornamentation of plain weaves; study of derivative structures of plain weave – regular and irregular warp rib, weft rib, hopsack and basket weaves. Catch-cord technique; design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves

UNIT II  TWILL WEAVES AND ITS DERIVATIVES
Study of twill weaves up to 12 threads; classification of twills - warp faced twill, weft faced twill and equal faced twill, Left hand twill and Right hand twill; angle of inclination of twill diagonals- Steep twill and Flat twill; influence of the twist direction of yarn over prominence of twill lines; study of derivatives of twill weaves - wavy twill, herringbone, transposed twill, broken twill, elongated twill, combined twill, figured twill– Drafts, lifting plan & tie up, treadling plan for the above designs

UNIT III  DIAMOND AND SATIN WEAVES
Diamond weave, twill dice check, diaper; regular and irregular sateen and satin up to 12 threads, satin dice check weaves; design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves. Difference between diamond and diaper, satin and sateen.

UNIT IV  TOWELLING WEAVES
Study of honey comb weaves– ordinary honey comb, stitched honey comb and Brighton's honey comb designs- cell formation; study of Huck-a-Back weave- Construction of Standard Huck- a - Back (10 X 10), Devon's Huck– a– Back ; mock-leno and corkscrew weaves. Design, draft, and peg/tie-up plan and thread interlacing diagram of above weaves

UNIT V  FANCY AND COLOUR AND WEAVE EFFECTS
Crepe weaves – construction upon sateen base, by combination of floating weaves with plain thread, by reversing and by insertion of one weave over another. Combination of weaves – twill and plain, mock-leno and plain, honey comb and plain, stripe and check effect by these combinations; Introduction to colour and weave effects- continuous line effect, hounds tooth patterns, bird’s eye and spot effects, hairline stripes, step patterns and all over effects. Distorted thread effects – salient feature, warp and weft distortion.

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Identify and construct plain weave and its derivatives.
CO2: Create different twill weaves structures and its derivatives.
CO3: Draw the designs of Diamond and satin weaves.
CO4: Develop woven fabric designs suitable for towels.
CO5: Create fabric designs using different color and weave effects.
TEXT BOOKS:

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

UNIT I  ENVIRONMENT AND BIODIVERSITY


UNIT II  ENVIRONMENTAL POLLUTION


UNIT III  RENEWABLE SOURCES OF ENERGY.

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

UNIT IV  SUSTAINABILITY AND MANAGEMENT

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

UNIT V  SUSTAINABILITY PRACTICES


TOTAL: 30 PERIODS

OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.

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

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

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

**REFERENCE BOOKS:**

**CO-PO & PSO MAPPING**

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- 1-low, 2-medium, 3-high, ‘-’- no correlation
PERSONALITY DEVELOPMENT
PD 3  Group Discussion: Change your mindset, Time Management, Social Skills  6
PD 5  Public Speaking  3

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

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

ENVIRONMENTAL AWARENESS & CONSERVATION
EA 1  Environmental Awareness and Conservation  3

GENERAL AWARENESS
GA 1  General Knowledge  4

ARMEDED FORCES
AF 1  Armed Forces, Army, CAPF, Police  6

ADVENTURE
AD 1  Introduction to Adventure Activities  1

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

TOTAL: 45 PERIODS
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**BORDER & COASTAL AREAS**

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**TOTAL: 45 PERIODS**

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**TT3461 FABRIC MANUFACTURE LABORATORY**

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**OBJECTIVE:**
To train the students on different mechanisms of plain loom

**LIST OF EXPERIMENTS**

1. Determination of depth of shed and heald shaft movements in tappet shedding mechanism
2. Preparation of pattern card for dobby shedding mechanism and way in which adjust the depth of shed
3. Study of dobby shedding mechanism
4. Study of jacquard shedding mechanism
5. Study of picking mechanisms in looms
6. Determination of sley eccentricity in shuttle loom
7. Study of let-off mechanisms
8. Determination of pick space through 5 and 7 wheel take-up mechanisms
9. Study of weft replenishment mechanism in shuttle looms
10. Method of achieving the required colour patterns in 4 X 1 drop box motion
11. Study of warp stop, weft stop and warp protector mechanisms
12. Understanding of the loom requirements from the given sample

**OUTCOMES:**
Upon completion of this course, the students would have practical knowledge on

CO1: Shedding and picking mechanism
CO2: Beat up, Let- off, take – up mechanisms and warp and weft stop motions
CO3: Colour patterning in weaving machine

**TOTAL: 45 PERIODS**
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<tr>
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<th>Statement</th>
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<td>Beat up, Let-off, take-up mechanisms and warp and weft stop motions</td>
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<td>Color patterning in weaving machine</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 analyse different fabrics for structure and constructional details

LIST OF EXPERIMENTS
- Analysis of weave and construction details (Design, Draft, lifting plan, thread density, warp, weft count, crimp, GSM) of fabrics with:
  1. Plain weave
  2. Rib/mat weaves
  3. Twill/wavy twill weaves
  4. Herringbone/diamond/diaper
  5. Sateen and satin weaves
  6. Crepe weaves
  7. Honeycomb, huck-a-back and mock-leno weaves
  8. Double cloth
  9. Terry weaves
  10. Bedford cord weaves
  11. Determination of weave plan for manufacturing 100 meter of different woven fabrics
  12. Analysis of structure and construction details of single jersey and double jersey knit fabrics

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to:
- CO1: Draw the structure of woven fabrics with different weaves and structure of knitted fabrics.
- CO2: Extract the weave from the given sample and draw the weave, draft and peg-plan for reproduction.
- CO3: Develop the weave plan for production of woven fabrics.
## Course Articulation Matrix:

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<td>Draw the structure of woven fabrics with different weaves and structure of knitted fabrics</td>
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<td>CO2</td>
<td>Extract the weave from the given sample and draw the weave, draft and peg-plan for re-production</td>
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<td>CO3</td>
<td>Develop the weave plan for production of woven fabrics</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
HT3512  INDUSTRIAL TRAINING / INTERNSHIP I*  L T P C  0 0 0 1

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: 02

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

TT3591  TESTING OF TEXTILE MATERIALS  L T P C  3 0 0 3

OBJECTIVES:
- To make the students understand the principle and method of working of equipment’s used for testing of textile materials

UNIT I  SAMPLING AND FIBRE TESTING  9

UNIT II  YARN TESTING  9
Yarn testing - yarn numbering, twist in single and ply yarns, single yarn strength, lea strength, yarn mass evenness, yarn hairiness; yarn friction– static and dynamic; standards and norms

UNIT III  TESTING OF FABRIC MECHANICAL PROPERTIES -  9
Fabric testing - tensile, tear, bursting strength, ballistic impact, Low stress mechanical properties - Kawabata Evaluation System; FAST; standards and norms

UNIT IV  TESTING OF SERVICEABILITY OF FABRIC  9
Test procedure - abrasion resistance, pilling resistance, stiffness, drape ability, crease recovery, wrinkle recovery, air permeability; skew and bowness standards and norms

UNIT V  FABRIC INSPECTION AND GARMENT QUALITY  9
Fabric defects – inspection and grading, acceptable quality level; quality assessment of garments - cutting, sewing, pressing, finishing and packaging defects; standards
OUTCOMES:
Upon completion of this course, the student will be able to
CO1: Explain the importance and test procedure for various fibres and its properties
CO2: Discuss the testing of various yarn properties
CO3: Describe various test procedure for fabric mechanical and aesthetic related properties
CO4: Explain the test procedure for determining low stress mechanical properties of fabric
CO5: Discuss the fabric inspection and quality assessments of garment

TEXTBOOKS

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OBJECTIVES:
- To enable the students to understand the concept of multi-layer fabrics and their production.
- To enable the students to construct weave, draft, peg plan for the production of compound and complex structures.
- To enable the students to design preparation for complex fabrics.
- To enable the students to furnish the data required for reproduction of simple and compound figured fabrics

UNIT I    CORDED AND RIB STRUCTURES
Bedford cord weaves – salient features, plain faced Bedford cord (regular and alternate pick principle), twill faced bed ford cord, wadded bed ford cord, and crepon Bedford cords. Welt & Pique structures – salient features and manufacturing techniques, ordinary structure, wadded structure (loose back and fast back); Difference between welts and piques, Difference between Bedford cord and welt. Design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves.

UNIT II    DOUBLE LAYER CLOTH AND ITS TYPES
Double cloth – classification, Step by step construction of self-stitched double cloth, reversible and non-reversible varieties using twill, sateen and satin; Centre stitched double cloth; double width plain cloth, plain Tubular cloth. Thread interchanging double cloth warp thread interchanging double cloth,weft thread interchanging double cloth, Cloth interchanging double cloth using plain and twill weaves; Stripes and check effects using cloth interchanging principle; wadded double cloth – warp wadding and weft wadding. Design, draft, denting, peg/tie-up plan and thread interlacing diagram of above weaves.

UNIT III   TREBLE CLOTH AND BACKED CLOTH
Treble width plain cloth – interlacement diagram and its graphical representation; Treble cloth using twill, satin, and sateen. Backed cloths- warp & weft backed cloths-warp wadded and weft wadded backed cloth-Reversible and non-reversible using twill, sateen and satin - Imitation backed cloth, imitation warp and weft backed cloths. Design, draft, denting, peg/tie-up and thread interlacing diagram of above weaves.

UNIT IV    COMPOUND WEAVE STRUCTURE- PILE WEAVE
Pile fabrics – Salient features, classification of pile fabrics- loop pile and cut pile; warp pile and weft pile. Terry piles – salient features, terry mechanism; classification of terry pile structures – 3 pick, 4 pick, 5 pick and 6 pick terry, graphical representation and thread interlacement diagram. Basic principles and weaves of warp pile fabrics produced with the aid of wires and face to face weaving. Construction of Weft pile designs - Construct Plain back, Twill back pile designs, Corded velveteen- design, draft, denting, peg plan, tie-up and thread interlacing diagram of above weaves.

UNIT V     INTRODUCTION TO COMPLEX WEAVES AND TRADITIONAL HANLOOM FABRICS

TOTAL: 75 PERIODS (45L + 30P)

LIST OF EXPERIMENTS:
1. Design development on graph paper and card punching procedures for reproduction of figured single cloth
2. Design development on graph paper and card punching procedures for reproduction of figured double cloth with 2 colour effect
3. Design development on graph paper and card punching procedures for reproduction of figured double cloth with 4 colour effect
4. Design development on graph paper and card punching procedures for reproduction of figured extra warp fabric
5. Design development on graph paper and card punching procedures for reproduction of figured extra weft fabric
6. Design development on graph paper and card and punching procedures for reproduction of figured terry structures.

OUTCOMES:
Upon the completion of this course the student will be able to
CO1 Sketch corded and rib structures using basic weaves
CO2 Create double cloth structures using different methods
CO3 Construct treble cloth and backed cloth structures
CO4 Select different weaves to produce compound fabric structures
CO5 Develop the designs for complex fabric structures
CO6 Draw designs for different varieties of figured and compound fabrics with colour combination for its reproduction

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS
1. Lab Desks - 15 Nos.
2. Card punching machines - 4 Nos.
4. Handloom with Jacquard - 5 Nos.

TEXT BOOKS:

REFERENCE BOOK:
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<td>CO2</td>
<td>Create double cloth structures using different methods</td>
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<td>CO3</td>
<td>Construct treble cloth and backed cloth structures</td>
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<td>CO4</td>
<td>Select different weaves to produce compound fabric structures</td>
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<td>CO5</td>
<td>Develop the designs for complex fabric structures</td>
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<td>CO6</td>
<td>Draw designs for different varieties of figured and compound fabrics with colour combination for its reproduction</td>
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
OBJECTIVE:
- To make the students practically learn various fibre, yarn and fabric evaluation procedures to determine characteristics of fibres, yarn and fabric

LIST OF EXPERIMENTS
Determination of
1. Fibre fineness, length and maturity
2. Fibre trash content, Bundle fibre strength
3. Sliver/roving/ yarn linear density
4. Single yarn strength and Yarn Lea strength
5. Yarn single and ply yarn twist
6. Unevenness of yarn and assessment of yarn appearance
7. Fabric tensile strength,
8. Fabric tear and bursting strength
9. Fabric flexural rigidity, bending modulus and crease recovery
10. Drapeability, skew and bowness of fabric
11. Fabric abrasion and pilling resistance
12. Fabric air permeability
13. Fabric weight, thickness and dimensional stability
14. Seam strength and seam slippage

OUTCOMES:
Upon the completion of this course the student will be able to
CO 1: Measure important characteristics of fibre and yarn
CO2: Determine the important characteristics of fabrics
CO3: Measure the seam strength and slippage of garment

TOTAL: 45 PERIODS
## Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>PO1</th>
<th>PO 2</th>
<th>PO 3</th>
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<th>PO1 2</th>
<th>PSO 1</th>
<th>PSO 2</th>
<th>PSO3</th>
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<td>Measure important characteristics of fibre and yarn</td>
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<tr>
<td>CO2</td>
<td>Determine the important characteristics of fabrics</td>
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<tr>
<td>CO3</td>
<td>Measure the seam strength and slippage of garment</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 Train the Students in different kinds of designing software and the CATD system.

LIST OF EXPERIMENTS:
1. Creation of design using paint shop pro.
2. Creation of design using Adobe Photoshop.
3. Creation of design using Corel draw.
4. Creation of design using Digibunai software.
5. Conversion of vector image into Raster image.
6. Creation of dobby designs using CATD software.
7. Creation of Jacquard designs using CATD software.
8. Creation of printing designs using CATD software.
9. Extraction of design from the given cloth sample using CATD software.
10. Extraction of design from the given paper painted design sample using CATD software.

OUTCOMES:
Upon completion of this course, the student will be able to
CO1: Recognise the application of computer in the field of textile designing
CO2: Creation of designs for various textile fabrics using paint shop pro, Adobe Photoshop and Corel draw
CO3: Creation of designs for various textile fabrics using CATD softwares.
## Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Recognise the application of computer in the field of textile designing</td>
<td>PO1</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td>CO2</td>
<td>Creation of designs for various textile fabrics using paint shop pro, Adobe Photoshop and Corel draw</td>
<td>PO1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>Creation of designs for various textile fabrics using CATD software.</td>
<td>PO1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
<td></td>
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</tr>
</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 to understand the color science, finishing, theory of dyeing and printing of woven fabrics, knitted fabrics and garments

UNIT I METHODS OF PRINTING

Hand, screen, roller, rotary, inkjet, digital and transfer printing; features and limitations of different methods of printing; constituents of printing paste; printing with direct, reactive, acid, basic and disperse dyes.

UNIT II STYLES OF PRINTING

Printing with pigments; styles of Printing: Direct, Discharge and Resist Styles; After Treatment: Steamers, Agers, Curing process.

UNIT III FINISHING

Introduction and classification of finishing; Calendering, Sanforising, compacting, Coating and lamination; wool and garment finishing.

UNIT IV FUNCTIONAL FINISHES

Water and oil repellent finishes; crease proofing; flame retardant finish; antibacterial finish; soil release finishes, UV resistant finishes; bio-polishing; assessment of finishes; safety measures to be taken at the textile chemical processing industry.

UNIT V TEXTILE EFFLUENT TREATMENT

Analysis of Textile Effluents: BOD, COD, TDS, PPM, SS and pH; Effluent treatment process - Primary, secondary and tertiary treatment; zero discharge treatments and standards.

OUTCOMES:

Upon completion of the course the student will be able to

CO1: Understand various methods of printing for different textile fibre material
CO2: Distinguish various styles of printing.
CO3: Classify various finishing of textile fabrics with detailed application techniques.
CO4: Apply various functional finishes to the textile fabrics.
CO5: Review the effluents of textiles and their treatments.

TEXT BOOKS


REFERENCES

2. Yin-Ling Lam, Chi-Wai Kan & Chun-Wah Marcus Yuen, " Developments in functional
finishing of cotton fibres – wrinkle-resistant, flame retardant and antimicrobial treatments”, Textile Progress, Vol. 44, Nos. 3-4, Septembr-December 2012, 175–249
### Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
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<tr>
<td>CO1</td>
<td>Understand various methods of printing for different textile fibre material</td>
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<tr>
<td>CO2</td>
<td>Distinguish various styles of printing</td>
<td>PO1  3  2  2  2  2  -  3  -  -  -  -  1  3  1  2</td>
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<tr>
<td>CO3</td>
<td>Classify various finishing of textile fabrics with detailed application techniques</td>
<td>PO1  3  2  2  2  2  -  3  -  -  -  -  1  3  1  2</td>
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<tr>
<td>CO4</td>
<td>Apply various functional finishes to the textile fabrics</td>
<td>PO1  3  2  2  2  2  -  3  -  -  -  -  1  3  1  2</td>
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<td>CO5</td>
<td>Review the effluents of textiles and their treatments</td>
<td>PO1  3  2  2  2  2  -  3  -  -  -  -  1  3  1  2</td>
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<td>PO1  3  2  2  2  2  -  3  -  -  -  -  1  3  1  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.
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–LAID 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

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>
<th>Statement</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>Explain the chemical and thermal bonding methods to produce nonwovens and their end uses</td>
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<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.
### PERSONALITY DEVELOPMENT
- **PD 3** Group Discussion: Team Work
- **PD 4** Career Counselling, SSB Procedure & Interview Skills
- **PD 5** Public Speaking

### BORDER & COASTAL AREAS
- **BCA 2** Security Setup and Border/Coastal management in the area
- **BCA 3** Security Challenges & Role of cadets in Border management

### ARMED FORCES
- **AF 2** Modes of Entry to Army, CAPF, Police

### COMMUNICATION
- **C 1** Introduction to Communication & Latest Trends

### INFANTRY
- **INF 1** Organisation of Infantry Battalion & its weapons

### MILITARY HISTORY
- **MH 1** Biographies of Renowned Generals
- **MH 2** War Heroes - PVC Awardees
- **MH 3** Study of Battles - Indo Pak War 1965, 1971 & Kargil
- **MH 4** War Movies

**TOTAL: 45 PERIODS**

### NAVAL ORIENTATION
- **NO 3** Modes of Entry - IN, ICG, Merchant Navy
- **AF 2** Naval Expeditions & Campaigns

### NAVAL COMMUNICATION
- **NC 1** Introduction to Naval Communications
- **NC 2** Semaphore

### NAVIGATION
- **N 1** Navigation of Ship - Basic Requirements
- **N 2** Chart Work

### SEAMANSHIP
- **MH 1** Introduction to Anchor Work
- **MH 2** Rigging Capsule
- **MH 3** Boatwork - Parts of Boat

**TOTAL: 45 PERIODS**
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Lectures</th>
<th>Tutorials</th>
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**TOTAL : 45 PERIODS**

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**NCC Credit Course Level 3**

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

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<td>Public Speaking</td>
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<td>Aircraft Controls</td>
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</tbody>
</table>

**TOTAL : 45 PERIODS**
OBJECTIVE:
- To enable the student to gain knowledge in quantitative analysis, pre-treatment, dyeing and printing of textile materials.

