1. PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

To enable the graduate students of Textile Technology and allied studies to

a. Enhance their knowledge related to the theory of colouration and textile wet processes
b. Enhance their knowledge on advances in textile chemical processes
c. Design, conduct and interpret the results of the textile experiments
d. Design new processes and products

2. PROGRAM OUTCOMES (POs):

Upon completion of the program, the student shall be able to

1. An ability to independently carry out research/investigation and development work to solve practical problems.
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.
4. Effectively teach the students at the undergraduate level
5. Manage textile wet processing industry and solve technological problems
6. Use the advanced techniques, skills, and modern tools necessary for practicing in the textile wet processing industry.

PEO/PO Mapping:

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### M.TECH. TEXTILE TECHNOLOGY (WITH SPECIALIZATION IN TEXTILE CHEMISTRY)

#### CHOICE BASED CREDIT SYSTEM

#### I TO IV SEMESTERS CURRICULUM AND SYLLABUS

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**TOTAL CREDITS**
## LIST OF PROFESSIONAL ELECTIVE COURSES

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### AUDIT COURSES - I (AC)

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COURSE OBJECTIVES:
- To provide the knowledge on classification and types of textile auxiliaries
- To provide the knowledge on importance and basic functions of textile auxiliaries
- To enable the students to know about the chemistry of textile auxiliaries

UNIT I MODIFICATION OF SURFACE TENSION  12
Auxiliaries: Importance and functions; Surfactants: Mode of action and classification of surfactants – cationic, anionic, nonionic and amphoteric surfactants.

UNIT II PREPARATORY PROCESS  12
Auxiliaries associated with De-sizing, scouring, Bleaching of cellulosic fibres, Protein fibres and synthetic fibres.

UNIT III DYEING PROCESS  12
Auxiliaries associated with Dyeing with Direct Dyes, Reactive, Vat, Azoic colors, Sulphur dyes, Acid dyes, Metal complex dyes, Basic and Disperse dyes.

UNIT IV PRINTING PROCESS  12
Auxiliaries associated with printing: Direct Style of Printing, Discharge style of Printing, Resist style of printing.

UNIT V FINISHING PROCESS  12
Auxiliaries used in Resin Finishing, Stiff finishing, soft finishing, Water repellent, Water Proof, Flame retardant, Soil release.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students will be able to know about role of auxiliaries in
- Modification of surface tension
- Preparatory Process
- Dyeing Process
- Printing Process
- Finishing Process

REFERENCES:
8. Dr. N N Mahapatra., “Textile dyeing”, Woodhead publishing India, 2018
## Mapping of CO with PO

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COURSE OBJECTIVES:
- To enable the students to study about the mechanism of Preparatory process
- To enable the students to study about elements of dye chemistry
- To enable the students to study about Printing methods & styles and the
- Necessity of Finishing

UNIT I DE-SIZING 12

UNIT II BLEACHING 12
Mechanism of Bleaching - important Bleaching agents for Textile fibres and their chemical actions -chemistry of peroxide bleach and use of per-acetic acid for synthetic fibres – concept of full bleach and half bleach- Application of OBA to textile materials. Mercerization: Mechanism of Mercerization -influencing parameters on Mercerization quality of textile materials — methods of Mercerization –evaluation of Mercerization.

UNIT III ELEMENTS OF DYE CHEMISTRY 12
Classification of dye stuffs according to their chemical constitution/ structure and specific applications VBT and MO Theory of colour - interaction of dye molecules with polymeric chains – Fick’s first and second Laws of diffusion – Adsorption theory – Study about natural dyes and their application to fibres like cotton, wool and silk.

UNIT IV PRINTING 12

UNIT V FINISHING 12

TOTAL :60 PERIODS

COURSE OUTCOMES
Upon completion of this course the student shall be able to know the mechanism of
- Desizing
- Bleaching
- Dye chemistry
- Printing
- Finishing

REFERENCES:
8. Mathews Kolanjikombil “Pretreatment of Textile Substrates”, Woodhead publishing India, 2019
## Mapping of CO with PO

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<td>Desizing</td>
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<td>Bleaching</td>
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<tr>
<td>CO4</td>
<td>Printing</td>
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<td>CO5</td>
<td>Finishing</td>
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<tr>
<td><strong>Overall CO</strong></td>
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</table>
COURSE OBJECTIVES:
To enable the students to learn about
- Fibre forming polymer characteristics and their related models and models describing fibre structure.
- Conducting of experiments to characterize the polymers and fibres

UNIT I BASIC CONCEPTS 9
Synthetic fibre forming polymers, definition, terms and fundamental concepts of polymerization; molecular architecture in polymers-configuration and conformation, molecular weight and its influence on fibre formation

UNIT II POLYMER PROPERTIES 9
Glass transition temperature (Tg), factors affecting Tg, WLF equation; rubber elasticity; melting and crystallization, polymer solutions- solubility parameter and its significance to fibre spinning.

UNIT III FLUID FLOW AND MASS TRANSFER 9
Newton’s law of viscosity, velocity distribution in flow systems Newtonian and non-newtonian fluids; mass transfer operations: Fick’s law of diffusion, solid-liquid extraction and drying operations with application to polymer chips.

UNIT IV VISCOELASTICITY 9
Deformation of elastic solid, viscoelasticity and its measurement, non-linear viscoelasticity, yield behavior of solids and breaking phenomena

UNIT V PROPERTIES OF FIBRES 9
Mechanical properties of natural and synthetic fibres; moisture sorption behavior of natural and synthetic fibres; Thermal, Frictional and optical properties of fibres

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student shall have knowledge on
CO1: The synthesis of polymers
CO2: Properties of polymers
CO3: Rheological characteristics
CO4: Viscoelastic behavior of polymers
CO5: Properties of fiber

REFERENCES:
## Mapping of CO with PO

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<tr>
<th>Course outcomes</th>
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<td>-</td>
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<td>CO5</td>
<td>Properties of fiber</td>
<td>1</td>
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</table>
MA4158 STATISTICAL APPLICATIONS IN TEXTILE ENGINEERING

COURSE OBJECTIVES:
- To understand the basics of random variables and point estimation with emphasis on the standard distributions.
- To apply the small and large sample tests through Tests of hypothesis.
- To understand the concept of analysis of variance and use it to investigate non-parametric model.
- To monitor a process and detect a situation when the process is out of control.
- To apply the concept of analysis of variance and use it to investigate factorial dependence.

UNIT I PROBABILITY DISTRIBUTION AND ESTIMATIONS 12
Applications of Binomial, Poisson, Normal, t, Exponential, Chi-square, F and Weibull distributions in textile engineering - Point estimates and interval estimations of the parameters of the distribution functions.

UNIT II HYPOTHESIS TESTING 12
Sampling distribution - Significance tests applicable to textile parameters – Normal test, t-test, Chi-square test and F-test - p-values - Selection of sample size and significance levels with relevance to textile applications - Acceptance sampling.

UNIT III ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS 12
Analysis of variance for different models – Non-parametric tests - Sign test - Rank test - Concordance test.

UNIT IV PROCESS CONTROL AND CAPABILITY ANALYSIS 12
Control charts for variables and attributes - Basis, Development, Interpretation, Sensitizing rules, Average run length - Process capability analysis.

UNIT V DESIGN AND ANALYSIS OF EXPERIMENTS 12
$2^k$ full-factorial designs - Composite designs - Robust designs - Development of regression Models - Regression coefficients - Adequacy test - Process optimizations.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
- Analyze the performance in terms of probabilities, distributions and point estimation achieved by the determined solutions.
- Apply the basic principles underlying statistical inference (estimation and hypothesis testing).
- Demonstrate the knowledge of applicable large sample theory of estimators and tests.
- Identify the applicable sample theory of estimators and tests.
- Obtain a better understanding of the importance of the methods in modern industrial processes.

REFERENCES:
UNIT I  RESEARCH DESIGN  6
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II  DATA COLLECTION AND SOURCES  6
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III  DATA ANALYSIS AND REPORTING  6
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV  INTELLECTUAL PROPERTY RIGHTS  6

UNIT V  PATENTS  6

REFERENCES:

TOTAL:30 PERIODS

TY4111  PRODUCTION PROCESS LABORATORY  L T P C 0 0 4 2

COURSE OBJECTIVES
- To enable the students to know about the preparatory and Dyeing processes for natural & Manmade fibres in suitable machines
- To enable the students to know about the Printing process.

LIST OF EXPERIMENTS
2. Bleaching of cotton fabric in laboratory using different machines.
3. Dyeing of cotton fabric in laboratory model jigger using reactive dyes to match a given sample
5. Dyeing of knitted cotton fabric in laboratory model winch using reactive dyes and to determine their fastness properties.
7. Pigment printing woven fabric using table screen printing and determine the appropriate
fastness properties.
8. Dry cleaning for different types of fabric using Garment washing Machine
9. Correction recipe predication from computer colour matching
10. Measurement of delta-E

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS REQUIRED
1. Dye Bath
2. Miniature Jigger
3. Miniature Winch
4. Miniature Kier
5. Padding Mangle (Manual & Pneumatic)
6. Soft flow Dyeing machine
7. Infrared dyeing machine
8. High Temperature Dyeing Machine
9. Tumble Dryer
10. Table screen printing machine
11. Steamer

COURSE OUTCOMES:
Upon completion of this course the student shall be able to know about the
CO1: Pre-treatment of textile using different machines
CO2: Dyeing processes for cotton fabric in suitable machines
CO3: Dyeing processes for cotton/polyester blend fabric in suitable machines
CO4: Screen printing with pigment
CO5: Colour matching and its importance
## Mapping of CO with PO

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<td>CO4</td>
<td>Screen printing with pigment</td>
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<tr>
<td>CO5</td>
<td>Colour matching and its importance</td>
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<td>Overall CO</td>
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</table>
COURSE OBJECTIVES:
To enable the students to learn about
• Characteristics of textile materials and their related models to describe their properties.
• Conducting experiments to characterize the polymers and fibres

LIST OF EXPERIMENTS
1. Determination / Analysis of Molecular weight determination using GPC
2. Rheological studies using viscometer
3. Determination of MFI
4. Determination / Analysis of Birefringence measurement
5. Determination / Analysis of Creep and Stress relaxation of filament
6. Determination / Analysis of DSC Thermogram of different fibres
7. Determination / Analysis of Thermograms using TGA
8. Analysis - FTIR and NMR graphs
9. Determination / Analysis of crystallinity by XRD
10. Determination of residual formaldehyde in fabrics
11. Evaluation of Flame retardant finish
12. Evaluation of Water repellent finish
13. Evaluation of conductivity of fabrics
14. Determination of surface tension of liquids
15. Determination / Analysis of contact angle for porous substrates

