

ANNA UNIVERSITY, CHENNAI : 600 025
NON AUTONOMOUS AFFILIATED COLLEGES
M.TECH.TEXTILE TECHNOLOGY
(WITH SPECIALIZATION IN TEXTILE CHEMISTRY)
REGULATIONS–2021
CHOICE BASED CREDIT SYSTEM

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 wetprocesses
- 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

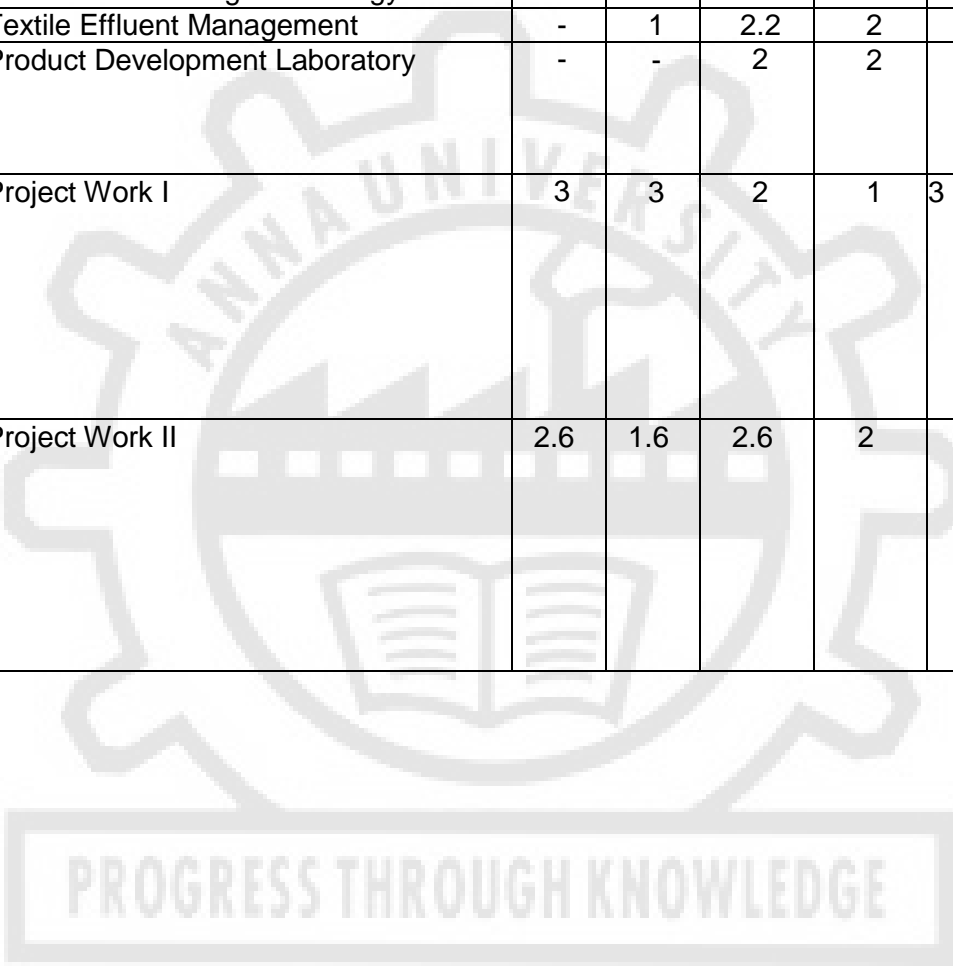
1. An ability to independently carry out research/investigation and development work to solve practical problems.
2. An ability to write and present a substantial technical report/document.
3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. 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:

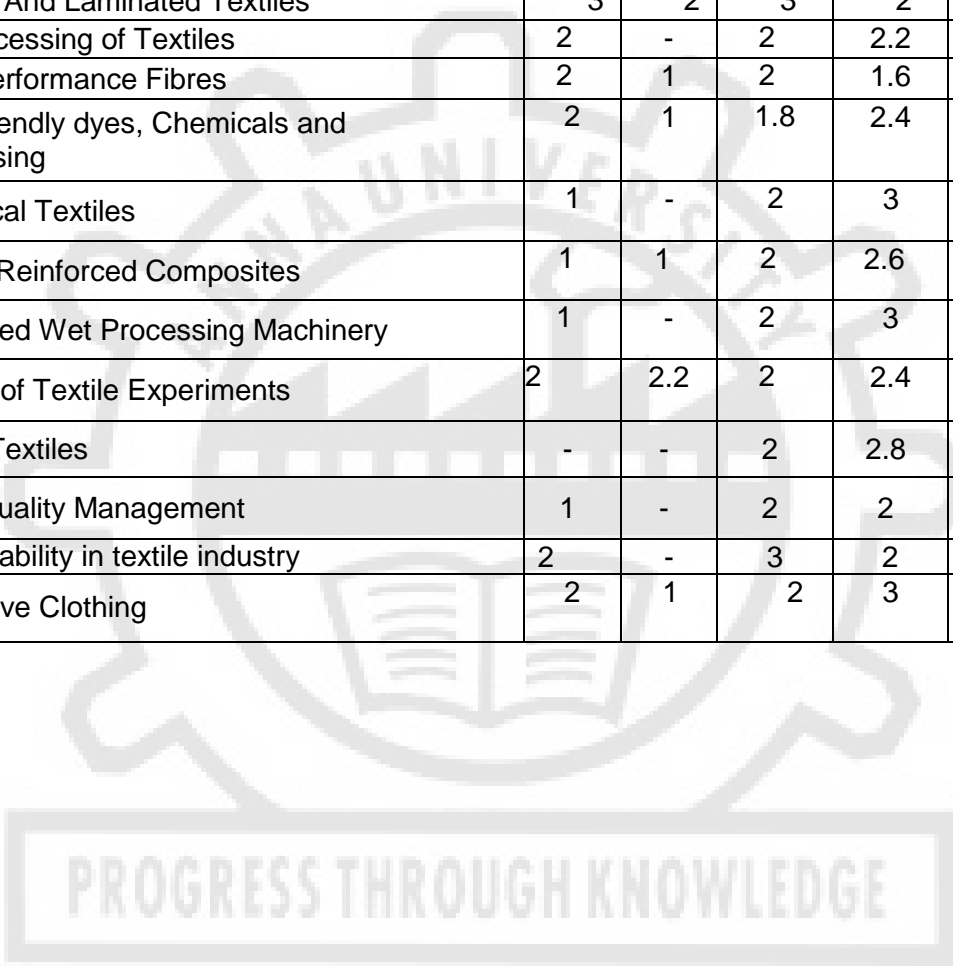
PEO	PO					
	1	2	3	4	5	6
1.	-	2	3	2	2	-
2.	2	-	2	2	1	2
3.	2	2	1	1	1	2
4.	2	1	2	2	1	2

MAPPING OF COURSE OUTCOMES AND PROGRAMME OUTCOMES

		COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6
YEAR I	SEMESTER I	Textile dyes and auxiliaries	1	-	1.4	2.4	2	-
		Textile chemical processing	1	-	2	2.6	1.6	-
		Polymer and Fibre Physics	1	-	2.2	2.2	1.4	-
		Statistical Applications in Textile Engineering	3	2	1	3	1	1
		Research Methodology and IPR	3	3	1	3	2	-
		Production Process Laboratory	3	2	3	2	2	3
	Advanced Textile Testing Laboratory	3	3	3	3	1	2	
	SEMESTER II	Technology of Textile Coloration	2	-	2	2.2	1.4	1.5
		Advanced Finishing Technology	-	-	2.2	2	1.6	-
		Textile Effluent Management	-	1	2.2	2	1.2	-
Product Development Laboratory		-	-	2	2	1	-	
YEAR II	SEMESTER III	Project Work I	3	3	2	1	3	3
	SEMESTER IV	Project Work II	2.6	1.6	2.6	2	3	2



	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6
PROFESSIONAL ELECTIVES	Textile Costing and process Optimization	1.6	1	2	1.4	3	3
	Functional Dyes	3	2	3	3	1	1
	Characterization of Textile Polymers	3	2	3	3	-	1
	Chemical Processing of Manmade fibres.	1	-	2	2	1	1
	Non woven and specialty Textiles	1	-	2	2	1	-
	Advanced Instruments for Textile Wet Processing.	1.5	1	2.2	2.2	1	1.5
	Coated And Laminated Textiles	3	2	3	2	-	1
	Bio processing of Textiles	2	-	2	2.2	1.5	1
	High Performance Fibres	2	1	2	1.6	1	-
	Eco-Friendly dyes, Chemicals and Processing	2	1	1.8	2.4	1	1
	Technical Textiles	1	-	2	3	1.2	1
	Textile Reinforced Composites	1	1	2	2.6	1.5	1
	Advanced Wet Processing Machinery	1	-	2	3	1	2
	Design of Textile Experiments	2	2.2	2	2.4	1.4	1
	Home Textiles	-	-	2	2.8	1.4	1
	Total Quality Management	1	-	2	2	1	2
	Sustainability in textile industry	2	-	3	2	2	1
	Protective Clothing	2	1	2	3	-	1



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REGULATIONS – 2021
M.TECH.TEXTILE TECHNOLOGY
(WITH SPECIALIZATION IN TEXTILE CHEMISTRY)
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND SYLLABUS
SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TY4101	Textile Dyes and Auxillaries	PCC	4	0	0	4	4
2.	TY4102	Textile Chemical Processing	PCC	4	0	0	4	4
3.	TX4151	Polymer and Fibre Physics	PCC	3	0	0	3	3
4.	MA4158	Statistical Applications in Textile Engineering	FC	4	0	0	4	4
5.	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
6.		Professional Elective I	PEC	3	0	0	3	3
7.		Audit Course – I *	AC	2	0	0	2	0
PRACTICALS								
8.	TY4111	Production Process Laboratory	PCC	0	0	4	4	2
9.	TX4161	Advanced Textile Testing Laboratory	PCC	0	0	6	6	3
TOTAL				22	0	10	32	25

*Audit Course is Optional

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	TY4201	Technology of Textile Coloration	PCC	3	0	0	3	3
2.	TY4202	Advanced Finishing Technology	PCC	2	0	2	4	3
3.	TY4203	Textile Effluent Management	PCC	2	0	2	4	3
4.		Professional Elective II	PEC	3	0	0	3	3
5.		Professional Elective III	PEC	3	0	0	3	3
6.		Professional Elective IV	PEC	3	0	0	3	3
7.		Audit Course – II *	AC	2	0	0	2	0
PRACTICALS								
8.	TY4211	Product Development Laboratory	PCC	0	0	8	8	4
TOTAL				16	0	12	28	22

*Audit Course is Optional

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective V	PEC	3	0	0	3	3
2.		Professional Elective VI	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICALS								
4.	TY4311	Project Work I	EEC	0	0	12	12	6
TOTAL				9	0	12	21	15

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATE-GORY	PERIOD PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICALS								
1.	TY4411	Project Work II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL NO. OF CREDITS: 74

FOUNDATION COURSES (FC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	MA4158	Statistical Applications in Textile Engineering	4	0	0	4	1

PROFESSIONAL CORE COURSES (PCC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	TY4101	Textile Dyes and	4	0	0	4	1
2.	TY4102	Textile Chemical	4	0	0	4	1
3.	TX4151	Polymer and Fibre Physics	3	0	0	3	1
4.	TY4111	Production Process Laboratory	0	0	4	2	1
5.	TX4161	Advanced Textile Testing Laboratory	0	0	6	3	2
6.	TY4201	Technology of Textile Coloration	3	0	0	3	2
7.	TY4202	Advanced Finishing Technology	2	0	2	3	2
8.	TY4203	Textile Effluent Management	2	0	2	3	2
9.	TY4211	Product Development Laboratory	0	0	8	4	2
TOTAL CREDITS						29	

LIST OF PROFESSIONAL ELECTIVE COURSES

SEMESTER I, ELECTIVE I

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TY4001	Textile Costing and Process Optimization	PEC	3	0	0	3	3
2.	TX4072	Functional Dyes	PEC	3	0	0	3	3
3.	TX4071	Characterization of Textile Polymers	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE II

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TY4002	Chemical Processing of Manmade Fibres	PEC	3	0	0	3	3
2.	TY4003	Non Woven and Specialty Textiles	PEC	3	0	0	3	3
3.	TY4004	Advanced Instruments for Textile Wet Processing	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE III

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TX4073	Coated and Laminated Textiles	PEC	3	0	0	3	3
2.	TY4005	Bioprocessing of Textiles	PEC	3	0	0	3	3
3.	TY4006	High Performance Fibres	PEC	3	0	0	3	3

SEMESTER II, ELECTIVE IV

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TY4007	Eco-Friendly dyes, Chemicals and Processing	PEC	3	0	0	3	3
2.	TY4008	Technical Textiles	PEC	3	0	0	3	3
3.	TX4092	Textile Reinforced Composites	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE V

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	TY4009	Advanced Wet Processing Machinery	PEC	3	0	0	3	3
2.	TY4010	Design of Textile Experiments	PEC	3	0	0	3	3
3.	TY4011	Home Textiles	PEC	3	0	0	3	3

SEMESTER III, ELECTIVE VI

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	IL4005	Total Quality Management	PEC	3	0	0	3	3
2.	TX4091	Sustainability in textile industry	PEC	3	0	0	3	3
3.	TX4074	Protective Clothing	PEC	3	0	0	3	3

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	RM4151	Research Methodology and IPR	2	0	0	2	1
TOTAL CREDITS						2	

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS	SEMESTER
			Lecture	Tutorial	Practical		
1.	TY4311	Project Work I	0	0	12	6	
2.	TY4411	Project Work II	0	0	24	12	
TOTAL CREDITS						18	

AUDIT COURSES - I (AC)

