PG PROGRAMME

MASTERS OF TECHNOLOGY MANAGEMENT (MTM)

REGULATIONS 2018

(After 22nd BoS)

CURRICULUM AND SYLLABUS

I - IV Semester

Department of Textile Technology

KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE

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MASTERS OF TECHNOLOGY MANAGEMENT

Program Educational Objectives (PEO)

At the end of the program

PEO 1: Graduates shall become management professionals with the ability to plan, evaluate, deploy, and manage emerging technologies.

PEO 2: Graduates shall be able to lead technology teams in an organisation to create business value with rigorous execution capabilities.

PEO 3 Graduates shall become professionals in leading research and innovation initiatives in academia, government & industry.

Program Outcomes (PO)

Upon completion of the Master of Technology Management program, the student will be able to:

PO 1: Independently carry out research / investigation and work to solve practical problems.

PO 2: Write and present a substantial technical report / document.

PO 3: 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.

PO 4: Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.

PO 5: Adapt and work efficiently with multidisciplinary teams across various organizational levels.

PO 6: Exhibit an ethical and responsible behaviours in all business decisions throughout their life.

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KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049

REGULATIONS 2018 (After 22nd BoS)

Master of Technology Management (MTM)

CURRICULUM AND SYLLABUS

SEMESTER I							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18TMT1104	Engineering Research Methodology	Theory	3	0	0	0	3
P18TMT1105	Business Operations and Strategy	Theory	3	0	0	0	3
P18TMT1106	Managerial Economics	Theory	3	0	0	0	3
P18TMP1501	Artificial Intelligence & Machine Learning	Practical	0	0	4	0	2
P18TME---	Elective - 1	Theory	3	0	0	0	3
P18TME---	Elective - 2	Theory	3	0	0	0	3
Total Credits							**17**
Total Hours per week							**19**

SEMESTER-II							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18TMT2104	Agile Product Management	Theory	3	0	0	0	3
P18TMT2105	Industrial Digital Transformation	Theory	3	0	0	0	3
P18TMT2106	Project Management	Theory	3	0	0	0	3
P18TME---	Elective - 3	Theory	3	0	0	0	3
P18TME---	Elective - 4	Theory	3	0	0	0	3
Total Credits							**15**
Total Hours per week							**15**

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SEMESTER-III							
Course code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18TME---	Elective - 5	Theory	3	0	0	0	3
P18TME---	Elective - 6	Theory	3	0	0	0	3
P18TMP3703	MSME Practicum	Presentation	0	0	0	8	4
P18TMP3704	Industrial Practicum- Phase 1	Project	0	0	0	20	10
Total credits							**20**
Total Hours per week							**34**

SEMESTER-IV							
Course code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
P18TMP4705	Industrial Practicum- Phase 2	Project	0	0	0	24	12
P18TME---	Elective - 7	Theory	3	0	0	0	3
P18TME---	Elective - 8	Theory	3	0	0	0	3
Total credits							**18**
Total Hours per week							**36**
Grand Total Credits							**70**

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List of Professional Elective specialization

S.No	List of Professional Electives
1	Textile Technology
2	Innovation and Technology
3	Business Management
4	Information Technology
5	Sustainability

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Professional Elective 1: Textile Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0001	Management of Textile Production	3	0	0	0	3
P18TME0002	Apparel Production	3	0	0	0	3
P18TME0003	Apparel Technology Management	3	0	0	0	3
P18TME0004	Strategic Technology Management in the Textile Complex	3	0	0	0	3
P18TME0005	Global Perspectives in Textiles Supply Chain Management	3	0	0	0	3
P18TME0060	Clothing Science and Comfort	3	0	0	0	3
P18TME0006	Fancy Yarn Technology	3	0	0	0	3
P18TME0061	Structural Mechanics of Yarns and Fabrics	3	0	0	0	3
P18TME0062	Theory of Drafting and Twisting	3	0	0	0	3
P18TME0063	Engineering of Functional Clothing and Finishes	3	0	0	0	3
P18TME0064	Yarn Quality Analysis	3	0	0	0	3
P18TME0065	Fabric Quality Analysis	3	0	0	0	3
P18TME0066	Advances in Textile Finishing	3	0	0	0	3
P18TME0067	Advanced knitwear Technology	3	0	0	0	3
P18TME0068	Textile Reinforced Composites	3	0	0	0	3
P18TME0069	Theory of Yarn Structures	3	0	0	0	3
P18TME0070	Technical Textiles	3	0	0	0	3
P18TME0071	Textiles In Civil Construction And Transportation	3	0	0	0	3
P18TME0072	Structural Mechanics of Fabrics	3	0	0	0	3
P18TME0073	Statistical Application In Textile Engineering	3	0	0	0	3
P18TME0074	Characterization of Textile Polymers	3	0	0	0	3
P18TME0075	Polymer Rheology	3	0	0	0	3
P18TME0076	Surface Modification of Textiles	3	0	0	0	3

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Professional Elective 2: Innovation and Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0034	Applied Design Thinking	3	0	0	0	3
P18TME0035	Industrial Design & Development	3	0	0	0	3
P18TME0036	IPR Fundamentals and Patent Drafting	3	0	0	0	3
P18TME0037	Rapid Prototyping Fundamentals	3	0	0	0	3
P18TME0077	Precision Engineering	3	0	0	0	3
P18TME0078	Industrial Automation	3	0	0	0	3
P18TME0079	Industrial Internet of Things	3	0	0	0	3

Professional Elective 3: Business Management		L	T	P	J	C
Course Code	**Course**					
P18TME0038	Supply Chain Management	3	0	0	0	3
P18TME0039	Nascent Market Strategies	3	0	0	0	3
P18TME0040	Organisation Behavior and Change Management	3	0	0	0	3
P18TME0058	Knowledge Management	3	0	0	0	3
P18TME0059	New Product Strategies	3	0	0	0	3
P18TME0043	Lean Six Sigma	3	0	0	0	3
P18TME0044	Finance for Engineers	3	0	0	0	3
P18TME0045	Digital Marketing	3	0	0	0	3
P18TME0046	Entrepreneurial Mindset and Methods	3	0	0	0	3

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Professional Elective 4: Information Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0047	Data Mining Techniques	3	0	0	0	3
P18TME0048	Data Science & Analytics with Python	3	0	0	0	3
P18TME0049	Data Visualization	3	0	0	0	3
P18TME0050	Big Data Technologies	3	0	0	0	3
P18TME0051	Block Chain Technology	3	0	0	0	3
P18TME0052	Artificial Intelligence	3	0	0	0	3

Professional Elective 5: Sustainability		L	T	P	J	C
Course Code	**Course**					
P18TME0053	Environmental Sustainability	3	0	0	0	3
P18TME0054	Industrial Sustainability	3	0	0	0	3
P18TME0055	Supply Chain and Procurement Sustainability	3	0	0	0	3
P18TME0056	Textile Sustainability and Innovation	3	0	0	0	3
P18TME0057	Circular Economy for Enterprise Innovation	3	0	0	0	3

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P18TMT1104	ENGINEERING RESEARCH METHODOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Define research; explain and apply research terms; describe the research process; Identify research gap and formulate research objectives

CO2: Develop a research plan; Explain and apply parametric tests and non-parametric tests in research.

CO3: Demonstrate the analytical skills by applying statistical tools and optimization techniques

CO4: Evaluate the paper to qualify for publication in indexed journals

Course Assessment Methods

Direct
1. Midterm Examination 2. Assignment; Field study, Group Presentation 3. End Semester Examination
Indirect
1. Course End survey

Introduction to Engineering Research Methodology	**6 Hours**

Objectives and Motivation in Research, Various approaches to Research, Scientific and Engineering Research, Observational Research, Significance of research, Selecting a Research Problem, Purpose of Research, Approaches in Research Process, Formulation of research objectives, Measure of Good Research, Literature Search, Need of Literature Review, Research gap, Identifying variables, Reference Management Software Zotero/Mendeley

Statistical Analysis	**11 Hours**

Data types, Measures of Central Tendency, Measures of Dispersion, Measures of Association, Sources of Error and uncertainty, One-dimensional Statistics, Two-dimensional statistics - Analysis using MS Excel

Research Design	**12 Hours**

Research Survey, Population and Sample, Sample size, Sampling Methods, Measurement of Scaling, Data collection Methods, , Questionnaires design, Validity and Reliability tests, Parametric and Non-parametric tests, Hypothesis Testing, t-test, z-test, ANOVA, Correlation Analysis, Regression Analysis, Chi-square test, Problem solving using SPSS software

Optimization Techniques	**12 Hours**

Cost of Production, Value Engineering, Process Improvement, Application of Linear Programming, Transport route optimization, Queuing Theory, Problem solving using Tora software

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Research Publication	**4 Hours**
Research Paper Writing, Journals in Engineering Management, Identifying Indexed Journals, Paper formatting, Reference Style of referencing, Conference Presentation, Patenting, Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Use of Latex software	
	Total Hours: 45 Hrs

REFERENCES

1. David V. Thiel, Research Methods for Engineers, Cambridge University Press, 2014
2. Donald Cooper & Pamela Schindler, Business Research Methods –TMGH, 9th edition
3. David M. Levine, David F. Stephan, Kathryn A. Szabat, " Statistics for Managers Using Microsoft Excel", Pearson,
4. S. Jaisankar, Data Analysis for Management Research, Archers and Elevators, 2015
5. Jaisankar S, Operations Research – Decision Models Approach, Excel Publications, New Delhi, 2009
6. C.R. Kothari, Research Methodology Methods and Techniques, 3/e, New Age International Publishers, 2014.

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P18TMT1105	BUSINESS OPERATIONS AND STRATEGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1**:** Explain strategy and strategic management process.
CO2: Analyse various environment and portfolio scenarios for an effective strategy formulation.
CO3: Formulate corporate, business, and functional strategies with a global outlook

Course Assessment Methods

Direct
1. Midterm Examination 2. Other Assessments 3. End Semester Examination
Indirect
1.Course-End survey

Foundations of Strategic Management	**10 Hours**
Strategic Planning Process, Levels of Strategy - Strategic Intent through Vision, Mission and Value Statement – Building business model –Business Model canvas.	
Internal Environment Analysis, External Environment Analysis	**12 Hours**
Core competence, Distinctive Competencies, Resource-Based View of the firm - Resource-Capabilities – Firm-specific resources, VRIO Framework. Competitive Profile analysis - Building Blocks of Competitive Advantage - Porters Five Force Model, Building Competitive Advantage - Value Creation and Value Preposition approach. Strategic Choice and Strategic Thrust.	
Strategy Formulation	**8 Hours**
Generic strategies, Functional strategies- Components - Relevant Techniques. Corporate Strategies, Disruptive strategies- Blue Ocean strategy. Global strategies. Termination strategies	
Strategy Implementation	**7 Hours**
Managing Change - Activating Strategies-Project Implementation – Procedural Implementation – Resource Allocation - Organizational Design – Structure, Control and Culture.	

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Strategy Evaluation and Control	**8 Hours**
Process of evaluation - Strategic and Operational controls - 7S Framework, Balanced Score Card. Benefit-Cost Analysis, Performance Gap Analysis, Responsibility Centres.	
	Total Hours: 45Hrs

REFERENCES

1. AzharKazmi, Strategic Management & Business Policy, 3rd edition, 2011, TMH
2. Arthur A. Thompson, Jr., A. J. Strickland III, John E. Gamble, Arun K Jain, Crafting and Executing Strategy (SIE): The Quest for Competitive Advantage: Concepts and Cases, 16/e TMH.
3. Charles W.L.Hill, Gareth R.Jones, Mellissa A. Schilling – Strategic Management: An integrated approach Cengage, 9th edition. 2012

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P18TMT1106	MANAGERIAL ECONOMICS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain the concepts revolving around Microeconomics.
CO2: Apply the concept in real time production and market environment.
CO3: Explain the concepts concerning to Macro Economics.

Course Assessment Methods

Direct
1. Midterm Examination 2. Other assessments 3. End Semester Examination
Indirect
1.Course-End survey

Introduction	**3 Hours**
Introduction of Managerial Economics - Scope, Relationship with other Disciplines	
Micro Economics	**6 Hours**
Microeconomics - Firms and Managerial Objectives - Demand, Law of Demand, Determinants of demand, Elasticity of demand, Law of diminishing marginal utility - Exceptions of Demand - Demand forecasting techniques (only theory) - Supply, Law of Supply, Elasticity of Supply	
Production Functions	**10 Hours**
Production functions – Short and long run laws of production, law of returns to scale - Cost - types of cost, Short and long run cost output relationship, Economies and diseconomies of Scale	
Market Structure	**14 Hours**
Market Structure - Perfect Competition, monopoly, duopoly, oligopoly, Monopolistic market structures - characteristics & Price - Output determination - Pricing Methods	
Macro Economics	**12 Hours**
Macroeconomics - nature & importance. National Income - concepts - GNP, GDP, NNP - Business cycle - Phases of Business Cycle - Controlling Trade Cycle - Inflation - Definition, Kinds and effects of Inflation, Demand Pull & Cost Push Inflation - Policy Measures to control - Indian Financial System, Fiscal Policy: Definition, Objectives. Monetary Policy- Meaning, Scope, Instruments	
	Total Hours: 45Hrs

REFERENCES

1. D N Diwedi (2009). Managerial Economics. Seventh Edition, Vikas Publication
2. Piyali Ghosh Geetika, Purba Roy Chowdhury (2017).Managerial Economics, 3 e, McGraw-Hill Education

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P18TMP1501	ARTIFICIAL INTELLIGENCE & MACHINE LEARNING	L	T	P	J	C
		0	0	4	0	2

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Apply the concepts of AI in building solutions for real-world problems
CO2: Apply the concepts of AI to data models & analyse the data obtained from AI applications and understand the significance of adding intelligence to IoT applications
CO3: Demonstrate the learning by identifying the opportunity to enhance the business potential using AI/ML technologies.

Course Assessment Methods

DIRECT

1. Other Assignments
2. End Semester Practical Examination

INDIRECT

1.Course-end survey

AI/ML 101	**10 Hours**

Introduction to AI/ML - Current scenario of AI research and its applications, Key business drivers of AI across various job functions, countries, and sectors. When could an Alexa-like personal assistant be able to plan my day?

Semiconductors & AI	**10 Hours**

AI Hardware- Semiconductors have accelerated the rise of AI applications and research, current state for lidar systems, sensors, actuators, other hardware

Natural Language Processing & Speech Recognition	**10 Hours**

Natural Language Processing & Speech Recognition- history of Natural Language Processing & Speech Recognition along with latest applications and researches. Case studies on Industry best practices.

Computer Vision	**10 Hours**

Computer Vision - Progression of Computer Vision over the years. This session will help them know the latest applications and research in CV, practice some best practices, autonomous vehicles.

AI Disruptions	**10 Hours**

AI Disruptions - Impact of AI/ML in various sectors and an avalanche of disruptions in Automotive, Insurance, Healthcare, Retail, Logistics, Consumer and more.

Investments In AI	**10 Hours**

AI Investment Landscape- Create a new product/service or create efficiencies with a human-centred approach to AI in an existing industry and discuss what the winning business models of AI are.

Total Hours: 60Hrs

REFERENCES

1. Required Textbook: "The New Acceleration: An Introduction to Artificial Intelligence and the Technologies Making Life Faster" by Kerrigan and David
2. "AIX: Designing Artificial Intelligence" by Sudha Jamthe
3. AI Playbook: http://aiplaybook.a16z.com/

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P18TMT2104	AGILE PRODUCT MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Determine what is valuable to a user early by focusing on testable narratives and creating a strong shared perspective

CO2: Drive a focus on outcomes over outputs by facilitating a culture of experimentation and a test-driven, results-driven approach to agile

CO3: Build an analytics (and data science) program that enhances the data-based decision making to achieve the core objectives

CO4: Iteratively identify and test the right agile practices from leading frameworks like Scrum, XP, and kanban in the team's work

Course Assessment Methods

Direct
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
Indirect
1.Course-End survey

Agility as a Concept	**10 Hours**

Identify what's hard about creating excellent products and how agile can help, the problems agile solves, Personas and problem scenarios focus development on driving toward a valuable outcome, drafting personas and hypothesizing user needs to test those assumptions, prepare agile user story to build something valuable for the user.

Hypothesis Driven Decisions	**10 Hours**

Hypothesis-driven decisions, Design various concept testing methods as an integral part of your product pipeline. Apply Product hypothesis tool & Product canvas, to design and run situation-appropriate experiments to test ideas, and how that works before the fact (when you're testing an idea) and after the fact (when you're testing the value of the prototype version deployed). Understand Usability, Feasibility & Viability.

Analytics for Decision Making	**15 Hours**

Customer Analytics, Demand Analytics, UX Analytic, Analytics & Data Science, Tools & techniques for startup founders to use data for decision making.

Scrum and Its Concepts	**10 Hours**

An overview of Agile method for modern day project management, an overview of the Scrum Framework, Scrum Roles & Responsibilities, Scrum Artefacts, Scrum Events, Supporting Tools & Best Practices.