TOTAL: 90 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the student will be able to
CO1: Analyze the characteristics of textile materials using advanced characterizing techniques
CO2: Analyze the graphs, charts of TGA, FTIR spectrometer and X-ray Diffractometer
CO3: Evaluate fabric finishes and nature of fabrics
CO4: Determine the property of liquids
CO5: Characterize the porous substrates

Course Articulation Matrix:

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<td>CO1</td>
<td>Analyze the characteristics of textile materials using advanced characterizing techniques</td>
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<tr>
<td>CO2</td>
<td>Analyze the graphs, charts of TGA, FTIR spectrometer and X-ray Diffractometer</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>Evaluate fabric finishes and nature of fabrics</td>
<td>3</td>
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<tr>
<td>CO4</td>
<td>Determine the property of liquids</td>
<td>3</td>
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<tr>
<td>CO5</td>
<td>Characterize the porous substrates</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 study about concept of colour vision & the measurement of colour
- To study about the influence of fibre structure on dyeing & various dyeing models
- To give basic idea about Application & importance of CCM

UNIT I  COLOUR AND COLOUR VISION 9
Definition of colour and its classification – Structure and function of the eye – Detail study about rods and cones – Modeling the colour vision process – Tests for defective colour vision. Study about metamerism

UNIT II  MODERN MEASUREMENT OF COLOUR 9
Detail study about colour measuring instruments like Spectro-photometer – Color eye – Derivation of KM equation and its application. Colour difference equations and application

UNIT III  COMPUTER COLOUR MATCHING 9
Derivation the equation for Evaluation of depth and relative depth – Evaluation of fastness test results– Evaluation of whiteness and yellowness–Recipe formulation and correction. Development in CCM. Problem and solution to measure OBA treated materials

UNIT IV  THE INFLUENCE OF FIBRE STRUCTURE ON DYEING 9
Dyeing properties related to the inherent physical structure of the fibre– The relationship between preparation and the physical properties of man-made fibres – The interaction between dyes &fibre forming polymers. Methods to find out nature of bonding in dyes materials. Study about four types of adsorption isotherms

UNIT V  DYEING MODELS 9
Mechanisms of reactions of reactive groups – Kinetics of hydrolysation of reactive groups – Methods to avoid hydrolysation and to get better fixation. Methods to improve dye ability of textile materials such as crafting, cationisation, solvent treatment etc

OUTCOMES

Upon completion of this course the student shall have knowledge on
- CO1: Concept of colour and colour vision
- CO2: Different colour measuring instruments and equations related to colour theory.
- CO3: Concepts of computer colour matching.
- CO4: The influence of fibre structure on dyeing process.
- CO5: The mechanism and kinetics involved in dyeing process

REFERENCES

5. Wyszecki.G., and W.S.Stile,‘Colour science, concept and methods, Quantitative data
## Mapping of CO with PO

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<td>CO1</td>
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<tr>
<td>CO2</td>
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<td><strong>Overall CO</strong></td>
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</table>
OBJECTIVES

- To enable the students to study about the importance of finishing, concept of flame proof and retardancy, soil release and ntipilling finish, mechanical finishing and other techniques in finishing

UNIT I


UNIT II

Concept of Flame proof & flame retardancy. Concept of pyrolysis, Flame retardant finishes for cotton, Concept of waterproof and water repellent Finishes, Durable water repellent finishes on cotton, Mildew proof finishes and Rot proof finishing.

UNIT III


UNIT IV


UNIT V

Mechanism in the weight reduction of PET by using alkali; microencapsulation techniques in finishing process, Detail study of the process to produce silk like Polyester. Felting of wool. Study about cationic, reactive and silicon emulsions ofteners. Brief study about stiffening of textile materials

LABORATORY

Application of finishing agent and characterization of fabrics

1. Formaldehyde and non formaldehyde finishing.
2. Flame proof & flame retardancy using THPC.
3. Water proof and water repellent
4. Soil Release and Antistatic agent
5. Weight reduction of PET using alkali
6. Felting of wool
7. Softeners & Stiffness

OUTCOMES

Upon completion of this course the student shall have knowledge on

- CO1: The chemistry of resin finishing.
- CO2: The mechanisms of flame retardant, water repellent finishes and mildew finishing
- CO3: The importance and mechanism of soil release and antistatic finish.
- CO4: The types of mechanical finishes used in the textile industry.
- CO5: The finishes carried out for silk, wool and polyester fabrics.

REFERENCES

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<td>The chemistry of resin finishing.</td>
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<tr>
<td>CO2</td>
<td>The mechanisms of flame retardant, water repellent finishes and mildew</td>
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<td>finishing</td>
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<td>The importance and mechanism of soil release and antistatic finish.</td>
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<td>Overall CO</td>
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</table>
OBJECTIVES

- To enable the students to study about the pollution monitoring and control, waste water characteristics, identification and reduction of pollution sources in textile wet processing, health, safety and waste management in textile industry.

UNIT I REGULATORY BODY 6
Industrial policy of India; pollution monitoring and control; functions and activities of Ministry of environment; Central and State pollution control boards; environmental clearance and guidelines for industries; environment impact assessment; fiscal incentives for environmental protection; environmental auditing.

UNIT II WASTE WATER TREATMENT 6
Waste water characteristics; waste water treatment- objectives, methods and implementation considerations; recycling of effluents.

UNIT III CHARACTERISATION 6
Identification and reduction of pollution sources in textile wet processing; pollution control in man – made fiber industry; analysis of textile processing effluents –colour, odour, pH, total solids, suspended solids, total dissolved solids, BOD, COD, total alkalinity, chloride, sulphates, calcium and chromium; tolerance limits for effluents; bio-degradability of textile chemicals and auxiliaries.

UNIT IV ECO FRIENDLY TEXTILE PROCESSING 6
Technical regulations on safety and health aspects of textile materials – banned dyes and chemicals; eco labeling, eco friendly textile processes - machines and specialty chemicals; natural dyes and environmental considerations.

UNIT V WASTE MANAGEMENT 6
Need for solid and hazardous waste management in textile industry, types and sources of solid and hazardous wastes, storage, collection and transport of wastes, waste processing technologies, waste disposal, Waste recycling, circular economy, zero liquid discharge.

TOTAL: 30 PERIODS

LABORATORY
Measurement of
1. Water hardness
2. Colour of effluent
3. pH
4. BOD and COD
5. Chromium content
6. Formaldehyde content on the fabric
7. Amines of banned dyes.
8. Mixed salt characterization (RO Reject Management System)

TOTAL: 30 PERIODS

OUTCOMES
Upon completion of this course the student shall have knowledge on

- CO1 Government policies and regulations associated with pollution control.
- CO2: The properties of waste water and types of waste water treatments.
- CO3: Analyze of textile processing effluent.
- CO4: The concepts of eco friendly textile process and banned dyes and chemicals.
- CO5: The solid and hazardous waste management in textile industry.

REFERENCES
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OBJECTIVES

- To enable the students to know about Ways to improve the absorbency, whiteness of fabric by various preparatory processes, development of simultaneous dyeing & finishing process and Transfer printing process for Natural Synthetics

LIST OF EXPERIMENTS

Reverse engineering of textile products with an emphasis on testing protocols – Four each for a student

TOTAL: 120 PERIODS

OUTCOMES

Upon completion of this course the student shall be able to

- Know about the combined preparatory & Dyeing processes
- Know about the eco friendly finishing processes
- know about the Method of Transfer printing for cotton & PET

LIST OF EQUIPMENTS REQUIRED

1. Dye bath -1no.
4. Miniature Kier -1no.
5. Padding Mangle -1no.
6. Vacuum ironing and steam iron box -1no.
7. Steamer -1no.
8. Garment Washing machine -1no.
9. High temperature dyeing machine -1no.
10. Curing Chamber -1no.

Mapping of CO with PO

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<td>Know about the combined preparatory &amp; Dyeing processes</td>
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<tr>
<td>CO2</td>
<td>Know about the eco friendly finishing processes</td>
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<tr>
<td>CO3</td>
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TY4311 PROJECT WORK I

OBJECTIVES

The course aims to enable the students to

- identify the problem/process relevant to their field of interest that can be carried out
- search databases and journals to collect and analyze relevant data
• plan, learn and perform experiments to find the solution
• prepare project report

TOTAL : 180 PERIODS

Individual students will identify a problem relevant to his/her field of study, collect and analyze literature, design, and carryout experiment, collect data, interpret the result and prepare the project report.

OUTCOMES:
At the end of the course the students will be able to
CO1 Identify the research/industrial problems
CO2 Collect and analyze the relevant literature
CO3 Design, conduct experiment and analyse the data
CO4 Prepare project report

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<td>Identify the research/industrial problems</td>
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<tr>
<td>CO2</td>
<td>Collect and analyze the relevant literature</td>
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<tr>
<td>CO3</td>
<td>Design and conduct of experiment</td>
<td>3 3 2 1 3 3</td>
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<tr>
<td>CO4</td>
<td>Analysis and Interpretation of data</td>
<td>3 3 2 1 3 3</td>
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<tr>
<td>CO5</td>
<td>Prepare project report</td>
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TY4411
PROJECT WORK II

OBJECTIVES
The course aims to
• Train students to analyze the problem/ think innovatively to develop new methods/product/process
• make them understand how to find solutions/ create products economically and in an environmentally sustainable way
• enable them to acquire technical and experimental skills to conduct experiment, analyze the results and prepare project report
• enable them to effectively think about strategies to commercialize the product.

TOTAL : 360 PERIODS

Individual students will identify a problem relevant to his/her field of study, collect and analyze literature, design, and carryout experiment, collect data, interpret the result and prepare the project report.