LIST OF EXPERIMENTS:
1. Desizing of cotton fabrics
2. Scouring of cotton yarn / fabric
3. Peroxide bleaching of cotton yarn /fabric
4. Dyeing of cotton yarn using reactive dyes (cold / hot brands)
5. Dyeing of cotton yarn using Vat dyes
6. Degumming and bleaching of silk yarn
7. Dyeing of silk yarn with acid dyes / Reactive dyes
8. Dyeing of polyester yarn using Disperse dye
9. Printing of cotton fabrics with Pigments by Direct style using Blocks / screens
10. Printing of polyester fabrics with Disperse dyes by Direct style using Blocks / Screens
11. Determination of wash and rubbing fastness of dyed yarn/fabrics
12. Printing of cotton fabric by resist style (Batik printing , tie and dye) using Reactive cold brand / colldyeing Vat dyes
13. Determination of whiteness and yellowness index using computer color matching

TOTAL: 45 PERIODS

OUTCOME:
Upon the completion of this course the student will be able to,
- CO1: Desize, scour and bleach cotton yarn / fabric
- CO2: Dye different yarn / fabric with different types of colorants and determine the different fastness
- CO 3: Print different fabric with different types of colorants by different styles
## Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
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<th>PO12</th>
<th>PSO1</th>
<th>PSO2</th>
<th>PSO3</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Desize, scour and bleach cotton yarn / fabric</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>CO2</td>
<td>Dye different yarns / fabrics with different types of colorants and determine the different fastness</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>1</td>
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<td>1</td>
<td>1</td>
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<td>3</td>
<td>1</td>
</tr>
<tr>
<td>CO3</td>
<td>Print different fabrics with different types of colorants by different styles</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>-</td>
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<tr>
<td>Overall CO</td>
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</tr>
</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 test and analyse the given product that include identification of fibre, yarn, sourcing of raw materials and accessories, fabric specifications, method of production of same and costing

LIST OF EXPERIMENTS
Reverse engineering of textile products with an emphasis on testing protocols – Two each for a student

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Identify the 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: Costing of product
### Course Articulation Matrix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>PO1</th>
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<th>PS O1</th>
<th>PS O2</th>
<th>PS O3</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Identify the materials used in the product</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>CO2</td>
<td>Carry out confirmative tests to identify specifications of materials used</td>
<td>3</td>
<td>3</td>
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<td>3</td>
<td>2</td>
<td>1</td>
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<td>3</td>
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</tr>
<tr>
<td>CO3</td>
<td>Suggest the production process required to make the product</td>
<td>3</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>CO4</td>
<td>Costing of product</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
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</tr>
</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
- 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: 02

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

SEMINAR VII

SEMINAR VII

TT3751  APPAREL AND HOME FURNISHINGS MANUFACTURE

OBJECTIVES:
- To enable the students to understand the basics of pattern making, cutting, sewing, pressing, inspection of garment and home furnishing items.

UNIT I  INTRODUCTION
Introduction and functional divisions of an apparel industry; Anthropometry, Technical specification sheet for basic styles, pattern making – principles, basic pattern set drafting, grading; Marker planning - requirements and marker planning efficiency.

UNIT II  CUTTING, SEAMS AND STITCHES
Spreading-types of Spreading, manual, semi automatic and fully automatic machines; Cutting-requirements, Hand shears, straight knife, band knife, die, laser, plasma, water jet and ultra sonic cutting machines; computer controlled cutting machines. Different types of seams and stitches- properties; Needle – functions, special needles, needlepoint, Sewing thread-construction, material, thread size, packages.

UNIT III  SEWING MACHINES
Sewing machine- fundamental and Classification. Parts, functions and threading diagram of Single needle lock stitch machine, over lock machines and Flat lock machines. Introduction to Special purpose sewing machines - Feed off Arm, button hole sewing, button sewing, bar tack and blind stitch machines.

UNIT IV  PRESSING AND ACCESSORIES
Steaming and pressing- garment pressing - categories and equipment, packing; Trims - Brand, size and care label; Accessories - linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners and buttons.
UNIT V  TEXTILE FURNISHING
TOTAL: 75 PERIODS (45L + 30P)

LIST OF EXPERIMENTS:
1. Construction of seams for various applications.
2. Construction of stitches for various applications.
3. Study of button hole making and button stitching machines.
4. Drafting and construction of basic T-shirt.
5. Drafting and construction of basic skirt.
6. Drafting and construction of baby frock.

OUTCOME:
Upon completion of the course, the students will be able to
CO1: Explain pattern making, grading and marker planning
CO2: Demonstrate the spreading and cutting process, and classify the stitches and seams for various applications
CO3: Discuss the functions of various sewing machines
CO4: Elaborate on garment pressing, packing, trims and accessories
CO5: Explain various types of furnishing materials and applications
CO6: Select the appropriate seams and stitches for various end uses.
CO7: Construct basic T shirt, basic skirt and baby frock

TEXTBOOKS

REFERENCES
## Course Articulation Matrix:

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<tr>
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<tbody>
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<td></td>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>CO1</td>
<td>Explain pattern making, grading, marker planning, spreading and cutting</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>Demonstrate the spreading and cutting process, and classify the stitches and seams for various applications</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>Discuss the functions of various sewing machines</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>Elaborate on garment pressing, packing, trims and accessories</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze the various types of furnishing materials and applications</td>
<td>3</td>
</tr>
<tr>
<td>CO6</td>
<td>Select the appropriate seams and stitches for various end uses.</td>
<td>3</td>
</tr>
<tr>
<td>CO7</td>
<td>Construct basic T shirt, basic skirt and baby frock</td>
<td>3</td>
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<tr>
<td>Overall CO</td>
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<td>3</td>
</tr>
</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 understand
• Basics of financial management which are required for the textile industry
• Determination of cost of yarn, fabric and garment

UNIT I  INTRODUCTION TO COSTING  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 II  COST ACCOUNTING FOR TEXTILE INDUSTRY  9
Costing of yarn, fabrics and Garments; tax structure

UNIT III  INVESTMENT ANALYSIS AND DEPRECIATION ACCOUNTING  9
Techniques of investment analysis – payback period method, accounting rate of return, Discounted Cash Flow methods - IRR, NPV, PI; Depreciation – method of computing depreciation

UNIT IV  CAPITAL MANAGEMENT AND BUDGETING  9
Capital structure; sources and cost of capital; working capital management; Budget, types of budgets, budgeting and control in textile industry

UNIT V  FINANCIAL STATEMENT ANALYSIS  9
Tools for financial analysis and control- profit and loss account, balance sheet; financial ratio analysis - illustrations from textile industry

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course the students will be able to
CO1: Explain the types and methods of costing, and preparation of cost sheet
CO2: Determine the cost of yarn, fabrics and garments
CO3: Carryout investment appraisal and calculate depreciation
CO4: Describe the different sources and cost of capital, and preparation of budget
CO5: Analyze and interpret the financial statements of textile company

TEXTBOOKS

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<tr>
<td>CO1</td>
<td>Explain the types and methods of costing, and preparation of cost sheet</td>
<td>PO1 2 3 4 5 6 7 8 9 PO1 2 PO1 2 PSO 1 PSO 2 PSO 3</td>
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<tr>
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<td></td>
<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
<tr>
<td>CO2</td>
<td>Determine the cost of yarn, fabrics and garments</td>
<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
<tr>
<td>CO3</td>
<td>Carry out investment appraisal and calculate depreciation</td>
<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
<tr>
<td>CO4</td>
<td>Describe the different sources and cost of capital, and preparation of</td>
<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
<tr>
<td></td>
<td>budget</td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>Analyze and interpret the financial statements of textile company</td>
<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
<tr>
<td>Overall CO</td>
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<td>3 3 1 2 2 - - - 2 2 1 3 2 1</td>
</tr>
</tbody>
</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
COURSE DESCRIPTION
This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

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

UNIT I  DEMOCRATIC VALUES  6
Reading Text: Excerpts from John Stuart Mills’ On Liberty

UNIT II  SECULAR VALUES  6
Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani

UNIT III  SCIENTIFIC VALUES  6
Reading Text: Excerpt from The Scientific Temper by Antony Michaelis R

UNIT IV  SOCIAL ETHICS  6
Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.
Reading Text: Excerpt from 21 Lessons for the 21st Century by Yuval Noah Harari

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

TOTAL: 30 PERIODS

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

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

Spinning and Weaving

CTT343  PROCESS AND QUALITY CONTROL IN SPINNING  L  T  P  C
3  0  0  3

OBJECTIVES:
To make the students understand
- Quality aspects of raw materials
- Process control measures in spinning
- Productivity limits of spinning machinery

UNIT I  RAW MATERIAL SELECTION AND CONTROL  9

UNIT II  CONTROL OF WASTE, NEPS AND FIBRE RUPTURE  9
Yarn realization – Factors influencing the yarn realization. Control of waste in blow room, card comber and ring frame - Influence of machine and process parameters on waste removal. Assessment of intensity of opening and cleaning. Control of Nep generation and fibre rupture in blow room. Improving the nep removal in carding and combing machines.

UNIT III  YARN QUALITY ANALYSIS AND CONTROL  9

UNIT IV  PROCESS CONTROL IN SPINNING OF SYNTHETIC FIBRES AND BLENDS  9

UNIT V  PRODUCTIVITY ANALYSIS  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will know,
CO1: Selection of raw material with optimum quality for spinning industry
CO2: Improving of yarn realization by minimization of process waste and setting optimal process parameters.
CO3: Control of Count, strength, hairiness, evenness and imperfections and analysis of quality charts
CO 4: Measures to be taken while processing manmade fibres and blends
CO 5: Method of computation of productivity indices and improve yarn productivity by proper machine balancing and maintaining parameters

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TEXT BOOKS:

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<tbody>
<tr>
<td>CO1</td>
<td>Selection of raw material with optimize quality for spinning industry</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3</td>
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<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    2</td>
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<tr>
<td>CO2</td>
<td>Improving of yarn realization by minimizing of process waste and setting optimal process parameters.</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3</td>
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<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    2</td>
</tr>
<tr>
<td>CO3</td>
<td>Control of Count, strength, hairiness, evenness and imperfections and analysis of quality charts</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3</td>
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<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    2</td>
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<tr>
<td>CO4</td>
<td>Measures to be taken while processing manmade fibres and blends</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3</td>
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<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    2</td>
</tr>
<tr>
<td>CO5</td>
<td>Method of computation of productivity indices and improve yarn productivity by proper machine balancing and maintaining parameters</td>
<td>PO1  PO2  PO3  PO4  PO5  PO6  PO7  PO8  PO9  PO10  PO11  PSO1  PSO2  PSO3</td>
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<td></td>
<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    2</td>
</tr>
<tr>
<td><strong>Overall CO</strong></td>
<td></td>
<td>3    3    3    3    2    1    1    1    -    -    -    2    3    2    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.
OBJECTIVES:
To make the students understand:
- Process control measures in weaving preparatory to meet the required yarn quality
- Factors influencing loom production efficiency

UNIT I  PROCESS CONTROL IN WINDING, PIRN WINDING

UNIT II  PROCESS CONTROL IN WARping

UNIT III  PROCESS CONTROL IN SIZING

UNIT IV  DRAWING-IN AND WARP TYEING
Quality of Weaver's beam. Control of Cross - Extra - Missing and Buried Ends. Selection and Care of Reeds - Healds and Drop Pins - process parameters of drawing in and Tyeing machines.

UNIT V  PROCESS AND QUALITY CONTROL IN LOOM SHED

OUTCOMES:
Upon completion of the course students will be able to,
CO1: Control productivity and quality in winding
CO2: Discuss the process control in warping
CO3: Explain the quality and process control in sizing
CO4: Control the quality in drawing-in and tyeing
CO5: Improve loom efficiency and cloth realization

TEXT BOOKS:

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<td>CO1</td>
<td>Control productivity and quality in winding</td>
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</tr>
<tr>
<td>CO2</td>
<td>Discuss the process control in warping</td>
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</tr>
<tr>
<td>CO3</td>
<td>Explain the quality and process control in sizing</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>Control the quality in drawing in and tying</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>Improve loom efficiency and cloth realization</td>
<td>3</td>
</tr>
<tr>
<td>Overall CO</td>
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<td>3</td>
</tr>
</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 understand the theory of drafting and twisting involved in spinning system.

UNIT I  IDEAL DRAFTING
Ideal drafting – definition, model, conditions required in roller drafting system; deviations from ideal drafting and actual drafting conditions; drafting wave – definition, causes, estimation, conditions to avoid formation, role of apron in controlling drafting wave formation, limitations of apron system

UNIT II  ROLLER SLIP AND ROLLER NIP MOVEMENT
Roller slip – definition, conditions for the formation of forward and backward slips in the roller drafting systems, measures to avoid roller slip occurrence; causes for roller nip movement and roller speed variation, control measures

UNIT III  ROLLER VS. WIRE POINT DRAFTING
Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine; comparison of roller drafting in draw frame, comber preparatory, comber, speed frame, ring frame, and condensed yarn spinning.

UNIT IV  FALSE TWISTING, TWISTING IN RING FRAME
Principle of false twisting; fundamental requirements to create real twist in the strand; principle of twist insertion in ring spinning; limitations of ring twisting; mechanics of balloon formed during twisting; principle of two-for-one twisting

UNIT V  TWISTING IN ALTERNATIVE SPINNING SYSTEMS
Principle of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; principle of twist formation in air-jet and air-vortex spinning; principle of twist insertion in core spinning, cover spinning and self-twist spinning.

OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Describe the concept of Ideal drafting and real drafting
CO2: Explain the phenomenon of roller slip and roller nip movement
CO3: Describe the principle of wire point drafting and its comparison with roller drafting and applications
CO4: Elucidate the fundamentals of false twisting and real twisting; twisting in ring spinning
CO5: Describe the theory of twist formation in rotor spinning, air jet and air vortex spinning systems

TEXTBOOKS:

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<tr>
<td>CO1</td>
<td>Describe the concept of Ideal drafting and real drafting</td>
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<tr>
<td>CO2</td>
<td>Explain the phenomenon of roller slip and roller nip movement</td>
<td>3</td>
<td>3</td>
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<tr>
<td>CO3</td>
<td>Describe the principle of wire point drafting and its comparison with roller drafting and applications</td>
<td>3</td>
<td>3</td>
<td>3</td>
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<tr>
<td>CO4</td>
<td>Elucidate the fundamentals of false twisting and real twisting; twisting in ring spinning</td>
<td>3</td>
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<tr>
<td>CO5</td>
<td>Describe the theory of twist formation in rotor spinning, air jet and air vortex spinning systems</td>
<td>3</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:
- Understand the requirements and production of sewing threads for different applications.
- Understand types of fancy and metallic yarns.
- Carry out tests to ensure the quality of sewing threads.

UNIT I  SEWING THREAD PROPERTIES  13
Sewing threads – property requirements for different applications; ticket numbering; characterization of sewing threads - stress–strain behaviour of sewing threads; thermal, friction behaviour of sewing threads; sewability of the thread; seam efficiency index

UNIT II  TYPES OF SEWING THREADS  13
Types of sewing thread – spun threads, core spun threads, filament threads; production, properties and applications

UNIT III  FANCY AND METALLIC YARN PRODUCTION  5
Yarn folding, fancy yarns – types and production; metallic yarns

UNIT IV  HIGH PERFORMANCE SEWING THREADS  9
Characteristics and application of high performance sewing threads - aramid threads, ceramic threads, polypropylene threads, polyethylene threads, polytetra fluoroethylene threads, fiberglass threads, other sewing threads – tencel, acrylic, linen, elastic, soluble; embroidery threads

UNIT V  TESTING OF SEWING THREADS  5
Physical testing of sewing threads, sewing defects – assessment and Control

OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Describe the characteristics of sewing thread
CO2: Explain the production of sewing thread
CO3: Discuss the manufacturing of ply and fancy yarns
CO4: Explain the characteristics of high performance sewing threads
CO5: Describe the testing and quality assurance of sewing threads

TEXTBOOKS

REFERENCES
### Course Articulation Matrix

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<th>Course Outcomes</th>
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<td>CO1</td>
<td>Describe the characteristics of sewing thread</td>
<td>PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 PSO1 PSO2 PSO3</td>
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<tr>
<td>CO2</td>
<td>Explain the production of sewing thread</td>
<td>3 3 1 1 1 - - - - - - 1 3 1 2</td>
</tr>
<tr>
<td>CO3</td>
<td>Discuss the manufacturing of ply and fancy yarns</td>
<td>3 3 1 1 1 - - - - - - 1 3 1 2</td>
</tr>
<tr>
<td>CO4</td>
<td>Explain the characteristics of high performance sewing threads</td>
<td>3 3 1 1 1 - - - - - - 1 3 1 2</td>
</tr>
<tr>
<td>CO5</td>
<td>Describe the testing and quality assurance of sewing threads</td>
<td>3 3 1 1 1 - - - - - - 1 3 1 2</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 make the students learn about the structure of ideal and real yarn, migration of fibres in the yarn, mechanics of blended yarns.
- To impart the knowledge about breakage mechanism of various yarns, relationship between structure and property of staple fibre yarns and continuous filaments.
- To make the students to learn and understand the geometry of woven, knitted and nonwoven fabrics, and structure influence on the mechanical properties of woven fabric.

UNIT I  YARN GEOMETRY  13
Idealized helical yarn structure; yarn count and twist factors, twist contraction and retraction; relationship between yarn parameters; Idealized packing; packing of fibers in yarns; measurement of packing density and radial packing density of yarn; measurement of yarn diameter; ideal migration, tracer fiber technique, characterization of migration behavior, migration in blended yarns, mechanisms of migration, effect of various parameters on migration behavior, effect of migration on yarn properties.

UNIT II  MECHANICS OF CONTINUOUS FILAMENT YARNS  9
Analysis of tensile behavior - filament strain and yarn strain, different models; influence of yarn parameters; prediction of breakage; analysis of yarn mechanics by energy method; observed extension and breakage of continuous filament yarns.

UNIT III  MECHANICS OF STAPLE FIBRE YARNS  5
Theoretical analysis; fiber obliquity and slippage; influence of fiber length, strength, fineness and friction; strength prediction model for blended yarns - Hamburger's model.

UNIT IV  WOVEN FABRIC GEOMETRY AND DEFORMATION  13
Elements of woven fabric geometry; Pierce and Olofsson models - form factor; jamming of threads, cover factor; crimp interchange, degree of set; mechanics of extension behavior of woven fabric; mechanics of other fabric deformations - shear, buckling, bending and compression; Effect of yarn structure on woven fabric properties.

UNIT V  KNITTED AND NONWOVEN STRUCTURES  5
Geometry of plain knitted structure, influence of friction on knit geometry; load extension of knitted fabrics; Geometry of Nonwoven structure, mechanical behaviour of needle felt.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course the student will be able to
CO1: Discuss the packing of fibres and yarn structure
CO2: Analyse the continuous filament properties
CO3: Explain the staple fibre yarn's tensile properties
CO4: Demonstrate the models proposed for geometry of woven fabrics and characteristics of fabric on deformation
CO5: Explain the structural characteristics of knitted and nonwovens

TEXT BOOKS:
REFERENCES:


Course Articulation Matrix:

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<td>Discuss the packing of fibres and yarn structure</td>
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<td>Analyse the continuous filament properties.</td>
<td>3 3 2 2 2 1 1 - - - - 1 3 1 2</td>
</tr>
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<td>CO3</td>
<td>Explain the staple fibre yarn’s tensile properties</td>
<td>3 3 2 2 2 1 1 - - - - 1 3 1 2</td>
</tr>
<tr>
<td>CO4</td>
<td>Demonstrate the models proposed for geometry of woven fabrics and characteristics of fabric on deformation</td>
<td>3 3 2 2 2 1 1 - - - - 1 3 1 2</td>
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<tr>
<td>CO5</td>
<td>Explain the structural characteristics of knitted and nonwovens</td>
<td>3 3 2 2 2 1 1 - - - - 1 3 1 2</td>
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVE:
To provide knowledge on
- Classification and types of textile auxiliaries.
- Importance and basic functions of auxiliaries.
- Chemistry of textile auxiliaries

UNIT I INTRODUCTION TO AUXILLARIES AND SURFACTANTS 9
Auxiliaries: Importance and functions; Surfactants: Mode of action and classification of surfactants – cationic, anionic, nonionic surfactants.

UNIT II AUXILLARIES IN PREPARATORY PROCESS 9
Auxiliaries associated with de-sizing, scouring, bleaching of cellulosic fibres, protein fibres and synthetic fibres.

UNIT III AUXILLARIES IN DYEING PROCESS 9
Auxiliaries associated with Dyeing with Direct Dyes, Reactive, Vat, Azoic colors, Sulphur dyes, Acid dyes, Metal complex dyes, Basic and Disperse dyes.

UNIT IV AUXILLARIES IN PRINTING PROCESS 9
Auxiliaries associated with printing: Direct Style of Printing, Discharge style of Printing, Resist style of printing.