Total Hours: 45Hrs

REFERENCES

1. Agile Project Management for Dummies Paperback – 4 May 2012 by Mark C. Layton
2. Agile Estimating and Planning (Robert C. Martin) Paperback – Illustrated, 1 November 2005 by Mike Cohn
3. Scrum Mastery: From Good to Great Servant Leadership Paperback – 1 June 2013 by Geoff Watts

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P18TMT2105	INDUSTRIAL DIGITAL TRANSFORMATION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the drivers and enablers of Industry 4.0
CO2. Discover the smartness in smart Factories, smart cities, smart products, and smart services
CO3. Able to outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world
CO4. Understand the power of cloud computing in a networked economy
CO5. Demonstrate the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Introduction to Industry 4.0	**9 Hours**

The Various Industrial Revolutions - Digitalization and the Networked Economy - Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 - The Journey so far: Developments in USA, Europe, China and other countries - Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation -Summary

Smart Technologies	**9 Hours**

Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services - Smart Manufacturing - Smart Devices and Products - Smart Logistics - Smart Cities - Predictive Analytics - Summary

Related Disciplines, System, Technologies for Enabling Industry 4.0	**9 Hours**

Cyber physical Systems - Robotic Automation and Collaborative Robots - Support System for Industry 4.0 - Mobile Computing - Related Disciplines - Cyber Security - Summary

Role of Data, Information, Knowledge and Collaboration in Future Organizations	**9 Hours**

Resource-based view of a firm - Data as a new resource for organizations - Harnessing and sharing knowledge in organizations - Cloud Computing Basics - Cloud Computing and Industry 4.0 - Summary

Other Applications and Case Studies	**9 Hours**

Industry 4.0 laboratories - IIoT case studies - Case studies from HKPolyU students – Summary

Business Issues in Industry 4.0	

Opportunities and Challenges - Future of Works and Skills for Workers in the Industry 4.0 Era - Strategies for competing in an Industry 4.0 world - Summary

Total Hours: 45Hrs

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REFERENCES

1. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
3. Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist- ISBN 978-1-4842-2047-4

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P18TMT2106	PROJECT MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain the knowledge areas of project management.
CO2: Apply tools and techniques of project management to monitor and control projects
CO3: Construct a project schedule and estimate cost using MS Project software

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Other Assignments
3. End Semester Examination

INDIRECT

1.Course-End survey

Introduction	**9 Hours**

Definition - Operations and Project Management - Program Management - Portfolio Management - Projects and Strategic Planning - Project Management Office - - Role of Project Manager –Processes and Processes Groups – Process Mapping – Project Team – Project Life Cycle – Stakeholders - Deliverables – Milestone - Organizational Structures - Organizational Cultures and Styles - Organizational Process Assets- Enterprise Environmental Factors - Project Charter

Project Scope Management	**7 Hours**

Define Scope - Project Management Plan - Project Scope Management Processes - Plan Scope Management - Collect Requirements - Create WBS – Work packages - Validate Scope – Control Scope

Project Time Management	**7 Hours**

Network models - Project Time Management Processes - Plan Schedule Management - Define Activities - Sequence Activities - Estimate Activity Resources— Estimate Activity Durations— Develop Schedule- Control Schedule

Project Cost Management	**7 Hours**

Managing Project Cost - Plan Cost Management—Estimate Costs— Determine Budget – Control cost – Earned Value Management – To complete performance index – Performance reviews

Project Quality Management	**7 Hours**

Quality definition – Project Quality Management- Quality Assurance Control Quality, Tools and Techniques

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Basics of Other Knowledge Areas	**8 Hours**
Project Human Resource Management – Project Communication Management - Project Risk Management - Project Procurement Management – Project Stakeholder Management - Introduction and basic concepts - Introduction to MS Project software– Exercise problems	
	Total Hours: 45Hrs

REFERENCES

1. A. Chandrasekaran, 2013, Road to Success, Info career Pvt. Ltd., 2nd Edition
2. Joseph Phillips, 2013, Project Management Professional, Tata McGraw Hill Ltd.,4th edition

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P18TMP3703	MSME PRACTICUM	L	T	P	J	C
		0	0	0	8	4

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Understand the operations of MSME organisations
CO 2: Identify the scope of technology interventions in MSME organisations
CO 2: Analyse and present solutions for technology interventions in MSME organisations

Course Assessment Methods

DIRECT
1. Project report and viva voce examination
INDIRECT
1.Course-End survey

The students shall seek their internship in MSME companies during their summer vacation and shall work part-time/full time as technology managers to understand the operation, study the challenges, and define the opportunities for changes and scope for industrial digital transformation.

During MSME Practicum, students shall get exposed to real-time industrial work, culture, and practices to become able technology managers. Students shall be jointly supervised and mentored by a team consisting of Academic mentor/company supervisor and Industry Mentor.

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P18TMP3704	INDUSTRIAL PRACTICUM- PHASE 1	L	T	P	J	C
		0	0	0	20	10

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Critically Evaluate and review the existing solutions and methodologies through reviewing literature to solve engineering problems.

CO2. Identify the modern tools and plan the project according to principles of project management.

Course Assessment Methods

DIRECT
1.Project report and viva voce
INDIRECT
1.Course-End Survey

Phase 1: Students start working on their project work in beginning of third semester. Student do the background research for identifying appropriate problems, methodology and tools for their respective project works. Each student is required to prepare a synopsis in the format provided and present it in front of a committee constituted by course facilitators

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P18TMP4705	INDUSTRIAL PRACTICUM- PHASE 2	L	T	P	J	C
		0	0	0	24	12

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Devise original solutions to complex engineering problems using modern engineering tools.
CO 2. Justify the outcomes of the project work.
CO 3. Organize and communicate (written and oral) ideas effectively.
CO 4. Develop solutions that meet ethical, societal, and legal considerations.

Course Assessment Methods

DIRECT
1.Project report and viva voce
INDIRECT
1.Course-End Survey

Phase 2: Students carry out implementation of their respective projects based on the problem identified, methodology and tools suggested in the synopsis prepared and presented in phase 1. They prepare the final project reports according to the format provided. Each student is required to present his/her project work in front of internal project guide and external examiner appointed by Controller of Examination

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Professional Elective - 1

Textile Technology

Professional Elective 1: Textile Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0001	Management of Textile Production	3	0	0	0	3
P18TME0002	Apparel Production	3	0	0	0	3
P18TME0003	Apparel Technology Management	3	0	0	0	3
P18TME0004	Strategic Technology Management in the Textile Complex	3	0	0	0	3
P18TME0005	Global Perspectives in Textiles Supply Chain Management	3	0	0	0	3
P18TME0060	Clothing Science and Comfort	3	0	0	0	3
P18TME0006	Fancy Yarn Technology	3	0	0	0	3
P18TME0061	Structural Mechanics of Yarns and Fabrics	3	0	0	0	3
P18TME0062	Theory of Drafting and Twisting	3	0	0	0	3
P18TME0063	Engineering of Functional Clothing and Finishes	3	0	0	0	3
P18TME0064	Yarn Quality Analysis	3	0	0	0	3
P18TME0065	Fabric Quality Analysis	3	0	0	0	3
P18TME0066	Advances in Textile Finishing	3	0	0	0	3
P18TME0067	Advanced knitwear Technology	3	0	0	0	3
P18TME0068	Textile Reinforced Composites	3	0	0	0	3
P18TME0069	Theory of Yarn Structures	3	0	0	0	3
P18TME0070	Technical Textiles	3	0	0	0	3
P18TME0071	Textiles In Civil Construction And Transportation	3	0	0	0	3
P18TME0072	Structural Mechanics of Fabrics	3	0	0	0	3
P18TME0073	Statistical Application In Textile Engineering	3	0	0	0	3
P18TME0074	Characterization of Textile Polymers	3	0	0	0	3

BOS Chairman Signature	V.Ramesh Babu,

P18TME0075	Polymer Rheology	3	0	0	0	3
P18TME0076	Surface Modification of Textiles	3	0	0	0	3

BOS Chairman Signature	V.Ramesh Babu,

P18TME0001	MANAGEMENT OF TEXTILE PRODUCTION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Analyze the structure of Textile Industry
CO2: Evaluate the production planning in spinning industry
CO3: Apply the quality management system in spinning industry
CO4: Explain the fabric production systems.
CO5: Evaluate wet processing and pollution control systems.
CO6: Apply the enterprise resource planning in Textile Industry

COURSE ASSESSMENT METHODS

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-end survey

Introduction — **9 Hours**

Indian Textile Industry: Structure, Cotton ginning Industry. Manmade fibre industry spinning Industry weaving Industry sequence of processes. Textile processing Industry, Knitting industry Garment industry Technical textiles Industry. Textile Policy. Sickness of Textile Industry-Analysis and options. Global textile scenario.

Ginning and Spinning Industry — **9 Hours**

Ginning concept cotton varieties cotton production in India and world. Spinning- blow room operating principle, carding operating principle, draw frame simplex, spinning-ring spinning, open end spinning Production, planning and control: types of production systems and problems of planning and control, Quality management. Balancing of Machinery, Waste Management, Power requirement,

Weaving Industry — **9 Hours**

Power loom sector. Type of looms used. Conventional looms, automatic looms, shuttles less looms-projectile, rapier, air jet, water jet looms. Production capacity Status of Technology used. Labour problems. Techno economics of power loom industry. Productivity and improvement techniques. Skill requirements. Organized mill sector, Quality management

Textile Wet Processing — **9 Hours**

Souring and bleaching, Dyeing methods, Dyeing machines-winch dyeing, Gigger dyeing, Soft flow dyeing, Water requirements for dyeing, effluent tremens, pollution control, statutory requirements, zero discharge of effluents

Knitting and Garment Industry — **9 Hours**

Knitting concept. Warp and weft knitting. Circular knitting machines- conventional and high-speed knitting machines productivity. Garment industry pattern making and cutting, stitching, quality checking and packing. Sourcing: Material Requirement Planning vendor relations, selection of vendors., Manpower requirement

BOS Chairman Signature	V.Ramesh Babu,

Total Hours: 45Hrs

REFERENCES

1. Oxtoby E "Spun Yarn Technology" butter worth's, London, New Edition 2002.
2. Adanur S., "Handbook of Weaving", Woodhead Publishing Limited, 2001.
3. Prabir Kumar Banerjee., "Principles of Fabric Formation", CRC Press, 2014.
4. W.Klein, "New spinning systems", The Textile Institute Manchester, U.K. 1993.
5. Broadbent D.A., "Basic Principles of Colouration", Society of Dyers &Colourists, 2001.
6. D.J. Spencer., "Knitting technology", Textile Institute Manchester, 2005.
7. A Vaidya, "Production of synthetic fibres", Prentice Hall of India Pvt. Ltd., New Delhi, 1988.
8. A Ormerod, Modern preparation and weaving Machinery, Woodhead publishing Ltd,2004
9. Ormerod.A., "Textile Project Management", The Textile Institute, Manchester, New eidition, ISBN: 1870812387, 2002.
10. Harold Carr and Barbara Latham, "The Technology of clothing manufacture", 4th Edition Wiley-Blackwell, 2008

BOS Chairman Signature	V.Ramesh Babu,

P18TME0002	APPAREL PRODUCTION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Analyze Pre- production activities in apparel industry
CO2: Develop the pattern making, for Kids, Baby's, Men's and Women's wear
CO3: Evaluate the Requirements and Methods of Marker planning and Cutting
CO4: Create different types of Stitches & Seams on apparel as per end use.
CO5: Evaluate different types of pressing and packing methods
CO6: Design on pattern/cutting by CAD and Plant layouts/Flexible

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-end survey

Introduction to Indian Apparel Industry — **9 Hours**

Technical pack- Pre-production activities: types of samples and sample approval – Principles and advantages of Eight Head Theory- Body measurements - Techniques in pattern making - (i) Drafting (ii) Draping (iii) Flat pattern their advantages and disadvantages. Tools for pattern making

Pattern Engineering — **9 Hours**

Set–in–sleeves: Plain, Puff, Bell, Bishop. Collars: Convertible, Shirt, Mandarin, Peter pan. Cuff: Shirt cuff, French cuff, and Contoured cuff. Drafting: Basic principles and Methodologies used to draft block patterns for the following garments: Shirt, Trousers, Skirts, Blouses, Nightwear

Marker Planning — **9 Hours**

Requirements and Methods-Marker efficiency Advantages of computer aided marker planning. Spreading: Requirements and Methods-Types spreading and lay. Cutting: Objectives-methods cutting machines-Straight Knife-Round Knife-Band knife- Die cutting computer-controlled cutting-Lectra-Gerber-Tuka-Reach CAD.

Sewing Technology — **9 Hours**

Definition of Stitch and Seam- Types Stitch and Seam- Needles: Parts, sizes and classification-sewing threads - Stitch and seam defects.; sewing machinery and working aids. Feed systems.

Fusing Technology — **9 Hours**

Means-equipment and Methods-Requirements- Pressing: Purpose Categories - Means-Equipment and methods-Pleating- Permanent press. Packing-Method-Components of packing-Trims and accessories-buttons Zippers-Velcro-Hook and eyehook and Bar- Fasteners-Closures-Lining Interlining-Wadding-Tapes-Elastic- Popular brands

Total Hours: 45Hrs

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REFERENCES

1.Harold Carr and Barbara Latham, “The Technology of clothing manufacture”, 4th Edition Wiley-Blackwell,2008.

2. K.R.Zarapkar, “System of cutting”, Navneet Publications, Mumbai, 2005.

3. Jacob Solinger, “Apparel Manufacturing Handbook”, Van Nostrand Reinhold Company, 1988.

4. Hayden Peggal, “The Complete Dress Maker”, Marshal Cavendish, London, 1984.

5. Laing R.M. and Webster J,“Fundamentals of stitches and Seams”, Textile Institute, 1998.

6. Gerry Cooklin, Steven George Hayes and John McLoughlin, “Introduction to Clothing Manufacture”, Wiley-Blackwell, 2006

BOS Chairman Signature	V.Ramesh Babu,

P18TME0003	APPAREL TECHNOLOGY MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Evaluate the product life cycle and clothing product strategies.
CO2: Analyse the clothing demand analysis and forecasting techniques.
CO3: Apply the supply chain strategies in Apparel Industry.
CO4: Create retail assortment and model stock plan.
CO5: Design the Inventory model and apparel sourcing method
CO6: Develop the merchandise planning for a Apparel Product

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-end survey

The Management of Clothing Products — **9 Hours**

Product concept -Classification of products-Clothing products: definition, occurrence and classification -Products mix: definition, features-Product life cycle (PLC) -Commercial product lifecycle -The process of developing new products-New product concept -Stages of developing new products -Particularities of the developing new clothing products-Clothing product strategies.

Clothing Demand Analysis — **9 Hours**

Demand Management-Demand Forecasting-Forecasting Components-Forecasting process-Forecasting methods and Techniques-Apply various forecast research methods in preparation for developing, planning, purchasing, or merchandising apparel lines and collections. Qualitative AND quantitative forecasting technique- Case study and trend research in identifying fashion opportunities.

Supply Chain Strategies in Apparel Industry — **9 Hours**

Industry Overview- Consumer Segments -Sales Channels-Supply Chain Structure -Trends and Drivers of Supply Chain- Sourcing Trends -Distribution Channels- Market Concentration-Supply Chain Challenges and Opportunities. Product Design and Launch-Merchandise Planning and Allocation-Sourcing and Production-Logistic.

Retail Merchandise Management — **9 Hours**

Product management - Retail Assortment Planning -model stock plan, constraining factors, types of suppliers and selection criteria, category management, merchandise management planning in retail and export segments. New technologies and the impact on consumers' shopping experiences-Employees contribution to sales productivity and customer satisfaction in retail establishments.

Apparel Sourcing and Inventory Management — **9 Hours**

Sourcing concepts-Sourcing strategies-Lean and agile supply chains-Risk and benefits of single and multiple sourcing -Risk and benefits of local and global sourcing-Purchasing Process-

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Supplier selection-Supplier selection criteria-Methods for supplier selection-Decision Inventory models -decisions making-inventory replenishment, and seasonal and long-term replenishment strategies. Case study method to developing seasonal financial plans, creating store plans, and balancing multi-store inventories.

Total Hours: 45Hrs

REFERENCES

1. Susan Dillon, ― The Fundamentals of Fashion Management, AVA Publishing (UK) LTd., 2012
2. Kathryn McKelvey and Janine Munslow, ―Fashion Forecasting, Wiley – Blackwell, USA, 2008
3. Maurice J. Johnson & Evelyn C.Moore, ―Apparel Product Development, Second Edition, Prentice Hall Upper saddle river, New Jersey, 2001.
4. Metha, P.L., ―Managerial Economics Sultan Chand and Co.Delhi, 2007.
5. Doris H. Kincade, Fay Gibson, and Ginger Woodard ―Merchandising Math: A Managerial Approach, Pearson Education, Inc. Published by Prentice Hall, 2004.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0004	STRATEGIC TECHNOLOGY MANAGEMENT IN THE TEXTILE COMPLEX.	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. To understand conceptual and analytical framework of strategic management
CO2. To study strategic management process
CO3. To understand basic approaches in strategy formulation, implementation, evaluation and control.
CO4. Analyse the Strategy Implementation
CO5. Explain Strategic Evaluation and Control
CO6. Explain Strategy Formulation

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Group Presentation 3. End Semester Examination
INDIRECT
1.Course-end survey

Introduction	**9 Hours**

Definition& nature of Corporate Planning, Advantages, and disadvantages, -Concept of strategy, levels at which strategy operates, strategic decision making, approaches to strategic decision making

Strategic Management	**9 Hours**

Definition of strategic management, strategic management process, -Strategic intent: Vision, Mission, Goals and Objectives. -Environmental scanning and appraisal, Organizational appraisal, strategic advantage analysis

Strategy Formulation	**9 Hours**

Corporate level strategies- Stability, Expansion, retrenchment, and Combination strategies - Business level strategies- Cost leadership, Differentiation and focus business Strategy -Strategic analysis and choice- Tools and techniques for strategic analysis, Arthur D Little Life Cycle Approach, SWOT analysis, Ansoff's Product - Market Matrix, Vulnerability Analysis, GAP analysis, Porter's five forces model, Value-chain analysis, Benchmarking, BCG Matrix, GE-9 Cell Matrix, TOWS Matrix, Grand Strategy Matrix, Mckinsey's 7'S framework.

Strategy Implementation	**9 Hours**

Interrelationship of formulation and implementation, Resource allocation, Structures for strategies, strategic leadership, corporate culture, politics and power, Ethics and Social responsibility, Guidelines for a Successful Responsible Firm, Functional Strategies- Financial, marketing, personnel and operations plans and policies.

Strategic Evaluation	**9 Hours**

Strategic Evaluation and Control Overview, Strategic Control, Techniques of strategic evaluation and control, Strategies for the Bottom of the Pyramid, Digitalisation strategies, Tailoring strategy to fit specific industry and company situation

Total Hours: 45Hrs

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REFERENCES
1. Strategic Management & Business Policy, AzarKazmi, Tata McGraw Hill, 3rd Ed. 2009. 2. Strategic Management, Concepts & Cases, Fred R. David, Pearson Education, 9th Ed.2005. 3. Competitive Advantage, Michael E. Porter, Free Press. 4. Globalisation, liberalisation and strategic Management, V. P. Michael, Himalaya Publishing House. 5. Crafting and Executing Strategy- The quest for competitive advantage, Concept & Cases-A.A. Thompson, A.J. Strickland, John E. Gamble, Arun K. Jain, Tata McGraw Hill-2010 6. Business Policy and Strategic Management, P. Subba Rao, Himalaya Publishing House

BOS Chairman Signature	V.Ramesh Babu,

P18TME0005	GLOBAL PERSPECTIVES IN TEXTILES SUPPLY CHAIN MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe the to Supply Chain Management
CO2. Analyse the global Sourcing of textiles
CO3. Analyse the logistics
CO4. Explain the global Forecasting
CO5. Explain the global Textile Supply Chain Management
CO6. Analyse the demand Planning of textiles

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-End survey

Introduction to Supply Chain Management	**9 Hours**

SCM Activities-Managing Flows Through the Supply Chain-The Bullwhip Effect- Customer Focus- Spanning Nature of SCM- Intra-Organizational Integration- Cross-Enterprise Integration-SCM Versus Logistics - The Rise of SCM& Characteristics of a Competitive Supply Chain - Trends in SCM-The Lean Supply Chain-Managing Supply Chain Disruptions- Supply Chain Security- Sustainability and the ‘‘Green’’ Supply Chain.