REGISTRATION FOR ANY OF THESE COURSES IS OPTIONAL TO STUDENTS

SL. NO	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0

LIST OF OPEN ELECTIVES FOR PG PROGRAMMES

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	OCE431	Integrated Water Resources Management	3	0	0	3
2.	OCE432	Water, Sanitation and Health	3	0	0	3
3.	OCE433	Principles of Sustainable Development	3	0	0	3
4.	OCE434	Environmental Impact Assessment	3	0	0	3
5.	OIC431	Blockchain Technologies	3	0	0	3
6.	OIC432	Deep Learning	3	0	0	3
7.	OME431	Vibration and Noise Control Strategies	3	0	0	3
8.	OME432	Energy Conservation and Management in Domestic Sectors	3	0	0	3
9.	OME433	Additive Manufacturing	3	0	0	3
10.	OME434	Electric Vehicle Technology	3	0	0	3
11.	OME435	New Product Development	3	0	0	3
12.	OBA431	Sustainable Management	3	0	0	3
13.	OBA432	Micro and Small Business Management	3	0	0	3
14.	OBA433	Intellectual Property Rights	3	0	0	3
15.	OBA434	Ethical Management	3	0	0	3
16.	ET4251	IoT for Smart Systems	3	0	0	3
17.	ET4072	Machine Learning and Deep Learning	3	0	0	3
18.	PX4012	Renewable Energy Technology	3	0	0	3
19.	PS4093	Smart Grid	3	0	0	3
20.	CP4391	Security Practices	3	0	0	3
21.	MP4251	Cloud Computing Technologies	3	0	0	3
22.	IF4072	Design Thinking	3	0	0	3
23.	MU4153	Principles of Multimedia	3	0	0	3
24.	DS4015	Big Data Analytics	3	0	0	3
25.	NC4201	Internet of Things and Cloud	3	0	0	3
26.	MX4073	Medical Robotics	3	0	0	3
27.	VE4202	Embedded Automation	3	0	0	3

PROGRESS THROUGH KNOWLEDGE

SUMMARY

Sl. No.	Name of the Programme: M.TECH. TEXTILE TECHNOLOGY(WITH SPECIALIZATION IN TEXTILE CHEMISTRY)					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	04	00	00	00	04
2.	PCC	16	13	00	00	29
3.	PEC	03	09	06	00	18
4.	RMC	02	00	00	00	02
5.	OEC	00	00	03	00	03
6.	EEC	00	00	06	12	18
7.	Non Credit/Audit Course	✓	✓	00	00	
8.	TOTAL CREDIT	25	22	15	12	74



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

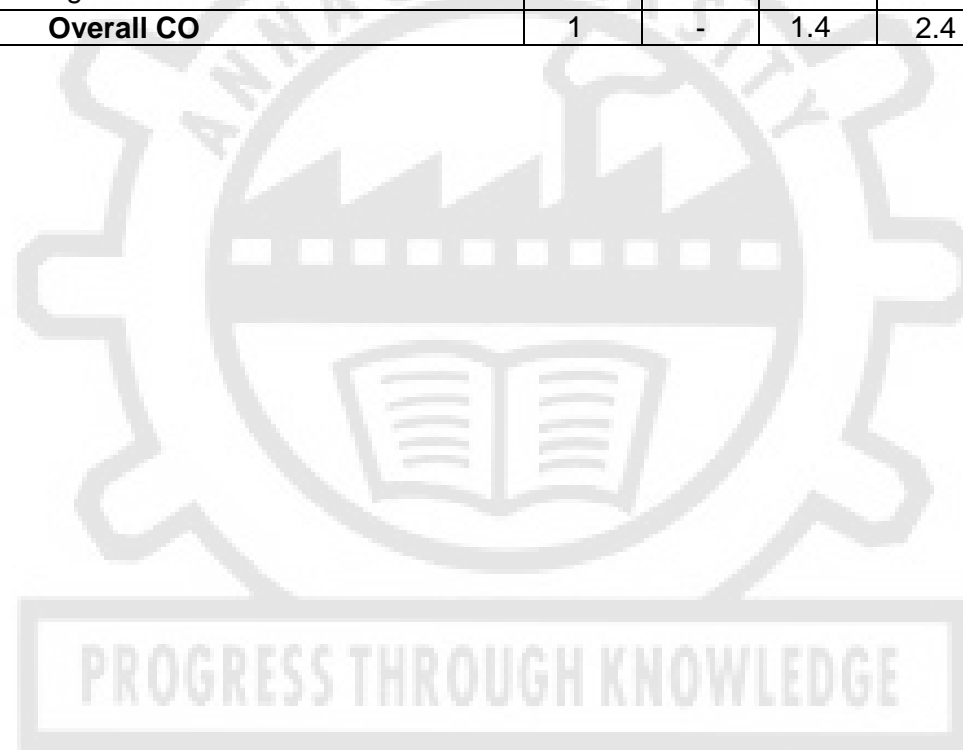
- Modification of surface tension
- Preparatory Process
- Dyeing Process
- Printing Process
- Finishing Process

REFERENCES:

1. John Shore, "Colourants & Auxiliaries" Wiley and Sons Ltd, New York, Volume I & II, 1999.
2. Chakraborty, J.N, "Fundamentals and Practices in colouration of Textiles", Woodhead Publishing India, 2009, ISBN-13:978-81-908001-4-3
3. Shennai.V.A, "Organic Textile Chemicals", Sevak Publication, Bombay, 1995
4. Vaidya.A.A, "Chemistry of Textile auxiliaries", Wheeler Publishing, New Delhi, 1999
5. W D Schindler P J Hauser., "Chemical Finishing of Textiles", Woodhead publishing Ltd, 2004.
6. Mathews Kolanjikombil., "Dyeing of Textile substrates III –Fibres, Yarns and Knitted fabrics", Woodhead publishing India , 2021
7. Trotman E. R., "Dyeing and Chemical Technology of Textile Fibres", Charles Griffin & Co. Ltd., U.K., 1984, ISBN : 0 85264 165 6.
8. Dr. N N Mahapatra., "Textile dyeing", Woodhead publishing India, 2018

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Modification of surface tension	1	-	1	3	2	-
CO2	Preparatory Process	1	-	1	3	2	-
CO3	Dyeing Process	1	-	2	2	2	-
CO4	Printing Process	1	-	1	2	2	-
CO5	Finishing Process.	1	-	2	2	2	-
Overall CO		1	-	1.4	2.4	2	-



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 the about Printing methods & styles and the
- Necessity of Finishing

UNIT I DE-SIZING**12**

Necessity for Desizing and grey preparation - Mechanism of Desizing– important Desizing chemicals for grey fabrics and their chemistry – Efficiency of Desizing. Scouring : Mechanism of Scouring -surface tension and the mode of action of surface-active compounds - theory of detergency – important Scouring agents for Textile fibres and their chemical actions – practical problems in the Scouring of cotton and its blends

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**

Printing methods and styles – Dye selection for Printing –Study about Printing thickeners and other Printing auxiliaries. Importance of various after treatment for printing materials. Printing of cellulosic, silk, polyester and nylon materials.

UNIT V FINISHING**12**

Necessity for Finishing – important mechanical finishes like heat setting, anti-shrink, calendaring, Finishing chemicals for textile fibres and their chemistry –assessment methods for finished materials.

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:

1. Burkinshaw S.M., "Chemical Principles of Synthetics Fibre Dyeing", Blackie, 1995, ISBN :0751400432.
2. Clifford Preston, "The Dyeing of Cellulosic fibres", Dyer Company Publications Trust,1986,ISBN :9780901956439.
3. LueasJ.etal, "Colour Measurement-Fundamentals Vol.1",Eurotex,1996
4. ShoreJ., "Cellulosics Dyeing",SDC,1995,ISBN:0901956686.
5. Trotman E. R., "Dyeing and Chemical Technology of Textile Fibres", Charles Griffin & Co. Ltd., U.K., 1984, ISBN : 0 85264 165 6.

6. W D Schindler P J Hauser., "Chemical Finishing of Textiles", Woodhead publishing Ltd, 2004.
7. L.W.C Miles "Textile Printing", Soceity of Dyers and Colourists, 2003, ISBN 0901956791
8. Mathews Kolanjikombil "Pretreatment of Textile Substrates", Woodhead publishing India, 2019



Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Desizing	1	-	2	2	1	-
CO2	Bleaching	1	-	2	3	2	-
CO3	Dye chemistry	-	-	2	2	1	-
CO4	Printing	1	-	2	3	2	-
CO5	Finishing	1	-	2	3	2	-
Overall CO		1	-	2	2.6	1.6	-



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 (T_g), factors affecting T_g, 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

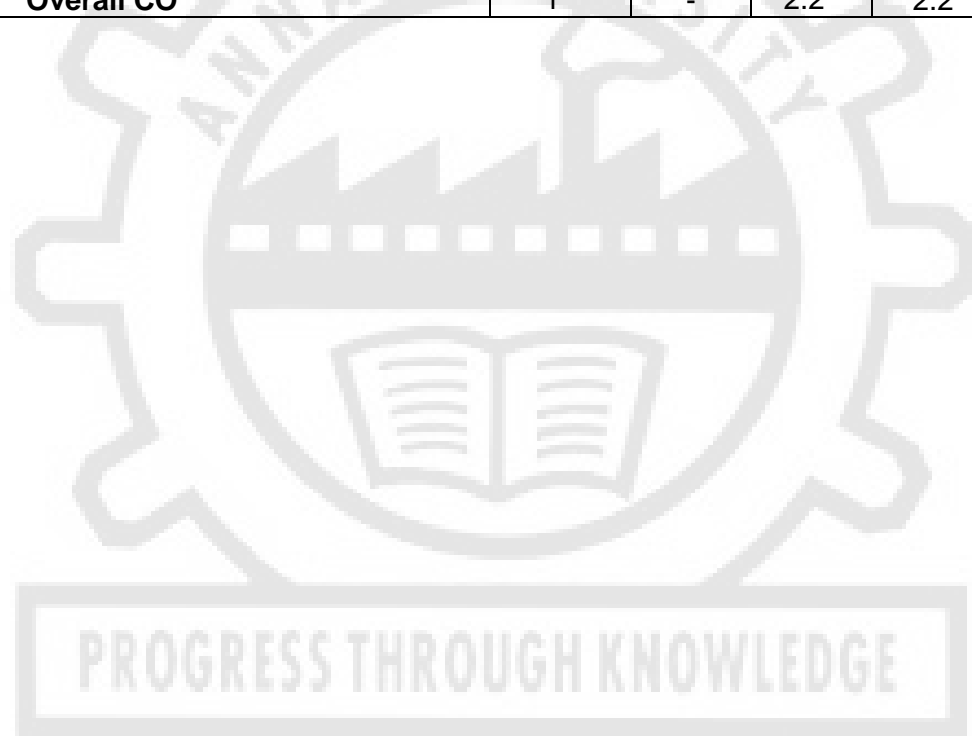
- CO1: The synthesis of polymers
- CO2: Properties of polymers
- CO3: Rheological characteristics
- CO4: Viscoelastic behavior of polymers
- CO5: Properties of fiber

REFERENCES:

1. Billmeyer, "Textbooks of Polymer Science", 3rd ed., Wiley, 1984.
2. Sperling, "Introduction to Physical Polymer Science", Wiley, 1986.
3. Odian, "Principle of Polymerization", 3rd ed., Wiley, 1991
4. Gordon, "High Polymers", Addison-Wesley, 1963.
5. Gupta.V.B. and Kothari V.K., "Man Made Fibre Production", Chapman and Hall, 1985
6. Kothari V.K., "Textile Fibres: Developments and innovations", IAFL Publication, 2000
7. Hongu T. and Philips G., "New Fibres", Wood Head Publishing Ltd,1997
8. Xiangwu Zhang, "Fundamentals of Fiber Science", DEStech Publications, Inc, 2014
9. Donald G. Baird, Dimitris I. Collias, "Polymer Processing: Principles and Design", Wiley Edition, 2014.
10. Walczak Z.K., "Processes of Fiber formation", Elsevier Science,2002
11. V R Gowariker., NV Viswanathan., Jayadev Sreedhar., "Polymer science", New age International Publishers, 2020

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	The synthesis of polymers	-	-	2	2	1	-
CO2	Properties of polymers	-	-	3	2	1	-
CO3	Rheological characteristics	-	-	2	2	2	-
CO4	Viscoelastic behavior of polymers	1	-	2	3	1	-
CO5	Properties of fiber	1	-	2	2	2	-
Overall CO		1	-	2.2	2.2	1.4	-



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:

1. Douglas C. Montgomery, "Design and analysis of experiments", 8th Edition, John Wiley & Sons, Singapore, 2013.
2. Leaf G.A.V., "Practical Statistics for the Textile Industry, Part I and II", the Textile Institute, Manchester, 1984.
3. Montgomery D.C., "Introduction to Statistical Quality Control", 6th Edition, John Wiley and Sons, Singapore, 2009.
4. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through planned experimentation", 3rd Edition, McGraw-Hill, 2012.

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C
2 0 0 2

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

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS

6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL:30 PERIODS

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

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

1. Scouring of cotton fabric in laboratory using different machines.
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
4. Dyeing of Polyester/ Cotton fabric in laboratory model jigger using Disperse/Reactive dyes
5. Dyeing of knitted cotton fabric in laboratory model winch using reactive dyes and to determine their fastness properties.
6. Dyeing of cotton woven fabric in laboratory model padding mangle and to determine the best mangle expression.
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
12. Garment washing machine.