UNIT V AUXILLARIES IN FINISHING PROCESS 9
Auxiliaries used in Resin Finishing, Softening, Crease recovery, Water repellent, Water Proof, Flame retardant, Soil release.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to understand
CO1: Role of auxiliaries in modification of surface tension
CO2: Role of auxiliaries in preparatory Process
CO3: Role of auxiliaries in dyeing of textiles
CO4: Role of auxiliaries in printing Process
CO5: Role of auxiliaries in finishing

TEXT BOOKS:

REFERENCES:
5. W D Schindler P J Hauser., "Chemical Finishing of Textiles", Woodhead publishing Ltd,
8. N N Mahapatra., “Textile dyeing”, Woodhead publishing India, 2018
### Course Articulation Matrix:

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<td>Role of auxiliaries in preparatory Process</td>
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<td>Role of auxiliaries in dyeing of textiles</td>
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<td>CO4</td>
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<td>Role of auxiliaries in finishing</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 learn the machines and mechanisms of machines used for garment production

UNIT I  FABRIC INSPECTION, SPREADING AND CUTTING MACHINES  9

Fabric inspection machinery; spreading machines – manual, semi-automatic and fully automatic machines; mechanism of straight knife, rotary, band knife, die, laser, plasma, water jet and ultrasonic cutting machines; notches, drills and thread markers; computer interfaced cutting machines; safety measures

UNIT II  SEWING MACHINES I  9

Lock stitch and chain stitch sewing machine – types, threading, driving arrangement, function of elements, stitch formation, timing, settings and feed mechanism; selection of machine and process parameters for different applications; safety measures

UNIT III  SEWING MACHINES II  9

Needles-geometry and types, selection; button fixing and button holing machine – mechanism and features

UNIT IV  SEWING MACHINES III  9

Overlock, flat lock, feed-off the arm, zig-zag and embroidery machines– driving arrangement, function of elements, stitch formation, timing, settings and feed mechanism; safety measures

UNIT V  FINISHING MACHINES  9

Pressing machineries – buck pressing, iron pressing, block or die pressing, form pressing, steamers; folding and packing machines; safety measures

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students would understand

CO1 - Fundamental principle and working of spreading and cutting machines
CO2 - Stitch formation and other mechanisms of SNLS machine and chain stitch machine
CO3 - Principle of button fixing and button holing machines and types of needles and geometry
CO4 - Stitch formation and other mechanisms of overlock, flatlock and other special sewing machines
CO5 - Different types of finishing machines used for garments

TEXTBOOKS


REFERENCES

Course Articulation Matrix:

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<td>Fundamental principle and working of machines used for spreading and cutting</td>
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<tr>
<td>CO2</td>
<td>Stitch formation and other mechanisms of SNLS machine and chain stitch machine</td>
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<tr>
<td>CO3</td>
<td>Principle of button fixing and button holing machines</td>
<td>2</td>
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<tr>
<td>CO4</td>
<td>Stitch formation and other mechanisms of overlock, flatlock and other special sewing machines</td>
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<td>Different types of finishing machines used for 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 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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<tr>
<th>Course Outcomes</th>
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<th>Program Outcome</th>
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<td>CO1</td>
<td>Understand the basics of industrial engineering</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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<tr>
<td>CO2</td>
<td>Gain knowledge on method study and its techniques</td>
<td>2    2    3    3    3    2    2    2    2    1    -    -    3    2    3</td>
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<tr>
<td>CO3</td>
<td>Acquire knowledge on work measurement</td>
<td>2    2    3    3    3    2    2    2    2    1    -    -    3    2    3</td>
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<td>CO4</td>
<td>Understand the concepts of layout and line balancing</td>
<td>2    2    3    3    3    2    2    2    2    1    -    -    3    2    3</td>
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<td>CO5</td>
<td>Interpret the result using statistical process control</td>
<td>2    3    3    3    3    1    1    1    1    1    -    -    3    2    3</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 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, Cowls, 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 related concepts and important body measurements
CO2: Prepare patterns for basic blocks using drafting and draping techniques
CO3: Develop knowledge on the techniques involved in 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:

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<tr>
<td>CO1 Understand Anthropometry related concepts and important body measurements</td>
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<tr>
<td>CO2 Prepare patterns for basic blocks using drafting and draping techniques</td>
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<td>CO3 Develop knowledge on the techniques involved in grading and in pattern alteration</td>
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<tr>
<td>CO4 Apply dart manipulation techniques to design, variation in garment components</td>
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<tr>
<td>CO5 Prepare patterns for basic collar and sleeve components</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
FT3691  APPAREL MARKETING AND MERCHANDISING  L T P C  3 0 0 3

COURSE OBJECTIVES

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

UNIT I  FASHION INDUSTRY OVERVIEW  9
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  9
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  9
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  9
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  9
Government policies, guidelines 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: Understanding the international apparel business and role of Asian countries in the apparel and fashion trade
CO2: Applying the concepts of marketing in the apparel industry
CO3: Understand the concepts of merchandising and new product development
CO4: Understand the apparel product dynamics in a market and relating it along the value chain.
CO5: Acquire knowledge in Export documentation and policies
<table>
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<th>PSO 2</th>
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<td>Understanding the international apparel business and role of Asian countries in the apparel and fashion trade</td>
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<td>Applying the concepts of marketing in the apparel industry</td>
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<td>Understand the concepts of merchandising and new product development</td>
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<td>Understand the apparel product dynamics in a market and relating it along the value chain</td>
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<td>Acquire knowledge in Export documentation and policies</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, construct different garment components.

LIST OF EXPERIMENTS
1. Sewing practice of stitch classes.
2. Sewing practice of seam types
3. Sewing of different types of plackets
4. Sewing of different types of pockets
5. Sewing of different types of sleeves
6. Sewing of different types of collars and cuff
7. Sewing of different types of neckline finishes.
8. Sewing of different types of pleats, tucks and gathers
9. Construct a men’s shirt
10. Construct a men’s trousers
11. Construct a women’s skirt

OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Make different seams and stitches
CO2: Make different cut component and parts of basic garment
CO3: Carryout sewing of cut component assembly in to basic garment

TOTAL: 90 PERIODS
Course Articulation Matrix:

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<td>Make different seams and stitches</td>
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<td>Make different cut component and parts of basic garment</td>
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<td>Carryout sewing of cut component assembly in to basic garment</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 get practical experience in understanding sewing machine components and to practically carryout pattern making

LIST OF EXPERIMENTS
1. Identification of single needle lockstitch machine (SNLS) components and understanding their functions.
2. Needle fixing and threading in single needle, double needle, over-lock, flat lock and feed-off the-arm machine.
3. Practice for pedal and knee lifter operations and winding the bobbin thread.
4. Sewing exercise on paper in SNLS - Exercise 1 - Parallel line - Exercise 2 - Square - Exercise 3 - Curves - Exercise 4 - Concentric curves
5. Stitching exercise on fabric panels in SNLS - Exercise 1 - Parallel line - Exercise 2 - Square - Exercise 3 - Curves - Exercise 4 - Concentric curves
6. Prepare samples in SNLS machine by varying the stitch length and thread tension.
7. Measuring the Dress Form – Male, female and child and formulating the measurement charts
8. Drafting the basic blocks of male
9. Drafting the basic blocks of female
10. Grading of basic block.
11. Drafting of men’s shirt
12. Drafting of men’s trousers.

TOTAL: 90 PERIODS

OUTCOMES:
Upon completion of this practical course, the student shall be able to
CO1. Identify the machine components and understand the basic settings in single needle machine
CO2. Identify the machine components and understand the basic settings in flatlock and feed off arm machine
CO3. Sew on line markings in paper using single needle lockstitch machine
CO4. Sew on fabric panels in single needle lockstitch machine
CO5. Draft the basic block and grade the same
### Course Articulation Matrix:

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<td>Identify the machine components and understand the basic settings in single needle machine</td>
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<td>CO2</td>
<td>Identify the machine components and understand the basic settings in flatlock and feed off arm machine</td>
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<td>Sew on line markings in paper using single needle lockstitch machine</td>
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<tr>
<td>CO4</td>
<td>Sew on fabric panels in single needle lockstitch machine</td>
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<tr>
<td>CO5</td>
<td>Draft the basic block and grade the same</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 learn about
- Various operations research (OR) methods that can be applied in the textile 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 Textile 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 problems.

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

UNIT IV
Replacement analysis; inventory control – ABC, VED analysis, EOQ – application in textile 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

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to
CO1: Design Operations Research problems from the cases arising in the Textile 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
REFERENCES
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<td>CO1</td>
<td>Design Operations Research problems from the cases arising in the Textile Industry and determine solution for linear programming problems</td>
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<td>CO2</td>
<td>Construct and solve transportation problems</td>
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<tr>
<td>CO3</td>
<td>Construct and solve assignment problems and understand decision making under different conditions.</td>
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<tr>
<td>CO4</td>
<td>Carryout replacement analysis and inventory control</td>
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<tr>
<td>CO5</td>
<td>Construct and solve project scheduling by PERT and CPM techniques and resource leveling</td>
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<td>Overall CO</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 provide an insight on the fundamentals of supply chain networks, tools and techniques.
- To train the students to new and recent developments in supply chains, e-business and information technology

UNIT I

Basic principles of supply chain management and logistics, supply chain models, supply chain for volatile market; supply chain drivers and metrics in apparel industries; roll of supply chain in the textile and apparel industries’ financial stability.

UNIT II

Planning supply and demand in apparel production house, managing economies of scale, supply cycle and inventory levels; managing uncertainty in supply chain, safety pricing and inventory; make vs buy decision, make vs hire decision; geographical identification of suppliers, supplier evaluation, supplier selection, contract negotiations and finalization.

UNIT III

Distribution network and design for global textile and apparel products, models of distribution – facility location and allocation of capacity, uncertainty on design and network optimization; the role of transportation in supply chain, modes of transportation, characteristics of transportation, transport design options for global textile and apparel network, trade-off in transport design, risk management in transportation, transport decision in practice for textile and apparel industries.

UNIT IV

Coordination in supply chain- the bullwhip effect, forecasting, obstacles to coordination in supply chain; supply chain management for apparel retail stores, high fashion fad; supply chain in e-business and b2b practices.

UNIT V

Import - export management, documentation, insurance, packing and foreign exchange; methods of payments – domestic, international, commercial terms; dispute handling modes and channels; supply chain and Information system; customer relationship management

OUTCOMES:

Upon completion of this course, the student shall have the

CO1 Knowledge on the basic frame work of supply chain management
CO2 Understanding the economics of supply and demand cycle
CO3 Knowledge on its functions in the industry
CO4 Understanding on coordination of supply chain management
CO5 Understanding supply chain management with apparel export and import

TOTAL: 45 PERIODS

TEXT BOOKS:

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<td>Knowledge of the framework and</td>
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<td>Knowledge on scope of supply chain networks and</td>
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<td>CO3</td>
<td>Knowledge on its functions in the industry</td>
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<td>CO4</td>
<td>Capacity to develop clear, concise and organized approach to operations management</td>
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<tr>
<td>CO5</td>
<td>Basic knowledge on the shipment procedure</td>
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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 understand about the Enterprise Resource Planning software and its modules

List of experiments
Practice on data entry, report generation in Enterprise Resource Planning software
1. Costing, order booking, MRP, purchase, production planning, production orders, inventory control, packing, shipping, scheduling, sample preparation and approval, business reports
2. ERP in apparel production – time study, cutting, production tracking, cut panel process, garment quality control, order completion, machine repairs and maintenance, reports
3. ERP in retail management – style template, finished goods barcoding, stock taking, stock inward, retail order booking, stock allocation, scan and pack, dispatch, invoice, point of sale, reports

TOTAL: 90 PERIODS

OUTCOME:
Upon the completion of this course the students shall be able to
CO1: Understand the structure of ERP software
CO2: Data entry in ERP software
CO3: Creating records and managing information at different section of apparel industry for decision making
### Course Articulation Matrix:

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<td>CO1</td>
<td>Understand the structure of ERP software</td>
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<tr>
<td>CO2</td>
<td>Data entry in ERP software</td>
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<tr>
<td>CO3</td>
<td>Creating records and managing information at different section of apparel industry for decision making</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 learn apparel costing, budgeting and working capital management

UNIT I
Cost accounting, elements of cost, classification of cost elements – examples from apparel industry; standard costing, analysis of variance; breakeven analysis, cost volume profit analysis

UNIT II
Costing of fabrics; costing of apparel – woven, knits of various styles, accounting of prime costs and overhead costs, allocation of overheads, cost control; cost sheet preparation

UNIT III
Working capital management in garment unit – determination, sources, cost; Budget, types of budgets, budgeting and control in apparel industry

UNIT IV
Detailed project report – elements, preparation for a garment unit

TOTAL : 45 PERIODS

OUTCOMES:
At the end of this course, the students will able to
CO1.explain the cost accounting and cost elements
CO2.estimate cost elements involved in fabric and apparel costing
CO3.demonstrate the working capital management
CO4.develop detailed project report preparation

TEXT BOOKS:

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<td>estimate cost elements involved in fabric and apparel costing</td>
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<td>demonstrate the working capital management</td>
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<tr>
<td>CO4</td>
<td>develop detailed project report preparation</td>
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</table>

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
CTT355 MANAGEMENT OF TEXTILE EFFLUENTS

OBJECTIVES
- To enable the students to understand the concepts of effluent treatment methods for textile industry and their management

UNIT I CHARACTERISATION OF EFFLUENTS
Characteristics of textile effluents — colour, pH, hardness TSS, TDS, COD, BOD, alkalinity, estimation of metal ions.

UNIT II PRELIMINARY TREATMENT
Effluent treatment flow chart; preliminary treatment — screening, shredding, grit removal. primary treatment — equalization, coagulation, flocculation, sedimentation.

UNIT III SECONDARY TREATMENT AND TERTIARY TREATMENT
Secondary treatment — activated sludge process; tertiary treatment - adsorption, membrane technology, radiation (uv, gamma, electron beam), electrochemical, chemical (h_2O_2, chlorine, Fenton’s reagent), thermal, corona discharge. Marine discharge of effluent.

UNIT IV RECYCLE AND REUSE
Recycling and reuse of waste water; reject management-importance, brine reject source; thermal evaporation — mechanical vacuum recompression evaporator, multiple effect evaporators; crystallizer; sludge management.

UNIT V EFFLUENT TREATMENT IN TEXTILE INDUSTRY
Generation of textile effluents; characteristics and norms of textile effluents; zero liquid discharge (zld) in chemical processing industry, zero discharge of hazardous chemicals (zdhc); effluent treatment plants in processing units.

OUTCOMES
Upon completion of this course the student shall be able to explain
- CO1: Characterization of effluents
- CO2: Different methods primary treatment of effluent
- CO3: Secondary and tertiary treatment of effluent
- CO4: Importance of recycling and reuse
- CO5: treatment of effluents from textile industry

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES
## Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcome</th>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.
OBJECTIVES:
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, woven fabrics; international market for cotton, silk, jute, wool and other fibres; 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, ECGC, Indian council of arbitration, FEMA; impact of foreign trade on Indian economy

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

TOTAL: 45 PERIODS

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

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 enable the students, understand the characteristics of textile materials and their selection for different applications viz., transport, sports, medical, protective and geo applications.

UNIT I AUTOMOTIVE AND INDUSTRIAL TEXTILES
Introduction-Classification and major applications of technical textiles and market potential; Design and characteristics required in textiles for automotive applications - tyres, airbags, seat belts and interiors; Textiles used for conveyor belts, power transfer belts in industry; Applications of textile reinforced composites in automatives.

UNIT II HYGIENE TEXTILE
Design and characteristics required in textiles for hygiene applications- surgical gowns and other coveralls, masks and respirators, gloves, hospital bedspreads, wipes – application of antimicrobial treatment; application of nanotechnology.

UNIT III PROTECTIVE AND SPORTS TEXTILE
Material requirements and garment design in protection from hazards due to mechanical, extreme climate, nuclear, biological, chemical and flame; textiles in sportswear.

UNIT IV GEO TEXTILES
Use of geo textiles - infiltration, drainage, separation and reinforcement application in construction; type of fibre and fabric to be used in such applications; evaluation of geo textiles; use of textile materials in permanent and temporary civil construction - tents, awnings, sound and thermal insulation.

UNIT V FILTRATION AND OTHERS
Filtration-mechanism of filtration, dust collection, solid-liquid separation, liquid – liquid filtration, liquid-gas separation. Fabric construction and general consideration for filtration; Quality requirement of materials used in fishing industry like nets, ropes; sound and thermal insulation; textile abrasives

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

CO1: Discuss the application of textiles and composites in automotive and industrial textiles
CO2: Explain the uses of textiles in hygiene applications
CO3: Selection of textile material and design of protective clothing and sports wear
CO4: Identify the textile materials and property requirements for geo textiles application
CO5: Review the functional requirements and properties of textile for filtration application.

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

UNIT I MATERIALS AND MANUFACTURING METHOD 13
Metals, ceramics, polymers used for bio medical applications – manufacture, features and limitations; super absorbent polymers, cell- biomaterial interaction

UNIT II NON-IMPLANTABLE TEXTILES 9
Non-implantable materials: wound dressing- requirements of wound dressing, types, properties and applications; bandages - types, evaluation and applications application of nanotechnology

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

UNIT IV HEALTHCARE TEXTILE 9
Healthcare and hygiene products: surgical gowns, masks, respirators, wipes, napkins, antibacterial, anti odour textiles application of nanotechnology

UNIT V QUALITY EVALUATION 5
Standards; safety, legal and ethical issues involved in conducting trials with medical textile materials; disposal of medical textile products

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student will be able to,
CO1: Explain different types of materials used for biomedical applications
CO2: Elaborate functional requirements, types and evaluation of wound dressings and bandages
CO3: Discuss the functional requirements and characterization of vascular grafts, sutures and scaffolds for tissue engineering applications
CO4: Explain the textile material used for hygiene and health care applications
CO5: Describe the Standards for testing, safety and ethical issues related to medical textiles

TEXTBOOKS

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 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; bedroom furnishings- types, fabric selection and design concepts; advances in the production of different types of bed linen, bed sheets, blankets, blanket covers, comforters, 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 repellant 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

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:

Course Articulation Matrix:

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<td>Evaluation of home textile products</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, understand the concept and construction of smart fabrics, intelligent textiles and interactive garments

UNIT I
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 textiles and clothing, thermally sensitive materials, cross – linked polymers of fibre substrates 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
Adaptive and responsive textile structures, bio-processing for smart textiles and clothing, tailor made intelligent polymers for biomedical application

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

UNIT IV
Smart interactive garments for combat training, hospital and patient care; smart garments in sports and fitness activities; smart garments for children; smart home textiles

OUTCOMES:
Upon completion of this course, the student will be able to,
CO1: Discuss the requirement of polymers and their properties used in smart textiles
CO2: Explain the polymers and textiles for biomedical applications
CO3: Explain the smart materials, fabrics and different electronic sensors
CO4: Describe the application of smart textiles

TEXTBOOKS

REFERENCES
**Course Articulation Matrix:**

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<th>Course Outcomes</th>
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<td>Discuss the requirement of polymers and their properties used in smart textiles</td>
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<td>CO2</td>
<td>Explain the polymers and textiles for biomedical applications</td>
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<tr>
<td>CO3</td>
<td>Explain the smart materials, fabrics and different electronic sensors</td>
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<tr>
<td>CO4</td>
<td>Describe the application of smart textiles</td>
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<td><strong>Overall CO</strong></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 enable the students, understand the selection of fibre, yarn, fabric and design of garments for different protective applications

UNIT I  FIBRES, YARNS AND FABRICS FOR PROTECTIVE FABRICS  13
Characteristic requirements of fibre, yarn and fabric for flame proof, heat resistant, ballistic resistance, electrical conduction, bacterial protection, radiation protection and radiation contamination protection

UNIT II  CHEMICAL FINISHES FOR PROTECTIVE FABRICS  5
Mechanism, chemistry, materials and methods - Flame retardant, Liquid repellent, Antistatic, Antibacterial, UV protection and mite protection finishes

UNIT III  PROTECTIVE FABRICS IN DIFFERENT APPLICATIONS  9
Protective fabrics used in the medical field and in hygiene; military combat clothing; protective fabrics against biological and chemical warfare; textiles for high visibility; antigravity suit

UNIT IV  PROTECTIVE GARMENT CONSTRUCTION  9
Garment construction - method of construction of garments according to various protective end uses; use of accessories for protective garment; ergonomics of protective clothing

UNIT V  EVALUATION OF PROTECTIVE TEXTILES  9
Standards and test method for protective fabric performance - flame retardant finishes, liquid repellent finishes, antistatic, liquid repellent, antibacterial, UV protection, mite protection; manikins-thermal manikins, segmented thermal manikins; evaporative resistance measurement-moisture permeability index, skin model; concept of dynamic manikins; permeation resistance test-index of penetration and index of repellency; liquid tight integrity and gas tight integrity

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student will be able to,
- CO1: Explain the functional requirement of fibres, yarns and fabrics for different protective applications
- CO2: Explain the mechanism, materials and method of application of chemical finishes for protective textiles
- CO3: Explain the protective fabrics used for different applications
- CO4: Elaborate the construction of protective garments
- CO5: Explain the evaluation of protective textiles

TEXTBOOKS

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<td>Explain the functional requirement of fibres, yarns and fabrics for different protective applications</td>
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<tr>
<td>CO2</td>
<td>Explain the mechanism, materials and method of application of chemical finishes for protective textiles</td>
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<td>CO3</td>
<td>Explain the protective fabrics used for different applications</td>
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<td>CO4</td>
<td>Elaborate the construction of protective garments</td>
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<td>CO5</td>
<td>Explain the evaluation of protective textiles</td>
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<td>Overall CO</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 enable the students to understand need for coating of textiles, different methods of coating of textile fabrics

UNIT I MATERIALS 9
Rubber-natural and synthetic, polyvinyl chloride, polyurethanes, acrylic polymers; adhesive treatment, radiation-cured coatings; materials and trends; textile fibres-spinning, woven fabrics, knitted fabrics, nonwoven fabrics

UNIT II PROPERTIES 9
Rheological behavior of fluids; rheology of plastisol's; hydrodynamic analysis of coating; clothing comfort, impermeable coating, breathable fabrics

UNIT III COATING METHODS 9
Coating features, methods of coating- knife coating, roll coating, dip coating, transfer coating, rotary screen printing, calendaring, hot-melt coating; general characteristics- tensile strength, elongation, adhesion, tear resistance, weathering behavior, microbiological degradation, yellowing

UNIT IV PRODUCTS 9
Synthetic leather, architectural textiles, fluid containers, tarpaulins, automotive air bag fabrics, carpet backing; textile foam laminates for automotive interiors; flocking fabrics for chemical protection; thermochromic fabrics, temperature adaptable fabrics, camouflage nets metal and conducting polymer, coated fabrics

UNIT V EVALUATION 9
Test methods for coated fabrics; environmental norms for the chemicals used in coating industry.