Global Sourcing of Textiles	**9 Hours**

What Is Sourcing-Purchasing, Sourcing, And Supply Management- Evolution Of The Sourcing Function- Commercial Versus Consumer Sourcing- Impact On The Organization And The Supply Chain - The Sourcing Function- The Sourcing Process-Cost Versus Price- Bidding Or Negotiation? - Sourcing And SCM- Functional Versus Innovative Products- Single Versus Multiple Sourcing- Domestic Versus Global Sourcing- Outsourcing- Electronic Auctions (E-Auctions)- Measuring Sourcing Performance

Logistics	**9 Hours**

What Is Logistics? - The Logistics Function- Evolution of Logistics- Impact on the Organization- Impact on the Supply Chain- Reverse Logistics-Logistics Tasks- Transportation- Storage- Material Handling- Packaging- Inventory Control- Order Fulfillment- Facility Location &multimodal Transportation- Role of Warehouses in the Supply Chain-Cross-Docking.

Global Forecasting & Demand Planning of Textiles	**9 Hours**

Forecasting Versus Planning- Impact on the Organization- Impact on Supply Chain Management-Principles of Forecasting- Steps in the Forecasting Process-Types of Forecasting Methods-Qualitative Forecasting Methods- Quantitative Forecasting Methods- Collaborative Forecasting and Demand Planning- Collaborative Planning, Forecasting and Replenishment (CPFR)- Sales and Operations Planning (S & OP)

Global Textile Supply Chain Management	**9 Hours**

The Global Environment-Opportunities and Barriers-Factors Impacting Global Supply Chains-& Global Market Challenges-The Global Consumer-Global Versus Local Marketing-Cultural Challenges-& Global Infrastructure Design-Infrastructure Challenges-Role of Technology-& Cost

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Considerations-Hidden Costs-Non-Cost Considerations-& Political and Economic Factors-Impact of Exchange Rate Fluctuations-Regional Trade Agreements-Impact of Non-Tariff Barriers.

Total Hours: 45Hrs

REFERENCES

1. Supply Chain Management: A Global Perspective, Nada R. Sanders, ISBN: 978-0-470-14117-5, Wiley
2. Global Purchasing and Supply Management: Fulfill the Vision, Victor H. Pooler, David J. Pooler, Samuel D. Farney, Kluwer Academic Publishers Norwell, MA, USA ©2004, ISBN:140207816
3. Fashion Logistics: Insights into the Fashion Retail Supply Chain-By John Fernie, David B. Grant, Kogan Page Publishers, New Delhi.
4. International Supply Chain Management and Collaboration Practices edited by Wolfgang Kersten, Books on Demand
5. The Global Textile and Garments Industry: The Role of Information and Communication Technologies (ICTs) in Exploiting the Value Chain AninfoDev publication prepared by Enlightenment Economics Edited by: Kerry McNamara (infoDev) June, 2008.
6. Global Operations and Logistics: text and cases (Philippe-Pierre Dornier, Ricardo Ernst, Michel Fender &PanosKouvelis, Wiley.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0006	FANCY YARN TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe the classification of fancy yarns
CO2. Analyse the design and construction of profiles of fancy yarns
CO3. Describe the manufacture of special purpose yarns.
CO4. Analyse the design of fancy yarn according to end use applications.
CO5. Describe the marketing of fancy yarn.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

CLASSIFICATION OF FANCY YARNS	**9 Hours**

Classification of fancy yarns - basic principle - study of productions methods - spinning techniques for the production of fancy yarns

DESIGN AND CONSTRUCTION OF THE BASIC PROFILES	**9 Hours**

Design and construction of the basic profiles such as Spiral, Gimp, Loop, Snarl, Knop, Cover, Slub, Nepy. Production and preparation of Mélange yarn, Lycra, Elastane yarns, Singed yarn

MANUFACTURE OF SPECIAL PURPOSE YARNS	**9 Hours**

Manufacture of special purpose yarns– Slub, double twist, Knop yarn, Chenille yarn, Diamond yarn, Eccentric yarn, Boucle yarn- Core and cover yarns: - Melange Yarn: - Concepts of producing mélange yarn. Process and sequence used for production of Melange yarn

DESIGN AND APPLICATION OF FANCY YARNS	**9 Hours**

The design and application of fancy yarns-The design implications of fancy yarns-Uses for fancy yarns- Designing the yarns-Designing fabrics using fancy yarns and fancy doubled yarns

MARKETING OF FANCY YARNS	**9 Hours**

The marketing of fancy yarns-The markets available and marketing techniques employed- The challenge of marketing-Management and marketing issues as they affect the fashion and fabrics industries

Total Hours: 45Hrs

REFERENCES

1. R H Gong and R M Wright “Fancy yarns Their manufacture and application” Woodhead Publishing Ltd,2002, ISBN 1 85573 577 6
2. Oxtoby, E, Spun Yarn Technology, Butterworths, London, 1987.
3. Textile Yarn, Technology, Structure and Application” – Goswami B.C., Martindale, J.G., Scardino F.L., Wiley Inter science publication, 1977, U.S.A

BOS Chairman Signature	V.Ramesh Babu,

P18TME0060	CLOTHING SCIENCE AND COMFORT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe the concept of clothing.
CO2. Analyse the thermal management in clothing.
CO3. Describe the moisture management in clothing.
CO4. Analyse the comfort properties of fabrics
CO5. Analyse the comfort properties of clothing

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-End survey

CONCEPT OF CLOTHING — **9 Hours**

Need and selection of clothing - definition of comfort - components of clothing comfort – Subjective perception of comfort: Psycho-Physiological factors of clothing - Aesthetic concepts of clothing - Various aspects of clothing comfort: thermal comfort - sensorial comfort - body movement comfort. Comfort variables: Thermal and non-thermal comfort variables

THERMAL MANAGEMENT IN CLOTHING — **9 Hours**

Human-clothing-environment system - Thermo-regulation in human body - Heat balance - Heat loss - Thermoregulation through clothing system: Heat exchange through clothing. Thermal comfort of clothing - Measurement of thermal transmission characteristics - Parameters for expressing thermal characteristics - Effect of body motion and wind.

MOISTURE MANAGEMENT IN CLOTHING — **9 Hours**

Moisture transport - Liquid water transfer: wicking and water absorption - Principles of moisture vapour transfer - Evaluation of moisture vapour transmission - Factors affecting heat and mass transfer through fabrics- Parameters expressing heat and mass transmission- Air permeability and measurement

COMFORT PROPERTIES OF FIBERS, YARNS AND FABRICS — **9 Hours**

Comfort properties of fibers: Physical modification of fibers - Comfort properties of yarns: Effect of yarn structure characteristics, effect of spinning technique, texturizing - Comfort properties of fabric structures: Fabric constructional parameters, finishing.

COMFORT PROPERTY OF CLOTHING — **9 Hours**

Physical Properties of Clothing and Comfort: Thermal resistance – Water vapor diffusion resistance – Water holding property – Effect of fabric properties – Radiation exchange – Flammability – Clothing with internal spaces.

Total Hours: 45Hrs

REFERENCES

1. 1. A Das, R.Alagirusamy, “Science in clothing comfort”, Woodhead publishing, India ISBN: 978184596789, Jan 2010.
2. G.song, “Improving comfort in clothing”, woodhead publishing services in textiles : 106, ISBN: 184569 539, Jan 2011

BOS Chairman Signature	V.Ramesh Babu,

P18TME0061	STRUCTURAL MECHANICS OF YARNS AND FABRICS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe the geometry of twisted structures.
CO2. Analyse the fibre migration.
CO3. Describe the mechanics of filament yarns
CO4. Analyse the geometry of cloth structure.
CO5. Describe the knitted fabric strcutures.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

GEOMETRY OF TWISTED YARNS — **9 Hours**

Idealized helical yarn structure; yarn count and twist factors, twist contraction; Limits of twist. Packing of fibers in yarns: Idealized packing; measurement of packing density and radial packing density of yarn; Packing in actual yarns; Specific volume of yarns; measurement of yarn diameter.

FIBRE MIGRATION — **9 Hours**

Ideal migration, tracer fiber technique, characterization of migration behavior, migration in spun yarns, mechanisms of migration, effect of various parameters on migration behavior

MECHANICS OF CONTINUOUS FILAMENT YARNS — **9 Hours**

Analysis of tensile behavior; prediction of breakage; analysis of yarn modulus by energy method; observed extension and breakage of continuous filament yarns; Mechanics of staple fibre yarns Theoretical analysis of tensile behavior; deduction based on fiber obliquity and slippage; influence of fiber length, fineness and friction on tensile behavior ; strength prediction model for blended yarns

GEOMETRY OF CLOTH STRUCTURE — **9 Hours**

Geometry of Plain and Non-Plain weaves; Peirce and Olofsson models; crimp ratio and thread spacing; Jamming of threads; Crimp interchange; Balance of crimp.
Fabric deformation: Fabric deformation under tensile stress; prediction of modulus; tensile properties in bias direction; other fabric deformation – compression, shear, bending and buckling; fabric handle; spiral and skewness formation and its control.

KNITTED FABRIC STRUCTURES — **9 Hours**

Geometry of weft and warp knitted structures, influence of friction on knit geometry; load extension of warp knit fabrics; biaxial stress behavior of plain-knit fabrics
Nonwoven structures: Structure of felts; mechanical behavior of needle felts; structure of stitch bonded fabrics

Total Hours: 45Hrs

BOS Chairman Signature	V.Ramesh Babu,

REFERENCES

1. Goswami B. C., “Textile Yarns: Technology, Structure and Applications”, Wiley-Interscience, New York, 1977, ISBN: 0471319007
2. Hassan M. Berery., “Effect of Mechanical and Physical Properties on Fabrics Hand”, Wood head publishing Ltd., 2005, ISBN: 13: 978 – 1- 85573 -9185
3. Hearle J. W. S., “Structural Mechanics of Fibers, Yarns and Fabrics”, Wiley Interscience, New York, 1969, ISBN: 0471366692
4. Hearle J. W. S., John J., Thwaites. and JafargholiAmirbayat., “Mechanics of Flexible Fibre Assemblies”, Sijthoff and Noordhoff, 1980, ISBN : 902860720X
5. Jinlian Hu., “Structure and Mechanics of Woven Fabrics”, Woodhead Publishing Ltd., 2004,ISBN: 1855739046

BOS Chairman Signature	V.Ramesh Babu,

P18TME0062	THEORY OF DRAFTING AND TWISTING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe about ideal drafting.
CO2. Describe about drafting waves.
CO3. Describe about drafting system.
CO4. Analyse the mechanics of imparting twist.
CO5. Describe about twist insertion principle.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

IDEAL DRAFTING	**9 Hours**

Definition of ideal drafting; conditions required to achieve ideal drafting in a roller drafting system; deviations from ideal drafting situation during actual drafting conditions

DRAFTING WAVE	**9 Hours**

Drafting Wave – Condition for drafting wave formation during roller drafting, methods to avoid drafting wave formation, role of apron in controlling drafting wave formation.
Roller Slip – Conditions for the formation of forward and backward slips in the roller drafting systems, measures to avoid roller slip occurrence, causes and control of roller nip movement and roller speed variation during drafting.

ROLLER DRAFTING SYSTEM	**9 Hours**

Comparison of roller drafting system with wire point drafting system; application of wire point drafting in card and rotor spinning machine

MECHANICS OF IMPARTING STRENGTH	**9 Hours**

Mechanics of imparting strength to a stable-fibre strand by twisting; twist multiplier and the basis of selection of required twist; principles of false twisting; fundamental requirements to create real twist in the strand.

PRINCIPLE OF TWIST INSERTION	**9 Hours**

Principle of twist insertion in ring spinning; limitation of ring twisting; principles of twist insertion in open-end spinning; application of this principle in rotor spinning and friction spinning machines; twist formation in air jet spinning and vortex spinning; principle of two-for-one twisting; operating principle involved in the twisting of wrap spun yarns.

Total Hours: 45Hrs

REFERENCES

1. Foster G.A.R, “The Principles of Roller Drafting and the Irregularity of Drafted Materials”, The Textile Institute, Manchester, 1958.
2. Grosberg P. and Iype C., “Yarn Production: Theoretical Aspects”, The Textile Institute, Manchester, 1999, ISBN 9781870372039

BOS Chairman Signature	V.Ramesh Babu,

3. Heinz Ernst, “The Rieter Manual of Spinning”, Vol. 5- Rotor Spinning,Rieter Machine works Ltd, 2014, ISBN 13 978-3-9523173-5-8.
4. Herbert Stalder, “The Rieter Manual of Spinning”, Vol. 6- Alternative Spinning System, Rieter Machine works Ltd, 2014, ISBN 13 978-3-9523173-6-5.
5. Peter R. Lord, “Handbook of Yarn Production: Technology, Science and Economics”,Woodhead Publishing, 2003, ISBN-13: 978-1855736962.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0063	ENGINEERING OF FUNCTIONAL CLOTHING AND FINISHES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describes about finishing.
CO2. Describes about softening finishes.
CO3. Analyse about hand building finishes.
CO4. Analyse on nonslip and elastomeric finishes
CO5. Analyse about protective finishes.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

FINISHING — **9 Hours**

Classification, processing methods, challenge, Importance. Applications, concentration relationship, wet pick up: Low wet pick up methods, factors affecting wet pick up. Calculations: wet pick up efficiency, concentration for padding solution, solution flow rate, and feed flow rate.

SOFTENING FINISHES — **9 Hours**

Types of Softeners, mechanisms of the softening effect. Compatibility and combinability of softeners. Evaluation and testing methods. Troubleshooting for softening finishes.

HAND BUILDING FINISHES — **9 Hours**

Effects of hand building finishing. textiles with hand building finishes. hand builder chemistry, evaluation and trouble shooting for hand building finishes

NON-SLIP AND ELASTOMERIC FINISHES — **9 Hours**

Mechanisms of non-slip finishes, chemistry of non-slip finishes, application methods and combinability, evaluation, trouble shooting for non-slip finishes. Mechanism of elastomeric effect, evaluation and trouble shooting for elastomeric finishes

PROTECTIVE FINISHES — **9 Hours**

PROTECTIVE FINISHES: Mechanism of UV protection, chemistry of UV protection finishes. EMI Shielding. Antimicrobial finish. mechanisms of antimicrobial finishes, evaluation and trouble shooting. Novel finishes: Need for novel finishing. Anti-odour and fragrance finishes. Mosquito repellent finish. Conductive finishing, microencapsulation technique, nano finishing. Enzyme finishing.

Total Hours: 45Hrs

REFERENCES

1. Schindler W D and Hauser P J, “Chemical Finishing of Textiles”, The Textile Institute, Woodhead Publishing Ltd., Cambridge, 2004.
2. Charles T, “Chemistry & Technology of Fabric Preparation & Finishing”, North Carolina State University, USA, 1992.
3. Perkins W S, “Textile Colouration and Finishing”, Carolina Academic Press, UK, 1996.

BOS Chairman Signature	V.Ramesh Babu,

4. Menachem L and Stephen B S, “Handbook of Fibre Science and Technology”, Volume II, Part B, Marcel Dekker Inc., New York, 1983.
5. Holme L, “New developments in chemical finishing of textiles”, Journal of Textile Institute, UK, 2008.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0064	YARN QUALITY ANALYSIS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Analyse the features and operational aspects in speed frame and ring frame for improving the evenness of the materials produced by them.
CO2. Select appropriate parameters of fibre quality and process parameters for maintaining and improving the product quality and process performance.
CO3. Analyze material flow control, evenness, strength, hairiness, packing of fibres in yarns, hairiness and migration behaviour.
CO4. Evaluate yarn quality on fabric wear, appearance and comfort properties.
CO5. Analyse faults and their representation in spectrogram.

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-End survey

MASS VARIATION OF TEXTILE STRANDS — **9 Hours**

Mass Variation: Determination of mass variation of textile strands in time and frequency domains- Interpretation and significance of U% and CV% for textile strands- Classification and analysis of yarn faults created by mass variations- Theoretical limit for strand regularity and index of irregularity.

VARIANCE LENGTH CURVES OF TEXTILE STRANDS — **9 Hours**

Variance – Length Curves: Introduction to variance-length curves – within length and between length variance curves- Effect of specimen length and total length on mass variation measurements of textile strands; Analysis of variance-length curves to understand and avoid the introduction of mass variation during the spinning operations.

SPECTGROGRAM OF TEXTILE STRANDS — **9 Hours**

Spectrogram: Determination of periodic mass variations of textile strands in the form of spectrogram - Comparison between normal spectrum and ideal spectrum- Type of faults and their representation in spectrogram- Interpretation of superimposed waves in spectrogram- Wavelength range for each machine in a spinning mill.

TENSILE PROPERTIES OF YARN — **9 Hours**

Tensile Properties: Influence of specimen length on yarn tensile properties- Measurement and application of yarn modulus, creep and stress relaxation- Effect of testing speed on yarn tensile properties- Significance of estimating minimum yarn strength.

INFLUENCE OF YARN QUALITY — **9 Hours**

Effect of yarn properties like evenness, strength, elongation, modulus, hairiness, abrasion resistance, fibre and yarn mix-up and yarn tension history on the performance of yarn during winding, warping, weaving and knitting- Effect of yarn quality on fabric wear, appearance and comfort properties.

Total Hours: 45Hrs

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REFERENCES

1. R.Furter, “Strength and Elongation Testing of Single and Ply Yarns”, The Textile Institute, Manchester, 1985.
2. Steadman, R.G, “Cotton Testing”, Textile Progress, Vol. 27, No.1.Text.Inst, ISBN: 1870812859, 1997.
3. Kothari V.K., “Progress in Textiles: Science & Technology Vol. 1, Testing and Quality Management”, IAFL Publications, New Delhi, ISBN: 81-s901033-0-X, 1999.
4. Barella.A and Manich.A.M, “Yarn Hairiness: A Further update, Textile Progress, Vol 31 No.4, 2000.
5. Lord P.R. and Grover G., “Roller drafting”, Textile Progress, Vol. 23 No.4, Textile Institute, ISBN:1870812468, 1993.
6. P Grosberg and C Iype ‘Yarn production: Theoretical aspects”,Woodhead Publishing Limited, January 1999.
7. R.Furter, “Evenness testing in yarn production: Part I &II”, The Textile Institute,Manchester,1982.

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P18TME0065	FABRIC QUALITY ANALYSIS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Analyze the mode of fabric failure

CO2. Explain the influence of fibre, yarn characteristics and fabric structure on the fabric failure.

CO3. Evaluate the Role of transmission properties on thermal properties and thermal comfort

CO4. Predict fabric handle, tailorability and sewability using low stress mechanical properties of fabrics

CO5. Apply the knowledge of Dimensional Stability, Flammability, Impact Resistance, and absorbency designing technical textiles products

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

MECHANISM OF FABRIC FAILURE — **9 Hours**

Mode of fabric failure – tensile, tear, abrasion, bursting and fatigue. Influence of fibre, yarn characteristics and fabric structure on the fabric failure.

COMFORT PROPERTIES OF FABRICS — **9 Hours**

Role of transmission properties on thermal properties and thermal comfort. Viz., Air permeability, Water Vapour Permeability, Resistance to penetration of liquid water, resistance to flow of heat and electrical conductivity.