COURSE OUTCOMES
At the end of the project the student will be able to
CO1 Formulate and analyze problems for developing new methods/solutions/processes.
CO2 Plan and conduct experiments to find solutions in a logical manner
CO3 Analyze the results, interpret and prepare project report/know the strategies for commercialization
COURSE OBJECTIVES:
To enable the students to know about the
- Textile Costing in manufacturing
- Cost control and reduction

UNIT I  FUNDAMENTALS OF COSTING  9
Cost concept; Classification of cost, elements of cost.; Methods of costing; Unit and operating costing, preparation of cost sheet; Estimation of cost of production and component of total cost. Profit planning, job order, batch process, conversion cost. Inventory costing

UNIT II  COSTING IN SPINNING INDUSTRY  9
Elements of cost – Ascertainment of Clean Cotton Cost – Cost Statements Quantity and value of total cotton/ Man-made fiber issued input, wastage and output in each processing cost center up to yarn stage- Net Mixing Cost- Waste multipliers for each cost center mixing wise Cost Centre wise conversion cost, Selling price of various wastes. Power cost estimation, Yarn realization statement, Decision making using Contribution per frame shift among various counts of yarn production.

UNIT III  COSTING IN WEAVING INDUSTRY  9
Elements of cost Calculation of Yarn requirements for weaving –computation of value loss and net realization, Cost Statements– Cost centre wise conversion cost from winding to weaving, Sort wise cost of production of Grey Cloth sort wise stock accounting of Grey cloth, Cost of Sizing material, Cost of sales of cloth sold in grey stage and sales realization

UNIT IV  COSTING IN KNITTING AND GARMENT INDUSTRY  9

UNIT V  COST CONTROL AND COST REDUCTION  9
Introduction, Process of Cost Control and Cost Reduction, Cost Reduction Programme and its implementation, Methods and Techniques-Value analysis and Value Engineering, Just -In-Time (JIT), Activity Based Costing(ABC).

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon Completion of This Course, the student shall have knowledge on
CO1: Fundamentals of Costing
CO2: Costing in spinning industry
CO3: Costing in Weaving industry
REFERENCES:

Mapping of CO with PO

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<td>CO4</td>
<td>Costing in Knitting and Garment Industry</td>
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<tr>
<td>CO5</td>
<td>Cost control and reduction</td>
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TX4072 FUNCTIONAL DYES L T P C 3 0 0 3

COURSE OBJECTIVES:
To enable the students to
- Recall the basics of dyes and their use in textile industry
- Define functional dyes and recognize their use
- Understand the application of functional dyes
- Know the importance of toxicity and health aspects of dyes

UNIT I BASICS OF DYES General survey of dyes; chemical structure of dyes, general properties of dyes, chromophores and dye classes for textile application

UNIT II DYES USEDIN TEXTILES Dyeing technology; standardization of textile dyes: dyes for cellulosic fibres, polyamides, polyesters and acrylic fibres; optical brightening agents: chemistry and evaluation of OBA

UNIT III FUNCTIONAL DYES Functional dyes: dyes for leather; fur; paper; hair; food and inks – introduction, chemical structure and requirements
UNIT IV APPLICATION OF FUNCTIONAL DYES
Dyes used for imaging, invisible imaging, displays, electronic materials and biomedical applications; solar cells

UNIT V TOXICOLOGY AND HEALTH ASPECTS
Toxicity and environmental assessment; regulatory and legislative aspects

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course the student shall have knowledge on
CO1: Chemical structure and properties of dyes
CO2: Dyes used in textiles
CO3: Functional dyes, their chemical structure and requirements
CO4: Applications of the functional dyes in different industries
CO5: Toxicity and health issues

REFERENCES:
8. Non-Textile Dyes, Freeman H. S.

Course Articulation Matrix:

<table>
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<tr>
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<td>Applications of the functional dyes in different industries</td>
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<td>Toxicity and health issues</td>
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1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively
COURSE OBJECTIVE:
- To enable the students to learn about characterization of polymers used in the production of textile fibres

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, high performance liquid chromatography

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

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

UNIT IV  MICROSCOPY  9
Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefringence

UNIT V  OTHER PROPERTIES  9
Crystallinity by density measurements, surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

COURSE OUTCOMES:
Upon completion of this course, the student shall be able to
CO1: Determine the molecular weight using various techniques
CO2: Interpret molecular structure obtained from various analytical instruments
CO3: Determine the thermal properties using various instruments
CO4: Analyze the various microscopic principles
CO5: Know about the properties of textile polymers

TOTAL: 45 PERIODS

REFERENCES:

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<td>Interpret molecular structure obtained from various analytical instruments</td>
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<tr>
<td>CO3</td>
<td>Determine properties instruments</td>
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</table>
OBJECTIVES
To enable the students to know about the
- Various Preparatory processes for manmade textile
- Practical problems and their solutions in wet processing of manmade textiles

UNIT I PREPARATORY PROCESSES

UNIT II DYEING

UNIT III BLENDED DYEING

UNIT IV PRINTING
Printing of synthetic and blended fabrics with different dye classes - Direct, resist and discharge styles of printing-Transfer printing of polyester and blends.

UNIT V FINISHING
Different functional and easy care finishes on synthetics and blends like anti-stat, soil-release, soil-resistant, flame-retardant.

TOTAL: 45PERIODS

OUTCOMES
Upon completion of this course the student shall have knowledge on
CO1: The concept of heat setting and mass colouration of manmade textiles
CO2: The concept of dyeing of polyester and acrylic fabrics.
CO3: The dyeing of the blend fabrics.
CO4: The printing of synthetic fabrics and their blends.
CO5: The different types of finishing of synthetic fabrics.
REFERENCES

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Overall CO

35

TY4003

NON WOVEN AND SPECIALITY TEXTILES

L T P C
3 0 0 3

OBJECTIVES
- To enable the students to know about the methods of producing nonwoven fabrics.
- To enable the students to know about the structure & application of nonwoven fabrics in industrial purposes.

UNIT I WEB FORMING AND BONDING

UNIT II STRUCTURE AND EVALUATION

UNIT III FABRIC PRODUCTION
Classification and Definition - Preparatory processes. Fabric Production – Conventional shuttle looms, Endless Tape Looms, Circular Hose Pipe looms. Shuttleless Looms – Catch thread and flat knitting edge looms; Multicolor Needle Jacquard looms.

UNIT IV UNCONVENTIONAL FABRICS
Production of Industrial Tapes, Elastic Tapes, Zip fastener tapes; Woven and printed labels. Stretch fabrics - classification and its production; Elastomeric stretch fabrics; Braided fabrics; -
Tubular structures - Braiding Machine; Nets and Laces - Types and description of Lace Machines - Knitting of laces - Tricot Lace Machines. Flocked fabrics –The process of flocking.

UNIT V  CARPETS  9
Carpets-Non-pile carpet weaves and their looms. Tufted carpets and their production–Pile surfaced carpet weaves and their looms. Needle felt floor coverings.  TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course the student shall have knowledge on
CO1: The different types of web forming and bonding techniques of non woven fabrics.
CO2: The structure and end uses of non woven fabrics.
CO3: The different types of associated with specialty textiles
CO4: The production and end uses of industrial tapes and laces.
CO5: The production of carpets and end uses.

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TOTAL: 45 PERIODS
OBJECTIVES:
- To enable the students to analyse the textiles and chemicals through various analytical instruments
- To enable the students to interpret the results from analytical instruments

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Errors, Precision and Accuracy: Definitions, Significant figures – Types of Errors – Methods of expressing accuracy and precision, Confidence limits.

OUTCOMES:
Upon completion of the course, the students shall have knowledge on
- The concepts of spectroscopy
- The spectroscopy instruments used in textile industry.
- Analysis of the textile samples using spectroscopy.
- The concepts and types of chromatography.
- Interpretation of the results from analytical instruments

REFERENCES:
Mapping of CO with PO

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TX4073 COATED AND LAMINATED TEXTILES L T P C 3 0 0 3

OBJECTIVE
- To enable the students to learn the production and applications of coated and laminated textile and their testing

UNIT I POLYMERS USED IN COATING 9
Natural Latex & synthetic rubbers, synthetic polymers: polyurethanes, poly (vinyl chloride), polyacrylate elastomers, silicone elastomers, poly (Tetrafluoroethylene), polyethylene, chlorinated and chlorosulphonated polyethylenes, foams for laminates; textile substrate for coating

UNIT II METHODS OF COATING 9
Knife coating, roll coating, dip coating, transfer coating, gravure coating, rotary screen printing, calendaring, hot melt coating, foam coating, lamination by adhesives, welding.

UNIT III END USES OF COATING I 9
Breathable textiles, microporous coatings and films, hydrophilic coatings, smart temperature responsive breathable coatings; synthetic leather, architectural textiles, fluid containers, tarpaulins, automotive applications, carpet backing, flocking, fusible interlinings.

UNIT IV END USES OF COATING II 9
Thermochromic fabrics, temperature adaptable fabrics, fabrics for chemical protection, camouflage nets, high visibility garments, intumescent coating, metal and conducting polymer coated fabrics, coating with hydrogel and shape memory polymers

UNIT V CHARACTERIZATION OF COATED TEXTILES 9
Tensile strength, elongation, adhesion, tear resistance, weathering behavior, microbiological degradation, yellowing, testing standards

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course the student shall have knowledge on
CO1: Different kinds of polymers used for coating and laminating
CO2: Different methods of coating and laminating
CO3: Application of coated and laminated textiles in weather proofing and upholstery
CO4: Application of coated and laminated textiles conductive and temperature applications
CO5: Characterization of coated textiles

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.

**TY4005**  
**BIO PROCESSING OF TEXTILES**  
**OBJECTIVES**  
To enable the students to know about the  
- Pollution and its control in textile processing industries  
- Application of bio technology in textile wet processing

**UNIT I**  
**INDUSTRIAL BIO-TECHNOLOGY**  
9  

**UNIT II**  
**ENVIRONMENTAL BIO-TECHNOLOGY**  
9  
Detailed study about pollution and its control in textile processing industries. Waste watert treament systems– Anaerobic & Aerobic systems, Bio-degradation– Micro organism in pollutioon control; Biomass production; waste as renewable sources of energy– Production of biogas production of hydrocarbon– Hydrogen fuel.

**UNIT III**  
**ENZYMES USED IN TEXTILE INDUSTRY**  
9  
UNIT IV  EVALUATION OF ENZYME TREATED FABRICS  9
Weight loss, Whiteness index, Absorbency, Tensile strength, Handle of fabric and Abrasion resistance. SEM analysis and other structure related studies.

UNIT V  BIO–PROCESSING IN TEXTILES  9
Bio-bleaching, combined bio - processing, bio washing, bio polishing, Denim fading, antiodour and antimicrobial finishes, biofinishing and other applications.

OUTCOMES
Upon completion of this course the student shall have knowledge on
- The origin and concept about enzymes.
- Waste water treatments associated with enzyme in textile wet processing industry.
- The contribution of enzyme in pretreatment processes.
- Analysis of fabric properties of enzyme treated fabrics.
- The bio processing in textile industry.