OUTCOMES:
Upon completion of this course, the student will be able to,
CO1: Explain the polymers and fabrics used for coating
CO2: Discuss the property requirements of coated textiles
CO3: Classify methods of coating of textiles
CO4: Elaborate the applications of coated fabrics
CO5: Evaluate of coated fabrics

TOTAL: 45 PERIODS

TEXTBOOKS

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<td>CO1</td>
<td>Explain the polymers, fibre spinning and fabrics used for coating</td>
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<td>Discuss the rheology of coated polymers</td>
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<td>Classify coating methods of textiles</td>
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<td>CO4</td>
<td>Elaborate the application of coated fabrics</td>
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<td>Evaluation of coated 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
OBJECTIVES:
To enable the students to learn about
- Molecular structure of the fibres.
- Characterization of fibres for physical and chemical properties.

UNIT I MOLECULAR WEIGHT 9
Polymer solution thermo dynamics; molecular weight and molecular dimensions by end group analysis, osmometry, light scattering, viscometry, gel permeation chromatography

UNIT II MOLECULAR STRUCTURE 9
Infrared, NMR, UV–visible Raman and mass spectroscopy

UNIT III THERMAL PROPERTIES 9
Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo gravimetry, thermo-mechanical analyzer, dynamic mechanical and dc-electric analysis

UNIT IV CHROMATOGRAPHIC TECHNIQUES 9
Chromatographic techniques – adsorption chromatography – TLC, GC, LC – HPLC, GPC – hyphenated techniques

UNIT V OTHER METHODS 9
Optical and electron microscopy; SEM, TEM, X-ray scattering from polymers, birefringence, crystallinity by density measurements

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student will be able to
CO1: Explain the molecular weight of the polymers and its measurement.
CO2: Explain the molecular structure of the polymers.
CO3: Explain the measurement and analysis of thermal properties of different polymers.
CO4: Describe the characterization of textile polymers using chromatographic techniques.
CO5: Explain the characterization of textile polymers for morphology and crystallinity.

TEXT BOOKS

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<td>Explain the molecular structure of the polymers.</td>
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<td>Explain the measurement and analysis of thermal properties of different polymers.</td>
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<td>Describe the characterization of textile polymers using chromatographic techniques.</td>
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<td>Explain the characterization of textile polymers for morphology and crystallinity.</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 learn about the
- Important characteristics of the fabric responsible for its comfort properties.
- Different phenomena which take place in the fabric related to the comfort properties of the fabric.

UNIT I INTRODUCTION TO CLOTHING COMFORT 9
Comfort – types and definition; human clothing system, comfort perception and preferences

UNIT II PSYCHOLOGY AND NEURO PHYSIOLOGICAL COMFORT 9
Psychological comfort; neuro-physiological comfort-basis of sensory perceptions; measurement techniques - mechanical stimuli and thermal stimuli

UNIT III THERMO PHYSIOLOGICAL COMFORT 9
Thermo physiological comfort – thermoregulatory mechanisms of the human body, role of clothing on thermal regulations

UNIT IV MOISTURE TRANSMISSION 9
Heat and moisture transfer – moisture exchange, wearer’s temperature regulations, effect of physical properties of fibres, behaviour of different types of fabrics

UNIT V FABRICS TACTILE AND MECHANICAL PROPERTIES 9
Fabric tactile and mechanical properties - fabric prickliness, itchiness, stiffness, softness, smoothness, roughness, and scratchiness; predictability of clothing comfort performance

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student will be able to
CO1: Explain the criteria for comfort of fabrics.
CO2: Discuss the psychological and physiological comfort with respect to clothing.
CO3: Describe the thermo physiological comfort of clothing.
CO4: Analyse the behaviour of different fabrics in relation to heat and moisture transfer.
CO5: Describe the properties of fabric with respect to comfort to the wearer.

TEXTBOOKS

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<td>Describe the thermo physiological comfort requirements of human and the role of clothing.</td>
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<td>CO4</td>
<td>Analyse the behaviour of different fabric in relation to heat and moisture transfer.</td>
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<td>Describe the low stress mechanical properties of fabric with respect to comfort to the wearer</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 enable the students to learn about
- Reinforcements, matrices used for the composites and techniques for making composites
- Manufacture and testing of composites and application of composites

UNIT I INTRODUCTION
Fibre reinforced polymers materials, properties; resins - thermoset and thermo plastics, additives release agents; composite material classification and its properties; reinforcement – matrix interface wettability

UNIT II PREPREGS AND PREFORMS
Introduction; manufacturing techniques, property requirements; textile preforms - weaving, knitting and braiding; geometrical aspects- fibre orientation, volume fraction, weight fraction and voids.

UNIT III TECHNIQUES FOR MANUFACTURE OF COMPOSITES
Introduction, manufacturing processes – open mould process, closed mould process and continuous process; metal matrix composites, ceramic matrix composites – types, importance and processing

UNIT IV MECHANICAL PROPERTIES OF TEXTILE COMPOSITES
Testing of reinforced plastics – tensile, flexural, impact, interlaminar shear and compression properties

UNIT V APPLICATION OF POLYMER COMPOSITES
Composites - application in aerospace, construction industry, and sports products; electrical, polymer composite for biomedical and vibration damping

OUTCOMES:
Upon completion of this course the student will be able to
CO1: Discuss the basics of composites.
CO2: Explain about the preforms, pre-pegs and their geometrical aspects.
CO3: Describe the different methods of composite making.
CO4: Explain the evaluation of characteristics of composites.
CO5: Select different types of composites for different applications.

TEXTBOOKS

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<td>Discuss the basics of composites.</td>
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<tr>
<td>CO2</td>
<td>Explain about the preforms, pre-peggs and their geometrical aspects.</td>
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<td>Describe the different methods of composite making.</td>
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<td>Explain the evaluation of characteristics of composites.</td>
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<td>CO5</td>
<td>Select different types of composites for different applications.</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 learn about
• Various high performance fibres which are used as technical textiles
• Production of high performance fibres

UNIT I  LINEAR POLYMER FIBRES  9
Aramid fibres - polymer preparation, spinning, structure and properties and applications; polyethylene fibres – manufacture, fibre characteristics, properties, yarn and fabric processing and applications

UNIT II  CARBON FIBRE  9
Manufacture of PAN-based, pitch-based carbon fibres - physical properties and applications

UNIT III  GLASS AND CERAMIC FIBRES  9
Glass fibres - fibre manufacture, properties; glass-fibre composites and other applications; manufacture of ceramic fibres, silicon carbide-based fibres, other non-oxide fibres, alumina-based fibres, other polycrystalline oxide fibres, single-crystal oxide fibres

UNIT IV  CHEMICAL AND THERMAL RESISTANCE FIBRES  12
Chlorinated fibres, fluorinated fibres, polyetherketones, polyphenylenesulphide, polyetherimide - properties and applications; thermo plastic and thermoset polymers, aromatic polyamides and polyaramids, semi carbon fibres, polybenzimidazole

UNIT V  SPECIALITY FIBRES  6
Specialty fibres - hollow and profile fibres; blended and bi-component fibres; super absorbent fibres

OUTCOMES:
Upon completion of this course, the student will be able to,
CO1: Explain the polymer preparation, properties and application
CO2: Elaborate the manufacturing, properties and application of Carbon fibres
CO3: Discuss the manufacturing, properties and application of glass and ceramic fibres
CO4: Explain the chemical and thermal resistance fibres
CO5: Discuss the application of hollow fibres, bi-component and super absorbent fibres

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES
# Course Articulation Matrix:

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<th>Course Outcomes</th>
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<td>CO1</td>
<td>Explain the polymer preparation, properties and application</td>
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<td>CO2</td>
<td>Elaborate the manufacturing, properties and application of Carbon fibres</td>
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<tr>
<td>CO3</td>
<td>Discuss the manufacturing, properties and application of glass and ceramic fibres</td>
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<tr>
<td>CO4</td>
<td>Explain the chemical and thermal resistance fibres</td>
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<tr>
<td>CO5</td>
<td>Discuss the application of hollow fibres, bi-component and super absorbent fibres</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
- learn about the functional and technical textiles testing.

UNIT I TESTING OF MEDICAL TEXTILES 9
Testing of characteristics - bandages, sutures, wound dressings, masks, respirators, coveralls; standards

UNIT II TESTING OF FIRE AND COLD PROTECTIVE TEXTILES 9
Testing of Transmission characteristics Moisture transmission (Vapour form and Liquid form) Thermal transmission, testing of extreme heat, fire and cold protective clothings; standards

UNIT III TESTING OF GEO AND AUTO MOTIVE TEXTILES 9
Testing of geotextiles materials-, testing of agro textile materials, testing of automotive textile materials; standards

UNIT IV TESTING OF COMPOSITES AND SPORTS WEARS 9
Testing of fibre reinforced composites, testing of electromagnetic shielding textiles, testing of active sports wears, testing of packaging materials; standards

UNIT V TESTING OF BALLISTIC AND UV PROTECTIVE TEXTILES 9
Testing of ballistic protective textiles, testing of UV protective textiles, testing of chemical protective textiles; standards

OUTCOMES:
Upon completion of the course the student will be able to explain testing of
CO1: medical textile materials
CO2: thermal transmission, extreme heat and cold protective textiles.
CO3: geotextiles, automove textiles and agro textiles.
CO4: reinforced composites, electromagnetic shielding textiles, sports and packing materials.
CO5: ballistic, UV, chemical protective textiles

TEXT BOOKS:

REFERENCES:
## Course Articulation Matrix:

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<td>medical textile materials</td>
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<td>CO2</td>
<td>Thermal transmission, extreme heat and cold protective textiles.</td>
<td>PO2 3 2 2 3 2 - 1 - - - - 1 3 1 2</td>
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<td>CO3</td>
<td>geotextiles, automove textiles and agro textiles.</td>
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<td>reinforced composites, electromagnetic shielding textiles, sports and packing materials.</td>
<td>PO4 3 2 2 3 2 - 1 - - - - 1 3 1 2</td>
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<td>ballistic, UV, chemical protective textiles</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 enable the students to learn the advances in the field of textile printing and finishing

UNIT I SUBLIMATION TRANSFER PRINTING 9
Mechanism of sublimation transfer printing; selection of the paper; Printing methods; dyes and inks; Transfer prints on both man-made fibres and natural fibres; Machineries

UNIT II INKJET PRINTING 9
Comparison with conventional printing techniques; Ink jet printing: Principles of ink jet printing technology: CIJ and DOD; pretreatment of substrates; inks used for printing; dye-fibre interaction; post treatment of substrate; importance of digital colour management in inkjet printing

UNIT III FUNCTIONAL FINISHES I 9
Wetting and wicking; surface energy — concept, measurement and relevance to repellency; water repellent, detergency and soil release concepts, soil release agents, mechanism of soil retention and soil release; application of water repellent, soil release finishes and its assessment.

UNIT IV FUNCTIONAL FINISHES II 9
Flame retardant mechanisms, flame retarding chemicals for textile materials and testing of flame retardant finishes; UV radiation: Factors affecting UV protection, UV protection finishes, Measurement of UV protection, Antistatic finishes-Mechanism, Agents applied and its assessment.

UNIT V FUNCTIONAL FINISHES III 9
Antimicrobial finishes- classification, chemistry and application of antimicrobial finishes, evaluation of antimicrobial finishes; Anti-odour and fragrance finishes, Mosquito repellent finish: application and assessment technique.

OUTCOMES
Upon completion of this course the student shall be able to understand
CO1: Sublimation transfer printing
CO2: Inkjet printing technology and its application
CO3: Water repellent and soil repellent finish
CO4: UV Protection, flame retardant and antistatic finishes
CO5: Antimicrobial, antiodour and mosquito repellent finish

TEXT BOOKS

REFERENCES
Course Articulation Matrix:

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<td>CO2</td>
<td>Inkjet printing technology and its application</td>
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<td>Water repellent and soil repellent finish</td>
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<td>CO4</td>
<td>UV Protection, flame retardant and antistatic finishes</td>
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<td>Antimicrobial, antidour and mosquito repellent finish</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:
- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS

UNIT II PLANNING

UNIT III ORGANISING

UNIT IV DIRECTING

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

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

TEXT BOOKS:
REFERENCES:

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GE3752  TOTAL QUALITY MANAGEMENT  L T P C
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COURSE OBJECTIVES:
- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I  INTRODUCTION  9
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II  TQM PRINCIPLES  9

UNIT III  TQM TOOLS & TECHNIQUES I  9

UNIT IV  TQM TOOLS & TECHNIQUES II  9
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.
UNIT V  QUALITY MANAGEMENT SYSTEM

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 andFMEA.
CO4: Ability to understand Taguchi’s Quality Loss Function, Performance Measures and applyQFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCES:

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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

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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

MAPPING OF COS AND POS:

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

UNIT I  INTRODUCTION TO HUMAN RESOURCE MANAGEMENT  9

UNIT II  HUMAN RESOURCE PLANNING  9

UNIT III  TRAINING AND EXECUTIVE DEVELOPMENT  9
Types of training and Executive development methods – purpose – benefits.

UNIT IV  EMPLOYEE COMPENSATION  9

UNIT V  PERFORMANCE EVALUATION AND CONTROL  9

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

| CO's  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 1  | 2  | 3  |
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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 9
Introduction: An Introduction to Knowledge Management - The foundations of knowledge management - including cultural issues - technology applications organizational concepts and processes - management aspects - and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

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

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

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

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Understand the process of acquiring knowledge from experts
CO2: Understand the learning organization.
CO3: Use the knowledge management tools.
CO4: Develop knowledge management Applications.
CO5: Design and develop enterprise applications.

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TEXT BOOK:

REFERENCE:

GE3792 INDUSTRIAL MANAGEMENT L T P C
3 0 0 3

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

UNIT – II FUNCTIONS OF MANAGEMENT - I 9
Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility –

UNIT – III FUNCTIONS OF MANAGEMENT - II 9
Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin)
– Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines;
Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics;
Nature; Process; Classifications.

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

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

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:
1 M. Govindarajan and S. Natarajan, “Principles of Management”, Prentice Hall of India,
New Delhi, 2009.

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MANDATORY COURSES I

MX3081 INTRODUCTION TO WOMEN AND GENDER STUDIES

COURSE OUTLINE

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

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

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

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

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

TOTAL : 45 PERIODS
OBJECTIVE:
- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. COURSE CONTENTS

Introduction to Elements of Literature

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

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

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

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


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

4. OTHER SESSION:

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

5.*ASSESSMENT:

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

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:

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

MX3083 FILM APPRECIATION L T P C
3 0 0 0

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

Theme - A: The Component of Films

214
A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making… structure of a film

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

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

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

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

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

MX3084 DISASTER RISK REDUCTION AND MANAGEMENT

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

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

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

UNIT III DISASTER MANAGEMENT 9
Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT 9

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

TOTAL : 45 PERIODS

TEXT BOOKS:
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 handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE 2+4

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


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

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

UNIT II DIET 4+6

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


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

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

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

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

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - 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
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
4. Simple lifestyle modifications to maintain health
   https://www.niddk.nih.gov/health-information/diet-nutrition/changes-habits-better-health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.
5. Read more: https://www.legit.ng/1163909-classes-food-examples-functions.html
9. BMI https://www.hsph.harvard.edu/nutritionsource/healthy-weight/
   https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations
10. Yoga https://www.healthifyme.com/blog/types-of-yoga/
    https://yogamedicine.com/guide-types-yoga-styles/
   Ayurveda : https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda
12. CAM : https://www.hindawi.com/journals/ecam/2013/376327/
13. Preventive herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSE OUTCOMES:
After completing the course, the students will be able to:
- Learn the importance of different components of health
- Gain confidence to lead a healthy life
- Learn new techniques to prevent lifestyle health disorders
- Understand the importance of diet and workouts in maintaining health
UNIT-I CONCEPTS AND PERSPECTIVES
Meaning of History
Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history
Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation versus evidence, concept of historical inevitability, Historical Positivism.
Science and Technology—Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

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

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

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

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

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

TOTAL : 45 PERIODS

MX3087 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY
Pre-Requirement: 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)
Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. (5 lectures)

(Refs: Adam smith, J S Mill)

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

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

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

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

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

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. (3 lectures)

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

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

Conclusion (2 lectures)

Total lectures: 39

Preferred Textbooks: See Reference Books

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

GRADING:

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**TOTAL**: 45 PERIODS

OUTCOME:

- The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.
OBJECTIVE:
The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

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

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

The idea of India.

1857 and the national awakening.

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

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

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

SUGGESTED READING:
OBJECTIVES

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

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

UNIT II  STANDARDS AND REGULATIONS

UNIT III  SAFETY ACTIVITIES

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

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

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

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<td>Obtain knowledge of Statutory Regulations and standards.</td>
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<td>CO3</td>
<td>Know about the safety Activities of the Working Place.</td>
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<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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OPEN ELECTIVE I AND II

OCS351 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING FUNDAMENTALS L T P C 2023

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

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

UNIT I INTRODUCTION TO INTERNET OF THINGS

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

UNIT III PROTOCOLS AND TECHNOLOGIES BEHIND IOT
UNIT IV  OPEN PLATFORMS AND PROGRAMMING  7

UNIT V  IOT APPLICATIONS  7
Business models for the internet of things, Smart city, Smart mobility and transport, Industrial IoT, Smart health, Environment monitoring and surveillance—Home Automation—Smart Agriculture

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  6
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  9

UNIT III  MACHINE LEARNING  5
The modeling process - Types of machine learning - Supervised learning - Unsupervised learning - Semi-supervised learning- Classification, regression - Clustering – Outliers and Outlier Analysis

UNIT IV  DATA VISUALIZATION  5

UNIT V  HANDLING LARGE DATA  5
Problems - techniques for handling large volumes of data - programming tips for dealing with large data sets- Case studies: Predicting malicious URLs, Building a recommender system - Tools and techniques needed - Research question - Data preparation - Model building – Presentation and automation.

PRACTICAL EXERCISES:  30 PERIODS

LAB EXERCISES
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.