FABRIC APPEARANCE — **9 Hours**

Study of fabric appearance in terms of Drape, Crease Recovery, Wrinkle Recovery and Pilling Resistance. Influence of fibre, yarn characteristics and fabric structure on the fabric appearance.

LOW STRESS MECHANICAL PROPERTIES — **9 Hours**

Study of low stress mechanical properties during tensile, compression, bending, shear and buckling deformation. Influence of low stress mechanical properties of fabrics on fabric handle, tailorability and sewability.

OTHER PROPERTIES — **9 Hours**

Evaluation of fabric properties like Dimensional Stability, Flammability, Impact Resistance, Absorbency. Evaluation of technical textile fabrics for various applications

Total Hours: 45Hrs

REFERENCES

1. Progress in Textiles: Science & Technology Vol. 1, Testing and Quality Management, V.K. Kothari, IAFL Publications, New Delhi, ISBN: 81- 901033-0-X, 1999.
2. Ukponmwan, J, Mukhopadhyay, A, Chatterjee, K, “Pilling”, Textile Progress, Vol. 28/3, ISBN: 1870372153, 1996.

BOS Chairman Signature	V.Ramesh Babu,

3. Seyam, “Structural Design of Woven Fabric: Theory and Practice”, Textile Progress, Vol., 31/3, 1999.
4. Laing &Sleivert, “Clothing Textiles and Human Performance”, Textile Progress, Vol. 32/4, 2000.
5. Hassan M.Behery Effect of mechanical and physical properties on fabric hand” wood head publishing., ltd, 2005
6. Mohsen Miratbab “Fatique failure of textile fibres, wood head publishing, ltd 2009.
7. AR.Bunsell “Handbook of tensile properties of textile and technical fibres” wood head publishing ltd., 2009.
8. J.Fan and L.Hunter, “engineering apparel fabrics and garments” wood heafpublsinglitd, ISBN: 978-1-84569-134-9 (2009)
9. D.L.Bishop, “Fabrics: Sensory and Mechanical Properties”, Textile Progress Vol. 26/3, ISBN: 1870812751, 1994.
10. Li, “The Science of Clothing Comfort”, Textile Progress, Vol., 29/3, ISBN: 1870372247, 1997

BOS Chairman Signature	V.Ramesh Babu,

P18TME0066	ADVANCES IN TEXTILE FINISHING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Explain the various finishing methods involved in fabric processing
CO2. Discuss the mechanism and chemistry of finishing
CO3. Summarize the functional finishes and its application
CO4. Identify the specialty polymers in finishing of fabric
CO5. Test the chemical finished fabric

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

EASY-CARE AND DURABLE PRESS FINISHES — 9 Hours

Commercial importance of finishing and its classification. Concepts of anticrease finish, Esterification and etherification, Mechanisms and chemistry of easy-care and durable press finishes- Formaldehyde and non-formaldehyde containing product, cross linking agent and catalyst, problem of formaldehyde release. Developments in resins, Application methods, Compatibility with other finishes, Evaluation methods. Trouble shooting and practical problems.

SOFTNERS AND SURFACTANT IN FINISHING — 9 Hours

Methods of softening, Chemistry of softeners, Application of softening techniques to technical textiles, Effect of softeners on textile properties, Environmental impact of softeners, Measurement of fabric softness. Raw materials for surfactants, Cationic and non ionic surfactants, Novel surfactants, Applications of surfactants

FLAME RETARDANT AND WATER REPELLENT FINISHES — 9 Hours

Burning behaviour of polymers and ways to affect flame retardancy, Condensed phase and gas phase mechanisms of FR. Classification, application and developments in flame redardants. Test methods for fire resistance. Mechanisms of water repellency, Repellent chemistry, Evaluation of textile treated with repellent finishes, Troubleshooting repellent finishes and particularities.

FUNCTIONAL FINISHES — 9 Hours

Soil release finish-mechanisms of soil release, Soil release chemistry, Evaluation of soil release. Anti-microbial finish- mechanism and chemistry, evaluation methods. Anti-static finish-mechanism & chemistry, conductive fibres, evaluation methods. Anti-pilling finish- mechanism and chemistry, evaluation methods. UV finish- mechanism and chemistry, evaluation methods.

SPECIALITY POLYMERS IN FINISHING — 9 Hours

Speciality polymer- Temperature responsive breathable coating. Bioactive finishes for protection against biological attack and other medical applications. Finishes for conductive textiles. Advances in application of speciality finishes/ coatings. Foam Finishing- Detailed study of various techniques of foam application. Drawbacks of foam finishing.

Total Hours: 45Hrs

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REFERENCES

1. Lewin & Sello, Functional finishes, Part A & Part B; CRC Press, ISBN: 0824771184, 1994.
2. Microencapsulation in finishing, Review of progress of Colouration, SDC, 2001
3. Marsh, J.T., "An Introduction to Textile Finishing", Chapman and Hall Ltd., London, 1979.
4. From waste to Profits, Technical Manual Series III, National Productivity Council, New Delhi, 1998.
5. Heywood, "Textile Finishing", Woodhead Publishing Limited, 2003.
6. Gulrajani M L, "Advances in the dyeing and finishing of technical textiles" Woodhead Publishing Limited, 2013.
7. Schindler W D and Hauser P J, "Chemical finishing of Textiles" Woodhead Publishing Limited, 2004

BOS Chairman Signature	V.Ramesh Babu,

P18TME0067	ADVANCED KNITWEAR TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Describe the weft knitting technology.
CO2. Analyse the knitting dynamics.
CO3. Describe the warp knitting techniques
CO4. Analyse the dimensional characteristics of warp knits
CO5. Describe the Speciality warp knits

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

WEFT KNITTING — **9 Hours**

Needle Selection Techniques in weft knitting - storage and positive feeding devices - Patterning for multitrack machines. Key developments in circular knitting: Ring and rotor yarn quality requirements for weft knitting - Garment length - High Pile and Socks Knitting Machines

KNITTING DYNAMICS — **9 Hours**

Yarn tension and knitting forces - effect of cam shape, increase in number of feeders and increase in linear speed - needle breakages. Fabric geometry and properties- Tightness factor - Dimensional properties - Spirality - Relaxation - shrinkage

WARP KNITTING — **9 Hours**

Tricot & Rachel Two, Three & Multibar Machines - Pattern Control Mechanisms - Pattern Wheels and Chain Links, fabric geometry,

DIMENSIONAL CHARACTERISTICS OF WARP KNITS — **9 Hours**

Dimensional characteristics of warp knits, Warp knitted fabric geometry - relation between loop length and construction - fabric relaxation and shrinkage

SPECIALITY WARP KNITS — **9 Hours**

Weft insertion - co-we-nit - cut presser – Laying-in - fall plate – double needle bar warp knitting machines – Jacquard knitting. Warp knitted technical textiles, Testing and Quality Control of Weft and Warp knitted fabrics. Various defects in knitting

Total Hours: 45Hrs

REFERENCES

1. Spencer D J, “Knitting Technology”, Woodhead Publishing Limited, 2005.
2. Raz S, “Warp Knitting Technology”, Verlag Melliand Textilberchte, GMBH, Heidelberg,1987.
3. Gottlieb N, “The Production and Properties of Warp knitted fabrics”, Textile Progress, Vol.7, No.2, 1975.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0068	TEXTILE REINFORCED COMPOSITES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Select different types of textile reinforcements and matrices for the manufacture of Composites for getting different characteristics and

CO2: Evaluate the characteristics of composites

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

REINFORCEMENTS — **9 Hours**

Manufacturing, properties and applications of Glass, Quartz, Boron, Silicon carbide, Carbon, HPPE and Aramid fibers.

MATRICES — **9 Hours**

Preparation, Chemistry, Properties and applications of thermoplastic and thermoset resins- Unsaturated Polyester, Vinyl Ester, Epoxy, Phenolics, polyimides, polyurethanes, polyamides, Polypropylene, PEEK and Polycorbanate

COMPOSITE MANUFACTURING — **9 Hours**

Composites manufacturing for both thermoplastics and thermosets- Hand layup, Filament winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vaccum impregnation methods, compression moulding; post processing of composites and Composite design requirements

TESTING — **9 Hours**

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

MECHANICS — **9 Hours**

Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using software

Total Hours: 45Hrs

REFERENCES

1. Mel. M. Schwartz, “Composite Materials”, Vol. 1 & 2, Prentice - Hall PTR, New Jersey,1997.
2. Bor Z.Jang, “Advanced Polymer composites”, ASM International, USA, 1994.
3. Carlsson L.A. and Pipes R.B., “Experimental Characterization of advanced composite Materials”, Second Edition, CRC Press, New Jersey, 1996.
4. George Lubin and Stanley T. Peters, “Handbook of Composites”, Springer Publications,1998.
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.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0069	THEORY OF YARN STRUCTURES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Enable the students to learn about the structure of ideal and real yarn, migration of fibres in the yarn,
CO2: Understand the breakage mechanism of yarn,
CO3: Enable the students to learn about the Mechanics of blended yarns and relationship between structure and property of yarns produced by different spinning systems

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

YARN GEOMETRY	**13 Hours**

Elements of yarn geometry; geometry of helix and its application to yarn structures; yarn diameter, packing of fibres in yarn; estimation of packing density and radial packing density of yarn; geometry of folded yarns

FIBRE MIGRATION	**5 Hours**

Migration characteristics in continuous filament and spun yarns; effect of various parameters on migration; measurement of fibre migration in yarn; effect of migration on tensile behaviors and hairiness of the yarn

YARN MECHANICS	**9 Hours**

Analysis of tensile behavior, prediction of breakage - continuous filament yarn and spun yarn; effect of fibre properties and geometrical configuration of yarn on the tensile and bending properties of yarn; design of yarn structures for certain functional uses.

BLENDED YARN MECHANICS	**9 Hours**

Blend irregularity; measurement of blending irregularity; concept of elongation balance; effect of properties of constituent fibres and blend composition on behavior of blended yarns

STRUCTURE - PROPERTIES RELATIONSHIP	**9 Hours**

Structure - property relationship in yarns produce from different spinning systems

Total Hours: 45Hrs

REFERENCES

1. Hearle J.W.S., Grosberg P. and Baker S., "Structural Mechanics of fibres, yarns and fabrics", Wiley Interscience, New York, 1969.
2. Goswami B.C., Martindale J.G. and Scardino F.L., "Textile Yarns: Technology, Structure and Applications", Wiley Interscience, New York, 1985.
3. Hearle J.W.S., Thwaitesand J.J. and Amikrbayhat A., "Mechanics of Flexible Fibre Assemblies", Maryland, 1980.
4. Postle P., Dejong S.and Carnaby G.A., "The Mechanics of Wool Structure", Ellis Horwood, London, 1988.

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5. Grosberg P. and Iype C., “Yarn production: Theoretical aspects”, Textile Institute publication, 1999, ISBN-13: 978 1 87037 203 9.

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P18TME0070	TECHNICAL TEXTILES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: List the requirements of various high performance fibres.
CO2: Demonstrate necessary knowledge in the designing of military textiles.
CO3: Review the various fibres, fabric structures used in filter fabric designing and filtrarion mechanisms.
CO4:Explain the functions of automotive textiles in automobiles.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

HIGH PERFORMANCE FIBRES — **9 Hours**

Requirements of high performance fibres. Aramid: Kevlar fibre – structure – properties and application. Nomex fibre: structure – properties and application. Polyphenylene Sulphide (PPS) fibre: properties – applications. Carbon fibres: classification - properties and applications. Glass fibres: Types and composition - properties – applications.

HIGH TECH FIBRES — **9 Hours**

Ceramic fibres: classification – composition – structure - properties and applications. Elastomeric (Polyurethane) fibre: properties - applications. HDPE fibres: properties - applications. Polybenzimidazole (PBI): structure - properties and applications. Polystyrene based fibres - properties – applications. Micro fibres: properties - applications; Poly Lactic Acid (PLA): properties – applications. Ultra-fine fibres and Hollow fibres: applications.

MILITARY TEXTILES — **9 Hours**

Current and Future Requirements of Soldier – Protective materials, devices and end-use requirements – role of comfort in military clothing – sweat management for military textiles –Cold weather clothing: physiological response to cold –clothing design principles – estimation of insulation – evaluation systems - selection of clothing. Designing Military clothing with high-tech materials: design process – features of military clothing - physiological monitoring - thermal management - signature management - chemical and biological defense management -flame resistance - environmental defense - body armor.

FILTRATION TEXTILES — **9 Hours**

Filtration: Introduction - definition – filtration mechanisms – classification of filter media – properties of filter media – fibres for high temperature filtration. Woven fabric media: Introduction - properties of yarns – effect of type of yarn & yarn structure on filter fabric performance – Effect of fabric weave pattern on filter fabric performance – filter fabric finishing processes – properties of woven fabric filters. Nonwoven fabric media: Introduction – Types – needle felts – electrostatic

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effects on nonwoven filters – bonded media: resin bonded – thermal bonded. Dry-laid spun filter media: spun bonded filter and melt blown filter. Composite nonwovens filter.

AUTOMOTIVE TEXTILES	**9 Hours**

Introduction - global scenario – Seat Belt: classification – global scenario – forces acting on passenger with and without seat belt – critical characteristics – fibres & fabric structure – manufacturing methods – performance testing. Air bags: principle of working –laws of motion – air bag inflation – types of air bags – raw materials and manufacturing methods. Filters: carburetor filter – engine oil filter – fuel tank filter - cabin filters – other filters. Tyre cord: functions – types of tyres – reinforcement materials – properties of tyre cords –manufacturing and finishing of tyre cords. Seating fabrics: property requirements - seat comfort – materials. Other minor components: headliners – hoses and belts – bonnet liners - door trims - roof trims - floor coverings – parcel shelves – trunk liners – dash board – sun visors – battery separators.

Total Hours: 45Hrs

REFERENCES

1. Derek B. Purchas, K. Sutherland (Editor) “Hand Book of Filter media”, Elsevier Science & Technology Books, ISBN: 1856173755, November 2002.
2. Eugene Wilusz “Military Textiles”, Wood head publications Ltd., ISBN 978-1-84569-206-3, 2008.
3. R.Senthil Kumar “Seat Belt” – A review article, Asian textile Journal, July2010.
4. W Fung, Collins and Aikman Automotive Fabrics and J M Hardcastle, Consultant, UK “Textiles in automotive engineering” Woodhead Publishing, ISBN 1855734931, November 2000.
5. R Shishoo, Shishoo Consulting AB, Sweden “Textile advances in the automotive industry” Woodhead Publishing, ISBN-13: 9781845693312, October 2008.
6. Mukhopadyay S.K., “High Performance Fibres”, Textile Progress, Textile Institute, Manchester, Vol. 25, 1993.
7. S.C.Anand&A.R.Horrocks, “Hand Book of Technical Textiles”, Wood head publications Ltd., ISBN 1 85573 385 4, 2000.

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P18TME0071	TEXTILES IN CIVIL CONSTRUCTION AND TRANSPORTATION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Comprehend the requirements of textiles used for civil construction
CO2: Design the textile materials for civil construction applications.
CO3: Comprehend the requirements of textiles used for transportation applications
CO4: Design the textile materials for transportation construction applications
CO5: Describe the evaluation method of textile material

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

GEO TEXTILES — **15 Hours**

Geo textile – definition, types, functions; types of fibers and fabrics used in geo textiles; applications of natural fibers in geo-textiles; joining of geo- textiles; multi functional uses of geo synthetics in civil engineering; usage of geo-synthetic in civil engineering applications as filters, reinforcement, separation and drainage medium; material specifications and design criteria of geo-synthetics for specific applications.

ARCHITECTURE TEXTILES — **15 Hours**

Fiber and fabric property requirements for architecture textiles; Coated textiles; Tents, Awnings and Canopies; Inflatable structures – high pressure and low pressure inflatable structures; Textile for roofing applications; Acoustic and heat insulation textiles; Floor and wall covering, scaffolding nets.

TRANSPORTATION TEXTILES — **9 Hours**

Quality and design of textile materials used in automobiles – tire cord, filter, air bag, belt, seat cover, noise insulation; Design and development of textile reinforced composites in automobile and aeronautic industry.

EVALUATION — **6 Hours**

Evaluation of textile material used in civil construction and transportation industry in terms of performance, construction surviability and durability.

Total Hours: 45Hrs

REFERENCES

1. Horrocks A.R. and Anand S.C., “Handbook of Technical Textiles”, The Textile Institute, Manchester, 2000, ISBN: 1855733854.
2. R. W. Sarsby, “Geo Synthetics in Civil Engineering”, Woodhead Publishing, ISBN-13: 978-1-85573-607-8
3. Mukhopadhyay S.K. and Partridge J.F., “Automotive Textiles”, Textile Progress, Vol.29,No1/2, 1999, ISBN:1870372212.
4. Adanur S., “Wellington sears handbook of Industrial textiles”, Technomic publishing co inc.,1995, ISBN : 1–56676–340–1.
5. Eugeniooñate and Bern kröplin “Textile Composites and Inflatable Structures”, Springer Dordrecht, Berlin, Heidelberg, New York, ISBN-10 1-4020-3316-8

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P18TME0072	STRUCTURAL MECHANICS OF FABRICS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:Analyze the geometry and construction of various fabrics and relate the geometry with fabric properties

CO2: Formulate equations for prediction of tensile properties of various fabrics and explain the reasons for such behavior.

CO3: Explain the relationship between shear and bending deformation and fabric drape and mechanical properties

CO4: Apply the knowledge of Dimensional properties and Relaxation – shrinkage in designing knitted garments.

CO5**:** Describe the theories on Fabric Bending, bending stiffness, and bending hysteresis

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

FABRIC MECHANICS	**9 Hours**

Fabric Mechanics: Fabric Specifications and cover factor. Plain cloth geometry - crimp ratio and thread spacing - setting theory and maximum set. Pierce's flexible and elastic thread model - Oloffson's general model. Crimp interchange in woven fabrics - crimp balance -geometrical structure of twill and mat weaves.

TENSILE PROPERTIES OF WOVEN FABRICS	**9 Hours**

Tensile properties of woven fabrics : stress-strain curve .Modeling of tensile behavior, anisotropy of woven fabric. geometrical changes during the extension of cloth - load extension modulus, Application of force, energy and finite element methods in fabric tensile behavior analysis.

THEORIES ON FABRIC BENDING	**9 Hours**

Theories on Fabric Bending: Moment-curvature curve of bending, bending stiffness, bending hysteresis modelling of bending behaviour, polar diagrams of the bending model.

FABRIC SHEAR AND COMPLEX DEFORMATION	**9 Hours**

Shear stress –strain curves , relationship between shear and bending deformation, Modelling of shear behavior, Buckling , Drape- two and three dimensional drape ,fabric drape and mechanical properties, modeling of drape.