COURSE OUTCOMES:

Upon completion of this course the student shall be able to know about the

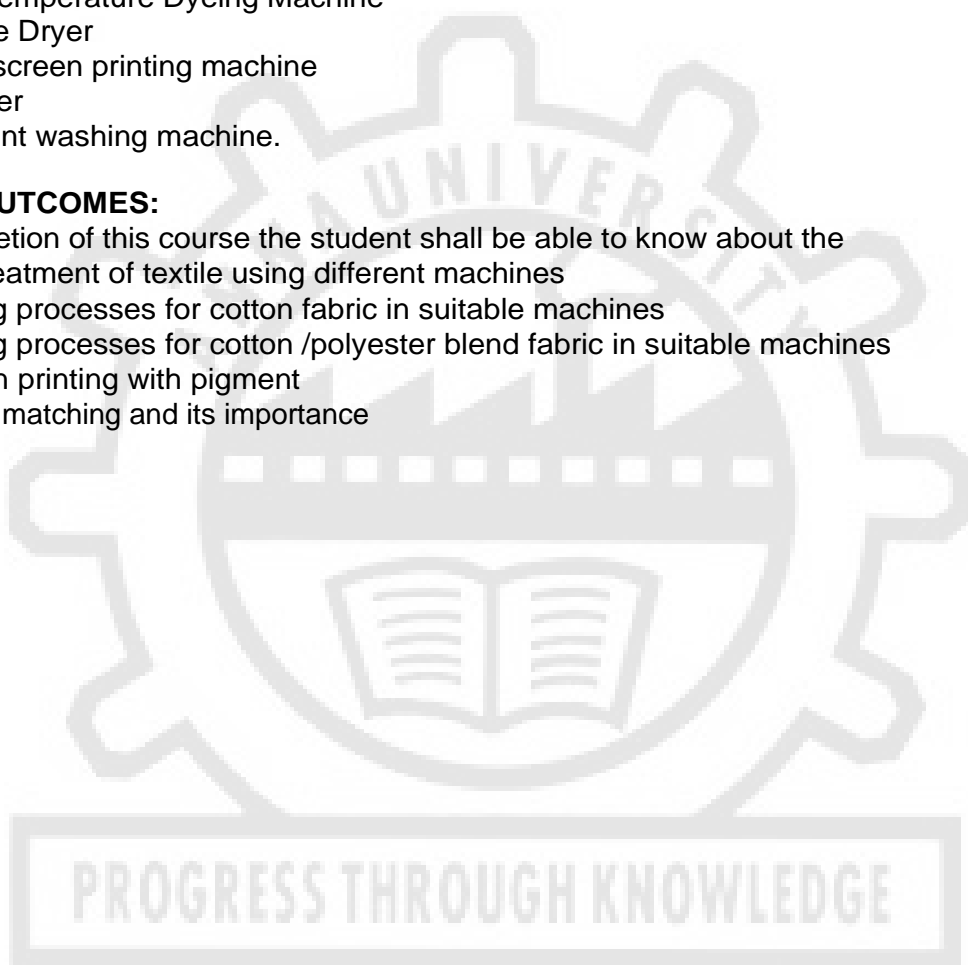
CO1: Pre-treatment of textile using different machines

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

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Pre-treatment of textile using different machines	3	2	3	2	2	3
CO2	Dyeing processes for cotton fabric in suitable machines	3	2	3	2	2	3
CO3	Dyeing processes for cotton /polyester blend fabric in suitable machines	3	2	3	2	2	3
CO4	Screen printing with pigment	3	2	3	2	2	3
CO5	Colour matching and its importance	3	2	3	2	2	3
Overall CO		3	2	3	2	2	3



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:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Analyze the characteristics of textile materials using advanced characterizing techniques	3	3	3	3	1	2
CO2	Analyze the graphs, charts of TGA, FTIR spectrometer and X-ray Diffractometer	3	3	3	3	1	2
CO3	Evaluate fabric finishes and nature of fabrics	3	3	3	3	1	2
CO4	Determine the property of liquids	3	3	3	3	1	2
CO5	Characterize the porous substrates	3	3	3	3	1	2
Overall CO		3	3	3	3	1	2

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 hydrolysis of reactive groups – Methods to avoid hydrolysis and to get better fixation. Methods to improve dye ability of textile materials such as crafting, cationisation, solvent treatment etc

TOTAL: 45 PERIODS**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

1. Shah.H.SandR.S.Gandhi, 'Instrumental colour measurements and computer aided colour matching for textiles', Mahajan book distributors,Ahmedabad,1990
2. Ashish Kumar Chaudry, "Colour Science". Mahajan book distributors,Ahmedabad,1990
3. Peters.A.TandFreemanH.S "Physico-chemical principles of colour chemistry",Blackie,1995.
4. AllanJohnson, The Theory of colouration of textiles,SDC,1989.
5. Wyszeccki.G., and W.S.Stile,'Colour science, concept and methods, Quantitative data

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Concept of colour and colour vision	-	-	2	2	2	-
CO2	Different colour measuring instruments and equations related to colour theory.	2	-	1	2	1	1
CO3	Concepts of computer colour matching.	2	-	2	2	2	2
CO4	The influence of fibre structure on dyeing process.	-	-	3	3	1	-
CO5	The mechanism and kinetics involved in dyeing process.	-	-	2	2	1	-
Overall CO		2	-	2	2.2	1.4	1.5



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**6**

Commercial importance of finishing – Advances in Resin finishing, Mechanism of creasing, Types of Resins. Anti crease, wash and wear, durable press resin finishing. Causes & remedies of strength losses of Resin finished fabric. Mechanism of Chlorine retention. Formaldehyde Release from Resin finished goods. Study about eco friendly method of anticrease finishing

UNIT II**6**

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**6**

Soil Release Finishing: Mechanism of soil retention & soil release. Various soil releases finishes for cotton, Polyester and its blends. Detail study of antistatic finishes. Anti pilling Finishing: chemical and mechanical methods to produce anti pilling finish.

UNIT IV**6**

Detail study about mechanical finishing of textile materials like calendaring, compacting, Sanforising, Beach finishing. Object of Heat setting. Various methods of heat setting and mechanism of heat setting. Foam Finishing. Detailed study of various techniques of foam application. Drawbacks of foam finishing.

UNIT V**6**

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 softeners. Brief study about stiffening of textile materials

TOTAL: 30 PERIODS**LABORATORY**

Application of finishing agent and characterization of fabrics

- Formaldehyde and non formaldehyde finishing.
- Flame proof & flame retardancy using THPC.
- waterproof and water repellent
- Soil Release and Antistatic agent
- Weight reduction of PET using alkali
- Felting of wool
- Softeners & Stiffness

TOTAL: 30 PERIODS**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.

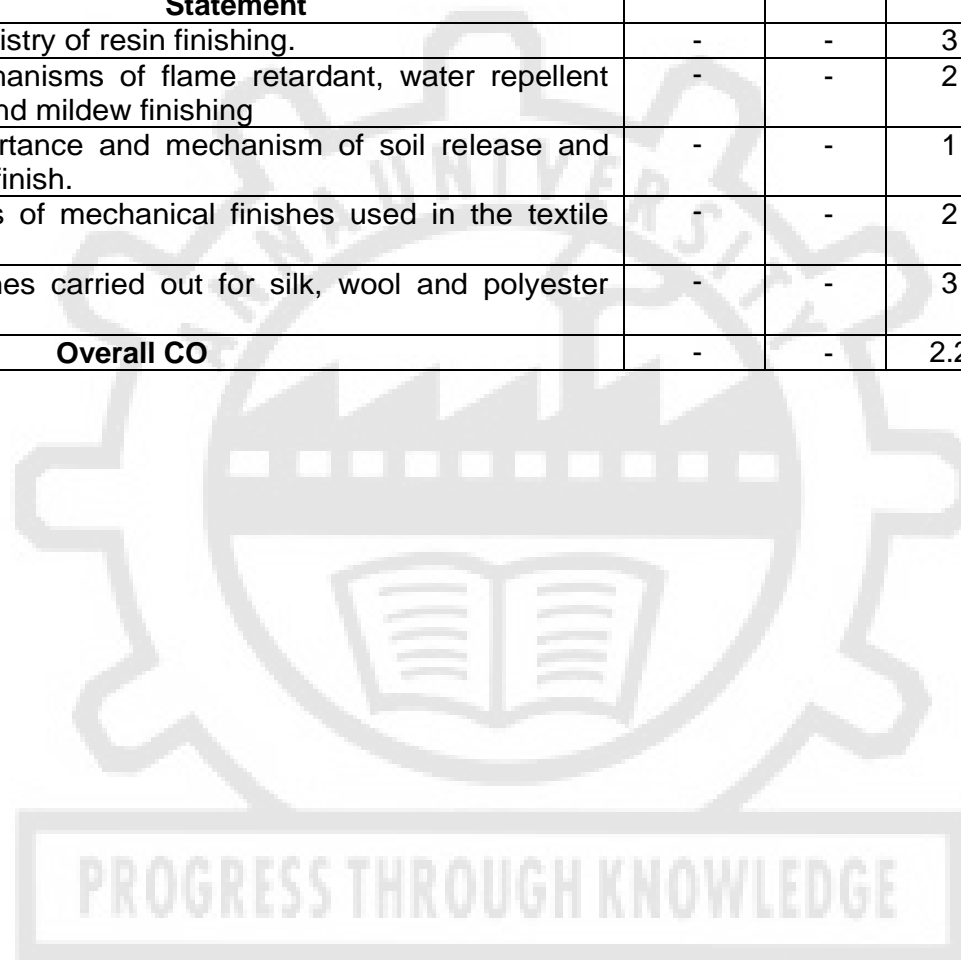
CO5: The finishes carried out for silk, wool and polyester fabrics.

REFERENCES

- Fiscus G. and Grunenwald D. "Textile finishing: A complete guide", Hightex, Blackwells Bookshop, Leeds, U.K, 2004.
- Lewin and Sello, "Functional finishes-Part A & Part B", CRC Press, 1994, ISBN: 0824771184.
- Microencapsulation in finishing, Review of progress of Colouration, SDC, 2001.
- Perkins W.S., "Textile colouration and finish in", Carolina Academic Press, U.K, 2001

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	The chemistry of resin finishing.	-	-	3	2	2	-
CO2	The mechanisms of flame retardant, water repellent finishes and mildew finishing	-	-	2	1	2	-
CO3	The importance and mechanism of soil release and antistatic finish.	-	-	1	2	1	-
CO4	The types of mechanical finishes used in the textile industry.	-	-	2	2	2	-
CO5	The finishes carried out for silk, wool and polyester fabrics.	-	-	3	3	1	-
Overall CO		-	-	2.2	2	1.6	-



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.

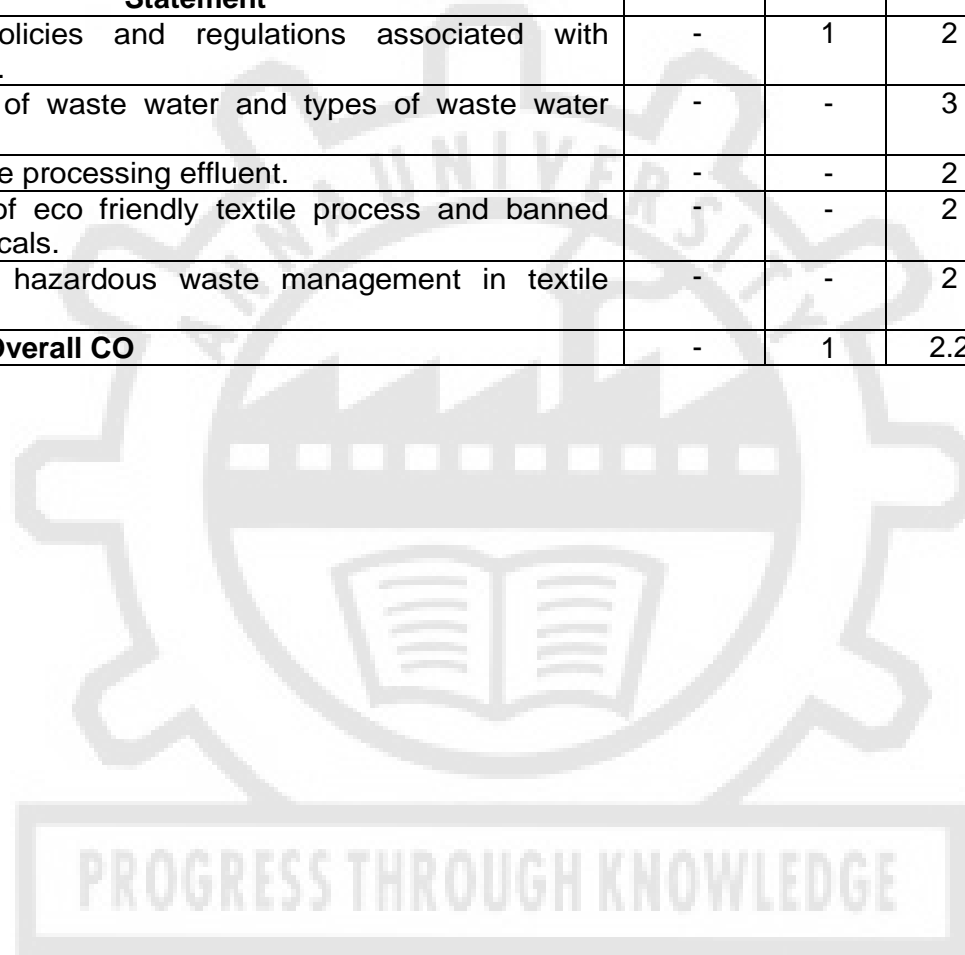
CO5: The solid and hazardous waste management in textile industry.

REFERENCES

1. Christie R., "Environmental aspects of textile dyeing", Woodhead Publishing Ltd, 2007, ISBN: 1845691156.
2. Cooper P., "Colour in Dye house Effluent", Woodhead Publishing Ltd., 1995, ISBN: 0901956

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Government policies and regulations associated with pollution control.	-	1	2	2	1	-
CO2	The properties of waste water and types of waste water treatments.	-	-	3	2	1	-
CO3	Analyze of textile processing effluent.	-	-	2	2	2	-
CO4	The concepts of eco friendly textile process and banned dyes and chemicals.	-	-	2	2	1	-
CO5	The solid and hazardous waste management in textile industry.	-	-	2	2	1	-
Overall CO		-	1	2.2	2	1.2	-



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.
2. Miniature Jigger	-1no.
3. Miniature Winch	-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

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Know about the combined preparatory & Dyeing processes	-	-	2	2	1	-
CO2	Know about the eco friendly finishing processes	-	-	2	2	1	-
CO3	know about the Method of Transfer printing for cotton & PET	-	-	2	2	1	-
Overall CO		-	-	2	2	1	-

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

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Identify the research/industrial problems	3	3	2	1	3	3
CO2	Collect and analyze the relevant literature	3	3	2	1	3	3
CO3	Design and conduct of experiment	3	3	2	1	3	3
CO4	Analysis and Interpretation of data	3	3	2	1	3	3
CO5	Prepare project report	3	3	2	1	3	3
Overall CO		3	3	2	1	3	3

TY4411

PROJECT WORK II

**L T P C
0 0 24 12**

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 outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Formulate and analyze problems for developing new methods/solutions/processes.	2	2	3	2	3	1
CO2	Plan and conduct experiments to find solutions in a logical manner	3	1	3	2	3	2
CO3	Analyze the results, interpret and prepare project report/know the strategies for commercialization	3	2	2	2	3	3
Overall CO		2.6	1.6	2.6	2	3	2

TY4001

TEXTILE COSTING AND PROCESS OPTIMIZATION

L T P C
3 0 0 3

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

Elements of cost –Calculation of garment weight of different sizes, Dia-determination, Setting the knitting program, Dyeing program, Consumption of fabric per garment. Estimating of cost of process loss in Compacting, Bleaching, Raising, Shearing, Printing and Dyeing. Estimating the Knitting rates, Calculation of CMT charges. Cost sheet with Profit margins and foreign quotes.