TEXT BOOKS

REFERENCES

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

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

UNIT I  INTRODUCTION

UNIT II   VR MODELING

UNIT III VR PROGRAMMING 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
## CO’s – PO’s & PSO’s MAPPING

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## OPEN ELECTIVE III

### Course Description:

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

### Objectives:

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

### UNIT I


### UNIT II


### UNIT III


### UNIT IV

Writing – Pre-writing techniques – Mindmap - Describing pictures and facts - Paragraph structure – organising points – Rhetoric writing – Improving an answer – Drafting, writing and developing an argument – Focus on cohesion – Using cohesive devices –Analytic writing – Structure and types
of essay – Mind maps – Structure of drafts, letters, memos, emails – Statements of Purpose – Structure, Content and Style.

UNIT V

TOTAL: 45 PERIODS

Learning Outcomes:
At the end of the course, learners will be able

• expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
• identify errors with precision and write with clarity and coherence
• understand the importance of task fulfilment and the usage of task-appropriate vocabulary
• communicate effectively in group discussions, presentations and interviews
• write topic based essays with precision and accuracy

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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:
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.

TOTAL: 45 PERIODS

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

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
UNIT-I (9)
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 (9)
Regulatory Institutions – SEBI, TRAI, Competition Commission of India,

UNIT-III (9)
Lobbying Institutions: Chambers of Commerce and Industries, Trade Unions, Farmers Associations, etc.

UNIT- IV (9)
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 (9)
Dynamics of Civil Society: New Social Movements, Role of NGO’s, Understanding the political significance of Media and Popular Culture.

TOTAL 45 : PERIODS

REFERENCES:
4. Saima Saeed: Screening the Public Sphere: Media and Democracy in India,2013
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  9
Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT – II  SOLAR ENERGY  9

UNIT – III  WIND ENERGY  9

UNIT – IV  BIO-ENERGY  9

UNIT – V  OCEAN AND GEOTHERMAL ENERGY  9

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.

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

OME354 APPLIED DESIGN THINKING

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

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

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

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

UNIT I INTRODUCTION & GEOMETRIC FORM 9 Hours
UNIT II  MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION  9 Hours
Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength –
Hardness – Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally
Induced Failure Material Specification - Composition Determination - Microstructure Analysis -
Manufacturing Process Verification.

UNIT III  DATA PROCESSING  9 Hours
– Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of
Performance Evaluation – System Compatibility.

UNIT IV  3D SCANNING AND MODELLING  9 Hours
Introduction, working principle and operations of 3D scanners: Laser, White Light, Blue Light -
Applications- Software for scanning and modelling: Types- Applications- Preparation techniques
for Scanning objects- Scanning and Measuring strategies - Calibration of 3D Scanner- Step by
step procedure: 3D scanning - Geometric modelling – 3D inspection- Case studies.

UNIT V  INDUSTRIAL APPLICATIONS  9 Hours
Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry.
Case studies and Solving Industrial projects in Reverse Engineering. Legality: Patent – Copyrights

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:
2. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New
5. Vinesh Raj and Kiran Fernandes, “Reverse Engineering: An Industrial Perspective”, Springer-
COURSE OBJECTIVES:
- To be acquainted with sustainability in manufacturing and its evaluation.
- To provide knowledge in environment and social sustainability.
- To provide the student with the knowledge of strategy to achieve sustainability.
- To familiarize with trends in sustainable operations.
- To create awareness in current sustainable practices in manufacturing industry.

UNIT – I  ECONOMIC SUSTAINABILITY

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

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

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

UNIT – V  TRENDS IN SUSTAINABLE OPERATIONS

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.
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**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  9
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  9
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  9
Main components and working principles of a hybrid and electric vehicles, Different configurations of hybrid and electric vehicles. Power Split devices for Hybrid Vehicles - Operation modes - Control Strategies for Hybrid Vehicle - Economy of hybrid Vehicles - Case study on specification of electric and hybrid vehicles.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

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OAS352  SPACE ENGINEERING  L T P C
3 0 0 3

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

UNIT I  STANDARD ATMOSPHERE

History of aviation – standard atmosphere - pressure, temperature and density altitude.

UNIT II  AERODYNAMICS

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

UNIT III  PERFORMANCE AND PROPULSION

Viscous and pressure drag - flow separation - aerodynamic drag - thrust calculations -thrust/power available and thrust/power required.

UNIT IV  AIRCRAFT STABILITY AND STRUCTURAL THEORY


UNIT V  SPACE APPLICATIONS

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

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

TEXT BOOKS:

REFERENCE:
UNIT I  INTRODUCTION

UNIT II  FUNCTIONS OF MANAGEMENT

UNIT III  ORGANIZATIONAL BEHAVIOUR

UNIT IV  GROUPDYNAMICS

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

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

REFERENCES:

TOTAL: 45 PERIODS
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 the special control procedures for service and process-oriented industries.
- Analyzing and understanding the process capability study.
- Developing the acceptance sampling procedures for incoming raw material.

UNIT I INTRODUCTION

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

UNIT III SPECIAL CONTROL PROCEDURES
- Warning and modified control limits, control chart for individual measurements, multi-vari chart, X-chart with a linear trend, chart for moving averages and ranges, cumulative-sum and exponentially weighted moving average control charts.

UNIT IV STATISTICAL PROCESS CONTROL
- Process stability, process capability analysis using a Histogram or probability plots and control chart. Gauge capability studies, setting specification limits.

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

TOTAL: 45 PERIODS

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

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

### UNIT I INHERENT SAFETY CONCEPTS

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

### UNIT II PLANT LOCATIONS

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

### UNIT III WORKING CONDITIONS

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

### UNIT IV FIRE SEVERITY AND REPAIR TECHNIQUES

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

### UNIT V WORKING AT HEIGHTS

COURSE OUTCOMES

On completion of the course the student will be able to

CO1: Understand the effect of fire on materials used for construction

CO2: Understand the method of test for non-combustibility and fire resistance; and will be able to select different structural elements and their dimensions for a particular fire resistance rating of a building.

CO3: To understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.

CO4: To decide the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.

CO5: Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

TEXT BOOKS


REFERENCES:


CO’s- PO’s & PSO’s MAPPING

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OML351

INTRODUCTION TO NON-DESTRUCTIVE TESTING

COURSE OBJECTIVES:

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

- Understanding the basic importance of NDT in quality assurance.
- Imbuing the basic principles of various NDT techniques, its applications, limitations, codes and standards.
- Equipping themselves to locate a flaw in various materials, products.
- Applying the testing methods for inspecting materials in accordance with industry specifications and standards.
- Acquiring the knowledge on the selection of the suitable NDT technique for a given application.
UNIT I INTRODUCTION TO NDT & VISUAL TESTING 9
Concepts of Non-destructive testing-relative merits and limitations-NDT Versus mechanical testing, Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting.

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

UNIT III EDDY CURRENT TESTING & THERMOGRAPHY 9
Thermography- Principle, Contact & Non-Contact inspection methods, Active & Passive methods, Liquid Crystal – Concept, example, advantages & limitations. Electromagnetic spectrum, infrared thermography- approaches, IR detectors, Instrumentation and methods, applications.

UNIT IV ULTRASONIC TESTING & AET 9
Ultrasonic Testing: Types of ultrasonic waves, characteristics, attenuation, couplants, probes, EMAT. Inspection methods-pulse echo, transmission and phased array techniques, types of scanning and displays, angle beam inspection of welds, time of flight diffraction (TOFD) technique, Thickness determination by ultrasonic method, Study of A, B and C scan presentations, calibration.

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

TOTAL: 45 PERIODS

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

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OMR351 MECHATRONICS

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

UNIT – I INTRODUCTION AND SENSORS

UNIT – II 8085 MICROPROCESSOR

UNIT – III PROGRAMMABLE PERIPHERAL INTERFACE
UNIT – IV  PROGRAMMABLE LOGIC CONTROLLER  9
Introduction – Architecture – Input / Output Processing – Programming with Timers, Counters and Internal relays – Data Handling – Selection of PLC.

UNIT – V  ACTUATORS AND MECHATRONICS SYSTEM DESIGN  9

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.
CO 4: Apply PLC as a controller in mechatronics system.
CO 5: Design and develop the apt mechatronics system for an application.

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Average: 1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS

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

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

UNIT – IV  SENSORS IN ROBOTICS 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 9
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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TEXT BOOKS:

REFERENCES:

OAE352 FUNDAMENTALS OF AERONAUTICAL ENGINEERING 3 0 0 3

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

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

252
UNIT II        AIRCRAFT CONFIGURATIONS AND ITS CONTROLS  10
Different types of flight vehicles, classifications-Components of an airplane and their functions- Conventional control, powered control- Basic instruments for flying-Typical systems for control actuation.

UNIT III        BASICS OF AERODYNAMICS  9

UNIT IV        BASICS OF AIRCRAFT STRUCTURES  9

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

TOTAL : 45 PERIODS

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

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

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

UNIT I        REMOTE SENSING AND ELECTROMAGNETIC RADIATION  9
Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum –
Radiation principles - Wave theory, Planck's law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff’s law – Radiation sources: active & passive - Radiation Quantities

UNIT II  EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL  9

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

UNIT IV  SENSING TECHNIQUES  9

UNIT V  DATA PRODUCTS AND INTERPRETATION  9
Photographic and digital products – Types, levels and open source satellite data products — selection and procurement of data– Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification

TOTAL:45 PERIODS

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

TEXTBOOKS:

REFERENCES:

254
CO-PO MAPPING

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<tr>
<th>PO</th>
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OAI351 URBAN AGRICULTURE

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

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

UNIT II VERTICAL FARMING

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

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

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:

CO-PO MAPPING

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PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies. | 2 | 1 | 2 | 1 | 1 | 1

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

OEN351 DRINKING WATER SUPPLY AND TREATMENT

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

OEE352 ELECTRIC VEHICLE TECHNOLOGY

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

UNIT I ROTATING POWER CONVERTERS

UNIT II STATIC POWER CONVERTERS
Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.
UNIT III  CONTROL OF DC AND AC MOTOR DRIVES  9
Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper
based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and
braking) of induction motor drives, Transformation theory, vector control operation of Induction
motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives

UNIT IV  HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS  9
History of evolution of Electric Vehicles - Comparison of Electric Vehicles with Internal Combustion Engines - Architecture of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV) –
Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches,
Transmission and Brakes.

UNIT V  MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES  9
Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard
drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory
control - Selection of modes - power spilt mode - parallel mode - engine brake mode -
regeneration mode - series parallel mode

TOTAL: 45 PERIODS

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

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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

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 Petruzzula, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
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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OFT352 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
Food production and accessibility - subsistence foraging, horticulture, agriculture and pastoralization, origin of agriculture, earliest crops grown. Food as source of physical sustenance, food as religious and cultural symbols; importance of food in understanding human culture - variability, diversity, from basic ingredients to food preparation; impact of customs and traditions on food habits, heterogeneity within cultures (social groups) and specific social contexts - festive occasions, specific religious festivals, mourning etc. Kosher, Halal foods; foods for religious and other fasts.

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

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

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

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:

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

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

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

UNIT IV FOOD WASTES IN VARIOUS PROCESSES 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

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

UNIT IV  ENFORCEMENT AND PRACTICAL ASPECTS OF IPR


UNIT V  INTERNATIONAL BACKGROUND OF INTELLECTUAL PROPERTY


TOTAL:45 PERIODS

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

TEXT BOOKS:


REFERENCES:

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

| CO – PO MAPPING |
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| IPR FOR PHARMA INDUSTRY |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
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| C2  | 3   | 3   |     |     | 2   | 2   |     |     |     |     |     |
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**

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

UNIT I  INTRODUCTION

UNIT II  MOLECULAR SELF ASSEMBLY

UNIT III  BIO-INSPIRED MATERIALS

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

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

TOTAL: 45 PERIODS

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
CPE334 ENERGY CONSERVATION AND MANAGEMENT L T P C 3 0 0 3

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 9

TOTAL: 45 PERIODS

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

REFERENCES

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

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

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9
Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals

UNIT II  ANALYSIS OF CONTINUOUS TIME SIGNALS  9
Fourier series for periodic signals - Fourier Transform – properties - Laplace Transforms and Properties

UNIT III  LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS  9

UNIT IV  ANALYSIS OF DISCRETE TIME SIGNALS  9
Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V  LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS  9
Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel. 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  L T P C 3 0 0 3

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

UNIT I BASICS OF PRODUCT DEVELOPMENT

UNIT II REQUIREMENTS AND SYSTEM DESIGN

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


UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY


TOTAL: 45 PERIODS

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

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

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

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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

REFERENCES:
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 dialysers 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

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
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

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.

TOTAL:45 PERIODS
• 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                          L T P C
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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  9
Rings - Polynomial rings - Irreducible polynomials over finite fields - Factorization of polynomials over finite fields.

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

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

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

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

UNIT I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9

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

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

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

UNIT V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9

TOTAL : 45 PERIODS

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

REFERENCES
OBT352  BASICS OF MICROBIAL TECHNOLOGY  LTPC  3003

COURSE OBJECTIVE:
- Enable the Non-biological student's to understand about the basics of life science and their pro and cons for living organisms.

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

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

UNIT III  PATHOGENIC MICROBES  9
Infectious Disease – Awareness, Causative agent, Prevention and control - Cholera, Dengue, Malaria, Diarrhea, Tuberculosis, Typhoid, Covid, HIV.

UNIT IV  BENEFICIAL MICROBES  9
Applications of microbes – Clinical microbiology, agricultural microbiology, Food Microbiology, Environmental Microbiology, Animal Microbiology, Marine Microbiology.

UNIT V  PRODUCTS FROM MICROBES  9
Fermented products – Fermented Beverages, Curd, Cheese, Mushroom, Agricultural products – Biopesticide, Biofertilizers, Vermi compost, Pharmaceutical products - Antibiotics, Vaccines

TOTAL: 45 PERIODS

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

UNIT I CARBOHYDRATES
Introduction to carbohydrate, classification, properties of monosaccharide, structural aspects of monosaccharides. Introduction to disaccharide (lactose, maltose, sucrose) and polysaccharide (Heparin, starch, and glycogen) biological function of carbohydrate.

UNIT II LIPID AND FATTY ACIDS
Introduction to lipid, occurrence, properties, classification of lipid. Importance of phospholipids, sphingolipid and glycerolipid. Biological function of lipid. Fatty acid, Introduction, Nomenclature and classification of fatty acid Essential and non essential fatty acids.

UNIT III AMINO ACIDS AND PROTEIN.

UNIT IV NUCLEIC ACIDS
Introduction to nucleic acid, Difference between nucleotide and nucleoside, composition of DNA & RNA Structure of Nitrogen bases in DNA and RNA along with the nomenclature· DNA double helix (Watson and crick) model, types of DNA, RNA.

UNIT V VITAMINS AND HORMONES

TOTAL: 45 PERIODS

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

TEXT BOOKS

REFERENCES
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, leucoplast, centrosome, lysosome, ribosome, peroxisome, Nucleus and nucleolus. Endo membrane system, concept of compartmentalisation.

UNIT III  BIO-MEMBRANE TRANSPORT 9

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

UNIT V  CENTRAL DOGMA 9

TOTAL: 45 PERIODS

OUTCOMES:
☐ Understand 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 BASIC OF INTEGRATED WATER RESOURCES MANAGEMENT  L T P C

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OBJECTIVES

- To introduce the interdisciplinary approach of water management.
- To develop knowledge base and capacity building on IWRM.

UNIT I OVERVIEW OF IWRM


UNIT II WATER USE SECTORS: IMPACTS AND SOLUTION

Water users: People, Agriculture, ecosystem and others - Impacts of the water use sectors on water resources - Securing water for people, food production, ecosystems and other uses - IWRM relevance in water resources management.

UNIT III WATER ECONOMICS

Economic characteristics of water good and services – Economic instruments – Private sector involvement in water resources management - PPP experiences through case studies.

UNIT IV RECENT TRENDS IN WATER MANAGEMENT

River basin management - Ecosystem Regeneration – 5 Rs - WASH - Sustainable livelihood - Water management in the context of climate change.

UNIT V IMPLEMENTATION OF IWRM

Barriers to implementing IWRM - Policy and legal framework - Bureaucratic reforms and inclusive development - Institutional Transformation - Capacity building - Case studies on conceptual framework of IWRM.

OUTCOMES

TOTAL: 45 PERIODS
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**

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**OBJECTIVE:**

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

**UNIT I**

**ALGEBRAIC EQUATIONS AND EIGENVALUE PROBLEM**


**UNIT II**

**INTERPOLATION**

- Central difference: Stirling and Bessel's interpolation formulae; Piecewise spline interpolation: Piecewise linear, piecewise quadratic and cubic spline; Least square approximation for continuous data (upto 3rd degree).

**UNIT III**

**NUMERICAL METHODS FOR ORDINARY DIFFERENTIAL EQUATIONS**


**UNIT IV**

**FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS**

- Laplace and Poisson’s equations in a rectangular region: Five point finite difference schemes - Leibmann’s iterative methods - Dirichlet's and Neumann conditions – Laplace equation in polar coordinates: Finite difference schemes.
UNIT V  FINE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS


OUTCOMES:
Upon completion of this course, the students will be able to:
CO1: demonstrate the understandings of common numerical methods for nonlinear equations, system of linear equations and eigenvalue problems;
CO2: understand the interpolation theory;
CO3: understand the concepts of numerical methods for ordinary differential equations;
CO4: demonstrate the understandings of common numerical methods for elliptic equations;
CO5: understand the concepts of numerical methods for time dependent partial differential equations

TEXT BOOKS:

REFERENCES:
• 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.

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.

TEXT BOOKS

REFERENCES
OMA357 QUEUEING AND RELIABILITY MODELLING

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

UNIT I RANDOM PROCESSES

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

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

UNIT IV SYSTEM RELIABILITY

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

TOTAL: 45 PERIODS

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.

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

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

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

UNIT IV PRODUCTION & OPERATIONS MANAGEMENT PROCESS

Production 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

Material requirement planning (MRP)- Concept- Process and control - Inventory control systems
and techniques – JIT and Lean manufacturing - Network techniques - Quality Management:
Preventive Vs Breakdown maintenance for Quality – Techniques for measuring quality - Control
Chart (X, R, p, np and C chart) - Cost of Quality, Continuous improvement (Kaizen) - Quality
awards - Supply Chain Management - Total Quality Management - 6 Sigma approach and Zero
Defect Manufacturing.

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

1. Mikell P. Groover, Automation, Production Systems, and Computer-Integrated Manufacturing,
4. Muhlemann, Okland and Lockyer, Production and Operation Management, Macmillan
India, 1992.

OMG355 MULTIVARIATE DATA ANALYSIS

OBJECTIVE:

• To know various multivariate data analysis techniques for business research.

UNIT I INTRODUCTION

Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques –
Guidelines for multivariate analysis and interpretation.

UNIT II PREPARING FOR MULTIVARIATE ANALYSIS

Conceptualization of research model with variables, collection of data —Approaches for dealing
with missing data – Testing the assumptions of multivariate analysis.
UNIT III  MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS  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.

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UNIT II  VAT POLYMERIZATION AND MATERIAL EXTRUSION 9

UNIT III  POWDER BED FUSION AND BINDER JETTING 9

UNIT IV  MATERIAL JETTING AND DIRECTED ENERGY DEPOSITION 9

UNIT V  SHEET LAMINATION AND DIRECT WRITE TECHNOLOGY 9
Ink-Based Direct Writing (DW): Nozzle Dispensing Processes, Inkjet Printing Processes, Aerosol DW - Applications of DW.

TOTAL: 45 PERIODS

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

TEXT BOOKS:

REFERENCES:
CME343 NEW PRODUCT DEVELOPMENT

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
9 Material specification standards – ISO, DIN, JIS, ASTM, EN, etc. – Awareness on various manufacturing process like Metal castings & Forming, Machining (Conventional, 3 Axis, 4 Axis, 5 Axis, ), Fabrications, Welding process. Qualifications of parts mechanical, physical & Chemical properties and their test report preparation and submission. Fundamentals of DFMEA & PFMEA, Fundamentals of FEA, Bend Analysis, Hot Distortion, Metal and Material Flow, Fill and Solidification analysis.