KNITTING DYNAMICS	**9 Hours**

Knitting Dynamics: Yarn tension and knitting forces - effect of cam shape, increase in number of feeders and increase in linear speed. Fabric Geometry and Properties: Tightness factor - Dimensional properties - Spirality - Relaxation – shrinkage

Total Hours: 45Hrs

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REFERENCES

1. Seyam A M, “Structural Design of Woven fabrics”, Textile progress Vol.31, No: 3. Wood Head Publishing Ltd, 2002
2. Hassan M.Behery Effect of mechanical and physical properties on fabric hand” wood head publishing., ltd, 2005
3. Progress in Textiles: Science & Technology Vol. 1, Testing and Quality Management, V.K. Kothari, IAFL Publications, New Delhi, ISBN: 81- 901033-0-X, 1999.
4. Ukponmwan, J, Mukhopadhyay, A, Chatterjee, K, “Pilling”, Textile Progress, Vol. 28/3, ISBN: 1870372153, 1996.
5. Laing &Sleivert, “Clothing Textiles and Human Performance”, Textile Progress, Vol. 32/4, 2000.
6. J Hu, “Structure and mechanics of Woven fabrics”, Hong Kong Polytechnic University, Wood Head Publishing Ltd, 2004.
7. Hearle J W S, Grosberg P and Backer S, “Structural mechanics of fibres, yarn and fabrics”, Wiley Interscience Publishing limited, 1969.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0073	STATISTICAL APPLICATION IN TEXTILE ENGINEERING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Apply the distribution functions in Textile related problems
CO2:Analyze the significance of sampling and its techniques
CO3:Analyze the different models of variance
CO4: Design and interpret the process control charts
CO5: Choose and evaluate the experiments by factorial designs

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

PROBABILITY DISTRIBUTION AND ESTIMATIONS — **9 Hours**

Applications of Binomial, Poisson, normal, student's, t, chi-square, f and Weibull distributions in textile engineering; point estimates and interval estimations of the parameters of the distribution functions

HYPOTHESIS TESTING — **9 Hours**

Sampling distribution; significance tests applicable to textile quality parameters – normal test, t-test, chi-square test and F-test; selection of sample size and significance levels with relevance to textile applications; acceptance sampling

ANALYSIS OF VARIANCE AND NON-PARAMETRIC TESTS — **9 Hours**

Analysis of variance for different models; non-parametric tests.

PROCESS CONTROL AND CAPABILITY ANALYSIS — **9 Hours**

Control charts for variables and attributes - basis, development, interpretation, sensitizing rules, average run length; capability analysis.

DESIGN AND ANALYSIS OF EXPERIMENTS — **9 Hours**

Limitations of experimental design; Latin square design,Randomized block design-2k full-factorial designs; development of regression models, calculation of regression coefficients; adequacy test for regression equations; process optimizations, multivariate analysis.

Total Hours: 45Hrs

REFERENCES

1. Douglas C. Montgomery, "Design and analysis of experiments", John Wiley & Sons, Inc, Singapore, ISBN 9971 51 329 3, 2000.
2. Ronald D. Moen, Thomas W. Nolan, Lloyd P. Provost, "Quality improvement through planned experimentation', McGraw-Hill, ISBN 0-07-913781-4, 1998.
3. Hayavadana. J, "Statistics for textile and apparel management" wood head publishing India (P) Ltd, 2012, ISBN – 8789380308-04-3
4. J.R.Nagla, "Statistics for textile engineers" woodhead publishing India (P) Ltd, 2013, ISBN: 1782420673

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5. Meloun, Miliky, “Statistical data analysis a practical guide” wood head publishing,, 2011, ISBN: 0857091093
6. Montgomery D.C., “Introduction to Statistical Quality Control”, John Wiley and Sons, Inc., Singapore, ISBN: 997151351X, 2002.
7. Leaf G.A.V., “Practical Statistics for the Textile Industry, Part I and II”, The Textile Institute, Manchester, ISBN: 0900739517, 1984.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0074	CHARACTERIZATION OF TEXTILE POLYMERS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Interpret data obtained from various analytical instruments.
CO2: Analyse the thermal properties

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

MOLECULAR WEIGHT	**9 Hours**

Polymer solution thermo dynamics; molecular weight and molecular dimensions by end group analysis, osmometry, light scattering, viscometry, gel permeation chromatography, high performance liquid chromatography

MOLECULAR STRUCTURE CHARACTERISATION	**13 Hours**

Infrared, NMR, UV–visible, Raman spectroscopy, mass spectroscopy.

THERMAL PROPERTIES	**9 Hours**

Thermal properties by differential scanning calorimetry, differential thermal analysis, thermo gravimetry, thermo-mechanical analyzer, dynamic mechanical and dielectric analysis

OTHER PROPERTIES	**14 Hours**

Optical and electron microscopy; TEM, SEM, AFM, X-ray scattering from polymers, birefregence, crystallinity by density measurements, Surface area, pore volume measurements by B.E.T. method, porosimetry, surface energy measurements and particle size measurement.

Total Hours: 45Hrs

REFERENCES

1. Gupta V.B. and Kothari V.K., “Man Made Fibre production,” Chapman and Hall, 1985.

2. Bill mayer, “Textbooks of Polymer Science,” 3rd ed., Wiley, 1984.

3. Sperling, “Introduction to Physical Polymer Science,” Wiley, 1986.

4. Campell D. and White J.R, “Polymer characterization, Physical Techniques”, McGraw – Hill, New York, 1969.

5. Stamm M., “Polymer surfaces and Interfaces”, Springer1st ed., 2008.

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P18TME0075	POLYMER RHEOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Learn about fluid flow and its related aspects with respect to melt and solution spinning.
CO2: Characterize the rheological behaviour of fluids.
CO3 : Analyze the effect of molecular parameters on the fluid flow.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

DEFORMATION PRINCIPLES	**9 Hours**

Basic modes of deformation, Start-up deformation, step strain, Oscillatory shear: Linear responses – Elastic Hookean solids, Viscous Newtonian liquids and non-Newtonian fluids: Viscoelastic responses – Boltzmann superposition principle, Maxwell model; Classical rubber elasticity.

VISCOSITY BEHAVIOUR	**9 Hours**

Viscosity – Effect of Pressure, temperature, activation energy, molecular weight and molecular weight distribution on viscosity, crosslinking, crystallinity branching, copolymerization, fillers, plasticizers, and shear rate dependence of viscosity.

RHEOLOGICAL MODELS	**9 Hours**

Laminar flow through various profiles, flow analysis – power law, turbulent flow analysis, turbulence dumpling; rheological models for extensional viscosity; Flow in coni-cylindrical dies – pressure drop due to shear, extensional flow and pressure drop at die entry, flow in wedge shape die; Swelling due to shear stress and tensile stresses.

OPTICAL METHODS	**9 Hours**

Shear rheometry – Linear displacement, sliding plate rheometer, Co-cylinder axial sliding rheometer; Rotational motion – Parelle disks, Come-plate, and Cone-partitioned plate; Rheo-optical methods – Flow Birefringence, Scattering (X-Ray, light, neutron), Spectroscopy (NMR, Fluorescence, IR, Raman, dielectric).

APPLICATIONS OF RHEOLOGY	**9 Hours**

Rheological behaviour of important thermoplastics, Applications of rheology to polymer processing.

Total Hours: 45Hrs

REFERENCES

1. Brydson J.A., “Flow properties of polymer melts”, life books, London, 1978.
2. Chang Dae Han, “Rheology in polymer processing”, Academic Press, Newyork, 1976.

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3.	Crawford R.J., “Plastics Engineering”, Butterworth – Heinemann, Oxford, 1988
4.	Ferry J.D., “Viscoelastic properties of polymers”, John Wiley & Sons, Newyork, 1986.
5.	Lenk R.S., “Polymer Rheology”, Applied Science, London, 1978.

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P18TME0076	SURFACE MODIFICATION OF TEXTILES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Learn about the importance and application of surface modification of textile materials.
CO2: Study about plasma technology and high energy radiation.
CO3 : Gain knowledge on surface modification of textile by physical methods and enzyme treatments and its characterization.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

INTRODUCTION	**9 Hours**

Importance of surface modification of textile materials. Physical, Chemical and Bio methods. Potential application.

PLASMA SCIENCE AND HIGH ENERGY RADIATIONS	**9 Hours**

Definition, Generation, characterization, classification of plasma with reference to cold plasma. Low pressure plasma versus atmospheric plasma. Micro discharge versus glow discharge. Corona, DBD, OAUGP. Electromagnetic spectrum. Wavelength and photon energy of electron beam, gamma rays, X-rays, VUV, and UV light. Equipment's based on light source, laser, and electron beam.

SURFACE MODIFICATION BY PHYSICAL METHODS	**9 Hours**

Interaction of plasma and light with substrate and mechanism of modifications. Plasma treatment for enhancement of hydrophilicity, hydrophobicity, shrink proofing of wool, enhancement in dyeing characteristics and for enhancements in pre-treatments. Plasma induce polymerization. Plasma metallisation, plasma cleaning, UV & VUV irradiations, electron beam for irradiations for similar applications.

ENZYME TREATMENT	**9 Hours**

Mechanism of specific interaction of enzymes with substrates. Surface modification of natural and synthetic fibres with enzymes – mechanism, characterization, and challenges.

CHARACTERIZATION	**9 Hours**

Characterization of modified and unmodified textile substrates using FTIR, XPS, SEM, AFM, TEM. Surface characterization challenges.

Total Hours: 45 Hrs

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REFERENCES

1. Pastore C.M. and Kieken P., “Surface characteristics of fibres and textiles,” Marcel Dekker, Inc., New York, 2001.
2. Perkin W.S., “Textile colouration and finishing”, Carolina Academic press, London, 1996.
3. Shishoo R., “Plasma technologies for textiles”, Woodhead Publishing Ltd., Cambridge, 2007
4. Tao X., “Smart fibres, Fabrics and Clothing”, Woodhead Publishing Ltd., Cambridge, 2007.

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Professional Elective 2

Innovation and Technology

Professional Elective 2: Innovation and Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0034	Applied Design Thinking	3	0	0	0	3
P18TME0035	Industrial Design & Development	3	0	0	0	3
P18TME0036	IPR Fundamentals and Patent Drafting	3	0	0	0	3
P18TME0037	Rapid Prototyping Fundamentals	3	0	0	0	3
P18TME0077	Precision Engineering	3	0	0	0	3
P18TME0078	Industrial Automation	3	0	0	0	3
P18TME0079	Industrial Internet of Things	3	0	0	0	3

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P18TME0034	APPLIED DESIGN THINKING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Apply a scientific method to define & test various hypotheses to mitigate the inherent risks in product innovations.
CO2: Demonstrate the learning to identify different beneficiaries & market segments, define the early adopters and choose the target user/buyer from the selected market.
CO3: Design the solution [MUP] concept based on the proposed value defined for the target customer exploring various alternate solutions to achieve value-price fit.
CO4: Develop skills in empathising, critical thinking, analysing, storytelling & pitching.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Project
INDIRECT
1.Course-End survey

Customer-Centric Innovation — **5 Hours**

Introduction to Customer-Centric Innovations-Validation Risk vs Valuation Risk, The Innovators, learn the metrics that matter when evaluating the risk of innovations on the dimensions of Customer Commitment, Customer Acceptance & Customer Motivation to assess the success potential of product innovations.

Problem Validation and Customer Discovery — **10 Hours**

Using tools and techniques of the managed innovation process toolkit (iTools), the Innovators understand the principles of design thinking for need-finding and use the innovation tools and techniques for problem validation and user discovery; learn to find the right buyer beneficiary and the use-case to solve.

Value Proposition — **10 Hours**

Designing and Testing Value Proposition- The value proposition is the most critical part of the customer development process, a compelling value proposition which is quantified and validated will help you determine the Value-Price fit. The innovators learn the process, tools and techniques of Value Proposition Design and learn to build a compelling value proposition for their product/ service

MUP Design — **10 Hours**

Solution Exploration, Concepts Generation and MUP design- The innovators are conceptualizing the solution concept must track their explorations and learnings while building the right prototype assessing the Capability, Usability and Feasibility. They learn the systematic concept generation process and evaluation of the concepts against a set of metrics.

Right Pitch, Pitch Right — **10 Hours**

Using the 3Min Pitch Canvas as the primary template and tool, participants learn the art and science of pitching their startup ideas to the jury of experts.

Total Hours: 45 Hrs

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REFERENCES
1. The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company", by Steven Blank and Bob Dorf Value Proposition Design by Alexander Osterwalder 2. Product Design and Development - Book by Karl Ulrich and Steven D. Eppinger (Chapter 7-Concept Generation

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P18TME0035	INDUSTRIAL DESIGN & DEVELOPMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Understand the product life cycle and management.
CO 2: Sketch UI and UX for the product / prototypes
CO 3: Build rapid prototypes using digital fabrication techniques.
CO 4: Use hand and power tools for building mechanical design for prototypes

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Integrated Product Design and Development	**12 Hours**

Product life cycle - Product design process - product requirement analysis - Design for manufacturability - design for testability - BoM Optimization & Alternate Vendor List - Optimization of Product parameters – Product Test Plan Generation - Product Testing, Validation and Qualification - Introduction to product design tools - QFD, Computer Aided Design – Product Enclosure, Thermal and Packaging analysis - Rapid Prototyping: Digital fabrication techniques - 3D printers - Hand and power tools for product development

UI and UX [User Interface and User Experience]	**12 Hours**

Fundamental concepts in UI & UX - Tools - Fundamentals of design principles - Psychology and Human factors for User Interface Design - Layout and composition for Web, Mobile and Devices - Typography - Information architecture - Colour theory - Design process flow, bet practices in industry - User engagement ethics - Design alternatives

Industrial Design 101	**10 Hours**

Introduction to Industrial Design - Industrial design innovations - Product design animations - Case studies of Industrial design: iPod, iPhone

Product Development Cycle	**11 Hours**

Idea generation - Idea screening - Concept testing - Business analysis - Testing - Quality assurance – Managing the Program and risk analysis

Total Hours: 45Hrs

REFERENCES

1. Integrated Product Design and Development: The product Realisation Process by Edward B. Magrab
2. Industrial Design A-Z by Peter Fiell, Charlotte Fiell
3. Hackernoon blogs on UI & UX

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P18TME0036	IPR FUNDAMENTALS AND PATENT DRAFTING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Have thorough knowledge on fundamental concepts of Intellectual Property.
CO2: Take strategic decisions regarding commercialization of IP.
CO3.Draft the Patent for a product

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Intellectual Property 101	**15 Hours**

Introduction and the need for Intellectual Property Rights - IPR Genesis and Development - Copyright - Trademark - Trade Secret - Geographical Indicators - Industrial Designs - Types of Patent – Sample Patent Application - IPR in INDIA & Global trends - Patent fees

Prior Art Search & Case Studies of IPR	**15 Hours**

Prior Art Search - IP Licensing - IP Commercialization - International agreements - Patent enforcement - IP Infringement- Case Study on Apple vs Samsung, Case study on basmati rice, blackberry case

Fundamentals of Patent Drafting	**15 Hours**

Invention as a concept - Keywords formation - Structure of patent - Key attributes in patent drafting - Drafting provisional specifications - Drafting complete specifications - Draft claims - Case studies on patent drafting

Total Hours: 45Hrs

REFERENCES

1. P.N. Cheremisinoff, R.P. Ouellette and R.M.Bartholomew,Biotechnology Applications and Research, Technomic Publishing Co., Inc. USA, 1985
2. D.Balasubramaniam, C.F.A.Bryce,K. Dharmalingam, J. Green and K. Jayaraman, Concepts in Biotechnology, University Press (Orient Longman Ltd.), 2002
3. Bourgagaize, Jewell and Buiser,Biotechnology: Demystifying the Concepts, Wesley Longman, USA, 2000.

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P18TME0037	RAPID PROTOTYPING FUNDAMENTALS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Define the importance of prototyping for an intrapreneur in Product Development.
CO2: Discover the appropriate approaches for rapid prototyping
CO3: Develop product concepts and prototypes to test the idea

Course Assessment Methods

Direct

1. Midterm Examination
2. Other Assignments
3. End Semester Examination

Indirect

2. Course End survey

Introduction to Rapid Prototyping	**7 Hours**

Prototyping Basics- The Prototyping: Why, What & How? Rapid Prototyping, Rapid Prototyping & Start-up's, Limits of Prototyping, Rapid Prototyping Steps, Rapid Prototyping Types, Intrapreneur Life Cycle & Prototype

Prototyping Techniques	**10 Hours**

Prototyping Techniques - Low fidelity prototype, High fidelity prototype, Paper Prototype & Examples, Wire framing & Tool based Prototype, Case Studies to showcase examples

Digital Prototyping	**10 Hours**

Digital Prototyping - Conceptual Design, Interactive Design Tools, CAD Modelling & Tools foundations, Product Sketching, Additive Manufacturing, Design Principles and Patterns, Examples & Case Studies

Hardware Prototyping	**10 Hours**

Hardware Prototyping- Introduction to EDA, Design & Simulation Tools, Architecture & Schematics basics, Introduction to Development Boards, Sensors, Actuators & Interfaces, Live Examples

Prototype Validation	**8 Hours**

Prototype Validation, Defining Metrics that Matters, Test plan, Validation experiments of Prototypes

Total Hours: 45 Hrs

REFERENCES

Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography", by Paul F. Jacobs

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P18TME0077	PRECISION ENGINEERING	L	T	P	J	C
		1	2	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Identify foundational precision engineering concepts, approaches, and machining.
CO2: Implement expertise in dimensions, tolerancing, quality assurance, and CAD.
CO3: Grasp micro-manufacturing processes, and practical CAD design.
CO4: Analyze fundamental machining techniques, tooling, and quality control.
CO5: Evaluate knowledge of smart structures, materials, and microactuators.

COURSE ASSESSMENT METHODS

DIRECT

1. Midterm Examination
2. Other assessments
3. End Semester Examination

INDIRECT

1. Course-End survey

Precision Engineering 101	**6 Hours**

Introduction to Precision Engineering - Approaches in Precision Machining - Concepts and significance - Classification - Top down - Bottom up approaches - Part Accuracy – errors, accuracy of machine tools – spindle accuracy– displacement accuracy – errors due to numerical interpolation – definition of accuracy of N.C system – errors in the NC machines –feed stiness – zero stability.