REFERENCES
1. Betrabet S. M.BTRA Seminar, Book of papers(Jan1994)

Mapping of CO with PO

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

TY4006  HIGH PERFORMANCE FIBRES  L T P C  3 0 0 3

OBJECTIVES
To enable the students to learn about
- Advanced spinning technology for manufacturing high performance fibres, their properties and applications

UNIT I  METHODS OF PRODUCTION  9
Fundamentals of high performance fibres; comparison of regular and high performance fibres; fibre forming process; manufacturing, properties and applications-aramid fibres, high performance polyethylene
UNIT II INDUSTRIAL APPLICATION FIBRES
Manufacturing, properties and applications—glass fibres, basalt fibres; carbon fibres, ceramic fibres

UNIT III BIODEGRADABLE FIBRES, PROTEIN FIBRES
Manufacturing, properties and applications—alginate fibres; chitosan fibres; regenerated protein fibres—silk, wool, casein, soy bean fibre; synthetic biodegradable fibres

UNIT IV CHEMICAL RESISTANT FIBRES
Manufacturing, properties and applications of chemical resistance fibres—chlorinated fibres, fluorinated fibres, PPS, PEEK and PEI; thermal resistant fibres—semi carbon fibres, PBI, PBO

UNIT V SPECIALTY FIBRES
Manufacturing, properties and applications—hollow fibres, profile fibres blended and bi-component fibres, film fibres; functionalization of fibres—methods and applications

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall have knowledge on
• The method of producing high performance fibres
• The industrial applications of High performance fibres
• Selection of high performance fibres for medical applications
• The properties of speciality fibres for specific applications
• The end uses of high performance fibres.

REFERENCES

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TY4007 ECO-FRIENDLY DYES, CHEMICALS AND PROCESSING L T P C

OBJECTIVES:
• To impart knowledge about the environmental and ecological aspects of various chemicals,
dyes and auxiliaries used in processing.
- To make the students aware of the alternative chemicals and dyes that can replace the harmful chemicals.
- To update the students on the various rules, regulation that governs the textile processing industry.

UNIT I IMPACT OF TEXTILE PROCESS CHEMICALS ON ECOLOGY
Pollution - definition - Types - Impact of pollution on environment- Pollution capability of chemicals and products used in processing - pollution load at every stages of processing – Pollution associated with various colouration process - Need for eco-friendly processing- Important issues in exports- Red listed chemicals - Possible sources of contamination of various red listed chemicals- German Laws – Ban on amines and Azo dyes- List of banned amines and chemicals.

UNIT II ECO STANDARDS

UNIT III ECO TESTING
Toxic substances used in processing and safe alternatives- Principles and procedures involved in the estimation of pH, pesticides, Residual formaldehyde, carcinogenic dyes, chlorinated phenols, phthalates, organo tin and heavy metals, – Consequences of presence of above compounds in Textiles – permissible limits – eco testing of antimicrobial finish with triclorsan.

UNIT IV ECO FRIENDLY PROCESSING

UNIT V CLEAN TECHNOLOGIES FOR FUTURE
Clean technology – Sustainable development – Ozone bleaching, RF drying, Microwave assisted dyeing, Ultrasonic assisted processing, Supercritical CO2 dyeing, importance of energy & water conservation – Energy audit - Basics & application scope of Nano technology in textiles - Occupational diseases & safety measures in Textile units.

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course the student shall have knowledge on
- The ecology associated with textile processing.
- The eco standards.
- The eco testing relevant to textile materials.
- The eco friendly textile wet processing.
- The auditing and safety measures related to effluents in textile industry.

REFERENCES:
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Overall CO: 2 1 1.8 2.4 1 1

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

TY4008 TECHNICAL TEXTILES

OBJECTIVES

- To enable the students to know about the concept, application & evaluation of technical textiles in various fields.
- To enable the students to know about finishing processes for technical textiles

UNIT I  INDUSTRIAL TEXTILES
Design and characteristics required in textiles for transport applications; applications of textile reinforced composites in transport sector; quality requirement of yarns used in fishing industry like nets, ropes; conveyor belts, power transmission belts.

UNIT II  MEDICAL AND HYGIENE TEXTILES
Design and characteristics required in textiles for medical and hygiene applications; antimicrobial, disposable and reusable products; textiles in sportswear

UNIT III  PROTECTIVE TEXTILES
Garment design and choice of materials in protection from hazards due to mechanical, extreme climate, nuclear, biological, chemical and flame

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,

UNIT V  FILTRATION AND INSULATION MATERIALS
Sound and thermal insulation materials; Filtration basics, Filters deployed for air and water pollutants and evaluation of filtration efficiency.

TOTAL: 45 PERIODS

OUTCOMES

Upon completion of this course the student shall have knowledge on

- The Concept, application and evaluation of filtration and geo textiles
- The Fabric requirements for protective textiles
- The Applications of textile in transportation
• The Requirements, properties and application of textiles in medical field
• The Finishing processes for technical textiles and properties of agro textiles

REFERENCES

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TX4092    TEXTILE REINFORCED COMPOSITES    L T P C
3 0 0 3

OBJECTIVES
To enable the students to learn about
• Reinforcements, matrices used for the composites
• Manufacture and testing of composites and
• Mechanics of failure of composites

UNIT I  REINFORCEMENTS  9
Introduction – composites –classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites

UNIT II  MATRICES  9
Preparation, chemistry, properties and applications of thermoplastic and thermostet resins; mechanism of interaction of matrices and reinforcements; optimization of matrices

UNIT III  COMPOSITE MANUFACTURING  9
Classification; methods of composites manufacturing for both thermoplastics and thermostets- Hand layup, Filament Winding, Resin transfer moulding, prepgres and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

UNIT IV  TESTING  9
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminal shear stress and fatigue properties of thermostet and thermoplastic composites.

UNIT V  MECHANICS  9
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminal stresses using at ware

TOTAL: 45 PERIODS

OUTCOMES
Upon completion of this course, the student shall have knowledge on
• Different types of textile reinforcements
• Different types of matrices
• Manufacturing of composites
• Evaluation of the properties of thermostet and thermoplastic composite
• Mechanics of composites failure

REFERENCES
Mapping of CO with PO

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<td>Evaluation of the properties of thermoset and thermoplastic composite</td>
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<tr>
<td>CO5</td>
<td>Mechanics of composites failure</td>
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<tr>
<td><strong>Overall CO</strong></td>
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<td>1</td>
</tr>
</tbody>
</table>

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

TY4009 ADVANCED WET PROCESSING MACHINERY

OBJECTIVES:
- To enable the students to learn about the working principles of wet processing machineries.
- To enable the students to know about the operations of machines and its maintenance schedules.
- To expose the students to latest wet processing machineries.

UNIT I YARN DYEING MACHINES
Advances in continuous processing of cotton and wool materials - Advances in heating systems hank and yarn dyeing machines (cheese and warp) - importance of winding in yarn dyeing — calculation of winding density - detailed maintenance schedule for cheese dyeing machines.

UNIT II FABRIC DYEING MACHINES
Advances in Beam dyeing - Advances in soft flow, overflow, jet dyeing machines — Developments in jiggers,— Detail maintenance schedule for beam dyeing, jet dyeing and jiggers.

UNIT III DRYING MACHINES
Detail study and developments in vertical drying ranges - RF dryer, yarn dryer, tubular & open width knitted fabric dryer, Tumble dryer, devellat bed screen printing machines. Principle and working of fully automatic flat bed screen printing Equipments in balloon padding, hydro extractor, rope opener, maintenance schedule for the above machines. Heating systems for hot air stenters, Clip & pin type of stenters; Jig stenters — over feeding system and its importance - Hot flue dryer—float dryer— maintenance schedule for the above machines.

UNIT IV PRINTING MACHINES

UNIT V FINISHING MACHINES

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the student shall have knowledge on
The latest developments in fibre and yarn dyeing machines.
The advancements in fabric dyeing machines.
The developments in drying machineries.
The latest developments in printing machines.
The advancements in finishing machines.

REFERENCES:

Mapping of CO with PO

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>Program Outcome</th>
</tr>
</thead>
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<tr>
<td>CO1</td>
<td>The latest developments in fibre and yarn dyeing machines.</td>
<td>PO1 PO2 PO3 PO4 PO5 PO6</td>
</tr>
<tr>
<td>CO2</td>
<td>The advancements in fabric dyeing machines.</td>
<td>1 - 2 3 1 2</td>
</tr>
<tr>
<td>CO3</td>
<td>The developments in drying machineries.</td>
<td>1 - 2 3 1 2</td>
</tr>
<tr>
<td>CO4</td>
<td>The latest developments in printing machines.</td>
<td>1 - 2 3 1 2</td>
</tr>
<tr>
<td>CO5</td>
<td>The advancements in finishing machines.</td>
<td>1 - 2 3 1 2</td>
</tr>
<tr>
<td>Overall CO</td>
<td></td>
<td>1 - 2 3 1 2</td>
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</tbody>
</table>

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TY4010 DESIGN OF TEXTILE EXPERIMENTS

OBJECTIVES
To make the students to learn about the
- Fundamentals of experimental design and
- Selection of suitable design and analysis of the results.

UNIT I EXPERIMENTAL DESIGN FUNDAMENTALS
Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

UNIT II SINGLE FACTOR EXPERIMENTS
Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests, in respect of textile process, machine and quality parameters.

UNIT III MULTIFACTOR EXPERIMENTS
Two and three factor full factorial experiments, 2^K factorial Experiments, Confounding and Blocking designs; application in textile experiments.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS
Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F-tests for textile applications.
UNIT V TAGUCHI METHODS

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies related to textile engineering.