UNIT III ESSENTIALS OF NPD

UNIT IV CRITERIONS OF NPD
9 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
9 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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Low (1) ; Medium (2) ; High (3)

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  9
Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV MECHANICAL RAPID PROTOTYPING  9
Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V ELECTRONIC RAPID PROTOTYPING  9
Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA

TOTAL: 45 PERIODS

Course Outcomes
At the end of the course, learners will be able to:
- Create quick UI/UX prototypes for customer needs
- Develop web application to test product traction / product feature
- Develop 3D models for prototyping various product ideas
- Built prototypes using Tools and Techniques in a quick iterative methodology

TEXT BOOKS

REFERENCES

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

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

UNIT I INTRODUCTION TO MICROSYSTEMS  9
Design, and material selection, micro-actuators: hydraulic, pneumatic, electrostatic/ magnetic etc. for medical to general purpose applications. Micro-sensors based on Thermal, mechanical,
electrical properties; micro-sensors for measurement of pressure, flow, temperature, inertia, force, acceleration, torque, vibration, and monitoring of manufacturing systems.

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

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

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
- 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 LT P C
3 0 0 3

COURSE OBJECTIVES:
- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management
UNIT – I  INTRODUCTION TO COSTING CONCEPTS  
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

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

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

UNIT – IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  

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

TOTAL: 45 PERIODS

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

TEXT BOOKS:  

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

COURSE OBJECTIVES:
The objective of this course is to make the students to understand the working and characteristics of different types of batteries and their management.

UNIT I ADVANCED BATTERIES 9
Li-ion Batteries—different formats, chemistry, safe operating area, efficiency, aging. Characteristics—SOC, DOD, SOH. Balancing—Passive Balancing Vs Active Balancing. Other Batteries—NCM and NCA Batteries. NCR18650B specifications.

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

UNIT III BATTERY MODELLING 9

UNIT IV BATTERY STATE ESTIMATION 9

UNIT V BMS ARCHITECTURE AND REAL TIME COMPONENTS 9
Battery Management System—need, operation, classification. BMS ASIC—bq76PL536A-Q1 Battery Monitor IC—CC2662R-Q1 Wireless BMS MCU. Communication Modules—CAN Open-Flex Ray—CANedge1 package. ARBIN Battery Tester. BMS Development with Modeling software and Model-Based Design. TOTAL ≈45 PERIODS

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

TEXT BOOKS

REFERENCE BOOKS
1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic NCR18650B- DataSheet
3. bq76PL536A-Q1- IC DataSheet
COURSE OBJECTIVES:
- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9

UNIT II VARIABLE RESISTANCE AND INDUTANCE SENSORS 9
Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III VARIABLE AND OTHER SPECIAL SENSORS 9
Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS 9

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS 9
Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

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:

OAS353 SPACE VEHICLES

OBJECTIVES:
- To interpret the missile space stations, space vs earth environment.
- To explain the life support systems, mission logistics and planning.
- To deploy the skills effectively in the understanding of space vehicle configuration design.
- To explain Engine system and support of space vehicle
- To interpret nose cone configuration of space vehicle

UNIT I FUNDAMENTAL ASPECTS
Energy and Efficiencies of power plants for space vehicles – Typical Performance Values – Mission design – Structural design aspects during launch - role of launch environment on launch vehicle integrity.

UNIT II SELECTION OF ROCKET PROPULSION SYSTEMS
Ascent flight mechanics – Launch vehicle selection process – Criteria for Selection for different missions – selection of subsystems – types of staging – Interfaces – selection and criteria for stages and their role in launch vehicle configuration design.

UNIT III ENGINE SYSTEMS, CONTROLS, AND INTEGRATION

UNIT IV THRUST VECTOR CONTROL

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

TOTAL: 45 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- Explain exotic space propulsion concepts, such as nuclear, solar sail, and antimatter.
- Apply knowledge in selecting the appropriate rocket propulsion systems.
- Interpret the air-breathing propulsion suitable for initial stages and fly-back boosters.
- Analyze aerodynamics aspect, including boost-phase lift and drag, hypersonic, and re-entry.
- Adapt from aircraft engineers moving into launch vehicle, spacecraft, and hypersonic vehicle design.
COURSE OBJECTIVES:
Of this course are
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, TrainingandDevelopment,WageandSalaryAdministration,Promotion,Transfer,PerformanceAppraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating –Capability Maturity Model (CMM)Levels.

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

UNIT V STRATEGIC MANAGEMENT AND CONTEMPORARY STRATEGIC ISSUES

TOTAL: 45 PERIODS

OURSEOUTCOMES:
Upon completion of the course, Students will be able to
CO1:Plananorganizationalstructureforagivencontextintheorganisationtocarryoutproductionoperatio throughWork-study.
CO2:Surveythemarkets,customersandcompetitionbetterandpricethegivenproductssappropriatey
CO3: Ensure quality for a given product or service.
CO4: Plan, schedule and control projects through PERT and CPM.
CO5: Evaluate strategy for a business or service organization.

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**TEXTBOOKS:**

**REFERENCES:**

**OIM353 PRODUCTION PLANNING AND CONTROL**

**COURSE OBJECTIVES:**
- To understand the concept of production planning and control act work study,
- To apply the concept of product planning,
- To analyze the production scheduling,
- To apply the Inventory Control concepts.
- To prepare the manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

**UNIT I INTRODUCTION**
Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

**UNIT II WORK STUDY**
Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.
UNIT III  PRODUCT PLANNING AND PROCESS PLANNING
Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi product system.

UNIT IV  PRODUCTION SCHEDULING

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

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course,
CO1:The students can able to prepare production planning and control act work study,
CO2:The students can able to prepare product planning,
CO3:The students can able to prepare production scheduling,
CO4:The students can able to prepare Inventory Control.
CO5:They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

REFERENCES
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corp.1984
OIE353                                      OPERATIONS MANAGEMENT                      L T P C
                                                                                               3 0 0 3

COURSE OBJECTIVE:

- Recognize and appreciate the concept of Production and Operations Management in creating and
  enhancing a firm’s competitive advantages.
- Describe the concept and contribution of various constituents of Production and Operations
  Management (both manufacturing and service).
- Relate the interdependence of the operations function with the other key functional areas of a firm.
- Teach analytical skills and problem-solving tools to the analysis of the operations problems.
- Apply scheduling and Lean Concepts for improving System Performance.

UNIT I                                     INTRODUCTION TO OPERATIONS MANAGEMENT         9
Operations Management – Nature, Importance, historical development, transformation processes,
differences between services and goods, a system perspective, functions, challenges, current
priorities, recent trends; Operations Strategy – Strategic fit, framework; Supply Chain
Management

UNIT II                                    FORECASTING, CAPACITY AND FACILITY DESIGN       9
Demand Forecasting - Need, Types, COURSE OBJECTIVES and Steps. Overview of
Qualitative and Quantitative methods. Capacity Planning - Long range, Types, Developing
capacity alternatives. Overview of sales and operations planning. Overview of MRP, MRP II
and ERP. Facility Location – Theories, Steps in Selection, Location Models. Facility Layout –
Principles, Types, Planning tools and techniques.

UNIT III                                   DESIGN OF PRODUCT, PROCESS AND WORK SYSTEMS       9
Product Design – Influencing factors, Approaches, Legal, Ethical and Environmental issues.
OBJECTIVES, Procedure. Method Study and Motion Study. Work Measurement and
Productivity – Measuring Productivity and Methods to improve productivity.

UNIT IV                                    MATERIALS MANAGEMENT                              9
Materials Management – COURSE OBJECTIVES, Planning, Budgeting and Control.
Purchasing – COURSE OBJECTIVES, Functions, Policies, Vendor rating and Value Analysis.
Stores Management – Nature, Layout, Classification and Coding. Inventory – COURSE
OBJECTIVES, Costs and control techniques. Overview of JIT.

UNIT V                                     SCHEDULING AND PROJECT MANAGEMENT                  9
Project Management – Scheduling Techniques, PERT, CPM; Scheduling - work centers –
nature, importance; Priority rules and techniques, shopfloor control; Flow shop scheduling –
Johnson’s Algorithm – Gantt charts; personnel scheduling in services.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: The students will appreciate the role of Production and Operations management in enabling and enhancing a firm’s competitive advantages in the dynamic business environment.
CO2: The students will obtain sufficient knowledge and skills to forecast demand for Production and Service Systems.
CO3: The students will be able to formulate and assess Aggregate Planning strategies and Material Requirement Plan.
CO4: The students will be able to develop analytical skills to calculate capacity requirements and developing capacity alternatives.
CO5: The students will be able to apply scheduling and Lean Concepts for improving System Performance.

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TEXT BOOKS

REFERENCES

OSF352 INDUSTRIAL HYGIENE

COURSE OBJECTIVES:
1. Demonstrate an understanding of how occupational hygiene standards are set and used in work health and safety.
2. Compare and contrast the roles of environmental and biological monitoring in work health and safety.
3. Outline strategies for identifying, assessing and controlling risks associated with airborne gases, vapours and particulates.

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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

TOTAL PERIODS: 45

COURSE OUTCOMES:
Students able to
CO1: Explain and apply human factors engineering concepts in both evaluation of existing systems and design of new systems.
CO2: Specify designs that avoid occupation related injuries.
CO3: Define and apply the principles of work design, motion economy, and work environment design.
CO4: Identify the basic human sensory, cognitive, and physical capabilities and limitations with respect to human-machine system performance.
CO5: Acknowledge the impact of workplace design and environment on productivity.

TEXT BOOKS:

REFERENCES:
2. Frank P Lees - Loss of prevention in Process Industries, Vol. 1 and 2,

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OSF353 CHEMICAL PROCESS SAFETY

COURSE OBJECTIVES
- Teach the principles of safety applicable to the design, and operation of chemical process plants.
- Ensure that potential hazards are identified and mitigation measures are in place to prevent unwanted release of energy.
- Learn about the hazardous chemicals into locations that could expose employees and others to serious harm.
- Focuses on preventing incidents and accidents during large scale manufacturing of chemicals and pharmaceuticals.
- Ensure that the general design of the plant is capable of complying with the dose limits in force and with the radioactive releases.

UNIT I SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES
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.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Students able to
CO1 Differentiate between inherent safety and engineered safety and recognize the
importance of safety in the design of chemical process plants.
CO2 Develop thorough knowledge about safety in the operation of chemical plants.
CO3Apply the principles of safety in the storage and handling of gases.
CO4Identify the conditions that lead to reaction hazards and adopt measures to prevent them.
CO5Develop thorough knowledge about

TEXT BOOK

REFERENCES:
1. Ralph King and Ron Hirst,"King’s safety in the process industries", Arnold, London,
   1998.
   1982.
5. Roy E Sanders, "Chemical Process Safety",3rd Edition, Gulf professional publishing,
   2006

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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 9
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 9
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 9
Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT – IV  MATERIALS FOR ELECTRICAL APPLICATIONS 9
Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT – V  OPTICAL AND OPTOELECTRONIC MATERIALS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
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:
1. Understanding the evolution of nanomaterials in the scientific era and make them to understand different types of nanomaterials for the future engineering applications
2. Gaining knowledge on dimensionality effects on different properties of nanomaterials
3. Getting acquainted with the different processing techniques employed for fabricating nanomaterials
4. Having knowledge on the different characterisation techniques employed to characterise the nanomaterials
5. Acquiring knowledge on different applications of nanomaterials in different disciplines of engineering.

UNIT I NANOMATERIALS 9
Introduction, Classification: 0D, 1D, 2D, 3D nanomaterials and nano-composites, their mechanical, electrical, optical, magnetic properties; Nanomaterials versus bulk materials.

UNIT II THERMODYNAMICS & KINETICS OF NANOSTRUCTURED MATERIALS 9
Size and interface/interphase effects, interfacial thermodynamics, phase diagrams, diffusivity, grain growth, and thermal stability of nanomaterials.

UNIT III PROCESSING 9
Bottom-up and top-down approaches for the synthesis of nanomaterials, mechanical alloying, chemical routes, severe plastic deformation, and electrical wire explosion technique.

UNIT IV STRUCTURAL CHARACTERISTICS 9
Principles of emerging nanoscale X-ray techniques such as small angle X-ray scattering and X-ray absorption fine structure (XAFS), electron and neutron diffraction techniques and their application to nanomaterials; SPM, Nanoindentation, Grain size, phase formation, texture, stress analysis
UNIT V  APPLICATIONS
Applications of nanoparticles, quantum dots, nanotubes, nanowires, nanocoatings; applications in electronic, electrical and medical industries

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completion of this course, the students will be able to
1. Evaluate nanomaterials and understand the different types of nanomaterials
2. Recognise the effects of dimensionality of materials on the properties
3. Process different nanomaterials and use them in engineering applications
4. Use appropriate techniques for characterising nanomaterials
5. Identify and use different nanomaterials for applications in different engineering fields.

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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 9

UNIT – III HYDRAULIC CIRCUITS AND SYSTEMS 9
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 9

UNIT – V TROUBLE SHOOTING AND APPLICATIONS 9

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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OMR353 SENSORS L T P C
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COURSE OBJECTIVES:
1. To learn the various types of sensors, transducers, sensor output signal types, calibration techniques, formulation of system equation and its characteristics.
2. To understand basic working principle, construction, Application and characteristics of displacement, speed and ranging sensors.
3. To understand and analyze the working principle, construction, application and characteristics of force, magnetic and heading sensors.
4. To learn and analyze the working principle, construction, application and characteristics of optical, pressure, temperature and other sensors.
5. To familiarize students with different signal conditioning circuits design and data acquisition system.

UNIT – I SENSOR CLASSIFICATION, CHARACTERISTICS AND SIGNAL TYPES

UNIT – II DISPLACEMENT, PROXIMITY AND RANGING SENSORS

UNIT – III FORCE, MAGNETIC AND HEADING SENSORS

UNIT – IV OPTICAL, PRESSURE, TEMPERATURE AND OTHER SENSORS
UNIT – V \hspace{0.5cm} 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

COURSE OBJECTIVES
1. To introduce mobile robotic technology and its types in detail.
2. To learn the kinematics of wheeled and legged robot.
3. To familiarize the intelligence into the mobile robots using various sensors.
4. To acquaint the localization strategies and mapping technique for mobile robot.
5. To aware the collaborative mobile robotics in task planning, navigation and intelligence.

UNIT I INTRODUCTION TO MOBILE ROBOTICS 9

UNIT II KINEMATICS 9

UNIT III PERCEPTION 9

UNIT IV LOCALIZATION 9

UNIT V PLANNING, NAVIGATION AND COLLABORATIVE ROBOTS 9

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

COOCOURSE 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, stern tube, stern tube sealing etc. degree of freedom, Modern propelling methods- water jet propulsion , screw propulsion.

UNIT II SHIPS MOVEMENTS AND SHIP STABILIZATION 9
Thrust augmented devices, Ship hull, modern ship propulsion design, bow thruster – Advantages, various methods to stabilize the ship- passive and active stabilizer, fin stabilizer, bilge keel - stabilizing and securing ship in port- effect of tides on ship – effect of river water and sea water sailing vessel, Load line and load line of marking- draught markings.

UNIT III SHIPS SPEED AND ITS PERFORMANCE 9
Ship propulsion factors, factors affecting ships speed, various velocities of ship, hull drag, effects of fouling on ships hull, ship wake, relation between powers, Fuel consumption of ship, cavitations - effects of cavitation’s, ship turning radius.

UNIT IV BASICS OF PROPELLER 9

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

COOCOURSE 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

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OMV351                         MARINE MERCHANT VESSELS                        LT P C
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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 HYDROSTATICSC 9
Archimedes Principle- Laws of floatation – Meta centre – stability of floating and submerged bodies-
Density, relative density - Displacement –Pressure –centre of pressure.

UNIT II TYPES OF SHIP 10
General cargo ship - Refrigerated cargo ships - Container ships - Roll-on Roll-off ships – Oil
 tankers- Bulk carriers - Liquefied Natural Gas carriers - Liquefied Petroleum 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

Role of IMO (International Maritime Organization), SOLAS (International Convention for the Safety of Life at Sea), MARPOL (International Convention for the Prevention of Pollution from Ships), MLC (Maritime Labour Convention), STCW 2010 (International Convention on Standards of Training, Certification and Watch keeping for Seafarers), Classification societies Administration authorities

TOTAL: 45 PERIODS

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 and rudder
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  9
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  9
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  9
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
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  L  T  P  C
3  0  0  3

COURSE OBJECTIVES:
1. To understand the basics of drone concepts
2. To learn and understand the fundamentals of design, fabrication and programming of drone
3. To impart the knowledge of 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  9
Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability
UNIT – II  DRONE DESIGN, FABRICATION AND PROGRAMMING  9
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 - Install program on computer - Running Programs - Multi rotor stabilization - Flight modes - Wi-Fi connection.

UNIT – III  DRONE FLYING AND OPERATION  9
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  9
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  9
The safety risks - Guidelines to fly safely - Specific aviation regulation and standardization - Drone license - Miniaturization of drones - Increasing autonomy of drones - The use of drones in swarms

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Createthe programs for various drones

CO-PO MAPPING:

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<th>COs/Pos&amp;PSOs</th>
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</tbody>
</table>

1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS

REFERENCES
1. John Baichtal, “Building Your Own Drones: A Beginners’ Guide to Drones, UAVs, and
OGI352 GEOGRAPHICAL INFORMATION SYSTEM L T P C 3 0 0 3

OBJECTIVES:
To impart the knowledge on basic components, data preparation and implementation of Geographical Information System.

UNIT I  FUNDAMENTALS OF GIS 9

UNIT II  SPATIAL DATA MODELS 9

UNIT III  DATA INPUT AND TOPOLOGY 9

UNIT IV  DATA QUALITY AND STANDARDS 9
Data quality - Basic aspects - completeness, logical consistency, positional accuracy, temporal accuracy, thematic accuracy and lineage – Metadata – GIS Standards –Interoperability - OGC - Spatial Data Infrastructure

UNIT V  DATA MANAGEMENT AND OUTPUT 9
Import/Export – Data Management functions- Raster to Vector and Vector to Raster Conversion - Data Output - Map Compilation – Chart/Graphs – Multimedia – Enterprise Vs. Desktop GIS- distributed GIS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Have basic idea about the fundamentals of GIS.
CO2 Understand the types of data models.
CO3 Get knowledge about data input and topology
CO4 Gain knowledge on data quality and standards
CO5 Understand data management functions and data output

TEXTBOOKS:

ROVs”, Que Publishing, 2016
REFERENCES:

CO – PO – PSO MAPPING: GEOGRAPHIC INFORMATION SYSTEM

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<thead>
<tr>
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<td>Knowledge of Geoinformatics</td>
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<td>PSO3</td>
<td>Conceptualization and evaluation of Design solutions</td>
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OAI352 AGRICULTURE ENTREPRENEURSHIP DEVELOPMENT L T P C

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 AGRIPRNEURSHIP 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).

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UNIT III ENTREPRENEURSHIP MANAGEMENT: FINANCIAL PERSPECTIVE
Entrepreneurship - Essence of managerial knowledge - Management functions - Planning, organizing, directing, motivation, ordering, leading, supervision - Understanding financial aspects of business - Importance of financial statements - Liquidity ratios, leverage ratios, coverage ratios, turnover ratios, profitability ratios. Agro-based industries - Project cycle - Project appraisal and evaluation techniques - Undiscounted measures - Payback period - Proceeds per rupee of outlay. Discounted measures - Net present value (NPV) - Benefit-cost ratio (BCR) - Internal rate of return (IRR) - Net benefit investment ratio (N/K ratio) - Sensitivity analysis.

UNIT IV ENTREPRENEURIAL OPPORTUNITIES: ECONOMIC GROWTH PERSPECTIVE
Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up management - 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 implications for decision making by individual entrepreneurs.

UNIT V ENTREPRENEURIAL PROMOTION MEASURES AND GOVERNMENT SUPPORT
Social responsibility of business. Morals and ethics in enterprise management - SWOT analysis - Government schemes and incentives for promotion of entrepreneurship. Government policy on small and medium enterprises (SMEs)/SSIs/MSME sectors - Venture capital (VC), contract framing (CF) and Joint Venture (JV), public-private partnerships (PPP) - Overview of agricultural engineering industry, characteristics of Indian farm machinery industry.

TOTAL: 45 PERIODS

COURSE OUTCOMES
1. Judge about agricultural finance, banking and cooperation
2. Evaluate basic concepts, principles and functions of financial management
3. Improve the skills on basic banking and insurance schemes available to customers
4. Analyze various financial data for efficient farm management
5. Identify the financial institutions

TEXT BOOKS

REFERENCES
CO-PO MAPPING

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<td>PSO2 To enhance students ability to formulate solutions to real-world problems pertaining to sustained agricultural productivity using modern technologies.</td>
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<td>PSO3 To inculcate entrepreneurial skills through strong Industry-Institution linkage.</td>
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OEN352 BIODIVERSITY CONSERVATION

OBJECTIVE:
The identification of different aspects of biological diversity and conservation techniques.