Dimensioning, Tolerancing, and Quality Assurance	**12 Hours**

Defining dimensions and key parameters in precision engineering - Geometric Tolerancing - Tolerance Assignments - Tolerance Stack-Up Analysis - Quality Assurance Principles - Statistical Process Control (SPC) - Using statistical methods for quality control - Inspection Methods for Precision Components - Non-destructive testing techniques for assessing component integrity - Calibration and maintenance of precision equipment - Precision Metrology: Measurement Techniques - Hands-On: Introduction to Computer-Aided Design (CAD) for Precision Engineering

Micro-Manufacturing	**9 Hours**

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Overview of Micro-Manufacturing - Materials in Micro - Micro-Manufacturing Processes - Micro-Manufacturing Challenges and Trends - Introduction to energy analysis in machining process - Non-Traditional Micro-Manufacturing - Fundamentals of Micro Electrochemical Machining and Micro Electro-Discharge Machining - Micro-Milling, Micro-Drilling, Micro-Machining, Micro Welding, Micro Casting - Fabrication processes for integrated circuits - Chemical Etching and Micro-Forming - Additive Micro-Manufacturing - Hands-On: Practical CAD Design of Precision Components	
Precision Machining and Machine Tools	**12 Hours**
Fundamentals of Machining - Tooling strategies and workholding techniques specific to micro-machining - Precision Machining Techniques: precision turning, milling, and drilling at the micro-level - Surface Finish and Quality Control in micro-machining - Machine Tool Accuracy and Errors - Effects of machine stiffness and thermal factors on precision - Cutting Forces and Deformation - Heat Sources and Thermal Effects - Achieving desired surface finish and roughness in precision machining - Case Study: Ultra-Precision Machining for Optics	
Smart Structures, Materials, and Micro Actuators	**6 Hours**
Smart structures – Smart materials types and applications – Smart Sensors – Micro Valves, Pumps, Motors, and Dynamometers - Micro Machines and Optics - Overview of MEMS technology and its applications - Case Studies: MEMS Healthcare Device, Smart Material in Aerospace	
	Total Hours: 45 Hrs

REFERENCES

1. “Basics of Precision Engineering” by Richard Leach and Stuart T. Smith
2. “Precision Machining Technology” by Peter J. Hoffman, Eric S. Hopewell, Brian Janes, and Kent M. Sharp
3. “Micromanufacturing Engineering and Technology” by Yi Qin
4. “Smart Structures and Materials” by B. Culshaw
5. “Machine Design with CAD and Optimization” by Sayed M. Metwalli

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P18TME0078	INDUSTRIAL AUTOMATION	L	T	P	J	C
		1	2	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Analyze and interpret pneumatic circuit designs and symbols.
CO2: Demonstrate an understanding of PLC architecture and programming languages.
CO3: Design user-friendly HMIs in line with HMI design principles.
CO4: Understand, Compare and select appropriate industrial communication protocols.
CO5: Demonstrate awareness of the integration of PLCs, HMIs, and SCADA systems.

COURSE ASSESSMENT METHODS

DIRECT

1. Midterm Examination
2. Other assessments
3. End Semester Examination

INDIRECT

4. Course-End survey

Industrial Automation and Control Systems 101	**6 Hours**

Basics of automation in different industries - Introduction to Pneumatics: Principles and uses Key pneumatic components: Compressors, cylinders, valves, actuators - Pneumatic circuit design and symbols - Hands-on session: Building simple pneumatic control circuits and understanding their working.

Basics of Industrial Controllers, PLCs & SCADA	**12 Hours**

Overview of Industrial Controllers and connections -Introduction to PLCs and their role PLC architecture and programming languages (Ladder Logic, Function Block Diagram. etc.) - Basic PLC programming and sequence control - Introduction to IEC 61131 - Understanding PLC input/output modules and addressing - Hands-on: Writing and testing simple PLC programs for basic automation tasks

Human-Machine Interface Development	**7 Hours**

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Introduction to Human Machine Interface (HMI) - Understanding the significance of HMIs - HMI design principles - HMI Software Tools - HMI best practices & safety considerations - Basic HMI scripting and programming - Hands-on session: Creating a simple user-friendly HMI interface for the PLC program in Module 2	
Industrial Communication Protocols	**11 Hours**
Importance of Reliable Communication in Industrial Automation - Serial Communication Protocols - I2C, SPI - Serial Fieldbus protocols, Modbus, OPC, CAN, PROFIBUS - Ethernet, HTTP, TCP/UDI, WiFi, Cloud data logging. Multi-sensor communication, Data parsing between Embedded platforms. Comparative study of Industrial communication protocols - Hands-on: HMI-PLC Communication Setup	
Advanced Automation 101 - SCADA Systems	**9 Hours**
Introduction to SCADA systems -Components of a SCADA system (RTUs, PLCs, HMI) - Basic SCADA Architecture - Integrating PLCs, HMIs, and SCADA systems for Advanced automation - Introduction to DCS (Distributed Control Systems) & Overview of MES (Manufacturing Execution Systems) and their role in industrial automation - Case studies and real-world examples of successful automation and control system implementations, emphasizing efficiency and precision.	
	Total Hours: 45 Hrs

REFERENCES

1. Willian Bolton, Programmable Logic Controllers, 6th edition, Newnes Publications, 2015
2. Richard Zurawski, Industrial Communication Technology Handbook, Second edition, CRC Press, 2014
3. Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, Fourth edition, Pearson Education, 2016
4. Michael J. Hamill, Industrial Communications and Control Protocols, PDH centre, 2016

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P18TME0079	INDUSTRIAL INTERNET OF THINGS	L	T	P	J	C
		1	2	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:Apply foundational knowledge of embedded systems, IoT, and Industry 4.0
CO2:Understand IIoT integration in manufacturing
CO3:Learn IIoT infrastructure and Integration for Smart Manufacturing
CO4:Gain the ability select the correct IIoT communication protocol for any scenarios
CO5:Develop skills to do IIoT Integration using Low Code Platforms

COURSE ASSESSMENT METHODS

DIRECT

1. Midterm Examination
2. Other assessments
3. End Semester Examination

INDIRECT

1. Course-End survey

Basics of Embedded Systems	**7 Hours**

Electronics 101 - Embedded Systems 101 - Embedded Platforms - Sensors & Actuators- Communication Protocols - Industry 4.0, Historical evolution in Industries - Electronics Simulation - Digitalization of Manufacturing Processes - Hands-on: TinerkCAD simulations, Protocol Visualization using Logic Analyzer

IIoT Primer	**10 Hours**

Concepts and Definitions of The Internet of Things (IoT) - Requirements, Functionalists and structure of IoT - IoT enabling technologies - IoT Architecture - Major component of IoT(Hardware & Software) - IoT communication and networking protocols, Role of wired and wireless communication - IoT services and applications - IoT Standards , Connectivity - Introduction to IIoT - IIoT Infrastructure - Embedded Platforms for IIoT - Integration of IIoT in Manufacturing - Case Study: IIoT Infrastructure for Automotive Industry

Smart Manufacturing with IIoT	**8 Hours**

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Smart Manufacturing Concepts - IIoT Applications in QC, QA, PC - Cloud Computing, Edge Computing, Fog Computing, IIoT Data Management and Analytics - Predictive Analytics - Real Time & Data-Driven Decision Making with IIoT - Cybersecurity Challenges in IIoT - IIoT Security Best Practices	
Communication Protocols for IIoT	**10 Hours**
Wireless Sensor Network (WSN) - IIoT Protocols: LoRaWAN, Zigbee, WiFi, BLE, OPC UA, MQTT, CoAP, M2M, XMPP- How to choose the Right Protocol - IIoT Hardware: Sensors, Actuators Hands-on: Real-time Monitoring in Industrial Environments	
Low Code Platform for Industrial IoT Integration	**10 Hours**
Introduction to Node-RED - Why Node-RED for IIoT - Case Studies - Setting up Node-RED, Node-RED Dashboard - Device Integration & Data Acquisition - Dashboard Development - API Integration Overview - Cloud-based data storage and analysis - Automate Actions Based Events - Other Advanced Features Hands-on: Upgrade Module 4 Project with Dashboard & Automation Features	
	Total Hours: 45 Hrs

REFERENCES

1. Industry 4.0: The Fourth Industrial Revolution by Kagermann, H., et al., 2016
2. Digital Manufacturing: Technology, Management and Applications by Karafyllis, I., & Giannopoulos, C., 2019
3. The Industrial Internet of Things: A Cyberphysical Systems Approach by Hedeler, C., & Sudra, A., 2016
4. Smart Manufacturing Concepts by GE Digital: https://www.ge.com/digital/industry/manufacturing-digital-plant
5. IIoT Data Management and Analytics by IBM: https://www.ibm.com/blog/real-time-analytics-on-iot-data/

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Professional Elective 3

Business Management

Professional Elective 3: Business Management		L	T	P	J	C
Course Code	Course					
P18TME0038	Supply Chain Management	3	0	0	0	3
P18TME0039	Nascent Market Strategies	3	0	0	0	3
P18TME0040	Organisation Behavior and Change Management	3	0	0	0	3
P18TME0058	Knowledge Management	3	0	0	0	3
P18TME0059	New Product Strategies	3	0	0	0	3
P18TME0043	Lean Six Sigma	3	0	0	0	3
P18TME0044	Finance for Engineers	3	0	0	0	3
P18TME0045	Digital Marketing	3	0	0	0	3
P18TME0046	Entrepreneurial Mindset & Methods	3	0	0	0	3

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18TME0038	SUPPLY CHAIN MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO 1: Outline operations management environment and label the business information flows.
CO 2: Contrast logistics and supply chain management and infer the increasing significance of logistics.
CO 3: Model the elements of supply chain management and recall its recent trends.
CO 4: Analyze impact of inventory on supply chain management and discuss its major issues.
CO 5: List software packages involved in supply chain planning and model the various steps involved.

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Operations Management Basics	**9 Hours**

Operations Management definition – Transformation Role – Organizational charts - Manufacture versus service organizations – growth of service sectors – Operations management decisions – Historical development – Operations Management environment – Business information flow.

Logistics Overview	**9 Hours**

Logistics versus Supply Chain Management – Contemporary Logistics terms – Logistics and Supply Chain Mission – Physical Distribution costs - Logistics Strategy and Planning – Logistics Strategy Triangle – Increasing significance of logistics – IT and Logistics.

Supply Chain Management Overview	**9 Hours**

Supply Chain Overview - Goals and Importance of Supply Chain Management -Flows in a Supply Chain – Typical Supply Chains –Elements of Supply Chain Management – Strategies for Supply Chain Management – Trends in Supply Chain management – Global concerns.

Supply Chain Inventory	**9 Hours**

Inventory and Inventory systems – Inventory positions in the supply chain – Reasons for inventories – Inventory and value – Functional roles of inventory – Reasons against inventory – Macro and micro issues in inventory management –Inventory management models - Planning supply chain activities.

Supply Chain Planning	**9 Hours**

Dynamics of material flow – Dynamics of order flow – Supply chain planning – definitions, processes and decisions – Software packages – Planning results – Supply Chain Design – Mass customization – Design for Logistics – Supplier Base design.

Total Hours: 45Hrs

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REFERENCES

1. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 5 th edition, 2012.
2. Sunil Chopra and Peter Meind l, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, 5 th edition, 2012.

   BOOKS:
3. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5 th edition, 2013.
4. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill,3 rd edition, 2007.
5. Altekar Rahul V, Supply Chain Management-Concept and Cases, PHI, 3 rd edition, 2005.
6. Shapiro Jeremy F, Modeling the Supply Chain, Thomson Learning, Second Reprint, 2013.
7. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, Principles of Supply Chain Management A Balanced Approach, South-Western, Cengage Learning, 3rd edition, 2011

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P18TME0039	NASCENT MARKET STRATEGIES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Acquaint students with the idea of a new product marketing process such as opportunity identification, concept selection, product design, pre-test, and test marketing, launching and profit management.

CO2: Demonstrate the utility of formal models and approaches in addressing relevant problems involving new products with a greater focus on the use of these models.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Product Marketing	**10 Hours**

Marketing overview, Introduction to various aspects of product marketing, market simulation exercises and case studies. Build, critique, and apply the B2B "buyer persona" to your enterprise or start-up business.

Go-To-Market Plan	**12 Hours**

Understand the process of creating a Go-to-Market plan with clearly defined objectives, effective strategies and realistic tactics to accomplish them - Market entry strategies, new product, process & marketing strategies.

Product Positioning	**12 Hours**

Product positioning and selling value, pricing models & strategies, Life value of customers, preference analysis & benefit segmentation.

Branding Strategies	**11 Hours**

Craft effective product messaging for various stakeholders, managing brand & positioning strategies. Channel Management multiple channels, electronic channels, vertical marketing system. Marketing Metrics, Marketing Action Plan, Financial Projections, Marketing Budget. Controls & contingency planning

Total Hours: 45Hrs

REFERENCES

1. Product Leadership: by Robert G. Cooper, Basic Books; ISBN: 046501433X; (2005).
2. Marketing Engineering: Computer-Assisted Marketing Analysis and Planning, Revised Second Edition, by: Gary L. Lilien and Arvind Rangaswamy; Trafford Publishing ISBN: 1-4120-2252-5
3. The Marketing Game, (2002) by Mason, Charlotte H. & William D. Perreault, Richard D. Irwin. (TMG!) Book with CD-ROM. THIRD Edition. McGraw-Hill.ISBN: 0072513802.

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P18TME0040	ORGANISATION BEHAVIOR AND CHANGE MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the concept of OB and application of OB frameworks
CO2: Understand how people and groups in organisation behave, react, and interpret events in a workplace.
CO3: Understand the theories, process, and models in Organisation development
CO4: Analyse appropriate intervention techniques in the organizational context
CO5: Design a simple intervention strategy to organizational situation

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Organisation Behavior **15 Hours**

Introduction to OB – Focus and Purpose -Need, importance, Nature, Scope, Individual Behaviour – Attitudes: sources and changing attitude– Personality: personality traits; attributes influencing OB; Perception: process, distortion, changing perception – Motivation: Theories and techniques in practice. Group Behaviour -Organisation structure, Influence, Group decision making techniques, Team building, Interpersonal relations, communication.

Organisation Change Management **15 Hours**

Definition, Growth and Relevance of OD, Evolution of OD – Theories of Planned Change – OD Process Entering and Contracting, developing a Contract – Diagnosis – Need for Diagnostic Models, Organizational level, Group Level and individual Level Diagnosis – Diagnostic Information – Collecting, Analysing, Feedback, Survey Feedback

Designing and Implementing Interventions **15 Hours**

Human Process Interventions – Interpersonal and Group, and Organisational Process – Techno structural Intervention – Organisational Design and Restructuring, Work design and Responsibility Charting-Evaluating and Institutionalising OD Interventions-Evaluation Feedback, Measurement, Institutionalisation framework, Indicators of institutionalisation

Total: 45 Hrs

REFERENCES

1. Stephen P Robbins, Timothy A.Judge and Neharika Vohra, Organisational Behavior, Pearson Education, ISBN 9789332500334.FERENCES
2. Aswathappa K, 2014 Organisational Behaviour: Text, Cases & Game, Himalaya Publishing House, ISBN: 9789350515884
3. Donald R.Brown, An Experiential Approach to Organization Development, 8/e, Pearson, ISBN 9789332518339
4. Thomas Cummings, Christopher Worley Organization Development and Change, 10/e, Cengage, ISBN 1305143035, 9781305143036

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P18TME0058	KNOWLEDGE MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Demonstrate a thorough understanding of Knowledge Management Concepts
CO2: Appreciate the importance of Knowledge Management and its implications to different businesses.
CO3: Able to design and implement successful Knowledge Management systems
CO4: Develop practical skills in the implementation and management of Knowledge Management practices across different business domains.
CO4: Learn to Innovate with Knowledge Management and transform Knowledge Management with Artificial Intelligence / Machine Learning

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Introduction to Knowledge Management	**9 Hours**

Understanding Knowledge, Knowledge Attributes – Knowledge Management (KM) definitions, Evolution, Morphology of KM – Why KM – need for KM – Scope of KM – Drivers, Triggers, and opportunities for KM - evaluation of current trends in knowledge management

Understanding Knowledge Management	**9 Hours**

KM Life cycle - KM Processes and Frameworks – Knowledge Creation, Sharing, Transfer - KM Practices and Strategies – Enabling conditions – Knowledge Audit – Knowledge Maps - Knowledge Discovery and Data Mining

Technology in Knowledge Management	**9 Hours**

Knowledge Management System (KMS) – Tools and Technologies in building a KMS - Challenges in setting up a KMS – Risks, Security and Controls - Taxonomy – Content Management - Collaborative Technologies - KMS as Expert Systems – Business Intelligence and KM – Knowledge based organizations

Driving Successful Knowledge Management	**9 Hours**

KM Maturity Models – KM Techniques – Enabling organisations to achieve sustainable competitive advantages - KM Culture – Driving engagement and managing change – Communities - KM Maturity and Measurement – Governance and Leadership - Role of CKO – KM Org Structure and Skillsets

Transforming Knowledge Management With AI/Ml	**9 Hours**

A case of KM Implementation – Best Practices in actualizing effective KM - KM and Innovation – Transforming KM with AI/ML – knowledge discovery and content intelligence – Recommendation systems - KM Analytics – Taking KM to the next level

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Total Hours: 45Hrs

REFERENCES

1. Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation by Dorothy-Leonard-Barton
2. Knowledge Management Tools and Techniques: Practitioners and Experts Evaluate KM Solutions, Madanmohan Rao
3. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David Schum (2016), Knowledge Engineering: Building
4. Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press
5. Davenport, T.H., Harris, J.G., 2007, Competing on Analytics: The New Science of Winning, Harvard Business School Press.
6. Becerra-Fernandez, I., Gonzalez, A., Sabherwal, R., 2004, Knowledge Management: Challenges, Solutions, and Technologies, Pearson Prentice Hall, ISBN: 0-13-101606-7.
7. Wenger, E. C. and W. M. Snyder, 2000, "Communities of practice: The organizational frontier."Harvard Business Review 78(1): 139.
8. Hansen, MT., Nohria, N., & Tierney, T., 1999, “What is Your Strategy for Managing a Knowledge”, Harvard Business Review, 77(2).
9. Davenport, T.H., Prusak, Laurence, 1998, “Working Knowledge: How Organizations Manage What They Know”, Harvard Business School Press.

BOS Chairman Signature	V.Ramesh Babu,

P18TME0059	NEW PRODUCT STRATEGIES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Apply tools & techniques to identify new opportunities and develop new ideas
CO2: Determine the layers in the design & development of the product, with specific classification on the requirements on software, hardware and integration.
CO3: Explain the approach for any product/services throughout its lifecycle - discovery, development, manage & market
CO4: Discuss the advantages of agile product development
CO5: Develop a roadmap for a new innovative product and predict its evolution & growth.

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Understanding concept of New Product	**10 Hours**

How to Come Up with New Product Ideas - What is a New Product? Is it a New feature on an existing product? A new add-on to an existing product? A brand-new company? A sister product? Learn to understand, observe the market, client, the technology, and the limitations and solve an existing problem for people.

Deep Dive into Solutions Components	**10 Hours**

Deep Dive into Solutions Components- Advantages and Disadvantages of a S/W only product, Open Source issues, IP Protection Issues, Cloud Vs. On-Premise - Advantages and Disadvantages of a H/W only product, issues of manufacturing, lead time, forecasting, Inventory, and supply chain - migration strategies from one to the other.