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

CO4: Costing in Knitting and Garment Industry
 CO5: Cost control and reduction

REFERENCES:

1. Cost control and costing in spinning mills–SITRA, Edition 1992.
2. Cost control and accounting for Textile industry–TAIRO, Edition 1990.
3. Kalyanaraman.A.R. "Energy Conservation in Textile Industries", SITRA, 1985.
4. V.Dudeja "Textile Industry Management" (ATIRA), 1985.
5. Modern production Technologies edited by M.L.Gulrajani, The Textile Association (India) Publications, 1983
6. Bhav P V and Srinivasan V, "Cost accounting in textile mills", ATIRA monograph, Ahmedabad, India, 1974
7. Varma H K, "Costing in Textile Industry", Dhanpat Rai publications, New Delhi, 1965
8. Shinn William, "Elements of Textile Costing" School of Textiles, North Carolina state, 1965
9. Jain IC, "Cost accounting-An introduction", Prentice hall, New Delhi, 2001
10. Ratnam T V, "Cost control and costing in spinning mills", Seshan printers, Coimbatore, India, 1992
11. Nathalie Evans, "Costing for the Fashion Industry" Bloomsbury Publishing, 2011

Mapping of CO with PO

Course outcomes	Statement	Program Outcomes					
		PO1	PO 2	PO 3	PO 4	PO 5	PO 6
CO1	Fundamentals of Costing	1	1	2	1	3	3
CO2	Costing in spinning industry	1	1	2	1	3	3
CO3	Costing in Weaving industry	2	1	2	1	3	3
CO4	Costing in Knitting and Garment Industry	2	1	2	2	3	3
CO5	Cost control and reduction	2	1	2	2	3	3
Overall CO		1.6	1	2	1.4	3	3

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

9

General survey of dyes; chemical structure of dyes, general properties of dyes, chromophores and dye classes for textile application

UNIT II DYES USED IN TEXTILES

9

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

9

Functional dyes: dyes for leather; fur; paper; hair; food and inks – introduction, chemical structure and requirements

UNIT IV APPLICATION OF FUNCTIONAL DYES**9**

Dyes used for imaging, invisible imaging, displays, electronic materials and biomedical applications; solar cells

UNIT V TOXICOLOGY AND HEALTH ASPECTS**9**

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:

1. McLaren K., "The Color Science of Dyes & Pigments", Adam Hilger Ltd., 1983, ISBN 0-85274-426-9.
2. Venkataraman K., "The Chemistry of Synthetic Dyes", Elsevier., 2012, ISBN 97801-271-70084
3. Choudhury A. K. R., "Modern Concepts of Colour and Appearance", Oxford and IBH Publishing Ltd, 2000.
4. G. Buxbaum (Ed.) Industrial Inorganic Pigments, Second, Completely Revised Edition, 1998 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim.
5. Willy Herbst, Klaus Hunger, Industrial Organic Pigments- Production, Properties, Applications Third, Completely Revised Edition (With Contributions by Gerhard Wilker, HeinfredOhleier and Rainer Winter) 2004 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim
6. Advances in Color Chemistry – Vol I, Peters A. T.
7. Advances in Color Chemistry – Vol II, Peters A. T.
8. Non-Textile Dyes, Freeman H. S.
9. Robert A. Charvat ., "Coloring of Plastics: Fundamentals", John Wiley & Sons, 2005

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Chemical structure and properties of dyes	3	2	3	3	1	1
CO2	Dyes used in textiles	3	2	3	3	1	1
CO3	Functional dyes, their chemical structure and requirements	3	2	3	3	1	1
CO4	Applications of the functional dyes in different industries	3	2	3	3	1	1
CO5	Toxicity and health issues	3	2	3	3	1	1
Overall CO		3	2	3	3	1	1

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.

TOTAL: 45 PERIODS**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

REFERENCES:

- Sperling, "Introduction to Physical Polymer Science," Wiley, 1986.
- Campbell D. and White J.R., "Polymer characterization, Physical Techniques", McGraw – Hill, New York, 1969.
- Stamm M., "Polymer surfaces and Interfaces", Springer 1st ed., 2008.
- Gupta V.B. and Kothari V.K., "Man Made Fibre production," Chapman and Hall, 1985.
- Billmeyer, "Textbooks of Polymer Science," 3rd ed., Wiley, 1984
- V R Gowariker., NV Viswanathan., Jayadev Sreedhar., "Polymer science"., New age International Publishers, 2020

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Determine weight techniques the using molecular various	3	2	3	3	-	1
CO2	Interpret molecular structure obtained from various analytical instruments	3	2	3	3	-	1
CO3	Determine properties instruments	3	2	3	3	-	1

CO4	Analyze the various microscopic principles	3	2	3	3	-	1
CO5	Know about the properties of textile polymers	3	2	3	3	-	1
Overall CO		3	2	3	3	-	1

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

TY4002

CHEMICAL PROCESSING OF MANMADE FIBRES

L T P C
3 0 0 3

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

9

Various Preparatory processes for manmade textile -Heat setting of synthetic fabrics –effects of heat setting on dyeing. Mass Colouration of Polyester, Nylon, Acrylic and polypropylene, Advantages & Disadvantages of Mass Colouration; Difference between Mass Colouration and Dyeing.

UNIT II DYEING

9

Polyester Dyeing: carrier, HTHP and thermosal methods of dyeing. Practical problems and their solutions. Stripping of dyed PET. Dyeing of nylon. Dyeing with acid dyes-High temperature dyeing .Low temperature dyeing of Nylon66– Dyeing with disperses dyes. Barriness of dyeing. Dyeing of Acrylic Fibres: – Dyeing with cationic dyes– stripping of cationic dyes, dyeing with disperse dyes, dyeing of acrylic blends, differentially dye able acrylic fibres.

UNIT III BLENDED DYEING

9

Dyeing of Polyester Blends: Various shop floor practices of dyeing of polyester /cellulosic blended fabrics. Practical problems and their solutions. Various shop floor practices of dyeing of polyester/ wool blended fabrics. Practical problems and their solutions. Dyeing of polyester with cationic dyes. Dyeing of Micro polyester fabric. Dyeing of polyamide cellulosic blends – polyamide/wool blends, polyamide/ polyester blends-Stripping of Nylon dyed material. Practical problems and remedies in Nylon Dyeing. Dyeing of unmodified and modified polypropylene.

UNIT IV PRINTING

9

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

9

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

1. Vaidya,A.A.,and Datye,K.V.,“Chemical processing of Synthetic Fibres and Blends”,John Wiley and Sons,NewDelhi,.1999
2. Shore,J.“BlendDyeing”,SDC,London,1998
3. Mittal.R.M.&Trivedi.S.S,ChemicalProcessingofpolyesterandblends–ATIRA.1998
4. C.Duckworth,Engineering inTextile colouration, Dyers company publications trust,U.K.1983.
5. Burkinshaw.S.M.,Chemical principles of syntheticfibredyeing,Blackie,1995.
6. Gulrajani,M.L.,“PolyesterDyeing”,IIT,NewDelhi,1995.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The concept of heat setting and mass colouration of manmade textiles	1	-	2	2	1	1
CO2	The concept of dyeing of polyester and acrylic fabrics.	1	-	2	2	1	1
CO3	The dyeing of the blend fabrics.	1	-	2	2	1	1
CO4	The printing of synthetic fabrics and their blends.	1	-	2	2	1	1
CO5	The different types of finishing of synthetic fabrics.	1	-	2	2	1	1
Overall CO		1	-	2	2	1	1

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 non woven fabrics in industrial purposes

UNIT I WEB FORMING AND BONDING

9

Classifications of Non-woven fabrics - Raw materials. Principles of web forming – Role of cross lapper. Web bonding techniques - chemical, mechanical, thermal, air-bonding, spun bonding, needle punching, hydro entanglement processes.

UNIT II STRUCTURE AND EVALUATION

9

Structure of Non-woven fabrics - Macro structure, Structural elements - their arrangement, bonding and binding. Homogeneity of nonwoven. Evaluation of Non-woven fabrics. End uses and Techno-economics. Felts and in the process of Felting – technical considerations of felting. Decorative techniques in non-woven production.

UNIT III FABRIC PRODUCTION

9

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

9

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

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.

REFERENCES

1. Gulrajani.M.L., "Nonwovens", The Textile Association (India) publication 1996.
2. Birrell.V., The Textile Arts, Harper & Brothers Publications, New York, 1999.
3. Denise Musk, Machine Knitting, B.T. Batsford Ltd, London, 1999
4. Wilhelm Albrecht et al., "Nonwoven fabrics", WILEY VCH Verlag GmbH & Company, Germany, 2003.
5. Russel.S, "Handbook of Nonwovens", The Textile Institute Publication, 2007.
6. Irsak.C, "Nonwoven Textiles" Textile Institute, Manchester, 1999
7. Krcma.R., Manual of Non-wovens, Textile Trade Press, Manchester 1993.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The different types of web forming and bonding techniques of non woven	1	-	2	2	1	-
CO2	The structure and end uses of non woven fabrics.	1	-	2	2	1	-
CO3	The different types of associated with specialty textiles	1	-	2	2	1	-
CO4	The production and end uses of industrial tapes and laces.	1	-	2	2	1	-
CO5	The production of carpets and end uses.	1	-	2	2	-	-
Overall CO		1	-	2	2	1	-

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**9**

UV– VIS spectroscopy- Theory, Franck- Condon principle, Electronic transitions, Deviations from Beer's law– Instrumentation (block diagram only)- Applications. Infra red spectroscopy– Theory, Fundamental vibrations, Hook's law– Instrumentation (block diagram only)- Finger print region – Vibrations involved in H₂O and CO₂ -Applications.

UNIT II**9**

NMR spectroscopy– Theory, Relaxation Process – Instrumentation (block diagram only) – Chemical shift – Internal standard – TMS – Shielding and De- Shielding Effects – Factors influencing Chemical shift - Applications. Mass spectroscopy: Theory, Instrumentation (block diagram only) – Ionization Techniques – Electron impact ionization, Chemical ionization and Desorption techniques. Nitrogen rule, Mc Lafferty re arrangement.

UNIT III**9**

Potentiometric measurements– Ion selective electrodes– Glass electrode – Determination of pH– Buffers– Types of potentiometric titrations– Applications of Potentiometric measurements. Thermal Methods: Thermo gravimetry– Factors affecting thermo gravimetric curves– Instrumental and sample characteristics– Instrumentation (block diagram only)– Applications. Differential Thermal Analysis– Introduction– Factors affecting DTA curves– Environmental, Instrumental and Sample factors– Instrumentation (block diagram only)– Applications.

UNIT IV**9**

Chromatographic Techniques – Introduction – classification – Theory, Instrumentation and Applications of Paper Chromatography, Thin Layer Chromatography, Column Chromatography, High Performance Liquid Chromatography and Gas – Liquid Chromatography.

UNIT V**9**

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

TOTAL: 45 PERIODS**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:

1. Rouessac,F., "Chemical analysis – modern international method and techniques", Wiely, New Delhi,1999.
2. Day, R.A., and Unerwood, A.L., "Qualitative inorganic analysis, 5th edition", Prentice-Hall of India, New Delhi,2004
3. Bona,M., "Modern control Techniques in textile finishing and making up", Eurotex, Blachwells Bookshop, London,2001
4. Banwell,G.C., "Fundamentals of molecular spectroscopy", TMH,2003.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The concepts of spectroscopy	1	-	3	2	1	1
CO2	The spectroscopy instruments used in textile industry.	2	1	3	2	1	1
CO3	Analysis of the textile samples using spectroscopy.	2	1	2	3	1	1
CO4	The concepts and types of chromatography.	-	-	2	3	1	-
CO5	Interpretation of the results from analytical instruments	1	1	2	2	-	2
Overall CO		1.5	1	2.2	2.2	1	1.5

TX4073

COATED AND LAMINATED TEXTILES

**L T P C
3 0 0 3**

OBJETIVE

- 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

1. Walter Fung, "Coated and Laminated Textiles", Woodhead Publishing Ltd, UK, 2002, ISBN

978-1-85573-576-7.

2. Carr C M, "Chemistry of the Textile Industry", Blackie Academic & Professional, UK, 1995.
3. Smith W C, "Smart textile Coatings and Laminates", Woodhead Publishing Ltd, UK, 2010, ISBN 978-1-84569-379-4.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Different kinds of polymers used for coating and laminating	3	2	3	2	-	1
CO2	Different methods of coating and laminating	3	2	3	2	-	1
CO3	Application of coated and laminated textiles in weather proofing and upholstery	3	2	3	2	-	1
CO4	Application of coated and laminated textiles conductive and temperature applications	3	2	3	2	-	1
CO5	Characterization of coated textiles	3	2	3	2	-	1
Overall CO		3	2	3	2	-	1

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

TY4005

BIO PROCESSING OF TEXTILES

**L T P C
3 0 0 3**

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

Industrial microbial products–applications, primary metabolites and secondary metabolites, Enzymes & Proteins– sources and applications, cell and enzyme immobilization, Industrial plant products– production of enzymes and poly sacchrides.

UNIT II ENVIRONMENTAL BIO-TECHNOLOGY

9

Detailed study about pollution and its control in textile processing industries. Waste water treatment systems– Anaerobic & Aerobic systems, Bio-degradation– Micro organism in pollution 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

Enzymes for desizing, scouring & bleaching Enzyme activity – initiation, propagation and termination reactions – reaction conditions – properties of substrates and results of enzyme treatment. Enzyme activity of amylo glucosidase, pectinase, glucose oxiclase, peroxidases and other enzymes used for bleaching decolourisation of textiles using laccases. Bio-Polishing enzymes such as cellulases. Bio- washing enzymes using cellulase proteases for scouring of animal fibres, degumming of silk and modification of wool properties.

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.