UNIT I INTRODUCTION
Concept of Species, Variation; Introduction to Major Plant Groups; Evolutionary relationships between Plant Groups; Nomenclature and History of plant taxonomy; Systems of Classification and their Application; Study of Plant Groups; Study of Identification Characters; Study of important families of Angiosperms; Plant Diversity Application.

UNIT II INTRODUCTION TO ANIMAL DIVERSITY AND TAXONOMY
Principles and Rules of Taxonomy; ICZN Rules, Animal Study Techniques; Concepts of Taxon, Categories, Holotype, Paratype, Topotype etc; Classification of Animal kingdom, Invertebrates, Vertebrates, Evolutionary relationships between Animal Groups.

UNIT III MICROBIAL DIVERSITY
Microbes and Earth History, Magnitude, Occurrence and Distribution. Concept of Species, Criteria for Classification, Outline Classification of Microorganisms (Bacteria, Viruses and Protozoa);
Criteria for Classification and Identification of Fungi; Chemical and Biochemical Methods of Microbial Diversity Analysis

UNIT IV MEGA DIVERSITY
Biodiversity Hot-spots, Floristic and Faunal Regions in India and World; IUCN Red List; Factors affecting Diversity, Impact of Exotic Species and Human Disturbance on Diversity, Dispersal, Diversity-Stability Relationship; Socio-economic Issues of Biodiversity; Sustainable Utilization of Bioresources; National Movements and International Convention/Treaties on Biodiversity.

UNIT V CONSERVATIONS OF BIODIVERSITY
In-Situ Conservation- National parks, Wildlife sanctuaries, Biosphere reserves; Ex-situ conservation- Gene bank, Cryopreservation, Tissue culture bank; Long term captive breeding, Botanical gardens, Animal Translocation, Zoological Gardens; Concept of Keystone Species, Endangered Species, Threatened Species, Rare Species, Extinct Species

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

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.
OBJECTIVES

- To impart knowledge on various representations of systems.
- To familiarize time response analysis of LTI systems and steady state error.
- To analyze the frequency responses and stability of the systems.
- To analyze the stability of linear systems in frequency domain and time domain.
- To develop linear models mainly state variable model and transfer function model.

UNIT I  MATHEMATICAL MODELS OF PHYSICAL SYSTEMS  9
Definition & classification of system – terminology & structure of feedback control theory – Analogous systems - Physical system representation by Differential equations – Block diagram reduction–Signal flow graphs.

UNIT II  TIME RESPONSE ANALYSIS & ROOTLOCUSTECHNIQUE  9

UNIT III  FREQUENCY RESPONSE ANALYSIS  9
Correlation between Time & Frequency response – Polar plots – Bode Plots – Determination of Transfer Function from Bode plot.

UNIT IV  STABILITY CONCEPTS & ANALYSIS  9

UNIT V  STATE VARIABLE ANALYSIS  9
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.
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  9

UNIT II    AUTOMATION COMPONENTS  9
Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS  9
Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS  9
Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM  9
Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc)  5
1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)

COURSE OUTCOMES:
Students able to
CO1  Design a signal conditioning circuits for various application (L3).
CO2  Acquire a detail knowledge on data acquisition system interface and DCS system (L2).
CO3  Understand the basics and Importance of communication buses in applied automation Engineering (L2).
CO4  Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function Block.(L3)
CO5  Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:

REFERENCES:

List of Open Source Software/ Learning website:
1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063

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329
OBJECTIVES
The course aims to
- acquaint and equip the students with different techniques of measurement of engineering properties.
- make the students understand the nature of food constituents in the design of processing equipment

UNIT I
Engineering properties of food materials: physical, thermal, aerodynamic, mechanical, optical and electromagnetic properties.

UNIT II
Drying and dehydration: Basic drying theory, heat and mass transfer in drying, drying rate curves, calculation of drying times, dryer efficiencies; classification and selection of dryers; tray, vacuum, osmotic, fluidized bed, pneumatic, rotary, tunnel, trough, bin, belt, microwave, IR, heat pump and freeze dryers; dryers for liquid: Drum or roller dryer, spray dryer and foammat dryers

UNIT III
Size reduction: Benefits, classification, determination and designation of the fineness of ground material, sieve/screen analysis, principle and mechanisms of comminution of food, Rittinger’s, Kick’s and Bond’s equations, work index, energy utilization; Size reduction equipment: Principal types, crushers (jaw crushers, gyratory, smooth roll), hammer mills and impactors, attrition mills, buhr mill, tumbling mills, tumbling mills, ultra fine grinders, fluid jet pulverizer, colloid mill, cutting machines (slicing, dicing, shredding, pulping)

UNIT IV
Mixing: theory of solids mixing, criteria of mixer effectiveness and mixing indices, rate of mixing, theory of liquid mixing, power requirement for liquids mixing; Mixing equipment: Mixers for low or medium-viscosity liquids (paddle agitators, impeller agitators, powder-liquid contacting devices, other mixers), mixers for high viscosity liquids and pastes, mixers for dry powders and particulate solids.

UNIT V
Mechanical Separations: Theory, centrifugation, liquid-liquid centrifugation, liquid-solid centrifugation, clarifiers, desludging and decanting machine, Filtration: Theory of filtration, rate of filtration, pressure drop during filtration, applications, constant-rate filtration and constant-pressure filtration, derivation of equation; Filtration equipment; plate and frame filter press, rotary filters, centrifugal filters and air filters, filter aids, Membrane separation: General considerations, materials for membrane construction, ultra-filtration, microfiltration, concentration, polarization, processing variables, membrane fouling, applications of ultra-filtration in food processing, reverse osmosis, mode of operation, and applications; Membrane separation methods, demineralization by electro-dialysis, gel filtration, ion exchange, per-evaporation and osmotic dehydration.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 understand the importance of food polymers
CO2 understand the effect of various methods of processing on the structure and texture of food materials
CO3 understand the interaction of food constituents with respect to thermal, electrical properties to develop new technologies for processing and preservation.
TEXTBOOKS:

OFD355 FOOD SAFETY AND QUALITY REGULATIONS L T P C
3 0 0 3

OBJECTIVES:
• To characterize different type of food hazards, physical, chemical and biological in the industry and food service establishments
• To help become skilled in systems for food safety surveillance
• To be aware of the regulatory and statutory bodies in India and the world
• To ensure processed food meets global standards

UNIT I
Introduction to food safety and security: Hygienic design of food plants and equipments, Food Contaminants (Microbial, Chemical, Physical), Food Adulteration (Common adulterants), Food Additives (functional role, safety issues), Food Packaging & labeling. Sanitation in warehousing, storage, shipping, receiving, containers and packaging materials. Control of rats, rodents, mice, birds, insects and microbes. Cleaning and Disinfection, ISO 22000 – Importance and Implementation

UNIT II
Food quality: Various Quality attributes of food, Instrumental, chemical and microbial Quality control. Sensory evaluation of food and statistical analysis. Water quality and other utilities.

UNIT III
Critical Quality control point in different stages of production including raw materials and processing materials. Food Quality and Quality control including the HACCP system. Food inspection and Food Law, Risk assessment – microbial risk assessment, dose response and exposure response modelling, risk management, implementation of food surveillance system to monitor food safety, risk communication

UNIT IV
Indian and global regulations: FAO in India, Technical Cooperation programmes, Bio-security in Food and Agriculture, World Health Organization (WHO), World Animal Health Organization (OIE), International Plant Protection Convention (IPPC)

UNIT V
Codex Alimentarius Commission - Codex India – Role of Codex Contact point, National Codex contact point (NCCP), National Codex Committee of India – ToR, Functions, Shadow Committees etc.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1 Thorough Knowledge of food hazards, physical, chemical and biological in the industry and food service establishments
CO2 Awareness on regulatory and statutory bodies in India and the world

REFERENCES:
1. Handbook of food toxicology by S. S. Deshpande, 2002
2. The food safety information handbook by Cynthia A. Robert, 2009
4. Microbiological safety of Food by Hobbs BC, 1973

OPY353 NUTRACEUTICALS L T P C
3 0 0 3

OBJECTIVES:
• To understand the basic concepts of Nutraceuticals and functional food, their chemical nature and methods of extraction.
• To understand the role of Nutraceuticals and functional food in health and disease.

UNIT I INTRODUCTION AND SIGNIFICANCE
Introduction to Nutraceuticals and functional foods; importance, history, definition, classification, list of functional foods and their benefits, Phytochemicals, zoochemicals and microbes in food, plants, animals and microbes.

UNIT II PHYTOCHEMICALS AS NUTRACEUTICALS
Phytoestrogens in plants; isoflavones; flavonols, polyphenols, tannins, saponins, lignans, lycopene, chitin, carotenoids. Manufacturing practice of selected nutraceuticals such as lycopene, isoflavonoids, glucosamine, phytosterols. Formulation of functional foods containing nutraceuticals - stability, analytical and labelling issues.

UNIT III ASSESSMENT OF ANTIOXIDANT ACTIVITY
In vitro and in vivo methods for the assessment of antioxidant activity, Comparison of different in vitro methods to evaluate the antioxidant, antioxidant mechanism, Prediction of the antioxidant activity of natural phenolics from electrotopological state indices, Optimising phytochemical release by process technology; Variation of Antioxidant Activity during technological treatments, new food grade peptidases from plant sources.

UNIT IV ROLE IN HEALTH AND DISEASE
The health benefit of - Soy protein, Spirulina, Tea, Olive oil, plant sterols, Broccoli, omega3 fatty acid and eicosanoids. Nutraceuticals and Functional foods in Gastrointestinal disorder, Cancer, CVD, Diabetic Mellitus, HIV and Dental disease; Importance and function of probiotic, prebiotic and symbiotic and their applications, Functional foods and immune competence; role and use in obesity and nervous system disorders.

UNIT V SAFETY ISSUES
Health Claims, Adverse effects and toxicity of nutraceuticals, regulations and safety issues International and national.

TOTAL: 45 PERIODS

TEXT BOOKS:
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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<th>Course outcome</th>
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CO – PO MAPPING
UNIT I  INTRODUCTION
8
Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II  CONVENTIONAL ENERGY
8
Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III  NON-CONVENTIONAL ENERGY
10
Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV  BIOMASS ENERGY
10
Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V  ENERGY CONSERVATION
9
Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL: 45 PERIODS

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

<table>
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<tr>
<th>Course Outcomes</th>
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<td>Compare different renewable energy technologies and choose the most appropriate based on local conditions.</td>
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<td>Explain the technological basis for harnessing renewable energy sources.</td>
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<td>CO5</td>
<td>Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.</td>
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1. 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively.

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**OCH354**

**SURFACE SCIENCE**

**OBJECTIVE:**

- To enable the students to analyze properties of a surfaces and correlate them to structure, chemistry, and physics and surface modification technique.

**UNIT I**

**SURFACE STRUCTURE AND EXPERIMENTAL PROBES**

Relevance of surface science to Chemical and Electrochemical Engineering, Heterogeneous Catalysis and Nanoscience; Surface structure and reconstructions, absorbate structure, Band and Vibrational structure, Importance of UHV techniques, Electronic probes and molecular beams, Scanning probes and diffraction, Qualitative introduction to electronic and vibrational spectroscopy
UNIT II ADSORPTION, DYNAMICS, THERMODYNAMICS AND KINETICS AT SURFACES
Interactions at the surface, Physisorption, Chemisorption, Diffusion, dynamics and reactions of atoms/molecules on surfaces, Generic reaction mechanism on surfaces, Adsorption isotherms, Kinetics of adsorption, Use of temperature desorption methods

UNIT III LIQUID INTERFACES
Structure and Thermodynamics of liquid-solid interface, Self-assembled monolayers, Electrified interfaces, Charge transfer at the liquid-solid interfaces, Photoelectrochemical processes, Gratzel cells

UNIT IV HETEROGENEOUS CATALYSIS
Characterization of heterogeneous catalytic processes, Microscopic kinetics to catalysis, Overview of important heterogeneous catalytic processes: Haber-Bosch, Fishcher-Tropsch and Automotive catalysis, Role of promoters and poisons, Bimetallic surfaces, surface functionalization and clusters in catalysis, Role of Sabatier principle in catalyst design, Rate oscillations and spatiotemporal pattern formation

UNIT V EPITAXIAL GROWTH AND NANO SURFACE-STRUCTURES

TOTAL: 45 PERIODS

OUTCOME:
- Upon completion of this course, the students can understand, predict and design surface properties based on surface structure. Students would understand the physics and chemistry behind surface phenomena.

TEXT BOOK:

REFERENCE:

OPE353 INDUSTRIAL SAFETY

OBJECTIVES:
- To educate about the health hazards and the safety measures to be followed in the industrial environment.
- Describe industrial legislations (Factories Acts, Workmen's Compensation and other laws) enacted for the protection of employees health at work settings
- Describe methods of prevention and control of Occupational Health diseases, accidents / emergencies and other hazards

UNIT I INTRODUCTION
Need for developing Environment, Health and Safety systems in work places - Accident Case Studies - Status and relationship of Acts - Regulations and Codes of Practice - Role of trade union safety representatives. International initiatives - Ergonomics and work place.
UNIT II OCCUPATIONAL HEALTH AND HYGIENE 9

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEMS 9

UNIT IV HAZARDS AND RISK MANAGEMENT 9

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 9

OUTCOMES:
After completion of this course, the student is expected to be able to:
- Describe, with example, the common work-related diseases and accidents in occupational setting
- Name essential members of the Occupational Health team
- What roles can a community health practitioners play in an Occupational setting to ensure the protection, promotion and maintenance of the health of the employee

OPE354 UNIT OPERATIONS IN PETRO CHEMICAL INDUSTRIES L T P C 3 0 0 3

OBJECTIVES:
- To impart to the student basic knowledge on fluid mechanics, mechanical operations, heat transfer operations and mass transfer operations.

UNIT I FLUID MECHANICS CONCEPTS 9
Fluid definition and classification of fluids, types of fluids, Rheological behaviour of fluids & Newton’s Law of viscosity. Fluid statics-Pascal’s law, Hydrostatic equilibrium, Barometric equation and pressure measurement(problems),Basic equations of fluid flow - Continuity equation, Euler’s equation and Bernoulli equation; Types of flow - laminar and turbulent; Reynolds experiment; Flow through circular and non-circular conduits - Hagen Poiseuille equation (no derivation). Flow through stagnant fluids – theory of Settling and Sedimentation – Equipment (cyclones, thickeners) Conceptual numericals.

UNIT II FLOW MEASUREMENTS & MECHANICAL OPERATIONS 9
Different types of flow measuring devices (Orifice meter, Venturimeter, Rotameter) with derivations, flow measurements –. Pumps – types of pumps (Centrifugal & Reciprocating pumps),

UNIT III  CONDUCTIVE & CONVECTIVE HEAT TRANSFER 9
Modes of heat transfer; Conduction – steady state heat conduction through unilayer and multilayer walls, cylinders; Insulation, critical thickness of insulation. Convection- Forced and Natural convection, principles of heat transfer co-efficient, log mean temperature difference, individual and overall heat transfer co-efficient, fouling factor; Condensation – film wise and drop wise (no derivation). Heat transfer equipments – double pipe heat exchanger, shell and tube heat exchanger (with working principle and construction with applications).

UNIT IV  BASICS OF MASS TRANSFER 9

UNIT V  MASS TRANSFER OPERATIONS 9
Basic concepts of Liquid-liquid extraction – equilibrium, stage type extractors (belt extraction and basket extraction). Distillation – Methods of distillation, distillation of binary mixtures using McCabe Thiele method. Drying- drying operations, batch and continuous drying. Conceptual numerical.

TOTAL: 45 PERIODS

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

COURSE OBJECTIVES
- Understand the advantages, disadvantages and general classification of plastic materials
- To know the manufacturing, sources, and applications of engineering thermoplastics
Understand the basics as well as the advanced applications of various plastic materials in the industry
To understand the preparation methods of thermosetting materials
Select suitable specialty plastics for different end applications

UNIT I INTRODUCTION TO PLASTIC MATERIALS
Introduction to Plastics – Brief history of plastics, advantages and disadvantages, thermoplastic and thermosetting behavior, amorphous polymers, crystalline polymers and cross-linked structures. General purpose thermoplastics/ Commodity plastics: manufacture, structure, properties and applications of polyethylene (PE), cross-linked PE, chlorinated PE, polypropylene, polyvinyl chloride-compounding, formulation, polypropylene (PP)

UNIT II ENGINEERING THERMOPLASTICS AND APPLICATIONS
Engineering thermoplastics – Aliphatic polyamides: structure, properties, manufacture and applications of Nylon 6, Nylon 66. Polyesters: manufacture, structure, properties and uses of PET, PBT. Manufacture, structure, properties and uses of Polycarbonates, acetal resins, polyimides, PMMA, polyphenylene oxide, thermoplastic polyurethane (PU)

UNIT III THERMOSETTING PLASTICS
Thermosetting Plastics – Manufacture, curing, moulding powder, laminates, properties and uses of phenol formaldehyde resins, urea formaldehyde, melamine formaldehyde, unsaturated polyester resin, epoxy resin, silicone resins, polyurethane resins.

UNIT IV MISCELLANEOUS PLASTICS FOR END APPLICATIONS
Miscellaneous plastics- Manufacture, properties and uses of polystyrene, HIPS, ABS, SAN, poly(tetrafluoroethylene) (PTFE), TFE and copolymers, PVDF, PVA, poly (vinyl acetate), poly (vinyl carbazole), cellulose acetate, PEEK, High energy absorbing polymers, super absorbent polymers- their synthesis, properties and applications

UNIT V PLASTICS MATERIALS FOR BIOMEDICAL APPLICATIONS
Sources, raw materials, methods of manufacturing, properties and applications of bio-based polymers- poly lactic acid (PLA), poly hydroxy alkanoates (PHA), PBAT, bioplastics- bio-PE, bio-PP, bio-PET, polymers for biomedical applications

TOTAL: 45 PERIODS

COURSE OUTCOMES
To study the importance, advantages and classification of plastic materials
Summarize the raw materials, sources, production, properties and applications of various engineering thermoplastics
To understand the application of polyamides, polyesters and other engineering thermoplastics, thermosetting resins
Know the manufacture, properties and uses of thermosetting resins based onpolyester, epoxy, silicone and PU
To understand the engineering applications of various polymers in miscellaneous areas and applications of different biopolymers

REFERENCES
COURSE OBJECTIVES

- To understand the relevance of standards and specifications as well as the specimen preparation for polymer testing.
- To study the mechanical properties and testing of polymer materials and their structural property relationships.
- To understand the thermal properties of polymers and their testing methods.
- To gain knowledge on the electrical and optical properties of polymers and their testing methods.
- To study about the environmental effects and prevent polymer degradation.

UNIT I  INTRODUCTION TO CHARACTERIZATION AND TESTING OF POLYMERS  9

UNIT II  MECHANICAL PROPERTIES  9
Mechanical properties: Tensile, compression, flexural, shear, tear strength, hardness, impact strength, resilience, abrasion resistance, creep and stress relaxation, compression set, dynamic fatigue, ageing properties, Basic concepts of stress and strain, short term tests: Viscoelastic behavior (simple models: Kelvin model for creep and stress relaxation, Maxwell-Voigt model, strain recovery and dynamic response), Effect of structure and composition on mechanical properties, Behavior of reinforced polymers

UNIT III  THERMAL RHEOLOGICAL PROPERTIES  9
Thermal properties: Transition temperatures, specific heat, thermal conductivity, co-efficient of thermal expansion, heat deflection temperature, Vicat softening point, shrinkage, brittleness temperature, thermal stability and flammability. Product testing: Plastic films, sheeting, pipes, laminates, foams, containers, cables and tubes.

UNIT IV  ELECTRICAL AND OPTICAL PROPERTIES  9
Electrical properties: volume and surface resistivity, dielectric strength, dielectric constant and power factor, arc resistance, tracking resistance, dielectric behavior of polymers (dielectric co-efficient, dielectric polarization), dissipation factor and its importance. Optical properties: transparency, refractive index, haze, gloss, clarity, birefringence.