Deep Dive into Business Solutions	**10 Hours**

Deep Dive into Business Solutions-Introduction to all 5 types: Product, PAAS, Service, Service-As-A-Result, Results only. Product: upfront recognition of revenue Vs. Delayed gratification. Product as a service: Reuse of product downstream. Service: Pay as you go, Time of use model, Downside of cost recovery. Service - as a - Results: Frictionless customer

Which Strategy Is Right for You?	**15 Hours**

Which Strategy is right for you? Manage the operations across the entire supply chain from associating with the vendors, sourcing components to meet the requirements, handle delivery and logistic operations, identify and return defective parts, etc and also build stronger linkages with supply-chain to optimise working capital needs. Sense opportunities by identifying where profit will be as your industry evolves and determine which operations are critical to be done in-house and which operations can be outsourced.

Total Hours: 45 Hrs

REFERENCE

1. Founders at Work: Stories of Startups' Early Days" by Jessica Livingston Crossing the Chasm - A Book by Geoffrey Moore.

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P18TME0043	LEAN SIX SIGMA	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Explain the concepts of Lean six sigma
CO2. Apply DMAIC tools for process improvement

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Problem Solving - Tools & Methodology	**4 Hours**

Introduction to Lean Six Sigma, History and advantages, Fundamentals of Quality Management, Benefits, Introduction to QC tools, Application, Implementation

Lean Tools	**4 Hours**

7 Wastes, Identification of Muda, 5S, Poke Yoke, SMED, TPM, Value Stream Mapping - Kanban

DMAIC Approach	**10 Hours**

Introduction to DMAIC phases and approach**,** Define: Problem definition, improvement activity, opportunity for improvement, project goals, customer (internal and external) requirements, Measure: Parameter(s) considered to measure process performance, Analyse: Determination of root causes of variation or poor performance, Improve: Improvement in the process performance by addressing the root causes, Control: Process monitoring and control

Statistical Quality Control	**6 Hours**

Statistics concepts and measures, Measures of Central Tendency, Measures of dispersion, Descriptive approach - Properties of normal distribution, Charts and Box Plot Theory and application, Overview of SPC charts -X Bar & R Chart preparation

Overview of Six Sigma	**5 Hours**

Introduction to Six Sigma, Understanding Six Sigma, Implementing Lean Six Sigma

- KAIZEN methodology	

DMAIC Methodology	**5 Hours**

Define Phase: CTQ, Project Charter, Milestone, SIPOC, QFD Chart, Value Stream Map, Process Flow Diagram, Measure Phase: Ishikawa Diagram, Root cause analysis, Data Collection, Introduction to Minitab Software, Sigma Level Calculation, Analyze Phase**:** Statistical Hypothesis Testing for Mean, Variance and Proportions, Dealing with non-normal data, Regression Analysis, FMEA, Improve and Control Phase**:** SPC, Kaizen and Mistake Proofing

Statistical Analysis	**6 Hours**

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Hypothesis tests - Test of independence, ANOVA (One way), Simple Regression and Multiple regression Analysis using Minitab	
Project	**5 Hours**
Application of DMAIC methodology, Report submission	
	Total Hours: 45Hrs

REFERENCES

1. Agile Project Management For Dummies Paperback – 4 May 2012 by Mark C. Layton
2. Agile Estimating and Planning (Robert C. Martin) Paperback – Illustrated, 1 November 2005 by Mike Cohn
3. Scrum Mastery: From Good to Great Servant Leadership Paperback – 1 June 2013 by Geoff Watts

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P18TME0044	FINANCE FOR ENGINEERS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Critically evaluate project and prepare financial information in a clear accurate way.
CO2: Demonstrate a critical understanding of the use of financial information for management decision making and control.
CO3: Demonstrate the applicability of the concept of financial management to understand the managerial decisions and also to know the impact of cost of capital and capital structure.

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments. 3. End Semester Examination
INDIRECT
1.Course-End survey

Financial Statement	**9 Hours**

The terminology of understanding and the structure and control of the main financial statement used by business organisations – the role and use of different financial statements. -different techniques of financial statement analysis.

Accounting Techniques	**9 Hours**

The use of Management accounting techniques for business planning and decision making – Business budgeting and budgetary control – applications of marginal costing,

Financial Management	**9 Hours**

Financial management – objectives – scope – profit vs wealth maximisation – Time value of money- recent trends in primary and capital. - role and functions of financial administration

Investment Appraisal Techniques	**9 Hours**

The use of investment appraisal techniques in business undertakings – pay back periods – Net present value – Internal rate of return - Average rate of return – Profitability index – capital rationing. - cost of capital – capital structure

Working Capital	**9 Hours**

Management of working capital – sources of working capital – Estimation of working capital – Management of working capital – cash, receivables, and inventory management. - venture capital

Total Hours: 45Hrs

REFERENCES

1. Shashi K.Gupta ; Management Accounting Principles and Practice , Kalyani publishers 13th edition
2. Pandey.I.M.; Financial Management, Vikas Publishing House Pvt Ltd,2015 edition

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P18TME0045	DIGITAL MARKETING	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1. Summarise the Digital Marketing concepts
CO2: Apply the Digital Marketing concepts in various business situations.
CO3: Develop and implement effective digital marketing strategies in business organisation.

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Introduction to Digital Marketing	**3 Hours**
Concepts, Key elements, Social media networking sites, characteristics & Implications of Digital Marketing	
Search Engine Optimizations	**6 Hours**
Concepts, Benefits of SEO, Search Behaviour, Optimization process, Analysis and review	
Pay Per Click	**5 Hours**
Concepts, Strength of pay per click, Keyword, Search Campaign Process, Analytics	
Digital Display Advertising	**6 Hours**
Concepts, advantages & Disadvantages of digital display, Ad formats, campaign planning and budget, campaign tracking and optimization.	
E - Commerce	**2 Hours**
Portals and Communities – tie ups	
Email Marketing	**4 Hours**
Data Email Marketing Process, Design and Content, Delivery and Discovery	
Social Media Marketing	**5 Hours**
Goals, channels – Face book, Twitter, LinkedIn, Google+, YouTube, insights and analytics	
Mobile Marketing	**4 Hours**
Concepts, SMS content, SMS Strategy, Mobile App, Mobile Advertising	

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Digital Analytics	**10 Hours**
Dashboards, Bounce Rate, Site Speed, Site Search, Conversions, Real Time Reporting, Intelligence Reporting, Customized Reporting	
	Total Hours: 45Hrs
REFERENCE	
1. Ian Dodson (2016), The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns, New Jerssey, John Wiley & Sons.	

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P18TME0046	ENTREPRENEURIAL MINDSET AND METHODS	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Develop an entrepreneurial mindset that will help them identify, assess, shape & act on opportunities in a variety of contexts & organisation.
CO2: Practise effectual reasoning to drive entrepreneurial success.
CO3: Assess the minds & methods of expert entrepreneurs to learn from their experience the lessons from failures & success.
CO4: Demonstrate learning the entrepreneurial mindset and method by doing.

Course Assessment Methods

DIRECT
1. Mid Term Assessment 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-End survey

Introduction — **10 Hours**

Introduction to Innovation-led, tech-powered entrepreneurship- Practical proven tools for transforming an idea into a product or service that creates value for others- Differentiate bad ideas from good- Building a winning strategy, Defining the value proposition, preparing a business model, compare the innovation to existing solutions, build flexibility into their plan and determine to pivot/quit.

Entrepreneurship Mindset — **10 Hours**

Entrepreneurship mindset - dealing with unknown & unknown - Entrepreneurial mindset is critical to being successful as an entrepreneur- understanding of the attributes and perspectives of an entrepreneurial mindset, and the process to acquire. Concepts that enables a person to start a transformative process in the way they think generally, and in the way they think about business specifically.

Effectuation — **10 Hours**

Effectuation - The 5 principle of effectual entrepreneurship - principles and tools of causal reasoning, the exact inverse of the effectual reasoning that drives entrepreneurial success. In causal reasoning, it begins with a specific goal and a given set of means for reaching it but in effectual reasoning, it starts with only a set of means in the process of deploying them, and goals gradually emerge. Principles of effectuation as an approach to entrepreneurship and it shall help the students identify the next, best step to solve the problem that they are working on.

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Experimentation	**15 Hours**
Learning from failures- Starting a technology powered innovation led enterprise comes with its share of risk. Hence it is important to read through many failure case studies and gain the knowledge to help them make better business decisions & to learn to learn from failures.	
	Total Hours: 45Hrs
REFERENCES	
1. Required Textbook: "The Startup Owner's Manual: The Step-by-Step Guide for Building a Great Company," by Steven Blank and Bob Dorf **2.** Effectuation: Elements of Entrepreneurial Expertise, by Dr.Saras Sarasvathy, New Horizons in Entrepreneurship series	

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Professional Elective - 4

Information Technology

Professional Elective 4. Information Technology		L	T	P	J	C
Course Code	**Course**					
P18TME0047	Data Mining Techniques	3	0	0	0	3
P18TME0048	Data Science & Analytics with Python	3	0	0	0	3
P18TME0049	Data Visualization	3	0	0	0	3
P18TME0050	Big Data Technologies	3	0	0	0	3
P18TME0051	Block Chain Technology	3	0	0	0	3
P18TME0052	Artificial Intelligence	3	0	0	0	3

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P18TME0047	DATA MINING TECHNIQUES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain the techniques for data pre processing.
CO2: Apply association rules algorithm for correlation analysis
CO3: Apply decision tree algorithm for classification.
CO4: Apply Bayesian networks algorithm for classification.
CO5: Apply various clustering algorithms for different datasets.
CO6: Estimate the classifier accuracy with training, testing and cross validation datasets

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1. Course-End survey

Introduction to Data Mining and Preprocessing — **9 Hours**

Data mining - Related technologies - Machine Learning, DBMS, OLAP, Statistics - Data Mining Goals - Stages of the Data Mining Process - Data Mining Techniques - Knowledge Representation Methods – Applications. Data preprocessing- Data cleaning- Data transformation - Data reduction - Discretization and generating concept hierarchies

Classification Algorithms I — **9 Hours**

Association rules: Basic idea: item sets - Generating item sets and rules efficiently - Correlation analysis Classification: Basic learning/mining tasks - Inferring rudimentary rules: 1R algorithm - Decision trees - Bayes Classification Methods - Rule-Based Classification - Model Evaluation and Selection - Techniques to Improve Classification Accuracy

Classification Algorithms — **9 Hours**

Bayesian Belief Networks - Classification by Back propagation - Support Vector Machines - Classification Using Frequent Patterns - k-Nearest-Neighbor Classifiers - Case-Based Reasoning- Multiclass Classification - Semi-Supervised Classification- Mining Time series Data, Periodicity Analysis for time related sequence data

Clustering — **9 Hours**

Basic issues in clustering - First conceptual clustering system: Cluster/2 - Partitioning methods: k-means, expectation maximization (EM) - Hierarchical methods: distance-based agglomerative and divisible clustering - Conceptual clustering: Cobweb

Outlier Detection — **9 Hours**

Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity Based Approaches, Clustering-Based Approaches, Classification-Based Approaches, Mining Contextual and Collective Outliers, Outlier Detection in High-Dimensional Data

Total Hours: 45 Hrs

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REFERENCES
1.Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Fourth Edition), Morgan Kaufmann, 2016 2.Jiawei Han, MichelineKamber, Jian Pei, “Data Mining Concepts and Techniques”, Morgan Kaufman Publications, Third Edition, 2011. 3.Pang-NingTan, Michael Steinbach, Vipin Kumar,” Introduction to Data Mining”, Pearson,20166. Gerry Cooklin, Steven George Hayes and John McLoughlin, “Introduction to Clothing Manufacture”, Wiley-Blackwell, 2006

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P18TME0048	DATA SCIENCE & ANALYTICS WITH PYTHON	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain the roles and stages of data science projects
CO2: Describe the data structures provided by NumPy library for arrays and vectorized computation
CO3: Explain data structures provided by pandas library for data analysis
CO4: Perform data wrangling, cleaning and transformation using python
CO5: Use Matplotlib for plotting and visualizing the datasets CO6: Demonstrate data aggregation and time series analysis using python programming Language

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-End survey

Introduction to Data Science	**5 Hours**

Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation.

NumPy Basic: Arrays	**6 Hours**

The NumPy Ndarray: A Multidimensional Array Object – Universal Functions: Fast Elementwise Array Functions – Data Processing Using Arrays

Vectorization Computation and Pandas	**7 Hours**

File Input and Output with Arrays – Linear Algebra – Random Number Generation – Random Walks. Introduction to pandas Data Structures – Essential Functionality – Summarizing and Computing Descriptive Statistics – Handling Missing Data – Hierarchical Indexing – Other pandas Topics

Data Loading, Storage, And File Formats & Data Wrangling: Clean, Transform, Merge, Reshape	**9 Hours**

Data loading, storage, and file formats: Reading and Writing Data in Text Format – Binary Data Formats – Interacting with HTML and Web APIs – Interacting with Databases – Data wrangling: clean, transform, merge, reshape Combining and Merging Data Sets – Reshaping and Pivoting – Data Transformation – String Manipulation – USDA Food Database

Plotting and Visualization	**9 Hours**

A brief Matplotlib API Primer – Plotting Functions in pandas – Plotting Maps: Visualizing Haiti Earthquake Crisis Data – Python Visualization Tool Ecosystem

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Data Aggregation and Group Operations & Time Series	**9 Hours**
Group by Mechanics – Data Aggregation – Group-wise Operations and Transformations – Pivot Tables and Cross-Tabulation TIME SERIES: Date and Time Data Types and Tools – Time Series Basics – Date Ranges, Frequencies, and Shifting – Time Zone Handling – Periods and Period Arithmetic – Resampling and Frequency Conversion – Time Series Plotting – Moving Window Functions – Performance and Memory Usage Notes	
	Total Hours: 45Hrs

REFERENCES

1. Wes McKinney, "Python for Data Analysis", O'Reilly Media.2012
2.Sebastian Raschka, “Python Machine Learning”, Packpub.com,2015
3. https://www.datacamp.com/courses/statistical-thinking-in-python-part-1

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P18TME0049	DATA VISUALIZATION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Explain principles of visual perception.
CO2: Apply core skills for visual analysis
CO3: Describe visualization for time-series analysis and ranking analysis.
CO4: Explain visualization for deviation analysis and distribution analysis.
CO5: Describe visualization for correlation analysis and multivariate analysis.
CO6: Summarize issues and best practices in information dashboard design.

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-end survey

Core Skills for Visual Analysis	**9 Hours**

Information visualization – effective data analysis – traits of meaningful data – visual perception –making abstract data visible – building blocks of information visualization – analytical interaction – analytical navigation – optimal quantitative scales – reference lines and regions – trellises and crosstabs – multiple concurrent views – focus and context – details on demand – over-plotting reduction – analytical patterns – pattern examples.

Time-Series, Ranking, And Deviation Analysis	**9 Hours**

Time-series analysis – time-series patterns – time-series displays – time-series best practices – part-to-whole and ranking patterns – part-to-whole and ranking displays – best practices – deviation analysis – deviation analysis displays – deviation analysis best practices.

Distribution, Correlation, And Multivariate Analysis	**9 Hours**

Distribution analysis – describing distributions – distribution patterns – distribution displays – distribution analysis best practices – correlation analysis – describing correlations – correlation patterns – correlation displays – correlation analysis techniques and best practices – multivariate analysis – multivariate patterns – multivariate displays – multivariate analysis techniques and best practices.

Information Dashboard Design	**9 Hours**

Information dashboard – Introduction– dashboard design issues and assessment of needs – Considerations for designing dashboard-visual perception – Achieving eloquence.

Graphics and Critical Design Practices	**9 Hours**

Advantages of Graphics _Library of Graphs – Designing Bullet Graphs – Designing Sparklines – Dashboard Display Media –Critical Design Practices – Putting it all together- Unveiling the dashboard.

Total Hours: 45Hrs

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REFERENCES

1. Ben Fry, "Visualizing data: Exploring and explaining data with the processing environment", O'Reilly, 2008.
2. Edward R. Tufte, "The visual display of quantitative information", Second Edition, Graphics Press, 2001.
3. Evan Stubbs, "The value of business analytics: Identifying the path to profitability", Wiley, 2011.
4. Gert H. N. Laursen and Jesper Thorlund, "Business Analytics for Managers: Taking business intelligence beyond reporting", Wiley, 2010.
5. Nathan Yau, "Data Points: Visualization that means something", Wiley, 2013.
6. Stephen Few, "Information dashboard design: Displaying data for at-a-glance monitoring", second edition, Analytics Press, 2013.
7. Stephen Few, "Now you see it: Simple Visualization techniques for quantitative analysis", Analytics Press, 2009.
8. Tamara Munzner, Visualization Analysis and Design, AK Peters Visualization Series, CRC Press, Nov. 2014

BOS Chairman Signature	V.Ramesh Babu,

P18TME0050	BIG DATA TECHNOLOGIES	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Identify applications require big data technologies
CO2: Explain Hadoop Architecture - HDFS, YARN and Map Reduce
CO3: Perform administration and configuration of Hadoop Ecosystem
CO4: Write basic queries and scripts in Hive and Pig
CO5: Write advanced queries and scripts using hive and pig - aggregation, joins, sorting
CO6: Discuss the need of HBase and write queries to use HBase as data source for Big Data

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-end survey

Introduction to Big Data — **9 Hours**

Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

Introduction to Hadoop — **9 Hours**

Big Data – Apache Hadoop & Hadoop Eco-System – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

Hadoop Architecture — **9 Hours**

Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., Name-Node, Secondary Name-Node, and Data-Node, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

Hadoop Ecosystem and Yarn — **9 Hours**

Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features – Name-Node High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

HIVE AND HIVEQL, HBASE — **9 Hours**

Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting and Aggregating, Map Reduce Scripts, Joins &Subqueries, HBase concepts - Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Total Hours: 45Hrs

REFERENCES

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.

2. Chris Eaton, Dirk derooset al., “Understanding Big data”, McGraw Hill, 2012.

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3. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.
4. Vignesh Prajapati, “Big Data Analytics with R and Haoop”, Packet Publishing 2013.
5. Tom Plunkett, Brian Macdonald et al, “Oracle Big Data Handbook”, Oracle Press, 2014.
6. http://www.bigdatauniversity.com/
7. JyLiebowitz, “Big Data and Business analytics”,CRC press, 2013.