TOTAL: 45 PERIODS**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)
2. Tyndall R. M and Raligh N.C. AATCC Book of papers(1991)
3. AsfertL.O and Videback. TIntl Textile Bulletin–Dyeing/Printing/Finishing(1990)
4. Cavaco-Paulo,Gubitz, Textile Processing With Enzymes, WoodHead Publishing Ltd, UK, 2003.
5. Ignacimuthu. S& Tata Mc GrawS.J,“Basic Bio-Technology”,-Hill Publications,1995

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The origin and concept about enzymes.	2	-	2	3	1	1
CO2	Waste water treatments associated with enzyme in textile wet processing industry.	2	-	2	3	1	1
CO3	The contribution of enzyme in pretreatment processes.	2	-	2	2	2	1
CO4	Analysis of fabric properties of enzyme treated fabrics.	2	-	2	1	1	1
CO5	The bio processing in textile industry.	2	-	2	3	1	1
Overall CO		2	-	2	2.2	1.5	1

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 METODS 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** **9**
 Manufacturing, properties and applications-glass fibres, basalt fibres; carbon fibres, ceramic fibres
- UNIT III BIODEGRADABLE FIBRES, PROTEIN FIBRES** **9**
 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** **9**
 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** **9**
 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

1. Hearle J. W. S., "High Performance Fibres", Woodhead Publishing Ltd., Cambridge, England, 2001.
2. Hongu T. and Phillips G.O., "New Fibres", Woodhead Publishing Ltd., England, 1997.
3. Kothari V. K., "Textile Fibres: Development and Innovations", Vol. 2, Progress in Textiles, IAFL Publications, 2000.
4. Peebles L.H., "Carbon Fibres", CRC Press, London, 1995

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The method of producing high performance fibres	-	-	2	2	1	-
CO2	The industrial applications of High performance fibres	-	-	2	1	1	-
CO3	Selection of high performance fibres for medical applications	2	1	2	1	1	-
CO4	The properties of speciality fibres for specific applications	-	-	2	2	1	-
CO5	The end uses of high performance fibres.	-	-	2	2	1	-
Overall CO		2	1	2	1.6	1	-

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

TY4007 ECO-FRIENDLY DYES, CHEMICALS AND PROCESSING

**L T P C
3 0 0 3**

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 9

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 9

Need for Eco - standards. Eco standards – European & USA. Permissible limits (norms) of chemicals, pH, colour fastness and heavy metals by different eco-standards such as MST, OEKOTEX, CLEANFASHION, STEILMANN & - Eco-labeling and labels - Eco- auditing - Eco-management - ISO 14000 – SA 8000 - Natural Textiles – Organic Cotton – GOTS & organic exchange certification –APEO , NPEO & OPEO Limitations

UNIT III ECO TESTING 9

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 triclosan.

UNIT IV ECO FRIENDLY PROCESSING 9

Eco-friendly dyeing of sulphur dyes- Eco-friendly per-acetic acid bleaching - Eco friendly pigment printing & discharge Printing. Organic stabilizer– Application of Diazo sensitizer in screen preparation– Application of Eco-friendly preservatives– Non PVC, Non Phthalate, Plastizol inks, Formaldehyde free dye fixing agents. Enzymes and their role. Application of Enzymes in Desizing, Scouring & Peroxide killing on cotton material, Degumming of silk - Application of Enzymes in finishing – eco friendly crease recovery finish, stone wash effect by Bio-polishing

UNIT V CLEAN TECHNOLOGIES FOR FUTURE 9

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: 45PERIODS

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:

1. Chavan R.B., Radhakrishnan J., Environmental Issues - Technology Options for Textile Industry, IIT Delhi Publication,1998
2. Reife A and Freeman H.S., Environmental Chemistry of dyes and pigments, Wiley,2001,ISBN:0471589276
3. Asokan R.,Eco-Friendly Textile Wet Processing, NCUTE Publications, NewDelhi,2001
4. Eco friendly Textiles: Challenges to the Textile Industry, Textiles Committee, Mumbai,1996.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The ecology associated with textile processing.	2	1	2	2	1	1
CO2	The eco standards.	2	1	2	2	1	-
CO3	The eco testing relevant to textile materials.	2	1	1	2	1	-
CO4	The eco friendly textile wet processing.	2	1	2	3	1	1
CO5	The auditing and safety measures related to effluents in textile industry.	2	1	2	3	1	1
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

L T P C
3 0 0 3

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

9

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

9

Design and characteristics required in textiles for medical and hygiene applications; antimicrobial, disposable and reusable products; textiles in sportswear

UNIT III PROTECTIVE TEXTILES

9

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

UNIT IV GEO TEXTILES

9

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

9

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

1. Horrocks A.R. and Anand S.C., -Handbook of Technical Textiles II, The Textile Institute, Manchester, 2000, ISBN:1855733854.
2. Anand S.C., -Medical Textiles II, Textile Institute, Manchester, 2001, ISBN:185573494X.
3. Adanur S., -Wellington search and book of Industrial textiles II Technomic publishing co. inc., 1995, ISBN : 1 – 56676 – 340 – 1.
4. Pushpa Bajaj and Sengupta A.K., - Protective clothing I, the Textile Institute, 1992, ISBN 1-870812 –44-1.
5. Scott R.A., -Textiles for protection I, Wood head Publishing Ltd, Cambridge, UK, 2005, ISBN1-85573-921-6.
6. Fung W, -Coated and laminated textiles II, Wood head Publishing Ltd, Cambridge, UK. 2002, ISBN1-85573-576-8.
7. Anand S.C, Kennedy J.F., Mirafat M. and Rajendran S., -Medical textiles and biomaterials for health care II, Wood head Publishing Ltd, Cambridge, UK. 2006, ISBN 1-85573-683-7.
8. Fung W. and Hard castle, -Textiles in automotive engineering I, Wood head Publishing Ltd, Cambridge, U K, 2001, ISBN1-85573-493-1.
9. John N.W.M., -Geo Textile II, Blackie and Sons Ltd, London, U.K. 1987, ISBN 0-412- 01351-7.
10. Allison Mathews and Martin Hardingham, - Medical and Hygiene Textile Production –A hand book I, Intermediate Technology Publications, 1994.
11. David Arvil, -An Innovative Approach to Spun bond Agricultural Crop Cover II, Journal of Industrial Textiles, Vol.30, No.4, April (2001)311-319.
12. Jurg Rupp, -Creating a garden with needle – punched fabrics II, Nonwovens and Industrial Textiles, 2 (2002)49-50.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The Concept, application and evaluation of filtration and geo textiles	1	-	2	3	1	1
CO2	The Fabric requirements for protective textiles	1	-	2	3	1	1
CO3	The Applications of textile in transportation	1	-	2	3	1	1
CO4	The Requirements, properties and application of textiles in medical field	1	-	2	3	1	1
CO5	The Finishing processes for technical textiles and properties of agro textiles	1	-	2	3	2	1
Overall CO		1	-	2	3	1.2	1

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

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 thermoset 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 thermosets- Hand layup, Filament Winding, Resin transfer moulding, prepregs 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 laminar shear stress and fatigue properties of thermoset 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 laminar 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 thermoset and thermoplastic composite
- Mechanics of composites failure

REFERENCES

1. BorZ.Jang, "Advanced Polymer composites", ASM International, USA, 1994.
2. Carlsson L.A. and Pipes R.B., "Experimental Characterization of advanced composite Materials", Second Edition, CRC Press, New Jersey, 1996.
3. George Lubin and Stanley T. Peters, "Handbook of Composites", Springer Publications, 1998.
4. Mel. M. Schwartz, "Composite Materials", Vol. 1 & 2, Prentice Hall PTR, New Jersey, 1997.
5. Richard M. Christensen, "Mechanics of composite materials", Dover Publications, 2005.
6. Sanjay K. Mazumdar, "Composites Manufacturing: Materials, Product, and Process Engineering", CRC Press, 2001

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Different types of textile reinforcements	-	-	2	3	1	1
CO2	Different types of matrices	-	-	2	3	1	1
CO3	Manufacturing of composites	-	-	2	3	2	1
CO4	Evaluation of the properties of thermoset and thermoplastic composite	1	1	2	2	1	-
CO5	Mechanics of composites failure	1	-	2	2	1	-
Overall CO		1	1	2	2.6	1.5	1

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

TY4009

ADVANCED WET PROCESSING MACHINERY

**L T P C
3 0 0 3**

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

9

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

9

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

9

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

9

Developments in preparation of screens for roller, rotary, machine—with programmer line diagram and its advantages- developments in agers- Developments in garment printing machines - various practical problems & possible remedies, Transfer printing machines and dyeing.

UNIT V FINISHING MACHINES

9

Developments in finishing machineries — Calenders, sanforising machine, Back-filling machine, maintenance schedule for the above machineries. Shop floor problems & possible remedies in finishing department, Sandblasting machine, Peach finishing, Raising, Shearing 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:

1. Datye.K.V.and Vaidya.A.A., Chemical Processing of Synthetic fibres and blends, JohnWiley & Sons, NewYork.1995
2. R.S.Bhagwat, "Development in Textile Processing Machines" Colour Publications pvt. Ltd, 2000.

Mapping of CO with PO

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

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

TY4010

DESIGN OF TEXTILE EXPERIMENTS

L T P C
3 0 0 3

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

9

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

9

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

9

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

UNIT IV SPECIAL EXPERIMENTAL DESIGNS

9

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**9**

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

1. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
2. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
3. Phillip J. Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
4. Leaf G.A.V., -Practical Statistics for the Textile Industry, Part I and III, The Textile Institute, Manchester, 1984, ISBN:0900739517.

Mapping of CO with PO

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

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

TY4011**HOMETEXTILES****L T P C
3 0 0 3****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**9**

Development in Textile Furnishing–Type of Furnishing Materials–Woven and Non woven Selection of facilities– Colours– Design – Textile wall hanging – Cession Cushion covers– Kitchen Textile – Apron-Dish cloth– Bread Bag– Pot Holders– Table mats– Upholstery application : Fixed upholstery –Non-stretch loose covers–Stretch covers.

UNIT II FLOOR COVERINGS 9

Recent development– Hand floor covering, Resilient Floor Soft floor Rugs- Cushion and pads. Care – Tufted - Needle felt backing woven.. Woven carpet manufacture – wilton weaving, Shedding mechanism-Aximinister. Tuftedcarpet Manufacture Broadloommachinery, Handtufting, Thermo-bonded products Unconventional methods for making carpets – Bonding knitted carpet, Stitch bonding flocking.

UNIT III CURTAIN SAND DRAPERIES 9

Advances in Home decoration– Draperies– Choice of Fabrics– Curtains– Developments in Finishing of Draperies– Developments in tucks and pleats- uses of Drapery Rods, Hooks, Tape Rings and pins. Table Textiles– Table cloths– colour– Woven Printed, Jacquard , embroidered types, non-woven types.Table mats– Colour–Woven-Printed jacquard, Embroidered.

UNIT IV BEDLINERS 9

Advances in the production –Different types: – Sheets – Blankets – Blanket Covers – Comforts – Comfort Covers – Bed Spreads – Mattress and Mattress Covers – Pads – Pillows. General: Hand /machine embroidered scarves- Stoles –Shawls–Made ups used in hospitals, Textiles care labeling Design aids.

UNIT V TOWELS 9

Types– Bathrobes– BeadTowel– KitchenTerry– Napkins.Construction:weave– Pileheight Pattern Dyeing and Finishing.Window Textile Sun Filters –Reflective textile. Velour Type of Velvet– Jacquard– Doddery– Plain Pointed Manufacturing Methods– Construction.

TOTAL: 45 PERIODS**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:

1. Wingatel.B.,&MohlerJ.E.,Textile Fabrics & Their Selection, Prentice HallInc, NewYork,1984.
2. Donserkery K.G. ,Interior Decoration in India, D.B.Taraporval Sons and Co. Pvt Ltd.,1973
3. Alexander N.G. Designing Interior Environment, Mass Court Brace Covanorich, Newyork,1972.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Different types of home furnishings.	-	-	2	3	1	1
CO2	Different types of floor coverings.	-	-	2	3	2	-
CO3	Different types of curtains.	-	-	2	3	1	-
CO4	Different types of bed liners.	-	-	2	3	2	-
CO5	The production and types of towels.	-	-	2	2	1	1
Overall CO		-	-	2	2.8	1.4	1

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**9**

Introduction - Need for quality -Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby- Barriersto TQM- Customer focus- Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNITII TQM PRINCIPLES**9**

Leadership-QualityStatements,Strategicqualityplanning,QualityCouncils Employee involvement Motivation, Empowerment, 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**9**

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**9**

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function-TPM-Concepts, improvement needs –Performance measures.

UNITV QUALITY MANAGEMENT SYSTEM**9**

Introduction— Benefits of ISO Registration— ISO 9000 Series of Standards— Sector-Specific Standards— AS 9100, TS16949 and TL 9000- ISO 9001 Requirements—Implementation— Documentation— Internal Audits— Registration- environmental management SYSTEM: Introduction— ISO 14000 Series Standards— Concepts of ISO 14001—Requirements of ISO14001— Benefits of EMS.

TOTAL: 45PERIODS**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:

- DaleH.Besterfield, CarolB.Michna, GlenH.Besterfield, MaryB.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, SixthImpression, 2013.
- JamesR .E vans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning,2012.
- Janakiraman.B and Gopal. R.K., "Total Quality Management-Text and Cases",Prentice Hall (India)Pvt.Ltd.,2006.
- Suganthi. Land Anand Samuel, "Total Quality Management", PrenticeHall (India)Pvt.

Mapping of CO with PO

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	The concept and importance of total quality management.	1	-	2	2	1	-
CO2	The principles of total quality management.	1	-	2	2	1	-
CO3	The tools and techniques in total quality management.	1	-	2	2	1	2
CO4	The quality circle and cost of	1	-	2	2	1	-

	quality.						
CO5	The quality management system.	1	-	2	2	1	-
Overall CO		1	-	2	2	1	2

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 dyeing of textiles

CO4: Importance of recycling in textile industry

CO5: Eco-labelling and eco-designing

REFERENCES

- Peter P Rogers., "An Introduction to Sustainable Development", Glen Educational Foundation, Inc, 2008, ISBN 978-1-84407-520-1.
- Blackburn R S., "Sustainable Textiles", Woodhead Publishing Limited, 2009, ISBN 978-1-84569-453-1.
- Marim I. Tobler. Rohr., "Handbook of Sustainable Textile Production", Woodhead Publishing Limited, Cambridge, 2011, ISBN 0-85274-426-9.
- Miraftab M and Horrocks R, "Eco-Textiles", Woodhead Publishing Limited, Cambridge 2007, ISBN 978-1-42004-444-7.
- Youjiang Wang, "Recycling in Textiles", Woodhead Publishing Limited, Cambridge, 2006, ISBN 1-85573-952-6.
- Chavan R B and Radhakrishnan J, "Environmental Issues - Technology Options for Textile Industry", IIT Delhi Publication, 1998.