TOTAL: 45 PERIODS

OUTCOME
Upon completion of this course, the student shall have knowledge on
- The fundamentals of experimental design
- Statistical analysis and the single factor experiments
- Experimental design, statistical tests and analysis of the results to arrive at the conclusion
- The response surface methodology and other experimental design
- Analysis of the design parameters and case studies related to textile engineering

REFERENCES

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<tr>
<td>CO1</td>
<td>The fundamentals of experimental design</td>
<td>PO1 PO2 PO3 PO4 PO5 PO6</td>
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<td>2  2 2 3 1 1</td>
</tr>
<tr>
<td>CO2</td>
<td>Statistical analysis and the single factor experiments</td>
<td>2  2 2 2 1 -</td>
</tr>
<tr>
<td>CO3</td>
<td>Experimental design, statistical tests and analysis of the results to arrive at the conclusion</td>
<td>2  3 2 2 1 -</td>
</tr>
<tr>
<td>CO4</td>
<td>The response surface methodology and other experimental design</td>
<td>2  2 2 3 3 1</td>
</tr>
<tr>
<td>CO5</td>
<td>Analysis of the design parameters and case studies related to textile engineering</td>
<td>2  2 2 2 1 -</td>
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<td>Overall CO</td>
<td>2  2.2 2 2.4 1.4 1</td>
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</table>

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

TY4011 HOMETEXTILES

OBJECTIVES:
To enable the students to learn about the
- Recent developments in furnishing, floor covering and other home textile products
- Various kinds of materials used in home textile.

UNIT I HOME FURNISHING
UNIT II  
FLOOR COVERINGS  

UNIT III  
CURTAIN SAND DRAPERIES  

UNIT IV  
BEDLINERS  

UNIT V  
TOWELS  

OUTCOMES:  
Upon completion of this course, the student shall have knowledge on  
- Different types of home furnishings.  
- Different types of floor coverings.  
- Different types of curtains.  
- Different types of bed liners.  
- The production and types of towels.

REFERENCE:  

<table>
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<tr>
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<th>Program Outcome</th>
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<tbody>
<tr>
<td>CO1</td>
<td>Different types of home furnishings.</td>
<td>PO1 PO2</td>
</tr>
<tr>
<td>CO2</td>
<td>Different types of floor coverings.</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>Different types of curtains.</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>Different types of bed liners.</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>The production and types of towels.</td>
<td>-</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 facilitate the understanding of Quality Management principles and process.

UNIT I  INTRODUCTION

UNITII   TQM PRINCIPLES
Leadership-Quality Statements, Strategic quality planning, Quality Councils, Employee involvement, Motivation, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen – Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNITIII  TQM TOOL SAND TECHNIQUES I
These ventraditional tools of quality-New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking – Reason to benchmark, Benchmarking process - FMEA - Stages, Types.

UNITIV   TQM TOOLS AND TECHNIQUES II

UNITV    QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS

OUTCOME:
Upon completion of this course the student shall have knowledge on
- The concept and importance of total quality management.
- The principles of total quality management.
- The tools and techniques in total quality management.
- The quality circle and cost of quality.
- The quality management system.

REFERENCES:

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

**TX4091**  SUSTAINABILITY IN TEXTILE INDUSTRY  L T P C

3 0 0 3

**OBJECTIVE**

- To enable the students to learn the concepts of sustainability and its importance in textile industry

**UNIT I**  INTRODUCTION TO SUSTAINABILITY  9

Sustainability; Concepts and terminologies in sustainable approach; principles of sustainability; importance and application of sustainable approaches in textile industry

**UNIT II**  SUSTAINABILITY IN TEXTILE INDUSTRY  9

Supply chain in textile industry; sustainable cotton, wool, and synthetic fibre production and processing

**UNIT III**  SUSTAINABILITY IN PROCESSING  9

Enzyme biotechnology, plasma technology in textiles; waterless dyeing technologies, low liquor dyeing; sustainability in effluent treatment, water saving, zero hazardous chemicals.

**UNIT IV**  RECYCLING  9

Textile recycling: polymer, fibre, yarn and fabric; consumer perception of recycled textile products

**UNIT V**  ECO DESIGNING AND ECOLABELLING  9

Eco-design, building eco-design through supply chain; sustainability for credit rating; environmental management systems; standards for labelling, textile labels and environmental labelling; life cycle analysis of textiles

TOTAL: 45 PERIODS

**OUTCOMES**

Upon completion of this course the student shall have knowledge on

CO1: Concept of sustainability and importance
CO2: Sustainability in textile fibre production
CO3: Sustainability in in dyeing of textiles
CO4: Importance of recycling in textile industry
CO5: Eco-labelling and eco-designing

**REFERENCES**


Course Articulation Matrix:

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Statement</th>
<th>PO1</th>
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<td>Sustainability in textile fibre production</td>
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<tr>
<td>CO3</td>
<td>Sustainability in in dyeing of textiles</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>CO4</td>
<td>Importance of recycling in textile industry</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>2</td>
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<tr>
<td>CO5</td>
<td>Eco-labelling and eco-designing</td>
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</table>

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TX4074 PROTECTIVE CLOTHING L T P C

3 0 0 3

OBJECTIVES:
To enable the students to learn about
- Functional requirements of protective clothing
- Selection of fibre, yarn and fabric for developing protective clothing
- Evaluation of protective clothing

UNIT I FIBRE REQUIREMENTS
Suitability and properties of high performance fibres for various protective clothing – chemical composition and physical structure

UNIT II YARN AND FABRIC REQUIREMENTS
Types of yarns, woven, knitted and nonwoven fabric structures used for protective garments, methods of production, effect of structure on their performance

UNIT III CLOTHING CONSTRUCTION
Method of construction of garments according to various protective end uses like protection against cold, ballistic protection; use of different fabric type (knitted, woven, and nonwoven), coated, laminated in different places; use of inter lining and composites; 3D structures; high tech textiles–wearable electronics; protective garments for industrial and apparel end uses

UNIT IV FINISHING OF PROTECTIVE CLOTHING
Types of finishes - fire retardant finishes, water repellent finishes, anti - microbial finishes; chemical finishes against radiation and chemicals; method of application of finishes; protective finishes for health care garments

UNIT V QUALITY EVALUATION
Evaluation of protective fabrics - desirable properties of protective textiles, method of testing for thermal protective performance, abrasion and wear resistance, evaluation of resistance to mildew, ageing, sunlight, chemical, electrostatic and electrical resistivity, impact properties; ASTM standards for protective garments

TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students shall have knowledge on
CO1: Properties of fibres required for protective clothing
CO2: Selection of fibre, yarn and fabric for developing protective clothing for different applications
CO3: Protective clothing construction
CO4: Different types of finishes given to develop protective clothing
CO5: Evaluation of protective clothing

REFERENCES
AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

COURSE OBJECTIVES:
3. Teach how to improve writing skills and level of readability
4. Tell about what to write in each section
5. Summarize the skills needed when writing a Title
6. Infer the skills needed when writing the Conclusion
7. Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES:

AX4092 DISASTER MANAGEMENT L T P C
2 0 0 0

COURSE OBJECTIVES:
• Summarize basics of disaster
• Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
• Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
• Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
• Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 6
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

UNIT III DISASTER PRONE AREAS IN INDIA 6
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS

COURSE OUTCOMES:
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches
REFERENCES:

AX4093 CONSTITUTION OF INDIA L T P C
2 0 0 0

COURSE OBJECTIVES:
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

UNIT IV ORGANS OF GOVERNANCE
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

UNIT VI ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
of social reforms leading to revolution in India.
Discuss the circumstances surrounding the foundation of the Congress Socialist Party (CSP) under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950 (Bare Act), Government Publication.
4. தமிழகத்தை திதியிலே வேங்கத்தோக
5. புதுக்கோடி
   - திதியிலே வேங்கத்தோக
6. அகழ்நூறு (4) - மூலோ
   கைதுகோள் (11) - தொனோ
   கலித்தொருகம் (11) - ப்னோம், ப்னோ
   துற்றுகோள் 50 (27) - மூலோ
   இலக்கிய புத்தகங்கள் பதிப்புகள்

UNIT V

தலைத்தள் புத்தகம்

1. எதிரூர்த்த குறிப்பிட்டு
   - தமிழில் பதிவு பற்றை
   - தமிழில் திறன் திறன்
   - கலும்பு திறன், திறன்
   - பெண் திறன் திறன்
   - தொனோ
2. தர்மபுருஷார் விளையாட்டு விளையாட்டு, திறன், திறன்
3. தமிழ் விளையாட்டு விளையாட்டு, திறன், திறன்
4. பொது விளையாட்டு விளையாட்டு விளையாட்டு, திறன், திறன், திறன்
5. அறிவியல் குறிப்பிட்டு
6. முல்லப்பகுதி குறிப்பிட்டு
7. முல்லப்பகுதி குறிப்பிட்டு, திறன், திறன்

TOTAL : 30 PERIODS

தமிழ் தொழில்நுட்பாட்டு / புத்தகங்கள்

1. தமிழ் விளையாட்டு விளையாட்டு கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விளையாட்டு விளையாட்டு (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தர்மபுருஷார் விளையாட்டு
4. பொது விளையாட்டு விளையாட்டு
   - தமிழ் புத்தகங்கள் பதிப்புகள், தற்கொலை
5. தமிழ் விளையாட்டு விளையாட்டு
   - தமிழ் புத்தகங்கள் பதிப்புகள் (thamilvalarchithurai.com)
6. அறிவியல் குறிப்பிட்டு
   - தமிழ் புத்தகங்கள் பதிப்புகள், தற்கொலை
OBJECTIVE

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM

- Water as a global issue: key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS

- Economic view of water issues: economic characteristics of water good and services – Non-market monetary valuation methods – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS

- Basic notion of law and governance: principles of international and national law in the area of water management - Understanding UN law on non-navigable uses of international water courses – International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework.

UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT

- Links between water and health: options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM


OUTCOMES

- On completion of the course, the student is expected to be able to
  CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.
  CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
  CO3 Apply law and governance in the context of IWRM.
  CO4 Discuss the linkages between water-health; develop a HIA framework.
  CO5 Analyse how the virtual water concept pave way to alternate policy options.

REFERENCES:

OBJECTIVES:

- Understand the accelerating health impacts due to the present managerial aspects and initiatives in water and sanitation and health sectors in the developing scenario

UNIT I  FUNDAMENTALS WASH

Meanings and Definition: Safe Water- Health, Nexus: Water- Sanitation - Health and Hygiene – Equity issues-Water security - Food Security. Sanitation And Hygiene (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH

UNIT II  MANAGERIAL IMPLICATIONS AND IMPACT


UNIT III  CHALLENGES IN MANAGEMENT AND DEVELOPMENT


UNIT IV  GOVERNANCE

Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance -

UNIT V  INITIATIVES

Management vs Development -Accelerating Development- Development Indicators -Inclusive Development-Global and Local- Millennium Development Goal (MDG) and Targets - Five Year Plans - Implementation - Capacity Building - Case studies on WASH.