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P18TME0051	BLOCK CHAIN TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1 Discover the secure and efficient transactions with Bitcoin
CO2 Identify and analyze the applications of Bitcoin script
CO3 Experiment with Bitcoin mining
CO4 Develop private Block chain environment and develop a smart contract on Ethereum
CO5 Build the Hyperledger architecture and the consensus mechanism applied in the Hyperledger

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Assignment; Presentation 3. End Semester Examination
INDIRECT
1.Course-end survey

Cryptocurrency and Blockchain - Introduction	**9 Hours**

Cryptography and Cryptocurrency- Anonymity and Pseudonymity in Cryptocurrencies-Digital Signatures-Crypto currency Hash Codes. Distributed networks-Block chain- An Introduction Distinction between databases and Block chain- Distributed Ledger-Block chain ecosystem - Block chain structure- Block chain technology- Working -Permissioned and permission-less Block chain

Bitcoin and Blockchain	**9 Hours**

Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions- Parameters that invalidate the transactions- Scripting language in Bitcoin Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem

Bitcoin Mining	**9 Hours**

Purpose of mining- Algorithm used in mining- Mining hardware- Bitcoin mining pools- cloud mining of Bitcoin -Mining Incentives-Security and centralizations

Ethereum	**9 Hours**

The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum different stages of a contract deployment- Viewing Information about blocks in Blockchain Developing smart contract on private Blockchain- Deploying contract from web and consol

Hyperledger	**9 Hours**

Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers - Application programming interface- Application model -Hyperledger frameworks - Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants

Total Hours: 45Hrs

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REFERENCES
1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018 2. Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016.

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P18IME0052	ARTIFICIAL INTELLIGENCE	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Identify problems that are amenable to solution by AI methods.
CO2: Identify appropriate AI methods to solve a given problem.
CO3: Formalize a given problem in the language/framework of different AI methods.
CO4: Implement basic AI algorithms.
CO5: Summarize the need for AI in Robotics

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Assignment; Presentation
3. End Semester Examination

INDIRECT

1.Course-end survey

Introduction to AI and Production Systems — **9 Hours**

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.

Representation Knowledge — **9 Hours**

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Knowledge Inference — **9 Hours**

Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory

Learning — **9 Hours**

Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

AI In Robotics — **9 Hours**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics

Total Hours: 45Hrs

REFERENCES

1. Kevin Night and Elaine Rich, Nair B., “Artificial Intelligence (SIE)”, Mc Graw Hill 2008
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.

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3. David Jefferis, “Artificial Intelligence: Robotics and Machine Evolution”, Crabtree Publishing Company, 19992

4. Peter Jackson, “Introduction to Expert Systems”, 3 rd Edition, Pearson Education, 2007.

5. Stuart Russel and Peter Norvig “AI – A Modern Approach”, 2 nd Edition, Pearson Education 2007.

6. Deepak Khemani “Artificial Intelligence”, Tata Mc Graw Hill Education 2013.

7. http://nptel.ac.in

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Professional Elective 5

Sustainability

Professional Elective 5: Sustainability		L	T	P	J	C
Course Code	**Course**					
P18TME0053	Environmental Sustainability	3	0	0	0	3
P18TME0054	Industrial Sustainability	3	0	0	0	3
P18TME0055	Supply Chain and Procurement Sustainability	3	0	0	0	3
P18TME0056	Textile Sustainability and Innovation	3	0	0	0	3
P18TME0057	Circular Economy for Enterprise Innovation	3	0	0	0	3

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P18TME0053	ENVIRONMENTAL SUSTAINABILITY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the drivers and enablers of Environmental Sustainability
CO2. Appreciate the smartness in timeline and evolution of Sustainability
CO3. Able to outline the various sustainable systems and methods to fight climate change
CO4. Demonstrate critical thinking in implementation of sustainability in day to day activities.
CO5. Understand the opportunities, challenges of Sustainability and how organizations and individuals should prepare to reap the benefits

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Examination
INDIRECT
1.Course-end survey

Introduction to Sustainability	**5 Hours**

Definition and Terminology – 3 dimensions of Sustainability – Circles of Sustainability – 7 modalities – Resiliency – Principals and Concepts – Scale and context – Consumption – Sustainability Development goals; Computational Sustainability

International Framework on Sustainability	**5 Hours**

International Frameworks Global Reporting Initiative Sustainability standards – UN Global Compact (Communication on Progress) – The International Integrated Reporting Council (IIRC) International Framework on Sustainability – Reference Standards – ASTM Sustainability standards – United Nations Forum on Sustainability Standards – Dow Jones Sustainability Indices – Leadership in Energy and Environmental Design (LEED) – Global Sustainability Standards Boards by GRI.

Challenges in Environment	**15 Hours**

Pollution – Air, Water, Land and Noise; Loss of Bio-diversity; Deforestation; Climate Change; Ozone depletion; Greenhouse gas emissions(GHG); Global Warming; Melting of Polar ice caps – Rise in sea water level; Degradation of Conventional Natural Resources; World Population Explosion; Ocean Acidification; Acid Rain; Waste Disposal – Landfills; Hazardous waste; Natural calamities; Extinction of Species – Endangered Species;

Fighting Climate Change	**20 Hours**

Sustainable design; Micro-Sustainability; Sustainability and Systematic change resistance – Applied Sustainability; Carbon footprint – Sustainable Architecture – Sustainable Buildings – Green Buildings – Sustainable Urban Planning – Sustainable city – Smart city – Sustainable Living – Sustainable Transportation; Anti-consumption a part of sustainable lifestyle; Sustainable Agricultural Practices; Sustainability Sanitation; Computational Sustainability; Sustainability in Businesses and Industries; Rain water Harvesting – Afforestation – Desiltation

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of ponds; ISO 50000 Environmental Management – Environmental Impact Assessment – Risk Assessment – Continuous Monitoring and Auditing – Contract Compliance services – Corporate Social Responsibility(CSR) Compliance – Clean Development Mechanism – Bioremediation – Carbon Trading – Water risk assessment – Water scarce areas – Water stress areas Measures and Technologies to reduce water consumption – Watershed Management; Social Governance – Sustainability claims – Eco labels – Sustainability certificates;
Total Hours: 45Hrs
REFERENCES
1. Rachel Carson, "Silent Spring", Mariner books First Publication 1962. 2. David Wallace – Wells, "The Uninhabitable Earth: Life after warming", Tim Duggan Books, 2019 3. Krishna Rubigha, "ISESR's Handbook on Sustainability", International Society for Energy and Sustainability Research, 2019.

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P18TME0054	INDUSTRIAL SUSTAINABILITY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the drivers and enablers of Industrial Sustainability
CO2. Appreciate the advanced technologies in implementation of Industrial Sustainability
CO3. Able to outline the various systems used in a Life Cycle Analysis
CO4. Appreciate the power of Clean and Lean Manufacturing
CO5. Understand the opportunities, challenges brought about by Corporate Social Responsibility and how organizations and individuals should prepare to reap the benefits

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Other Assignments
3. End Semester Project

INDIRECT

1.Course-end survey

Introduction to Life Cycle Analysis	**4 Hours**
Goal Definition & Scoping – Inventory Analysis – Impact Assessment – Interpretation – Full Cost Accounting	
Clean & Lean Manufacturing	**4 Hours**
Pollution Prevention – Elimination of Downtime – Relation between Lean Manufacturing & Waste Reduction – Ambition of No waste	
Waste – Value Stream Mapping (VSM)	**4 Hours**
Identification of waste through VSM – Timelines – Material Lines – Future state maps	
Waste Management Hierarchy	**4 Hours**
Source Reduction & Reuse – Recycling & Compositing – Energy Recovery - Disposal	
Beyond Traditional 3R's	**5 Hours**
Reduce – Reuse – Recycle; New Age 3 R's – Rethink – Reject – Recover	
Energy Efficiency for Manufacturing	**6 Hours**
Economic Imperative – Energy Security – Environmental Impacts – Energy Efficiency Opportunities – Energy Auditing	
How Manufacturers Pay for Energy	**5 Hours**
Fuel Costs – Consumption charges – Demand charges – Transmission charges – Power Factor Adjustments – Fuel Adjustment Charges	
Corporate Social Responsibility	**8 Hours**
Stakeholder Theory – Institutional Theory – Partnerships with NGOs – Dow Jones Sustainability – FSTE4Good – Social Report & Accounting – Shift towards Environmental, Social and Corporate Governance (ESG)	

Industrial Sustainability Project	**5 hours**
	Total Hours: 45Hrs

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REFERENCES
1. Salah M. El -Haggar, “Sustainable industrial Development and Waste Management”, Elsiever, 2007. 2. Gabrie Ibrahim, “Sustainability in Manufacturing Enterprises,” Springer, 2016

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P18TME0055	SUPPLY CHAIN AND PROCUREMENT SUSTAINABILITY	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Understand the drivers and enablers of Supply chain Sustainability
CO2. Appreciate the smartness in FMCG Supply chain, Inventory and Logistics
CO3. Able to outline the various sustainable systems used in a manufacturing industry
CO4. Appreciate the power of carbon strategies to fight climate change
CO5. Understand the opportunities, challenges brought about by Supply chain and Procurement Sustainability and how organizations and individuals should prepare to reap the benefits

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3.End Semester Examination
INDIRECT
1.Course-end survey

Introduction to Supply Chain Management — **9 Hours**

Fundamentals of Supply chain – Customer Management processes – Demand Management Processes - Supply chain structure design – Supply chain uncertainty – Supply chain complexity – Evaluation of Supply chain strategy – Information flow design – Risk and Resilience development in Supply chains – Integration of Sustainability with Supply chain procurement.

Green Purchasing Fundamentals — **9 Hours**

Design for environment principles - International green labelling – Ecolabels – Green Information systems – Green product standards -Environmentally preferred purchasing - Green purchasing program development – Principles and standards for Procuring sustainably – BS 8903 – ISO 20400 – Drivers for Sustainable Procurement – Setting Sustainable Procurement Priorities – Sustainable Procurement Plan and Policy – Sustainable Risk assessment – Adoption of sustainable practices in Product design – Ethical Sourcing – Manufacturing – Packaging – Transportation – Warehousing and storage – Wholesale and retail trade – Consumption and customer service – End use – Green reverse logistics.

Carbon Strategies — **9 Hours**

Climate strategy and Carbon policy - Supporting GHG emission reduction - Tools for tracking emissions – Carbon Mapping – Carbon footprint – Logistics and Transport Sector Carbon footprint – Total supply chain Carbon footprint – Assessing Value chain emissions – Carbon Emissions Modelling – ISO 14000 – Emission Vs Performance –Emission laws – Waste management – Closed Loop Supply Chain – Concepts and Characteristics – Carbon efficient supply chains – Supply chain decarbonization – Enabling Low Carbon Production – Optimized Networks – Energy Efficient Buildings – Packaging design initiatives – Modal Switches in Transportation – Nearshoring – Carbon Offsetting – Increased Home Delivery – Carbon labelling.

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Green Logistics and Transportation	**9 Hours**
Logistical factors in green Transportation - Energy efficiency in 3PL operations – EPA smart-way program – Changing Internal Company Practices – Impacting Supply chain practices – Environmental Logistic Performance Index – Oil intensity – Emissions Intensity – Transportation modes – Green Transportation Challenges – Reverse Logistics – Renewable Energy & Biofuels – Hybrid Vehicles.	
Selection Criteria for Sustainable Vendors	**9 Hours**
Sustainable selection criteria – Supplier pre-qualification – Criteria for proposal/tender evaluation – Whole life costing techniques – Developing Key Performance Indicators (KPI) – Upstream partners – Downstream partners – Economic, Social, Environmental and Financial Factors.	
	Total Hours: 45Hrs
REFERENCES	
1. Joelle Moranna, "Sustainable Supply Chain Management," Wiley books, 2013. 2. Bouchery**,** Y., Corbett**,** C.J., Fransoo, J.C., Tan**,** T. (Eds.): Sustainable Supply Chains: A Research based text book on Operations and Strategy	

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P18TME0056	TEXTILE SUSTAINABILITY AND INNOVATION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Demonstrate a thorough understanding of Sustainable Textile Concepts
CO2: Appreciate the importance of Sustainable Textile and its implications to different businesses.
CO3: Be able to design and implement successful Sustainable Textile systems
CO4: Develop practical skills in the implementation and management of Sustainable Textile practices across different business domains.
CO4: Learn to Innovate with Sustainable Textile
CO5: Transform Sustainable Textile with Artificial Intelligence / Machine Learning

Course Assessment Methods

DIRECT

1. Midterm Examination
2. Other Assignments
3. End Semester Project

INDIRECT

1.Course-end survey

Introduction to Sustainable Fashion	**3 Hours**

Agendas of Sustainable Fashion – Social Agenda – Economic Agenda – Economic agenda – Cultural Agenda; Critical Planetary Boundaries – Sustainable Development Goals

Hazard Assessment of Effect & Process Chemicals	**7 Hours**

Behaviour of Textile Chemicals in Waste water and Sewage sludge treatment – Waste water relevant characteristics of textile chemicals – Biodegradability or eliminability of textile chemicals

Usage and Production of Fibre From Renewable Sources	**7 Hours**

Manmade Cellulosic fibres – Synthetic Fibres from Vegetable oil/starch – Biopolymers – Production Modification – Usage of Textile Chemicals from Biopolymers – Biofuel based Auxiliaries – Natural dyestuffs.

Certifications / Eco-Labels	**10 Hours**

Voluntary Certification Schemes for Textile raw materials, textile chemicals and textile products – Cradle to Cradle – Bluesign – Global Organic Textile Standard (GOTS) – OEK – TEX 100 – Biopreffered;

Designing of Sustainable Fashion	**10 Hours**

Concepts & Approaches – Dematerialization – Durability – Zero waste – Disassembly – Up-cycling – Mon-materiality.

Textile Sustainability and Innovation Project	**8 Hours**

Total Hours: 45 Hrs

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REFERENCES

1. Muthu, Subramanian Senthilkannan, Gardetti, Miguel Ángel, “Sustainability in the Textile and Apparel Industries: Sustainable clothing, Clothing Design and Repurposing”, Springer, 2020.
2. Kate Fletcher, “Sustainable Fashion and Textiles: Design Journeys,” Earthscan, 2008

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P18TME0057	CIRCULAR ECONOMY FOR ENTERPRISE INNOVATION	L	T	P	J	C
		3	0	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Demonstrate a thorough understanding of Circular Economy Concepts
CO2: Appreciate the importance of Circular Economy and its implications to different businesses.
CO3: Be able to design and implement successful Circular Economy systems
CO4: Develop practical skills in the implementation and management of Circular Economy practices across different business domains.
CO4: Learn to Innovate with Circular Economy
CO5: Transform Circular Economy with Artificial Intelligence / Machine Learning

Course Assessment Methods

DIRECT
1. Midterm Examination 2. Other Assignments 3. End Semester Project
INDIRECT
1.Course-end survey

Introduction to Circular Economy	**5 Hours**
Business Value in Circular Economy – Longer Lasting Products – Remanufacturing – Thinking in systems	
Design for The Future	**5 Hours**
Design out waste – Design for cyclability – Design for durability	
Incorporate Digital Technology	**5 Hours**
Data & Insights – Digital Platform	
Stretching the Lifetime	**5 Hours**
Maximise lifetime of products – INUSE; Maximise lifetime of products - AFTERUSE	
Collaborate to Create Joint Value	**5 Hours**
Industry Collaboration – Customer/Consumer Collaboration – Government Collaboration – Internal Collaboration – Community Collaboration	
Priortise Regenerative Resources	**5 Hours**
Regenerative Materials – Regenerative Water – Regenerative Energy	

Use Waste as A Resource	**5 Hours**
Valorise waste streams – Closed Loop; Valorise waste streams – Open Loop – Energy Recovery from waste	
Rethink Business Model	**5 Hours**
Product Business Models – Service Business Models	
Circular Economy for Enterprise Innovation Project	**5 Hours**
	Total Hours: 45 Hrs

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REFERENCES:

1.Walter R. Stahel, “The Circular Economy – A user’s guide,” Routledge, 2019
2. Ken Webster, “The Circular Economy: A Wealth of Flows – 2nd Edition,” EllenMacArthur Foundation, 2015

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P18INR0001	RESEARCH ETHICS (Common to All PG programs)	L	T	P	J	C
		1	0	0	0	0

Course Outcomes

After successful completion of this course, the students should be able to

CO1: Comprehend the importance of ethical practices in research.
CO2: Distinguish ethical practices from unethical practices in Research Design.
CO3: Understand ethical practices in conducting research and its dissemination

Pre-requisites: Nil

CO/PO Mapping
(S/M/W indicates strength of correlation)
S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO 1				S						S		
CO 2				S						S		
CO 3				S			M	M		S		

Course Assessment methods

Direct

1. Continuous Assessment Tests
2. Assignment
3. End Examination (Internal evaluation)

INTRODUCTION TO ETHICAL PRACTICE IN RESEARCH	**2 Hours**

Values Underlying Research Integrity; Framework for Good Academic Research Practices

ETHICS IN RESEARCH DESIGN & CONDUCTING RESEARCH	**5 Hours**

Planning; Research Questions and Documentation; Literature Review; Data, Precision, Accuracy & errors, Research Execution, Documentation & Manuscript writing; Checks for Plagiarism, Falsification, Fabrication, and Misrepresentation;

COLLABORATIVE RESEARCH & IPR	**5 Hours**

Collaboration and Authorship; Sharing of Credits; Intellectual Property

DISSEMINATION	**3 Hours**

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Selection of the Right Medium for Publication; Choosing the Right Journal for Publication; Translation of Research
Theory: 15 Tutorial: 0 Practical: 0 Project: 0 Total: 15 Hours

REFERENCES:

1. Guidance Document: Good Academic Research Practices. New Delhi: University Grants Commission, Sep 2020 (https://www.ugc.ac.in/e-book/grap_29092020/mobile/index.html)
2. UGC Regulation: Promotion of Academic Integrity and Prevention of Plagiarism in HEI's, Regulation 2018 (https://www.ugc.ac.in/pdfnews/7771545_academic-integrity-Regulation2018.pdf)

   Books
3. P. Chaddah (2018) Ethics in Competitive Research: Do not get scooped; Do not get plagiarised, ISBN: 978-9387480865
4. Beall, J. (2012). Predatory publishers are corrupting open access. Nature News, 489(7415), 179.

   Online Books/ Courses
5. Muralidhar, K., Ghosh, A., & Singhvi, A. K. (2019). Ethics in Science Education, Research and Governance. ISBN: 978-81-939482-1-7 (https://www.insaindia.res.in/pdf/Ethics_Book.pdf)
6. Griffiths, P. A., McCormick Adams, R., Albertis, B. M., Blout, E. R., Browder, F. E., Challoner, M. D., & Stine, D. D. (1995). On being a scientist: responsible conduct in research. Washington (DC): National Academy Press. (https://www.nap.edu/read/12192/chapter/1)
7. Steven D. Krause (2007) Process of Research writing (Open Textbook Library, University of Michigan) https://open.umn.edu/opentextbooks/textbooks/the-process-of-research-writing
8. Chery Lowry (2016) Choosing & Using sources: A guide to academic research (Open Textbook Library, University of Michigan), https://open.umn.edu/opentextbooks/textbooks/choosing-using-sources-a-guide-to-academic-research
9. Introduction to Research - NPTEL course (https://nptel.ac.in/courses/121/106/121106007/)
10. Research Ethics - Swayam course (https://onlinecourses.swayam2.ac.in/cec20_ge33/preview)

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