7. Cavaco-Paulo and Gübitz G M, "Textile Processing with Enzymes", Woodhead Publishing Ltd., UK, 2003, ISBN 978-1-85573-610-8.

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Concept of sustainability and importance	2	-	3	2	2	1
CO2	Sustainability in textile fibre production	2	-	3	2	2	1
CO3	Sustainability in in dyeing of textiles	2	-	3	2	2	1
CO4	Importance of recycling in textile industry	2	-	3	2	2	1
CO5	Eco-labelling and eco-designing	2	-	3	2	2	1
Overall CO		2	-	3	2	2	1

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

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

9

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

UNIT II YARN AND FABRIC REQUIREMENTS

9

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

9

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

9

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

9

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

1. Adanur S., "Wellington sears handbook of Industrial textiles" Technomic publishing co. inc., 1995, ISBN : 1 – 56676 – 340 – 1
2. Pushpa Bajaj and Sengupta A.K, "Protective clothing", the Textile Institute, 1992, ISBN 1-870812 – 44-1
3. Chellamani K.P. and Chattopadhyay D., "Yarns and Technical Textiles", SITRA, 1999.
4. Mukhopadhyay S.K. and Partridge J.F., "Automotive Textiles", Textile Progress, Vol29, No1/2, 1999, ISBN:1870372212
5. Horrocks A.R. and Anand S.C., "Handbook of Technical Textiles", The Textile Institute, Manchester, 2000, ISBN: 1855733854.
6. Anand S.C., "Medical Textiles", Textile Institute, Manchester, 2001, ISBN:185573494X.
7. Scott R.A., "Textiles for protection", Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-921-6.
8. Saville B.P., "Physical testing of textiles", Woodhead Publishing Ltd., Cambridge, UK, 1999, ISBN 1-85573-367-6.
9. Long A.C., "Design and manufacture of Textile Composites", Woodhead Publishing Ltd., Cambridge, UK, 2005, ISBN 1-85573-744-2.
10. Fung W, "Coated and laminated textiles", Woodhead Publishing Ltd, Cambridge, UK, 2002, ISBN 1-85573-576-8.
11. Anand S.C., Kennedy J.F., Mirafab.M and Rajendran.S., "Medical textiles and biomaterials for health care", Woodhead Publishing Ltd, Cambridge, UK,2006, ISBN 1-85573-683-7.
12. Fung W. and Hardcastle, "Textiles in automotive engineering", Woodhead Publishing Ltd, Cambridge, UK, 2001, ISBN 1-85573-493-1.
13. John N.W.M., "Geo Textile", Blackie and Sons Ltd, London, U.K. , 1987, ISBN 0-412-01351-7.
14. Allison Mathews. and Martin Hardingham, "Medical and Hygiene Textile Production – A hand book" Intermediate Technology Publications, 1994.

PROGRESSTHROUGH KNOWLEDGE

Course Articulation Matrix:

Course Outcomes	Statement	Program Outcome					
		PO1	PO2	PO3	PO4	PO5	PO6
CO1	Properties of fibres required for protective clothing	2	1	2	3	-	1
CO2	Selection of fibre, yarn and fabric for developing protective clothing for different applications	2	1	2	3	-	1
CO3	Protective clothing construction	2	1	2	3	-	1
CO4	Different types of finishes given to develop protective clothing	2	1	2	3	-	1
CO5	Evaluation of protective clothing	2	1	2	3	-	1
Overall CO		2	1	2	3	-	1

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

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

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

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:

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

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

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

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:

1. Goel S. L., Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi, 2009.
2. Nishitha Rai, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “New Royal book Company, 2007.
3. Sahni, Pardeep Et. Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi, 2001.

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

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental 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

District’s Administration head: Role and Importance, □ Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

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.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094

நற்றமிழ் இலக்கியம்

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UNIT I

சங்க இலக்கியம்

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
- எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
- போரை நிறுத்திய ஔவையார்

UNIT II

அறநெறித் தமிழ்

6

1. அறநெறி வகுத்த திருவள்ளுவர்
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புரவறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
- ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III

இரட்டைக் காப்பியங்கள்

6

1. கண்ணகியின் புரட்சி
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV

அருள்நெறித் தமிழ்

6

1. சிறுபாணாற்றுப்படை
- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஔவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
- அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
- இயமம் நியமம் விதிகள்

4. தர்மச்சாலையை நிறுவிய வள்ளலார்
 5. புறநானூறு
 - சிறுவனே வள்ளலானான்
 6. அகநானூறு (4) - வண்டு
 - நற்றிணை (11) - நண்டு
 - கலித்தொகை (11) - யானை, புறா
 - ஐந்திணை 50 (27) - மான்
- ஆகியவை பற்றிய செய்திகள்

UNIT V

நவீன தமிழ் இலக்கியம்

6

1. உரைநடைத் தமிழ்,
 - தமிழின் முதல் புதினம்,
 - தமிழின் முதல் சிறுகதை,
 - கட்டுரை இலக்கியம்,
 - பயண இலக்கியம்,
 - நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL : 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
 - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
 - https://ta.wikipedia.org
3. தர்மபுர ஆதீன வெளியீடு
4. வாழ்வியல் களஞ்சியம்
 - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
 - தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
 - தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

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 9

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 9

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 9

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 9

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 9

Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security – Irrigation efficiencies, irrigation methods - current water pricing policy– scope to relook pricing.

TOTAL: 45 PERIODS**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:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. 2003.
2. Mollinga .P. etal “ Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
3. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
4. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
5. Technical Advisory Committee, Effective Water Governance”. Technical Advisory Committee Background paper No: 7. Global water partnership, Stockholm, Sweden, 2003.

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**9**

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**9**

Third World Scenario – Poor and Multidimensional Deprivation--Health Burden in Developing Scenario -Factors contribute to water, sanitation and hygiene related diseases-Social: Social Stratification and Literacy Demography: Population and Migration- Fertility - Mortality- Environment: Water Borne-Water Washed and Water Based Diseases - Economic: Wage - Water and Health Budgeting -Psychological: Non-compliance - Disease Relapse - Political: Political Will.

UNIT III CHALLENGES IN MANAGEMENT AND DEVELOPMENT**9**

Common Challenges in WASH - Bureaucracy and Users- Water Utilities -Sectoral Allocation:- Infrastructure- Service Delivery: Health services: Macro and Micro- level: Community and Gender Issues- Equity Issues - Paradigm Shift: Democratization of Reforms and Initiatives.

UNIT IV GOVERNANCE**9**

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**9**

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.

TOTAL: 45 PERIODS**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

1. Bonitha R., Beaglehole R., Kjellstorm, 2006, "Basic Epidemiology", 2nd Edition, World Health Organization.
2. Van Note Chism, N. and Bickford, D. J. (2002), Improving the environment for learning: An expanded agenda. New Directions for Teaching and Learning, 2002: 91–98. doi: 10.1002/tl.83Improving the Environment for learning: An Expanded Agenda
3. National Research Council. Global Issues in Water, Sanitation, and Health: Workshop Summary. Washington, DC: The National Academies Press, 2009.
4. Sen, Amartya 1997. On Economic Inequality. Enlarged edition, with annex by James Foster and Amartya Sen, Oxford: Clarendon Press, 1997.
5. Intersectoral Water Allocation Planning and Management, 2000, World Bank Publishers www. Amazon.com

OCE433

PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L T P C

3 0 0 3

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

9

Definition of sustainability – environmental, economical and social dimensions of sustainability - sustainable development models – strong and weak sustainability – defining development-millennium development goals – mindsets for sustainability: earthly, analytical, precautionary, action and collaborative– syndromes of global change: utilisation syndromes, development syndromes, and sink syndromes – core problems and cross cutting Issues of the 21 century - global, regional and local environmental issues – social insecurity - resource degradation –climate change – desertification.

UNIT II PRINCIPLES AND FRAME WORK

9

History and emergence of the concept of sustainable development - our common future - Stockholm to Rio plus 20– Rio Principles of sustainable development – Agenda 21 natural step-peoples earth charter – business charter for sustainable development –UN Global Compact - Role of civil society, business and government – United Nations’ 2030 Agenda for sustainable development – 17 sustainable development goals and targets, indicators and intervention areas

UNIT III SUSTAINABLE DEVELOPMENT AND WELLBEING

9

The Unjust World and inequities - Quality of Life - Poverty, Population and Pollution - Combating Poverty - - Demographic dynamics of sustainability - Strategies to end Rural and Urban Poverty and Hunger – Sustainable Livelihood Framework- Health, Education and Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities and Industry for Prevention, Precaution , Preservation and Public participation.

UNIT IV SUSTAINABLE SOCIO-ECONOMIC SYSTEMS

10

Sustainable Development Goals and Linkage to Sustainable Consumption and Production – Investing in Natural Capital- Agriculture, Forests, Fisheries - Food security and nutrition and sustainable agriculture- Water and sanitation - Biodiversity conservation and Ecosystem integrity – Ecotourism - Sustainable Cities – Sustainable Habitats- Green Buildings - Sustainable Transportation — Sustainable Mining - Sustainable Energy– Climate Change –Mitigation and Adaptation - Safeguarding Marine Resources - Financial Resources and Mechanisms

UNIT V ASSESSING PROGRESS AND WAY FORWARD

8

Nature of sustainable development strategies and current practice- Sustainability in global, regional and national context –Approaches to measuring and analysing sustainability– limitations of GDP- Ecological Footprint- Human Development Index- Human Development Report – National initiatives for Sustainable Development - Hurdles to Sustainability - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Inclusive Green Growth and Green Economy – National Sustainable Development Strategy Planning and National Status of Sustainable Development Goals

TOTAL: 45 PERIODS

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
3. Karel Mulder, Sustainable Development for Engineers - A Handbook and Resource Guide, Roulledge Taylor and Francis, 2017.
4. The New Global Frontier - Urbanization, Poverty and Environmentin the 21st Century - *George Martine,Gordon McGranahan,Mark Montgomery and Rogelio Fernández-Castilla*, IIED and UNFPA, Earthscan, UK, 2008
5. Nolberto Munier, Introduction to Sustainability: Road to a Better Future, Springer, 2006
6. Barry Dalal Clayton and Stephen Bass, Sustainable Development Strategies- a resource book”, Earthscan Publications Ltd, London, 2002.

**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- screening – scoping - terms of reference in EIA- setting – analysis – mitigation. Cross sectoral issues –public hearing in EIA- EIA consultant accreditation.

UNIT II IMPACT IDENTIFICATION AND PREDICTION 10

Matrices – networks – checklists – cost benefit analysis – analysis of alternatives – expert systems in EIA. prediction tools for EIA – mathematical modeling for impact prediction – assessment of impacts – air – water – soil – noise – biological — cumulative impact assessment

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
3. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York. 1996
4. Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey. 2003
5. Lee N. and George C. 2000. Environmental Assessment in Developing and Transitional Countries. Chichester: Willey
6. World Bank –Source book on EIA ,1999
7. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

OIC431

BLOCKCHAIN TECHNOLOGIES

**LT PC
3 0 0 3**

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 9

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 9

Introduction to Bitcoin, The Bitcoin Network, The Bitcoin Mining Process, Mining Developments, Bitcoin Wallets, Decentralization and Hard Forks, Ethereum Virtual Machine (EVM), Merkle Tree, Double-Spend Problem, Blockchain and Digital Currency, Transactional Blocks, Impact of Blockchain Technology on Cryptocurrency.

UNIT III INTRODUCTION TO ETHEREUM 9

Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.

UNIT-IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING 10

Introduction to Hyperledger, Distributed Ledger Technology & its Challenges, Hyperledger & Distributed Ledger Technology, Hyperledger Fabric, Hyperledger Composer. Solidity - Language of Smart Contracts, Installing Solidity & Ethereum Wallet, Basics of Solidity, Layout of a Solidity Source File & Structure of Smart Contracts, General Value Types.

UNIT V BLOCKCHAIN APPLICATIONS 8

Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

TOTAL: 45 PERIODS

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:

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained", Second Edition, Packt Publishing, 2018.
2. Narayanan, J. Bonneau, E. Felten, A. Miller, S. Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" Princeton University Press, 2016
3. Antonopoulos, Mastering Bitcoin, O'Reilly Publishing, 2014. .
4. Antonopoulos and G. Wood, "Mastering Ethereum: Building Smart Contracts and Dapps", O'Reilly Publishing, 2018.
5. D. Drescher, Blockchain Basics. Apress, 2017.

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

Fundamentals about Deep Learning. Perception Learning Algorithms. Probabilistic modelling. Early Neural Networks. How Deep Learning different from Machine Learning. Scalars. Vectors. Matrixes, Higher Dimensional Tensors. Manipulating Tensors. Vector Data. Time Series Data. Image Data. Video Data.

UNIT II NEURAL NETWORKS 9

About Neural Network. Building Blocks of Neural Network. Optimizers. Activation Functions. Loss Functions. Data Pre-processing for neural networks, Feature Engineering. Overfitting and Underfitting. Hyperparameters.

UNIT III CONVOLUTIONAL NEURAL NETWORK 10

About CNN. Linear Time Invariant. Image Processing Filtering. Building a convolutional neural network. Input Layers, Convolution Layers. Pooling Layers. Dense Layers. Backpropagation Through the Convolutional Layer. Filters and Feature Maps. Backpropagation Through the Pooling Layers. Dropout Layers and Regularization. Batch Normalization. Various Activation Functions.

Various Optimizers. LeNet, AlexNet, VGG16, ResNet. Transfer Learning with Image Data. Transfer Learning using Inception Oxford VGG Model, Google Inception Model, Microsoft ResNet Model. R-CNN, Fast R-CNN, Faster R-CNN, Mask-RCNN, YOLO

UNIT IV NATURAL LANGUAGE PROCESSING USING RNN 10

About NLP & its Toolkits. Language Modeling . Vector Space Model (VSM). Continuous Bag of Words (CBOW). Skip-Gram Model for Word Embedding. Part of Speech (PoS) Global Co-occurrence Statistics–based Word Vectors. Transfer Learning. Word2Vec. Global Vectors for Word Representation GloVe. Backpropagation Through Time. Bidirectional RNNs (BRNN) . Long Short Term Memory (LSTM). Bi-directional LSTM. Sequence-to-Sequence Models (Seq2Seq). Gated recurrent unit GRU.

UNIT V DEEP REINFORCEMENT & UNSUPERVISED LEARNING 10

About Deep Reinforcement Learning. Q-Learning. Deep Q-Network (DQN). Policy Gradient Methods. Actor-Critic Algorithm. About Autoencoding. Convolutional Auto Encoding. Variational Auto Encoding. Generative Adversarial Networks. Autoencoders for Feature Extraction. Auto Encoders for Classification. Denoising Autoencoders. Sparse Autoencoders

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
3. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017
5. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017

**OME431 VIBRATION AND NOISE CONTROL STRATEGIES L T P C
3 0 0 3**

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 9

Introduction – Sources and causes of Vibration-Mathematical Models - Displacement, velocity and Acceleration - Classification of vibration: free and forced vibration, undamped and damped vibration, linear and non-linear vibration - Single Degree Freedom Systems - Vibration isolation - Determination of natural frequencies

UNIT- II BASICS OF NOISE 9

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 9

Experimental Methods in Vibration Analysis.- Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings - Vibration Exciters - Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments -. System Identification from Frequency Response -Testing for resonance and mode shapes

UNIT- IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS 9

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 9

Specification of Vibration Limits – Vibration severity standards - Vibration as condition Monitoring Tool – Case Studies - Vibration Isolation methods - Dynamic Vibration Absorber – Need for Balancing - Static and Dynamic Balancing machines – Field balancing - Major sources of noise - Noise survey techniques – Measurement technique for vehicular noise - Road vehicles Noise standard – Noise due to construction equipment and domestic appliances – Industrial noise sources and its strategies – Noise control at the source – Noise control along the path – Acoustic Barriers – Noise control at the receiver -- Sound transmission through barriers – Noise reduction Vs Transmission loss - Enclosures

TOTAL: 45 PERIODS

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:

1. Singiresu S. Rao, "Mechanical Vibrations", Pearson Education Incorporated, 2017.
2. Graham Kelly. Sand Shashidhar K. Kudari, "Mechanical Vibrations", Tata McGraw –Hill Publishing Com. Ltd., 2007.
3. Ramamurti. V, "Mechanical Vibration Practice with Basic Theory", Narosa Publishing House, 2000.
4. William T. Thomson, "Theory of Vibration with Applications", Taylor & Francis, 2003.
5. G.K. Grover, "Mechanical Vibrations", Nem Chand and Bros.,Roorkee, 2014.
6. A.G. Ambekar, "Mechanical Vibrations and Noise Engineering", PHI Learning Pvt. Ltd., 2014.
7. David A. Bies and Colin H. Hansen, "Engineering Noise Control – Theory and Practice", Spon Press, London and New York, 2009.

OME432 ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS L T P C

3 0 0 3

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 9
 Primary energy resources - Sectorial energy consumption (domestic, industrial and other sectors), Energy pricing, Energy conservation and its importance, Energy Conservation Act-2001 and its features – Energy star rating.

UNIT II HEATING, VENTILLATION & AIR CONDITIONING 9
 Basics of Refrigeration and Air Conditioning – COP / EER / SEC Evaluation – SPV system design & optimization for Solar Refrigeration.

UNIT III LIGHTING, COMPUTER, TV 9
 Specification of Luminaries – Types – Efficacy – Selection & Application – Time Sensors – Occupancy Sensors – Energy conservation measures in computer – Television – Electronic devices.

UNIT IV ENERGY EFFICIENT BUILDINGS 9
 Conventional versus Energy efficient buildings – Landscape design – Envelope heat loss and heat gain – Passive cooling and heating – Renewable sources integration.

UNIT V ENERGY STORAGE TECHNOLOGIES 9
 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:

1. Yogi Goswami, Frank Kreith, Energy Efficiency and Renewable energy Handbook, CRC Press, 2016
2. ASHRAE Handbook 2020 – HVAC Systems & Equipment
3. Paolo Bertoldi, Andrea Ricci, Anibal de Almeida, Energy Efficiency in Household Appliances and Lighting, Conference proceedings, Springer, 2001
4. David A. Bainbridge, Ken Haggard, Kenneth L. Haggard, Passive Solar Architecture: Heating, Cooling, Ventilation, Daylighting, and More Using Natural Flows, Chelsea Green Publishing, 2011.
5. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
6. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications, John Wiley & Sons 2002.
7. Robert Huggins, Energy Storage: Fundamentals, Materials and Applications, 2nd edition, Springer, 2015
8. Ru-shiliu, Leizhang, Xueliang sun, Electrochemical technologies for energy storage and conversion, Wiley publications, 2012.

UNIT I INTRODUCTION

Need - Development - Rapid Prototyping Rapid Tooling – Rapid Manufacturing – Additive Manufacturing. AM Process Chain- Classification – Benefits.

UNIT II DESIGN FOR ADDITIVE MANUFACTURING

9

CAD Model Preparation - Part Orientation and Support Structure Generation -Model Slicing - Tool Path Generation Customized Design and Fabrication - Case Studies.

UNIT III VAT POLYMERIZATION

9

Stereolithography Apparatus (SLA)- Materials -Process -Advantages Limitations- Applications. Digital Light Processing (DLP) - Materials – Process - Advantages - Applications. Multi Jet Modelling (MJM) - Principles - Process - Materials - Advantages and Limitations.

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION

9

Fused Deposition Modeling (FDM)- Process-Materials - Applications and Limitations. Sheet Lamination Process: Laminated Object Manufacturing (LOM)- Basic Principle- Mechanism: Gluing or Adhesive Bonding – Thermal Bonding- Materials- Application and Limitation - Bio-Additive Manufacturing Computer Aided Tissue Engineering (CATE) – Case studies

POWDER BASED PROCESS

Selective Laser Sintering (SLS): Process –Mechanism– Typical Materials and Application- Multi Jet Fusion - Basic Principle-- Materials- Application and Limitation - Three Dimensional Printing - Materials -Process - Benefits and Limitations. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Materials – Process - Advantages and Applications. Beam Deposition Process: Laser Engineered Net Shaping (LENS)- Process -Material Delivery - Process Parameters - Materials -Benefits -Applications.

UNIT V CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES

9

Education and training - Automobile- pattern and mould - tooling - Building Printing-Bio Printing - medical implants -development of surgical tools Food Printing -Printing Electronics. Business Opportunities and Future Directions - Intellectual Property.

TOTAL: 45 PERIODS**REFERENCES:**

1. Andreas Gebhardt and Jan-Steffen Hötter “Additive Manufacturing: 3D Printing for Prototyping and Manufacturing”, Hanser publications, United States, 2015, ISBN: 978-1- 56990-582-1.
2. Ian Gibson, David W. Rosen and Brent Stucker “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, 2nd edition, Springer., United States, 2015, ISBN13: 978-1493921126.
3. Amit Bandyopadhyay and Susmita Bose, “Additive Manufacturing”, 1st Edition, CRC Press., United States, 2015, ISBN-13: 978-1482223590
4. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Manufacturing”, Hanser Gardner Publication, Cincinnati., Ohio, 2011, ISBN :9783446425521.
5. Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third edition, World Scientific Publishers, 2010.

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

Materials and types of production, Chassis skate board design, motor sizing, power pack sizing, component matching, Ideal gear box – Gear ratio, torque–speed characteristics, Dynamic equation of vehicle motion, Maximum tractive effort – Power train tractive effort Acceleration performance, rated vehicle velocity – maximum gradability, Brake performance, Electronic control system, safety and challenges in electric vehicles. Case study of Nissan leaf, Toyota Prius, tesla model 3, and Renault Zoe cars.

TOTAL: 45 PERIODS

REFERENCES:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition CRC Press, 2011.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained - Wiley, 2003.
4. Ehsani, M, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2005

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
Introduction – Characteristics of Successful Product Development – People involved in Product Design and Development – Duration and Cost of Product Development – The Challenges of Product Development – The Product Development Process – Concept Development: The Front-End Process – Adapting the Generic Product Development Process – Product Development Process Flows – Product Development Organizations.

UNIT II OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING 9
Opportunity Identification: Definition – Types of Opportunities – Tournament Structure of Opportunity Identification – Effective Opportunity Tournaments – Opportunity Identification Process – Product Planning: Four types of Product Development Projects – The Process of Product Planning.

UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS 9
Identifying Customer Needs: The Importance of Latent Needs – The Process of Identifying Customer Needs. Product Specifications: Definition – Time of Specifications Establishment – Establishing Target Specifications – Setting the Final Specifications

UNIT IV CONCEPT GENERATION, SELECTION & TESTING 9
Concept Generation: Activity of Concept Generation – Structured Approach – Five step method of Concept Generation. Concept Selection: Methodology – Concept Screening and Concepts Scoring. Concept testing: Seven Step activities of concept testing.

UNIT V INDUSTRIAL DESIGN & PROTOTYPING 9
Industrial Design: Need and Impact–Industrial Design Process. Prototyping – Principles of Prototyping – Prototyping Technologies – Planning for Prototypes.

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:

1. Ulrich K.T., Eppinger S. D. and Anita Goyal, “Product Design and Development “McGraw-Hill Education; 7 edition, 2020.

REFERENCES:

1. Belz A., 36-Hour Course: “Product Development” McGraw-Hill, 2010.
2. Rosenthal S., “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN1-55623-603-4.

**OBA431 SUSTAINABLE MANAGEMENT LT P C
3 0 0 3**

COURSE OBJECTIVES:

- To provide students with fundamental knowledge of the notion of corporate sustainability.

- 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
Energy management, Water management, Waste management, Wild Life Conservation, Emerging trends in sustainable management, Case Studies.		

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:

1. Daddi, T., Iraldo, F., Testa, Environmental Certification for Organizations and Products: Management, 2015
2. Christian N. Madu, Handbook of Sustainability Management 2012
3. Petra Molthan-Hill, The Business Student's Guide to Sustainable Management: Principles and Practice, 2014
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

Creation, Innovation, entrepreneurship and small business - Defining Small Business –Role of Owner – Manager – government policy towards small business sector –elements of entrepreneurship –evolution of entrepreneurship –Types of Entrepreneurship – social, civic, corporate - Business life cycle - barriers and triggers to new venture creation – process to assist start ups – small business and family business.

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

1. Hankinson,A.(2000). “The key factors in the profile of small firm owner-managers that influence business performance. The South Coast Small Firms Survey, 1997-2000.” Industrial and Commercial Training 32(3):94-98.

2. Parker,R.(2000). "Small is not necessarily beautiful: An evaluation of policy support for small and medium-sized enterprise in Australia." Australian Journal of Political Science 35(2):239-253.
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

International Treaties and conventions on IPRs, The TRIPs Agreement, PCT Agreement, The Patent Act of India, Patent Amendment Act (2005), Design Act, Trademark Act, Geographical Indication Act, Bayh- Dole Act and Issues of Academic Entrepreneurship.

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

1. V. Sople Vinod, Managing Intellectual Property by (Prentice hall of India Pvt.Ltd), 2006.
2. Intellectual Property rights and copyrights, EssEss Publications.
3. Primer, R. Anita Rao and Bhanoji Rao, Intellectual Property Rights, Lastain Book company.
4. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2006.
5. WIPO Intellectual Property Hand book.

COURSE OBJECTIVE

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

UNIT I ETHICS AND SOCIETY**9**

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**9**

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**9**

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**9**

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**9**

Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modelling 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

1. Brad Agle, Aaron Miller, Bill O' Rourke, The Business Ethics Field Guide: the essential companion to leading your career and your company, 2016.
2. Steiner & Steiner, Business, Government & Society: A managerial Perspective, 2011.
3. Lawrence & Weber, Business and Society: Stakeholders, Ethics, Public Policy, 2020.

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

IoT reference model and architecture -Node Structure - Sensing, Processing, Communication, Powering, Networking - Topologies, Layer/Stack architecture, IoT standards, Cloud computing for IoT, Bluetooth, Bluetooth Low Energy beacons.

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:

1. ArshdeepBahga and VijaiMadiseti : A Hands-on Approach "Internet of Things", Universities Press 2015.
2. Oliver Hersent , David Boswarthick and Omar Elloumi " The Internet of Things", Wiley,2016.
3. Samuel Greengard, " The Internet of Things", The MIT press, 2015.
4. Adrian McEwen and Hakim Cassimally"Designing the Internet of Things "Wiley,2014.
5. Jean- Philippe Vasseur, Adam Dunkels, "Interconnecting Smart Objects with IP: The Next Internet" Morgan Kuffmann Publishers, 2010.
6. Adrian McEwen and Hakim Cassimally, "Designing the Internet of Things", John Wiley and sons, 2014.
7. Lingyang Song/DusitNiyato/ Zhu Han/ Ekram Hossain," Wireless Device-to-Device Communications and Networks, CAMBRIDGE UNIVERSITY PRESS,2015.
8. OvidiuVermesan and Peter Friess (Editors), "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers Series in Communication, 2013.
9. Vijay Madiseti , ArshdeepBahga, "Internet of Things (A Hands on-Approach)", 2014.

10. Zach Shelby, Carsten Bormann, "6LoWPAN: The Wireless Embedded Internet", John Wiley and sons, 2009.
11. Lars T. Berger and Krzysztof Iniewski, "Smart Grid applications, communications and security", Wiley, 2015.
12. Janaka Ekanayake, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama and Nick Jenkins, "Smart Grid Technology and Applications", Wiley, 2015.
13. Upena Dalal, "Wireless Communications & Networks, Oxford, 2015.

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

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, Multi-layer neural network, Linear Separability, Hebb Net, Perceptron, Adaline, Standard Back propagation Training Algorithms for Pattern Association - Hebb rule and Delta rule, Hetero associative, Auto associative, Kohonen Self Organising Maps, Examples of Feature Maps, Learning Vector Quantization, Gradient descent, Boltzmann Machine Learning.

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:

1. J. S. R. Jang, C. T. Sun, E. Mizutani, Neuro Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, 2012, PHI learning
2. Deep Learning, Ian Good fellow, YoshuaBengio and Aaron Courville, MIT Press, ISBN: 9780262035613, 2016.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman. Second Edition. 2009.
4. Pattern Recognition and Machine Learning. Christopher Bishop. Springer. 2006.
5. Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.

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

9

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 – Achievements– Applications.

UNIT II SOLAR PHOTOVOLTAICS

9

Solar Energy: Sun and Earth-Basic Characteristics of solar radiation- angle of sunrays on solar collector-Estimating Solar Radiation Empirically - Equivalent circuit of PV Cell- Photovoltaic cell-characteristics: P-V and I-V curve of cell-Impact of Temperature and Insolation on I-V characteristics-Shading Impacts on I-V characteristics-Bypass diode -Blocking diode.

UNIT III PHOTOVOLTAIC SYSTEM DESIGN

9

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

9

Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz's limit-Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed-Tip Speed Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.

UNIT V OTHER RENEWABLE ENERGY SOURCES

9

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:

1. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009.
2. Rai. G.D, "Non conventional energy sources", Khanna publishes, 1993.
3. Rai. G.D," Solar energy utilization", Khanna publishes, 1993.
4. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Private Limited, 2012.
5. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006
6. Gray, L. Johnson, "Wind energy system", prentice hall of India, 1995.
7. B.H.Khan, " Non-conventional Energy sources", , McGraw-hill, 2nd Edition, 2009.
8. Fang Lin Luo Hong Ye, " Renewable Energy systems", Taylor & Francis Group,2013.

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

9

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

9

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 9

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 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS 9

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.

TOTAL : 45 PERIODS

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

1. Stuart Borlase 'Smart Grid: Infrastructure, Technology and Solutions', CRC Press 2012.
2. JanakaEkanayake, Nick Jenkins, KithsiriLiyanage, Jianzhong Wu, Akihiko Yokoyama, 'Smart Grid: Technology and Applications', Wiley, 2012.
3. Mini S. Thomas, John D McDonald, 'Power System SCADA and Smart Grids', CRC Press, 2015
4. Kenneth C.Budka, Jayant G. Deshpande, Marina Thottan, 'Communication Networks for Smart Grids', Springer, 2014
5. SMART GRID Fundamentals of Design and Analysis, James Momoh, IEEE press, A John Wiley & Sons, Inc., Publication.

CP4391

SECURITY PRACTICES

L T P C

3 0 0 3

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 9

Model of network security – Security attacks, services and mechanisms – OSI security architecture -A Cryptography primer- Intrusion detection system- Intrusion Prevention system - Security web applications- Case study: OWASP - Top 10 Web Application Security Risks.

UNIT II NETWORK SECURITY 9

Internet Security - Intranet security- Local Area Network Security - Wireless Network Security - Wireless Sensor Network Security- Cellular Network Security - Mobile security - IOT security - Case Study - Kali Linux.

UNIT III SECURITY MANAGEMENT 9
Information security essentials for IT Managers- Security Management System - Policy Driven System Management- IT Security - Online Identity and User Management System. Case study: Metasploit

UNIT IV CYBER SECURITY AND CLOUD SECURITY 9
Cyber Forensics- Disk Forensics – Network Forensics – Wireless Forensics – Database Forensics – Malware Forensics – Mobile Forensics – Email Forensics- Best security practices for automate Cloud infrastructure management – Establishing trust in IaaS, PaaS, and SaaS Cloud types. Case study: DVWA

UNIT V PRIVACY AND STORAGE SECURITY 9
Privacy on the Internet - Privacy Enhancing Technologies - Personal privacy Policies - Detection of Conflicts in security policies- privacy and security in environment monitoring systems. Storage Area Network Security - Storage Area Network Security Devices - Risk management - Physical Security Essentials.

TOTAL: 45 PERIODS

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

1. John R. Vacca, Computer and Information Security Handbook, Third Edition, Elsevier 2017
2. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Seventh Edition, Cengage Learning, 2022
3. Richard E. Smith, Elementary Information Security, Third Edition, Jones and Bartlett Learning, 2019
4. Mayor, K.K.Mookhey, Jacopo Cervini, Fairuzan Roslan, Kevin Beaver, Metasploit Toolkit for Penetration Testing, Exploit Development and Vulnerability Research, Syngress publications, Elsevier, 2007. ISBN : 978-1-59749-074-0
5. John Sammons, "The Basics of Digital Forensics- The Primer for Getting Started in Digital Forensics", Syngress, 2012
6. Cory Altheide and Harlan Carvey, "Digital Forensics with Open Source Tools",2011 Syngress, ISBN: 9781597495875.
7. Siani Pearson, George Yee "Privacy and Security for Cloud Computing" Computer Communications and Networks, Springer, 2013.

**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: Origin of Windows Azure, Features, The Fabric Controller – First Cloud APP in 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

1. Bernard Golden, Amazon Web Service for Dummies, John Wiley & Sons, 2013.
2. Raoul Alongi, AWS: The Most Complete Guide to Amazon Web Service from Beginner to Advanced Level, Amazon Asia- Pacific Holdings Private Limited, 2019.
3. Sriram Krishnan, Programming: Windows Azure, O'Reilly,2010.
4. Rajkumar Buyya, Christian Vacchiola, S.Thamarai Selvi, Mastering Cloud Computing , McGraw Hill Education (India) Pvt. Ltd., 2013.
5. Danielle Ruest, Nelson Ruest, —Virtualization: A Beginner"s Guidell, McGraw-Hill Osborne Media, 2009.
6. Jim Smith, Ravi Nair , "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
7. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.
8. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", McGraw-Hill Osborne Media, 2009.
9. Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012.

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

Introduction. A UX process lifecycle template. Choosing a process instance for your project. The system complexity space. Meet the user interface team. Scope of UX presence within the team. More about UX lifecycles. Business Strategy. Value Innovation. Validated User Research. Killer UX Design. The Blockbuster Value Proposition. What Is a Value Proposition?.

UNIT II CONTEXTUAL INQUIRY 10

The system concept statement. User work activity data gathering. Look for emotional aspects of work practice. Abridged contextual inquiry process. Data-driven vs. model-driven inquiry. Organizing concepts: work roles and flow model. Creating and managing work activity notes. Constructing your work activity affinity diagram (WAAD). Abridged contextual analysis process. History of affinity diagrams.

UNIT III DESIGN THINKING, IDEATION, AND SKETCHING 9

Design-informing models: second span of the bridge . Some general “how to” suggestions. A New example domain: slideshow presentations. User models. Usage models. Work environment models. Barrier summaries. Model consolidation. Protecting your sources. Abridged methods for design-informing models extraction. Design paradigms. Design thinking. Design perspectives. User personas. Ideation. Sketching

UNIT IV UX GOALS, METRICS, AND TARGETS 8

Introduction. UX goals. UX target tables. Work roles, user classes, and UX goals. UX measures. Measuring instruments. UX metrics. Baseline level. Target level. Setting levels. Observed results. Practical tips and cautions for creating UX targets. How UX targets help manage the user experience engineering process.

UNIT V ANALYSING USER EXPERIENCE 10

Sharpening Your Thinking Tools. UX Research and Strength of Evidence. Agile Personas. How to Prioritize Usability Problems. Creating Insights, Hypotheses and Testable Design Ideas. How to Manage Design Projects with User Experience Metrics. Two Measures that Will Justify Any Design Change. Evangelizing UX Research. How to Create a User Journey Map. Generating Solutions to Usability Problems. Building UX Research Into the Design Studio Methodology. Dealing with Common objections to UX Research. The User Experience Debrief Meeting. Creating a User Experience Dashboard.

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

1. UX for Developers: How to Integrate User-Centered Design Principles Into Your Day-to-Day Development Work, Westley Knight. Apress, 2018
2. The UX Book: Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson, Pardha Pyla. Morgan Kaufmann, 2012
3. UX Fundamentals for Non-UX Professionals: User Experience Principles for Managers, Writers, Designers, and Developers, Edward Stull. Apress, 2018
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

L T P C

3 0 0 3

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

9

Introduction to Multimedia – Characteristics of Multimedia Presentation – Multimedia Components – Promotion of Multimedia Based Components – Digital Representation – Media and Data Streams – Multimedia Architecture – Multimedia Documents, Multimedia Tasks and Concerns, Production, sharing and distribution, Hypermedia, WWW and Internet, Authoring, Multimedia over wireless and mobile networks.

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

9

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.
2. External learning – Adobe after effects, Adobe Media Encoder, Adobe Audition.

Suggested Evaluation Methods:

1. Demonstration on after effects animations.
2. Quizzes on file formats and color models.

UNIT III MULTIMEDIA TOOLS**9**

Authoring Tools – Features and Types – Card and Page Based Tools – Icon and Object Based Tools – Time Based Tools – Cross Platform Authoring Tools – Editing Tools – Painting and Drawing Tools – 3D Modeling and Animation Tools – Image Editing Tools – Sound Editing Tools – Digital Movie Tools.

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**

Compression Types and Techniques: CODEC, Text Compression: GIF Coding Standards, JPEG standard – JPEG 2000, basic audio compression – ADPCM, MPEG Psychoacoustics, basic Video compression techniques – MPEG, H.26X – Multimedia Database System – User Interfaces – OS Multimedia Support – Hardware Support – Real Time Protocols – Play Back Architectures – Synchronization – Document Architecture – Hypermedia Concepts: Hypermedia Design – Digital Copyrights, Content analysis.

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**

ADDIE Model – Conceptualization – Content Collection – Storyboard–Script Authoring Metaphors – Testing – Report Writing – Documentation. Multimedia for the web and mobile platforms. Virtual Reality, Internet multimedia content distribution, Multimedia Information sharing – social media sharing, cloud computing for multimedia services, interactive cloud gaming. Multimedia information retrieval.

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:

1. Li, Ze-Nian, Drew, Mark, Liu, Jiangchuan, “Fundamentals of Multimedia”, Springer, Third Edition, 2021.

2. Prabhat K.Andleigh, Kiran Thakrar, "MULTIMEDIA SYSTEMS DESIGN", Pearson Education, 2015.
3. Gerald Friedland, Ramesh Jain, "Multimedia Computing", Cambridge University Press, 2018. (digital book)
4. Ranjan Parekh, "Principles of Multimedia", Second Edition, McGraw-Hill Education, 2017

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 9

Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis –Nature of Data - Analytic Processes and Tools - Analysis Vs Reporting - Modern Data Analytic Tools- Statistical Concepts: Sampling Distributions - Re-Sampling - Statistical Inference - Prediction Error.

UNIT II SEARCH METHODS AND VISUALIZATION 9

Search by simulated Annealing – Stochastic, Adaptive search by Evaluation – Evaluation Strategies –Genetic Algorithm – Genetic Programming – Visualization – Classification of Visual Data Analysis Techniques – Data Types – Visualization Techniques – Interaction techniques – Specific Visual data analysis Techniques

UNIT III MINING DATA STREAMS 9

Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time Sentiment Analysis, Stock Market Predictions

UNIT IV FRAMEWORKS 9

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 9

Overview, Programming structures: Control statements -Operators -Functions -Environment and scope issues -Recursion -Replacement functions, R data structures: Vectors -Matrices and arrays - Lists -Data frames -Classes, Input/output, String manipulations

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:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
2. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 3rd edition 2020.
3. Norman Matloff, The Art of R Programming: A Tour of Statistical Software Design, No Starch Press, USA, 2011.
4. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, John Wiley & sons, 2012.
5. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007.

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

9

Introduction to IoT – IoT definition – Characteristics – IoT Complete Architectural Stack – IoT enabling Technologies – IoT Challenges. Sensors and Hardware for IoT – Hardware Platforms – Arduino, Raspberry Pi, Node MCU. A Case study with any one of the boards and data acquisition from sensors.

UNIT II PROTOCOLS FOR IoT

9

Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery, Data Protocols, Device Management Protocols. – A Case Study with MQTT/CoAP usage-IoT privacy, security and vulnerability solutions.

UNIT III CASE STUDIES/INDUSTRIAL APPLICATIONS

9

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

9

Introduction to Cloud Computing - Service Model – Deployment Model- Virtualization Concepts – Cloud Platforms – Amazon AWS – Microsoft Azure – Google APIs.

UNIT V IoT AND CLOUD

9

IoT and the Cloud - Role of Cloud Computing in IoT - AWS Components - S3 – Lambda - AWS IoT Core -Connecting a web application to AWS IoT using MQTT- AWS IoT Examples. Security Concerns, Risk Issues, and Legal Aspects of Cloud Computing- Cloud Data Security

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

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman ,CRC Press, 2017
2. Adrian McEwen, Designing the Internet of Things, Wiley,2013.
3. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.
4. Simon Walkowiak, "Big Data Analytics with R" PackT Publishers, 2016
5. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Publishers, 2015.

MX4073

MEDICAL ROBOTICS

**LT PC
3 0 0 3**

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

9

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

9

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

9

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

9

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

9

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

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

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw Hill, First edition, 2003
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons, First edition, 2008
3. Fu.K.S, Gonzalez. R.C., Lee, C.S.G, "Robotics, control", sensing, Vision and Intelligence, Tata McGraw Hill International, First edition, 2008
4. Bruno Siciliano, Oussama Khatib, Springer Handbook of Robotics, 1st Edition, Springer, 2008
5. Shane (S.Q.) Xie, Advanced Robotics for Medical Rehabilitation - Current State of the Art and Recent Advances, Springer, 2016
6. Sashi S Kommu, Rehabilitation Robotics, I-Tech Education and Publishing, 2007
7. Jose L. Pons, Wearable Robots: Biomechatronic Exoskeletons, John Wiley & Sons Ltd, England, 2008
8. Howie Choset, Kevin Lynch, Seth Hutchinson, "Principles of Robot Motion: Theory, Algorithms, and Implementations", Prentice Hall of India, First edition, 2005
9. Philippe Coiffet, Michel Chirouze, "An Introduction to Robot Technology", Tata McGraw Hill, First Edition, 1983
10. Jacob Rosen, Blake Hannaford & Richard M Satava, "Surgical Robotics: System Applications & Visions", Springer 2011
11. Jocelyn Troccaz, Medical Robotics, Wiley, 2012
12. Achim Schweikard, Floris Ernst, Medical Robotics, Springer, 2015

VE4202

EMBEDDED AUTOMATION

L T P C

3 0 0 3

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

9

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

9

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

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

9

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

9

Fundamentals of Image Processing - Filtering - Morphological Operations - Feature Detection and Matching - Blurring and Sharpening - Segmentation - Thresholding - Contours - Advanced Contour Properties - Gradient - Canny Edge Detector - Object Detection - Background Subtraction

UNIT – V HOME AUTOMATION

9

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:

1. Dhananjay V. Gadre, "Programming and Customizing the AVR Microcontroller", McGraw-Hill, 2001.
2. Joe Pardue, "C Programming for Microcontrollers ", Smiley Micros, 2005.
3. Steven F. Barrett, Daniel J. Pack, "ATMEL AVR Microcontroller Primer : Programming and Interfacing", Morgan & Claypool Publishers, 2012
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