OUTCOMES:

- CO1 Capture to fundamental concepts and terms which are to be applied and understood all through the study.
- CO2 Comprehend the various factors affecting water sanitation and health through the lens of third world scenario.
- CO3 Critically analyse and articulate the underlying common challenges in water, sanitation and health.
- CO4 Acquire knowledge on the attributes of governance and its say on water sanitation and health.
- CO5 Gain an overarching insight in to the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects.

REFERENCES

OBJECTIVES:

- To impart knowledge on environmental, social and economic dimensions of sustainability and the principles evolved through landmark events so as to develop an action mindset for sustainable development.

UNIT I: SUSTAINABILITY AND DEVELOPMENT CHALLENGES


UNIT II: PRINCIPLES AND FRAMEWORK


UNIT III: SUSTAINABLE DEVELOPMENT AND WELLBEING


UNIT IV: SUSTAINABLE SOCIO-ECONOMIC SYSTEMS


UNIT V: ASSESSING PROGRESS AND WAY FORWARD


OUTCOMES:

- On completion of the course, the student is expected to be able to
  CO1 Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.
  CO2 Identify and critically analyze the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals
CO3 Develop a fair understanding of the social, economic and ecological linkage of
Human well being, production and consumption.

CO4 Evaluate sustainability issues and solutions using a holistic approach that focuses on
connections between complex human and natural systems.

CO5 Integrate knowledge from multiple sources and perspectives to understand
environmental limits governing human societies and economies and social justice
dimensions of sustainability.

REFERENCES:
1. Tom Theis and Jonathan Tomkin, Sustainability: A Comprehensive Foundation, Rice
   University, Houston, Texas, 2012
2. A guide to SDG interactions: from science to implementation, International Council for
   Science, Paris, 2017
   Rouledge Taylor and Francis, 2017.
4. The New Global Frontier - Urbanization, Poverty and Environment in the 21st Century -
   George Martine, Gordon McGranahan, Mark Montgomery and Rogelio Fernández-Castilla,
   IIED and UNFPA, Earthscan, UK, 2008

OCE434 ENVIRONMENTAL IMPACT ASSESSMENT  L T P C
3  0  0  3

OBJECTIVES:
• To make the students to understand environmental clearance, its legal requirements and to
  provide knowledge on overall methodology of EIA, prediction tools and models,
  environmental management plan and case studies.

UNIT I INTRODUCTION 9
Historical development of Environmental Impact Assessment (EIA). Environmental Clearance- EIA
in project cycle. legal and regulatory aspects in India – types and limitations of EIA – EIA process-
issues – public hearing in EIA- EIA consultant accreditation.

UNIT II IMPACT IDENTIFICATION AND PREDICTION 10
in EIA. prediction tools for EIA – mathematical modeling for impact prediction – assessment of

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT 8
Socio-economic impact assessment - relationship between social impacts and change in
community and institutional arrangements. factors and methodologies- individual and family level
impacts. communities in transition-rehabilitation

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN 9
Environmental management plan - preparation, implementation and review – mitigation and
rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project
audit – documentation of EIA findings – ethical and quality aspects of environmental impact
assessment

UNIT V CASE STUDIES 9
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

TOTAL: 45 PERIODS

OUTCOMES:
- On completion of the course, the student is expected to be able to
  
  CO1 Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles
  
  CO2 Understand various impact identification methodologies, prediction techniques and model of impacts on various environments
  
  CO3 Understand relationship between social impacts and change in community due to development activities and rehabilitation methods
  
  CO4 Document the EIA findings and prepare environmental management and monitoring plan
  
  CO5 Identify, predict and assess impacts of similar projects based on case studies

REFERENCES:
1. EIA Notification 2006 including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India
2. Sectoral Guidelines under EIA Notification by Ministry of Environment, Forest and Climate Change, Government of India

OIC431 BLOCKCHAIN TECHNOLOGIES

COURSE OBJECTIVES:
- This course is intended to study the basics of Blockchain technology.
- During this course the learner will explore various aspects of Blockchain technology like application in various domains.
- By implementing, learners will have idea about private and public Blockchain, and smart contract.

UNIT I INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN
Introduction to Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

UNIT II BITCOIN AND CRYPTOCURRENCY

UNIT III INTRODUCTION TO ETHEREUM
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.
UNIT-IV  INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING  10

UNIT V  BLOCKCHAIN APPLICATIONS  8
Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

COURSE OUTCOMES:
After the completion of this course, student will be able to
CO1: Understand and explore the working of Blockchain technology
CO2: Analyze the working of Smart Contracts
CO3: Understand and analyze the working of Hyperledger
CO4: Apply the learning of solidity to build de-centralized apps on Ethereum
CO5: Develop applications on Blockchain

REFERENCES:

OIC432  DEEP LEARNING  L T P C
            3 0 0 3

COURSE OBJECTIVES:
- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

UNIT I  DEEP LEARNING CONCEPTS  6

UNIT II  NEURAL NETWORKS  9

UNIT III  CONVOLUTIONAL NEURAL NETWORK  10

UNIT IV  NATURAL LANGUAGE PROCESSING USING RNN

UNIT V  DEEP REINFORCEMENT & UNSUPERVISED LEARNING

COURSE OUTCOMES:
CO1: Feature Extraction from Image and Video Data
CO2: Implement Image Segmentation and Instance Segmentation in Images
CO3: Implement image recognition and image classification using a pretrained network (Transfer Learning)
CO4: Traffic Information analysis using Twitter Data
CO5: Autoencoder for Classification & Feature Extraction

TOTAL : 45 PERIODS

REFERENCES
1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017

OME431 VIBRATION AND NOISE CONTROL STRATEGIES
OBJECTIVES
- To appreciate the basic concepts of vibration in damped and undamped systems
- To appreciate the basic concepts of noise, its effect on hearing and related terminology
- To use the instruments for measuring and analyzing the vibration levels in a body
- To use the instruments for measuring and analyzing the noise levels in a system
- To learn the standards of vibration and noise levels and their control techniques

UNIT- I  BASICS OF VIBRATION

UNIT- II  BASICS OF NOISE
Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound
pressure level - Addition, subtraction and averaging decibel levels - sound spectra - Types of sound fields - Octave band analysis - Loudness.

UNIT- III INSTRUMENTATION FOR VIBRATION MEASUREMENT


UNIT- IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS

Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization.

UNIT- V METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL


OUTCOMES:

On Completion of the course the student will be able to
1. apply the basic concepts of vibration in damped and undamped systems
2. apply the basic concepts of noise and to understand its effects on systems
3. select the instruments required for vibration measurement and its analysis
4. select the instruments required for noise measurement and its analysis.
5. recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.

REFERENCES:

OME432 ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS

COURSE OBJECTIVES:

1. To learn the present energy scenario and the need for energy conservation.
2. To understand the different measures for energy conservation in utilities.
3. Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
4. To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
5. To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement

UNIT I ENERGY SCENARIO

UNIT II HEATING, VENTILLATION & AIR CONDITIONING

UNIT III LIGHTING, COMPUTER, TV

UNIT IV ENERGY EFFICIENT BUILDINGS

UNIT V ENERGY STORAGE TECHNOLOGIES
Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Understand technical aspects of energy conservation scenario.
2. Energy audit in any type for domestic buildings and suggest the conservation measures.
3. Perform building load estimates and design the energy efficient landscape system.
4. Gain knowledge to utilize an appliance/device sustainably.
5. Understand the status and current technological advancement in energy storage field.

REFERENCES:
UNIT I  INTRODUCTION

UNIT II  DESIGN FOR ADDITIVE MANUFACTURING

UNIT III  VAT POLYMERIZATION

UNIT IV  MATERIAL EXTRUSION AND SHEET LAMINATION

POWDER BASED PROCESS

UNIT V  CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES

REFERENCES:
OME434  ELECTRIC VEHICLE TECHNOLOGY  L T P C  3 0 0 3

UNIT I  NEED FOR ELECTRIC VEHICLES  9
History and need for electric and hybrid vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, comparison of diesel, petrol, electric and hybrid vehicles, limitations, technical challenges

UNIT II  ELECTRIC VEHICLE ARCHITECTURE  9
Electric vehicle types, layout and power delivery, performance – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, Concepts of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and demerits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles, Fuel cell vehicles.

UNIT III  ENERGY STORAGE  9
Batteries – types – lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, Battery modeling and equivalent circuit, battery charging and types, battery cooling, Ultra-capacitors, Flywheel technology, Hydrogen fuel cell, Thermal Management of the PEM fuel cell

UNIT IV  ELECTRIC DRIVES AND CONTROL  9
Types of electric motors – working principle of AC and DC motors, advantages and limitations, DC motor drives and control, Induction motor drives and control, PMSM and brushless DC motor - drives and control, AC and Switch reluctance motor drives and control – Drive system efficiency – Inverters – DC and AC motor speed controllers

UNIT V  DESIGN OF ELECTRIC VEHICLES  9

REFERENCES:

TOTAL: 45 PERIODS

OME435  NEW PRODUCT DEVELOPMENT  L T P C  3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Applying the principles of generic development process; and understanding the organization structure for new product design and development.
2. Identifying opportunity and planning for new product design and development.
3. Conducting customer need analysis; and setting product specification for new product design and development.
4. Generating, selecting, and testing the concepts for new product design and development.
5. Applying the principles of Industrial design and prototype for new product design and development.

UNIT I  INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT  9

UNIT II  OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING  9

UNIT III  IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS  9

UNIT IV  CONCEPT GENERATION, SELECTION & TESTING  9

UNIT V  INDUSTRIAL DESIGN & PROTOTYPING  9

TOTAL: 45 PERIODS

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

▪ Apply the principles of generic development process; and understand the organization structure for new product design and development.
▪ Identify opportunity and plan for new product design and development.
▪ Conduct customer need analysis; and set product specification for new product design and development.
▪ Generate, select, and test the concepts for new product design and development.
▪ Apply the principles of Industrial design and prototype for design and develop new products.

TEXT BOOK:

REFERENCES:
To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.

UNIT I MANAGEMENT OF SUSTAINABILITY 9
Management of sustainability rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.

UNIT II CORPORATE SUSTAINABILITY AND RESPONSIBILITY 9
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.

UNIT III SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES 9
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.

UNIT IV SUSTAINABILITY AND INNOVATION 9
Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.