UNIT V  ENVIRONMENTAL AND CHEMICAL RESISTANCE  9

TOTAL: 45 PERIODS

COURSE OUTCOMES

- Understand the relevance of standards and specifications.
- Summarize the various test methods for evaluating the mechanical properties of the polymers.
- To know the thermal, electrical & optical properties of polymers.
- Identify various techniques used for characterizing polymers.
- Distinguish the processability tests used for thermoplastics, thermosets and elastomers.
REFERENCES

OEC353 VLSI DESIGN

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.

TEXTBOOKS

REFERENCES

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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
CO5: Compare the various wearable devices in healthcare system

TEXT BOOKS

REFERENCES

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CBM356 MEDICAL INFORMATICS

Preamble:
1. To study the applications of information technology in health care management.
2. This course provides knowledge on resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.
UNIT I  INTRODUCTION TO MEDICAL INFORMATICS  9
Introduction - Structure of Medical Informatics -Internet and Medicine -Security issues ,
Computer based medical information retrieval, Hospital management and information system,
Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics,
Bioinformatics

UNIT II  COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING  9
Automated clinical laboratories-Automated methods in hematology, cytology and histology,
Intelligent Laboratory Information System - Computer assisted medical imaging- nuclear
medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and
planning, Nuclear Magnetic Resonance.

UNIT III  COMPUTERISED PATIENT RECORD  9
Introduction - conventional patient record, Components and functionality of CPR, Development
tools, Intranet, CPR in Radiology- Application server provider, Clinical information system,
Computerized prescriptions for patients.

UNIT IV  COMPUTER ASSISTED MEDICAL DECISION-MAKING  9
Neuro computers and Artificial Neural Networks application, Expert system-General model of
CMD, Computer--assisted decision support system-production rule system cognitive model,
semantic networks, decisions analysis in clinical medicine-computers in the care of critically ill
patients, Computer aids for the handicapped.

UNIT V  RECENT TRENDS IN MEDICAL INFORMATICS  9
Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical
simulation, Telemedicine - Tele surgery, Computer assisted patient education and health- Medical
education and healthcare information, computer assisted instruction in medicine.

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:

CO’s- PO’s & PSO’s MAPPING

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</table>
UNIT I  BIOLOGICAL TREATMENT PROCESS  

UNIT II  WASTE BIOMASS AND ITS VALUE ADDITION  
Types of waste biomass – Solid waste management - Nature of biomass feedstock – Biobased economy/process – Value addition of waste biomass – Biotransformation of biomass – Biotransformation of marine processing wastes – Direct extraction of biochemicals from biomass – Plant biomass for industrial application

UNIT III  BIOCONVERSION OF WASTES TO ENERGY  
Perspective of biofuels from wastes - Bioethanol production – Biohydrogen Production – dark and photofermentative process - Biobutanol production – Biogas and Biomethane production - Single stage anaerobic digestion, Two stage anaerobic digestion - Biodiesel production - Enzymatic hydrolysis technologies

UNIT IV  CHEMICALS AND ENZYME PRODUCTION FROM WASTES  
Production of lactic acid, succinic acid, citric acid – Biopolymer synthesis – Production of Amylases - Lignocellulolytic enzymes - Pectinolytic enzymes - Proteases – Lipases

UNIT V  BIOCOMPOSTING OF ORGANIC WASTES  
Overview of composting process - Benefits of composting, Role of microorganisms in composting - Factors affecting the composting process - Waste Materials for Composting, Fundamentals of composting process - Composting technologies, Composting systems – Nonreactor Composting, Reactor composting - Compost Quality

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should be able
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
UNIT I  INTRODUCTION  
Lifestyle diseases – Definition; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II  CANCER  
Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III  CARDIOVASCULAR DISEASES  
Coronary atherosclerosis – Coronary artery disease; Causes - Fat and lipids, Alcohol abuse – Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV  DIABETES AND OBESITY  
Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V  RESPIRATORY DISEASES  
Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:

UNIT I  PUBLIC HEALTH  

UNIT II  CLINICAL DISEASES  
Communicable diseases: Chickenpox / Shingles, COVID-19, Tuberculosis, Hepatitis B, Hepatitis C, HIV / AIDS, Influenza, Swine flu. Non Communicable diseases: Diabetes mellitus, atherosclerosis, fatty liver, Obesity, Cancer
UNIT III VACCINOLOGY 9
History of Vaccinology, conventional approaches to vaccine development, live attenuated and killed vaccines, adjuvants, quality control, preservation and monitoring of microorganisms in seed lot systems. Instruments related to monitoring of temperature, sterilization, environment.

UNIT IV OUTPATIENT & IN PATIENT SERVICES 9
Radiotherapy, Nuclear medicine, surgical units, OT Medical units, G & Obs. units Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation, Neurology, Gastroenterology, Endoscopy, Pulmonology, Cardiology.

UNIT V BASICS OF IMAGING MODALITIES 9

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE BOOKS

VERTICAL 1: FINTECH AND BLOCK CHAIN

CMG331 FINANCIAL MANAGEMENT LT P C 3 0 0 3

LEARNING OBJECTIVES
1. To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital.
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL 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
Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IV FINANCING AND DIVIDEND DECISION 9
Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy

UNIT V WORKING CAPITAL DECISION 9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
2. Prasanna Chandra, Financial Management,

CMG332 FUNDAMENTALS OF INVESTMENT LT P C 3 0 0 3

OBJECTIVES:
1. Describe the investment environment in which investment decisions are taken.
2. Explain how to Value bonds and equities
3. Explain the various approaches to value securities
4. Describe how to create efficient portfolios through diversification
5. Discuss the mechanism of investor protection in India.

UNIT I THE INVESTMENT ENVIRONMENT 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, securiymarket indices, sources of financial information, Concept of return and risk, Impact of Taxes andInflationonreturn.

UNIT II FIXED INCOME SECURITIES 9
Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, defaultrisk andcreditrating.

UNIT III APPROACHES TOEQUITYANALYSIS 9
Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES 9
Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India
UNIT V INVESTOR PROTECTION

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors’ awareness and activism

TOTAL : 45 PERIODS

REFERENCES

CMG333 BANKING, FINANCIAL SERVICES AND INSURANCE

OBJECTIVES
- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM
Overview of Banking system – Structure – Functions – Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY

UNIT IV FINANCIAL SERVICES

UNIT V INSURANCE

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<td>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.</td>
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<td>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</td>
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TOTAL : 45 PERIODS

REFERENCE
2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018

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Payments, Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues

UNIT II  DIGITAL FINANCE AND ALTERNATIVE FINANCE  9
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  9
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  9
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  9

TOTAL : 45 PERIODS

REFERENCE
5. IIBF, Digital Banking, Taxmann Publication, 2016

CMG336  INTRODUCTION TO FINTECH  LT P C
3 0 0 3

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  9
Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.
UNIT II  PAYMENT INDUSTRY  
FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III  INSURANCE INDUSTRY  

UNIT IV  FINTECH AROUND THE GLOBE  

UNIT V  FUTURE OF FINTECH  
How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

TOTAL : 45 PERIODS

REFERENCES
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018
entrepreneurial development – Achievement Motivation – Contributions of Entrepreneurship to Economic Development.


UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP 9 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 9 Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -- Success Stories of Technopreneurs - Case Studies


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

CO 1 Learn the basics of Entrepreneurship
CO 2 Understand the business ownership patterns and environment
CO 3 Understand the Job opportunities in Industries relating to Technopreneurship
CO 4 Learn about applications of technopreneurship and successful technopreneurs
CO 5 Acquaint with the recent and emerging trends in entrepreneurhip

TEXT BOOKS:

REFERENCES:
4) David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
7) Basics of Technopreneurship: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship

353
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 9
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 9
Team-based Organisations - Leadership roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III  INTRODUCTION TO LEADERSHIP 9
Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment.

UNIT IV  LEADERSHIP IN ORGANISATIONS 9

UNIT V  LEADERSHIP EFFECTIVENESS 9

TOTAL 45 : PERIODS

OUTCOMES
Upon completion of this course, the student should be able to:
CO 1 Learn the basics of managing teams for business.
CO 2 Understand developing effective teams for business management.
CO 3 Understand the fundamentals of leadership for running a business.
CO 4 Learn about the importance of leadership for business development.
CO 5 Acquaint with emerging trends in leadership effectiveness for entrepreneurs.”

REFERENCES:

CMG339  CREATIVITY & INNOVATION IN ENTREPRENEURSHIP  L T P C
3 0 0 3

COURSE OBJECTIVES
• To develop the creativity skills among the learners
• To impart the knowledge of creative intelligence essential for entrepreneurs
• To know the applications of innovation in entrepreneurship.
• To develop innovative business models for business.

UNIT I  CREATIVITY
Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities-Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment- Creative Technology- - Creative Personality and Motivation.

UNIT II  CREATIVE INTELLIGENCE
Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training--Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities- Strategies for Unblocking- Designing Creativity Enabling Environment.

UNIT III  INNOVATION

UNIT IV  INNOVATION AND ENTREPRENEURSHIP

UNIT V  INNOVATIVE BUSINESS MODELS

TOTAL 45 : PERIODS

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
Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business
COURSE OUTCOMES:
After completion of this course, the students will be able to:
CO1 Have the awareness of marketing management process
CO2 Understand the marketing environment
CO3 Acquaint about product and pricing strategies
CO4 Knowledge of promotion and distribution in marketing management.
CO5 Comprehend the contemporary marketing scenarios and offer solutions to marketing issues.

REFERENCES:

CMG341 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS

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

UNIT II HUMAN RESOURCE PLANNING
HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III RECRUITMENT AND SELECTION
Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources - eRecruitment - Selection Process- Selection techniques - eSelection- Interview Types- Employee Engagement.

UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT
UNIT V  CONTROLLING HUMAN RESOURCES


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 acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES

CMG342  FINANCING NEW BUSINESS VENTURES  L T P C

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 rasiing for new ventures effectively.

UNIT I  ESSENTIALS OF NEW BUSINES VENTURE

UNIT II  INTRODUCTION TO VENTURE FINANCING

UNIT III  SOURCES OF DEBT FINANCING
UNIT IV SOURCES OF EQUITY FINANCING 9
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 9

OUTCOMES:
Upon completion of this course, the students should be able to:
CO 1 Learn the basics of starting a new business venture.
CO 2 Understand the basics of venture financing.
CO 3 Understand the sources of debt financing.
CO 4 Understand the sources of equity financing.
CO 5 Acquaint with the methods of fund raising for new business ventures.

REFERENCES:
1) Principles of Corporate Finance by Brealey and Myers et al., 12TH ed, McGraw Hill Education (India) Private Limited, 2018
UNIT-III
1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT-IV
1. Bureaucratic Approach: Max Weber
2. Human Relations Approach : Elton Mayo
3. Ecological Approach : Riggs

UNIT-V
1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers

REFERENCES:
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.
### CMG345: PUBLIC PERSONNEL ADMINISTRATION

**UNIT I**
1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

**UNIT II**
1. Generalist Vs Specialist
2. Civil Servants’ Relationship with Political Executive
3. Integrity in Administration.

**UNIT III**
1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

**UNIT IV**
1. All India Services
2. Service Conditions
3. State Public Service Commission

**UNIT V**
1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

**REFERENCES:**
1. Stahl Glean O: Public Personnel Administration
4. Dwivedi O.P and Jain R.B: India’s Administrative state.
7. Davar R.S. Personnel Management & Industrial Relations

### CMG346: ADMINISTRATIVE THEORIES

**UNIT I**
Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration

**UNIT II**
Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

**UNIT III**

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3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi
Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.

UNIT IV
Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making

UNIT V
Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker

REFERENCES:
1. Crozier M : The Bureaucratic phenomenon (Chand)
3. Presthus. R : The Organizational Society (MAC)
5. Keith Davis : Organization Theory (MAC)

TOTAL: 45 PERIODS

CMG347 INDIAN ADMINISTRATIVE SYSTEM

UNIT I
Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II
Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III
Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV
Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V
Corruption – Ombudsman, Lok Pal & Lok Ayuktha

REFERENCES:
1. S.R. Maheswari : Indian Administration
2. Khera. S.S : Administration in India
3. Ramesh K. Arora : Indian Public Administration
4. T.N. Chaturvedi : State administration in India
5. Basu, D.D : Introduction to the Constitution of India

TOTAL: 45 PERIODS

CMG348 PUBLIC POLICY ADMINISTRATION

UNIT-I
UNIT-II
Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System’s Approach – Dror’s Optimal Model

UNIT-III

UNIT-IV
Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT-V
Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

REFERENCES:
4. Pradeep Saxena : Public Policy Administration and Development

TOTAL: 45 PERIODS

VERTICAL 4: BUSINESS DATA ANALYTICS
CMG349
STATISTICS FOR MANAGEMENT

OBJECTIVE:
➢ To learn the applications of statistics in business decision making.

UNIT I
INTRODUCTION
Basic definitions and rules for probability, Baye’s theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II
SAMPLING DISTRIBUTION AND ESTIMATION
Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III
TESTING OF HYPOTHESIS - PARAMETIRC TESTS
Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV
NON-PARAMETRIC TESTS

UNIT V
CORRELATION AND REGRESSION
OUTCOMES:
- To facilitate objective solutions in business decision making.
- To understand and solve business problems.
- To apply statistical techniques to data sets, and correctly interpret the results.
- To develop skill-set that is in demand in both the research and business environments.
- To enable the students to apply the statistical techniques in a work setting.

REFERENCES:

CMG350 DATAMINING FOR BUSINESS INTELLIGENCE

OBJECTIVES:
- To know how to derive meaning form huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.

UNIT I INTRODUCTION
Data mining, Text mining, Web mining, Data ware house.

UNIT II DATA MINING PROCESS
Datamining process – KDD, CRISP-DM, SEMMA
Prediction performance measures

UNIT III PREDICTION TECHNIQUES
Data visualization, Time series – ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES
Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI
Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization

TOTAL: 45 PERIODS

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
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

9

People Analytics - stages of maturity - Human Capital in the Value Chain: impact on business – HR metrics and KPIs.

UNIT II - HR ANALYTICS I: RECRUITMENT

9

Recruitment Metrics: Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio - Quality of hire.

UNIT III - HR ANALYTICS - TRAINING AND DEVELOPMENT

9

Training & Development Metrics: Percentage of employees trained - Internally and externally trained - Training hours and cost per employee - ROI.

UNIT IV - HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION

9

Employee Engagement Metrics: Talent Retention index - Voluntary and involuntary turnover - grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V - HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT

9

Workforce Diversity and Development Metrics: Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

OUTCOME:

- The learners will be conversant about HR metrics and ready to apply at work settings.
The learners will be able to resolve HR issues using people analytics.

REFERENCES:

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS

OBJECTIVE:
- To showcase the opportunities that exist today to leverage the power of the web and social media

UNIT I MARKETING ANALYTICS
Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

UNIT II COMMUNITY BUILDING AND MANAGEMENT
History and Evolution of Social Media- Understanding Science of Social Media - Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts- The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS
Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS
Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V SEARCH ANALYTICS
Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

OUTCOME:
- The Learners will understand social media, web and social media analytics and their potential impact.

TOTAL: 45 PERIODS
REFERENCES:
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004

CMG353 OPERATION AND SUPPLY CHAIN ANALYTICS L T P C = 3 0 0 3

OBJECTIVE:
- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I INTRODUCTION
Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

UNIT II WAREHOUSING DECISIONS
P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III INVENTORY MANAGEMENT
Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV TRANSPORTATION NETWORK MODELS

UNIT V MCDM MODELS
Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic and Techniques, the analytical network process (ANP), TOPSIS.

OUTCOME:
- To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:
CMG354 FINANCIAL ANALYTICS

OBJECTIVE:
➢ This course introduces a core set of modern analytical tools that specifically target finance applications.

UNIT I CORPORATE FINANCE ANALYSIS
Basic corporate financial predictive modelling - Project analysis - cash flow analysis - cost of capital, Financial Break even modelling, Capital Budget model - Payback, NPV, IRR.

UNIT II FINANCIAL MARKET ANALYSIS
Estimation and prediction of risk and return (bond investment and stock investment) – Time series-examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS
Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models - binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS

UNIT V CREDIT RISK ANALYSIS
Credit Risk analysis - Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

OUTCOME
➢ The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:
OBJECTIVE:

- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I  SUSTAINABLE DEVELOPMENT GOALS


UNIT II  SUSTAINABLE INFRASTRUCTURE PLANNING


UNIT III  SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES


UNIT IV  SUSTAINABLE CONSTRUCTION MATERIALS


UNIT V  SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and

369
OUTCOME:
On completion of the course, the student is expected to be able to
CO1 Understand the environment sustainability goals at global and Indian scenario.
CO2 Understand risks in development of projects and suggest mitigation measures.
CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.
CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:
5. New Building Materials and Construction World magazine
7. Munier N, "Introduction to Sustainability", Springer2005

CO’s- PO’s & PSO’s MAPPING

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TOTAL: 45 PERIODS

OUTCOME:
On completion of the course, the student is expected to be able to
CO1 Understand the environment sustainability goals at global and Indian scenario.
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OBJECTIVES:
• To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS
Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT
Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT
Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT
Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS
Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

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

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 –Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III BIO CERAMICS AND BIOCOMPOSITES
General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical
Composites-Polymer Matrix Composite (PMC)-Ceramic Matrix Composite (CMC)-Metal Matrix Composite (MMC)—glass ceramics—Orthopedic implants—Tissue engineering scaffolds

UNIT IV METALS AS BIOMATERIALS 9
Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)-magnesium-based biodegradable alloys-surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants—biological tolerance of implant metals

UNIT V NANOBIO MATERIALS 9

TOTAL : 45 PERIODS

OUTCOMES

- Students will gain familiarity with Biomaterials and they will understand their importance.
- Students will get an overview of different biopolymers and their properties
- Students gain knowledge on some of the important Bioceramics and Biocomposite materials
- Students gain knowledge on metals as biomaterials
- Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES

6. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018

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
Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II  ELECTROCHEMICAL DEVICES
Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O₂ battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, LiCoO₂, LiFePO₄, LiMn₂O₄) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III  FUEL CELLS

UNIT IV  PHOTOVOLTAICS

UNIT V  SUPERCAPACITORS
Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite-conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS

OUTCOMES
• Students will acquire knowledge about energy sustainability.
• Students understand the principles of different electrochemical devices.
• Students learn about the working of fuel cells and their application.
• Students will learn about various Photovoltaic applications and the materials used.
• The students gain knowledge on different types of supercapacitors and the performance of various materials

REFERENCES
5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh

CES335 GREEN TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVE:
• To acquire knowledge on green systems and the environment, energy technology and sustainability.
• To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY
Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES
Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS
Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions.

UNIT IV DESIGNING GREEN PROCESSES
UNIT V  GREEN NANOTECHNOLOGY
Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5 – To understand advanced technology in green synthesis

TEXT BOOKS

REFERENCE BOOKS
1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

UNIT I  ENVIRONMENTAL MONITORING AND STANDARDS  9

UNIT II  MONITORING OF ENVIRONMENTAL PARAMETERS  9

UNIT III  ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING  9
Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods - Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV  ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISK ASSESSMENT  9
UNIT V  AUTOMATED DATA ACQUISITION AND PROCESSING
Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks - Sensors and transducers - classification of transducers - data acquisition system - types of data acquisition systems - data management and quality control; regulatory overview.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students will know

CO1 Basic concepts of environmental standards and monitoring.
CO2 the ambient air quality and water quality standards;
CO3 the various instrumental methods and their principles for environmental monitoring
CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 the various ways of raising environmental awareness among the people.
CO6 Know the standard research methods that are used worldwide for monitoring the environment.

TEXTBOOKS
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and solid wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc

REFERENCES
1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.

Course Articulation Matrix

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COURSE OBJECTIVES:
1. To create awareness on the energy scenario of India with respect to world
2. To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
3. Familiarisation on the concept of sustainable development and its benefits
4. Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development
5. Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO
9
Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT II ENERGY AND ENVIRONMENT
9
Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT
9

UNIT IV RENEWABLE ENERGY TECHNOLOGY
9

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT
9

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:
CES338 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT  
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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, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES  
Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVTION IN ELECTRICAL UTILITIES  
Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V SUSTAINABLE DEVELOPMENT  

TOTAL: 45 PERIODS

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