UNIT V SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS 9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.
CO2: An understanding of corporate sustainability and responsible Business Practices
CO3: Knowledge and skills to understand, to measure and interpret sustainability performances.
CO4: Knowledge of innovative practices in sustainable business and community management
CO5: Deep understanding of sustainable management of resources and commodities

REFERENCES:
4. Margaret Robertson, Sustainability Principles and Practice, 2014
5. Peter Rogers, An Introduction to Sustainable Development, 2006
COURSE OBJECTIVES

- To familiarize students with the theory and practice of small business management.
- To learn the legal issues faced by small business and how they impact operations.

UNIT I  INTRODUCTION TO SMALL BUSINESS 9

UNIT II  SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN 9
Concepts of opportunity recognition; Key factors leading to new venture failure; New venture screening process; Applying new venture screening process to the early stage small firm Role planning in small business – importance of strategy formulation – management skills for small business creation and development.

UNIT III  BUILDING THE RIGHT TEAM AND MARKETING STRATEGY 9
Management and Leadership – employee assessments – Tuckman’s stages of group development - The entrepreneurial process model - Delegation and team building - Comparison of HR management in small and large firms - Importance of coaching and how to apply a coaching model.
Marketing within the small business - success strategies for small business marketing - customer delight and business generating systems, - market research, - assessing market performance-sales management and strategy - the marketing mix and marketing strategy.

UNIT IV  FINANCING SMALL BUSINESS 9
Main sources of entrepreneurial capital; Nature of ‘bootstrap’ financing - Difference between cash and profit - Nature of bank financing and equity financing - Funding-equity gap for small firms. Importance of working capital cycle - Calculation of break-even point - Power of gross profit margin- Pricing for profit - Credit policy issues and relating these to cash flow management and profitability.

UNIT V  VALUING SMALL BUSINESS AND CRISIS MANAGEMENT 9
Causes of small business failure - Danger signals of impending trouble - Characteristics of poorly performing firms - Turnaround strategies - Concept of business valuation - Different valuation measurements - Nature of goodwill and how to measure it - Advantages and disadvantages of buying an established small firm - Process of preparing a business for sale.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1. Familiarise the students with the concept of small business
CO2. In depth knowledge on small business opportunities and challenges
CO3. Ability to devise plans for small business by building the right skills and marketing strategies
CO4. Identify the funding source for small start ups
CO5. Business evaluation for buying and selling of small firms

REFERENCES

3. Journal articles on SME’s.

OBA433 INTELLECTUAL PROPERTY RIGHTS L T P C
3 0 0 3

COURSE OBJECTIVE
➢ To understand intellectual property rights and its valuation.

UNIT I INTRODUCTION 9
Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.

UNIT II PROCESS 9
New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.

UNIT III STATUTES 9

UNIT IV STRATEGIES IN INTELLECTUAL PROPERTY 9
Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.

UNIT V MODELS 9
The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: Understanding of intellectual property and appreciation of the need to protect it
CO2: Awareness about the process of patenting
CO3: Understanding of the statutes related to IPR
CO4: Ability to apply strategies to protect intellectual property
CO5: Ability to apply models for making strategic decisions related to IPR

REFERENCES
COURSE OBJECTIVE

- To help students develop knowledge and competence in ethical management and decision making in organizational contexts.

UNIT I  ETHICS AND SOCIETY  
Ethical Management: Definition, Motivation, Advantages—Practical implications of ethical management. Managerial ethics, professional ethics, and social Responsibility—Role of culture and society’s expectations—Individual and organizational responsibility to society and the community.

UNIT II  ETHICAL DECISION MAKING AND MANAGEMENT IN A CRISIS  
Managing in an ethical crisis, the nature of a crisis, ethics in crisis management, discuss case studies, analyze real-world scenarios, develop ethical management skills, knowledge, and competencies. Proactive crisis management.

UNIT III  STAKEHOLDERS IN ETHICAL MANAGEMENT  
Stakeholders in ethical management, identifying internal and external stakeholders, nature of stakeholders, ethical management of various kinds of stakeholders: customers (product and service issues), employees (leadership, fairness, justice, diversity) suppliers, collaborators, business, community, the natural environment (the sustainability imperative, green management, contemporary issues).

UNIT IV  INDIVIDUAL VARIABLES IN ETHICAL MANAGEMENT  
Understanding individual variables in ethics, managerial ethics, concepts in ethical psychology—ethical awareness, ethical courage, ethical judgment, ethical foundations, ethical emotions/intuitions/intensity. Utilization of these concepts and competencies for ethical decision-making and management.

UNIT V  PRACTICAL FIELD-GUIDE, TECHNIQUES AND SKILLS  
Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modeling and creating a culture of ethical management and human flourishing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: Role modelling and influencing the ethical and cultural context.
CO2: Respond to ethical crises and proactively address potential crises situations.
CO3: Understand and implement stakeholder management decisions.
CO4: Develop the ability, knowledge, and skills for ethical management.
CO5: Develop practical skills to navigate, resolve and thrive in management situations

REFERENCES


ET4251  IoT FOR SMART SYSTEMS  
COURSE OBJECTIVES:
1. To study about Internet of Things technologies and its role in real time applications.
2. To introduce the infrastructure required for IoT
3. To familiarize the accessories and communication techniques for IoT.
4. To provide insight about the embedded processor and sensors required for IoT
5. To familiarize the different platforms and Attributes for IoT

UNIT I  INTRODUCTION TO INTERNET OF THINGS  9
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

UNIT II  IOT ARCHITECTURE  9

UNIT III  PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT  9
PROTOCOLS:
NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell.

*Wireless technologies for IoT:* WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

UNIT IV  IOT PROCESSORS  9
Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability.
Embedded processors for IOT :Introduction to Python programming -Building IOT with RASPERRY PI and Arduino.

UNIT V  CASE STUDIES  9
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Analyze the concepts of IoT and its present developments.
CO2: Compare and contrast different platforms and infrastructures available for IoT
CO3: Explain different protocols and communication technologies used in IoT
CO4: Analyze the big data analytic and programming of IoT
CO5: Implement IoT solutions for smart applications

REFERENCES:

ET4072 MACHINE LEARNING AND DEEP LEARNING L T P C 3 0 0 3

COURSE OBJECTIVES:
The course is aimed at
1. Understanding about the learning problem and algorithms
2. Providing insight about neural networks
3. Introducing the machine learning fundamentals and significance
4. Enabling the students to acquire knowledge about pattern recognition.
5. Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS 9
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II NEURAL NETWORKS 9

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS 9
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction. Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.

UNIT IV DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS 9
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V DEEP LEARNING: RNNS, AUTOENCODERS AND GANS 9
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

TOTAL: 45 PERIODS

COURSE OUTCOMES (CO):
At the end of the course the student will be able to
CO1: Illustrate the categorization of machine learning algorithms.
CO2: Compare and contrast the types of neural network architectures, activation functions
CO3: Acquaint with the pattern association using neural networks
CO4: Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
CO5: Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

REFERENCES:

PX4012 RENEWABLE ENERGY TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:
To impart knowledge on
• Different types of renewable energy technologies
• Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION
Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India - Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO2 Emission - importance of renewable energy sources, Potentials – AchievementsApplications.

UNIT II SOLAR PHOTOVOLTAICS

UNIT III PHOTOVOLTAIC SYSTEM DESIGN
Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV WIND ENERGY CONVERSION SYSTEMS
UNIT V OTHER RENEWABLE ENERGY SOURCES

Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

TOTAL : 45 PERIODS

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

CO1: Demonstrate the need for renewable energy sources.
CO2: Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.
CO3: Design a stand-alone and Grid connected PV system.
CO4: Analyze the different configurations of the wind energy conversion systems.
CO5: Realize the basic of various available renewable energy sources

REFERENCES:

PS4093 SMART GRID  L T P C 3 0 0 3

COURSE OBJECTIVES
- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To know about the function of smart grid.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications
- To get familiarized with the communication networks for Smart Grid applications

UNIT I INTRODUCTION TO SMART GRID
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India – Case Study.

UNIT II SMART GRID TECHNOLOGIES
Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) – Grid to Vehicle and Vehicle to Grid charging concepts.
UNIT III SMART METERS AND ADVANCED METERING INFRASTRUCTURE
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID

Unit V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS
Architecture and Standards -Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

COURSE OUTCOME:
Students able to
CO1: Relate with the smart resources, smart meters and other smart devices.
CO2: Explain the function of Smart Grid.
CO3: Experiment the issues of Power Quality in Smart Grid.
CO4: Analyze the performance of Smart Grid.
CO5: Recommend suitable communication networks for smart grid applications

REFERENCES

CP4391 SECURITY PRACTICES

COURSE OBJECTIVES:
- To learn the core fundamentals of system and web security concepts
- To have through understanding in the security concepts related to networks
- To deploy the security essentials in IT Sector
- To be exposed to the concepts of Cyber Security and cloud security
- To perform a detailed study of Privacy and Storage security and related Issues

UNIT I SYSTEM SECURITY

UNIT II NETWORK SECURITY
UNIT III SECURITY MANAGEMENT

UNIT IV CYBER SECURITY AND CLOUD SECURITY

UNIT V PRIVACY AND STORAGE SECURITY

COURSE OUTCOMES:
CO1: Understand the core fundamentals of system security
CO2: Apply the security concepts to wired and wireless networks
CO3: Implement and Manage the security essentials in IT Sector
CO4: Explain the concepts of Cyber Security and Cyber forensics
CO5: Be aware of Privacy and Storage security Issues.

REFERENCES

MP4251 CLOUD COMPUTING TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:
- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
- To develop the cloud application using various programming model of Hadoop and Aneka
UNIT I  VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE  6
Basics of Virtual Machines - Process Virtual Machines – System Virtual Machines –Emulation –
Interpretation – Binary Translation - Taxonomy of Virtual Machines. Virtualization –Management
Virtualization — Hardware Maximization – Architectures – Virtualization Management – Storage
Virtualization – Network Virtualization- Implementation levels of virtualization – virtualization
structure – virtualization of CPU, Memory and I/O devices – virtual clusters and Resource
Management – Virtualization for data center automation

UNIT II  CLOUD PLATFORM ARCHITECTURE  12
Cloud Computing: Definition, Characteristics - Cloud deployment models: public, private, hybrid,
community – Categories of cloud computing: Everything as a service: Infrastructure, platform,
software- A Generic Cloud Architecture Design – Layered cloud Architectural Development –
Architectural Design Challenges

UNIT III  AWS CLOUD PLATFORM - IAAS  9
Amazon Web Services: AWS Infrastructure- AWS API- AWS Management Console - Setting up
AWS Storage - Stretching out with Elastic Compute Cloud - Elastic Container Service for
Kubernetes- AWS Developer Tools: AWS Code Commit, AWS Code Build, AWS Code Deploy,
AWS Code Pipeline, AWS code Star - AWS Management Tools: Cloud Watch, AWS Auto Scaling,
AWS control Tower, Cloud Formation, Cloud Trail, AWS License Manager

UNIT IV  PAAS CLOUD PLATFORM  9
Windows Azure- Service Model and Managing Services: Definition and Configuration, Service
runtime API- Windows Azure Developer Portal- Service Management API- Windows Azure Storage
Characteristics-Storage Services- REST API- Blops

UNIT V  PROGRAMMING MODEL  9
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions,
specifying input and output parameters, configuring and running a job –Developing Map Reduce
Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application
Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Employ the concepts of virtualization in the cloud computing
CO2: Identify the architecture, infrastructure and delivery models of cloud computing
CO3: Develop the Cloud Application in AWS platform
CO4: Apply the concepts of Windows Azure to design Cloud Application
CO5: Develop services using various Cloud computing programming models.

REFERENCES
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to
Media, 2009.
Elsevier/Morgan Kaufmann, 2005.
COURSE OBJECTIVES:
- To provide a sound knowledge in UI & UX
- To understand the need for UI and UX
- Research Methods used in Design
- Tools used in UI & UX
- Creating a wireframe and prototype

UNIT I  UX LIFECYCLE TEMPLATE  8

UNIT II  CONTEXTUAL INQUIRY  10

UNIT III  DESIGN THINKING, IDEATION, AND SKETCHING  9

UNIT IV  UX GOALS, METRICS, AND TARGETS  8

UNIT V  ANALYSING USER EXPERIENCE  10

SUGGESTED ACTIVITIES:
1: Hands on Design Thinking process for a product
2: Defining the Look and Feel of any new Project
3: Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
4: Identify a customer problem to solve.
5: Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

TOTAL : 45 PERIODS
COURSE OUTCOMES:
CO1: Build UI for user Applications
CO2: Use the UI Interaction behaviors and principles
CO3: Evaluate UX design of any product or application
CO4: Demonstrate UX Skills in product development
CO5: Implement Sketching principles

REFERENCES
4. Lean UX: Designing Great Products with Agile Teams, Gothelf, Jeff, Seiden, and Josh. O'Reilly Media, 2016
5. Designing UX: Prototyping: Because Modern Design is Never Static, Ben Coleman, and Dan Goodwin. SitePoint, 2017

MU4153 PRINCIPLES OF MULTIMEDIA

COURSE OBJECTIVES:
• To get familiarity with gamut of multimedia and its significance
• To acquire knowledge in multimedia components.
• To acquire knowledge about multimedia tools and authoring.
• To acquire knowledge in the development of multimedia applications.
• To explore the latest trends and technologies in multimedia

UNIT I INTRODUCTION

Suggested Activities:
1. Flipped classroom on media Components.
2. External learning – Interactive presentation.

Suggested Evaluation Methods:
1. Tutorial – Handling media components
2. Quizzes on different types of data presentation.

UNIT II ELEMENTS OF MULTIMEDIA
Text-Types, Font, Unicode Standard, File Formats, Graphics and Image data representations – data types, file formats, color models; video – color models in video, analog video, digital video, file formats, video display interfaces, 3D video and TV: Audio – Digitization, SNR, SQNR, quantization, audio quality, file formats, MIDI; Animation- Key Frames and Tweening, other Techniques, 2D and 3D Animation.

Suggested Activities:
1. Flipped classroom on different file formats of various media elements.
UNIT III  MULTIMEDIA TOOLS  9

Suggested Activities:
1. Flipped classroom on multimedia tools.
2. External learning – Comparison of various authoring tools.

Suggested Evaluation Methods:
1. Tutorial – Audio editing tool.
2. Quizzes on animation tools.

UNIT IV  MULTIMEDIA SYSTEMS  9

Suggested Activities:
1. Flipped classroom on concepts of multimedia hardware architectures.
2. External learning – Digital repositories and hypermedia design.

Suggested Evaluation Methods:
1. Quizzes on multimedia hardware and compression techniques.
2. Tutorial – Hypermedia design.

UNIT V  MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS  9

Suggested Activities:
1. External learning – Game consoles.
2. External learning – VRML scripting languages.

Suggested Evaluation Methods:
1. Demonstration of simple interactive games.
2. Tutorial – Simple VRML program.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Handle the multimedia elements effectively.
CO2: Articulate the concepts and techniques used in multimedia applications.
CO3: Develop effective strategies to deliver Quality of Experience in multimedia applications.
CO4: Design and implement algorithms and techniques applied to multimedia objects.
CO5: Design and develop multimedia applications following software engineering models.

REFERENCES:
DS4015 BIG DATA ANALYTICS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of big data analytics
- To understand the search methods and visualization
- To learn mining data streams
- To learn frameworks
- To gain knowledge on R language

UNIT I INTRODUCTION TO BIG DATA

UNIT II SEARCH METHODS AND VISUALIZATION

UNIT III MINING DATA STREAMS

UNIT IV FRAMEWORKS
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Case Study- Preventing Private Information Inference Attacks on Social Networks- Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation

UNIT V R LANGUAGE
COURSE OUTCOMES:
CO1: understand the basics of big data analytics
CO2: Ability to use Hadoop, Map Reduce Framework.
CO3: Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4: gain knowledge on R language
CO5: Contextually integrate and correlate large amounts of information to gain faster insights.

TOTAL: 45 PERIODS

REFERENCE:

NC4201  INTERNET OF THINGS AND CLOUD  L  T  P  C
3  0  0  3

COURSE OBJECTIVES:
• To understand Smart Objects and IoT Architectures
• To learn about various IOT-related protocols
• To build simple IOT Systems using Arduino and Raspberry Pi.
• To understand data analytics and cloud in the context of IoT
• To develop IoT infrastructure for popular applications

UNIT I  FUNDAMENTALS OF IoT

UNIT II  PROTOCOLS FOR IoT

UNIT III  CASE STUDIES/INDUSTRIAL APPLICATIONS
Case studies with architectural analysis: IOT applications – Smart City – Smart Water – Smart Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart waste management.

UNIT IV  CLOUD COMPUTING INTRODUCTION

UNIT V  IOT AND CLOUD

TOTAL: 45 PERIODS
COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Understand the various concept of the IoT and their technologies.
CO2: Develop IoT application using different hardware platforms
CO3: Implement the various IoT Protocols
CO4: Understand the basic principles of cloud computing.
CO5: Develop and deploy the IoT application into cloud environment

REFERENCES

MX4073 MEDICAL ROBOTICS

COURSE OBJECTIVES:
- To explain the basic concepts of robots and types of robots
- To discuss the designing procedure of manipulators, actuators and grippers
- To impart knowledge on various types of sensors and power sources
- To explore various applications of Robots in Medicine
- To impart knowledge on wearable robots

UNIT I INTRODUCTION TO ROBOTICS
Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization

Sensors and Actuators
Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, PD and PID feedback actuator models

UNIT II MANIPULATORS & BASIC KINEMATICS
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems

Navigation and Treatment Planning
Variable speed arrangements, Path determination – Machinery vision, Ranging – Laser – Acoustic, Magnetic, fiber optic and Tactile sensor

UNIT III SURGICAL ROBOTS
Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump, CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics. Case Study

UNIT IV REHABILITATION AND ASSISTIVE ROBOTS
Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking, Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking, Motion Prediction, Motion Replication. Portable Robot for Tele rehabilitation, Robotic Exoskeletons – Design considerations,
Hybrid assistive limb. Case Study

UNIT V WEARABLE ROBOTS
Augmented Reality, Kinematics and Dynamics for Wearable Robots, Wearable Robot technology, Sensors, Actuators, Portable Energy Storage, Human–robot cognitive interaction (cHRI), Human–robot physical interaction (pHRI), Wearable Robotic Communication - case study

COURSE OUTCOMES:
CO1: Describe the configuration, applications of robots and the concept of grippers and actuators
CO2: Explain the functions of manipulators and basic kinematics
CO3: Describe the application of robots in various surgeries
CO4: Design and analyze the robotic systems for rehabilitation
CO5: Design the wearable robots

REFERENCES

VE4202 EMBEDDED AUTOMATION

COURSE OBJECTIVES:
- To learn about the process involved in the design and development of real-time embedded system
- To develop the embedded C programming skills on 8-bit microcontroller
- To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
- To learn about the tools, firmware related to microcontroller programming
- To build a home automation system

UNIT - I INTRODUCTION TO EMBEDDED C PROGRAMMING
C Overview and Program Structure - C Types, Operators and Expressions - C Control Flow - C Functions and Program Structures - C Pointers And Arrays - FIFO and LIFO - C Structures - Development Tools

UNIT - II AVR MICROCONTROLLER
ATMEGA 16 Architecture - Nonvolatile and Data Memories - Port System - Peripheral Features : Time Base, Timing Subsystem, Pulse Width Modulation, USART, SPI, Two Wire Serial Interface, ADC, Interrupts - Physical and Operating Parameters

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Describe the configuration, applications of robots and the concept of grippers and actuators
CO2: Explain the functions of manipulators and basic kinematics
CO3: Describe the application of robots in various surgeries
CO4: Design and analyze the robotic systems for rehabilitation
CO5: Design the wearable robots

REFERENCES
UNIT – III HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS

Lights and Switches - Stack Operation - Implementing Combinational Logic - Expanding I/O - Interfacing Analog To Digital Convertors - Interfacing Digital To Analog Convertors - LED Displays : Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor Interface - Serial EEPROM - Real Time Clock - Accessing Constants Table - Arbitrary Waveform Generation - Communication Links - System Development Tools

UNIT – IV VISION SYSTEM


UNIT – V HOME AUTOMATION

Home Automation - Requirements - Water Level Notifier - Electric Guard Dog - Tweeting Bird Feeder - Package Delivery Detector - Web Enabled Light Switch - Curtain Automation - Android Door Lock - Voice Controlled Home Automation - Smart Lighting - Smart Mailbox - Electricity Usage Monitor - Proximity Garage Door Opener - Vision Based Authentic Entry System

TOTAL: 45 PERIODS

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

CO1: analyze the 8-bit series microcontroller architecture, features and pin details
CO2: write embedded C programs for embedded system application
CO3: design and develop real time systems using AVR microcontrollers
CO4: design and develop the systems based on vision mechanism
CO5: design and develop a real time home automation system

REFERENCES: