DEPARTMENT OF INDUSTRIAL ENGINEERING
ANNA UNIVERSITY, CHENNAI

VISION:

To emerge as a Centre of excellence in the field of Industrial Engineering where the world class practices of teaching, learning and research synergize.

MISSION:

- Development of state-of-the-art curriculum to meet the dynamic industry needs.
- Knowledge dissemination through student centric teaching learning process.
- Enriching laboratories with modern facilities
- Research contribution in the field of Industrial Engineering
- Maintaining continuous interaction with industry
- Cultivate the spirit of Entrepreneurship.

Attested

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Centre for Academic Courses
Anna University, Chennai-600 025

ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. QUALITY ENGINEERING AND MANAGEMENT
REGULATIONS 2023
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA & SYLLABI

1. PROGRAMME EDUCATIONAL OBJECTIVES(PEOs):

I.	To prepare students to excel in research or to succeed in Quality engineering and Management profession through global, rigorous post graduate education.
II.	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve quality engineering problems.
III.	To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real-life problems.
IV.	To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate quality engineering issues to broader social context.
V.	To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career.

2. PROGRAMME OUTCOMES(POs):

PO#	Programme Outcomes
1	An ability to independently carry out research/investigation and development work to solve practical problems to write and present a substantial technical report
2	To demonstrate the knowledge and understanding of Quality Engineering and Management and apply them to improve quality of products and services and achieve optimality in any organization
3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

3. PROGRAMME SPECIFIC OUTCOMES(PSOs):

PSO#	Programme Specific Outcomes
1	To use the knowledge of Quality Engineering and Management to design and develop quality management system and environmentally sustainable system to fulfill the needs of society.
2	Graduates should be able to design and develop enterprises and establish themselves as successful entrepreneurs
3	Graduates should be able to design and manage systems, processes and operations of different sectors of economy.

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4. PEO/PO/PSO Mapping:

PEO	PO			PSO		
	1	**2**	**3**	**1**	**2**	**3**
I.	3	2	3	-	2	-
II.	-	3	1	-	2	2
III.	-	-	3	-	-	-
IV.	3	-	-	3	2	2
V.	2	-	-	-	3	3

1,2,3, -, scale against the correlation PO's with PEO's

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PROGRAM ARTICULATION MATRIX OF PG QUALITY ENGINEERING AND MANAGEMENT

		COURSE NAME	PO1	PO2	PO3	PSO1	PSO2	PSO3
YEAR I	SEMESTER I	Statistical Methods and Design of Experiments	2.75	3	3	3	3	2.75
		Research Methodology and IPR	3	3	2	-	-	-
		Measurement Systems	3	2.60	3	2	2	2
		Industrial System Design	2.33	3	2	3	1	2
		Quality Engineering	3	2.6	3	3	3	2
		Decision Science	3	3	3	3	2	2
		Measurements Laboratory	3	2	3	2	3	2
	SEMESTER II	Lean Six Sigma	2.33	3	3	2	3	2
		Reliability Engineering Models	1.2	2	1.3	1.25	1.5	2
		Data Analytics	1.5	2	2	2	-	-
		Software Quality Engineering	2.5	2	1.6	2.5	-	1.3
		Professional Elective I						
		Professional Elective II						
		System Design Laboratory	2	2	2.5	-	3	2
		Technical Seminar	3	2.5	-	2	2	2
		Data Analytics Laboratory	2	3	1	1.6	-	2
YEAR II	SEMESTER	Professional Elective III						
		Professional Elective IV						
		Professional Elective V						
		Professional Elective VI						
		Project Work I	2.25	2.8	1.2	1.6	2	2
	SEMESTER IV	Project Work II	2.25	2.8	1.2	1.6	2	2

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ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

M.E. QUALITY ENGINEERING AND MANAGEMENT

REGULATIONS – 2023

CHOICE BASED CREDIT SYSTEM

CURRICULUM AND SYLLABI FOR SEMESTER I TO IV

SEMESTER I

S. No.	Course code	Course title	Category	Periods per week			Total contact periods	Credits
				L	T	P		
THEORY								
1.	IL3151	Statistical Methods and Design of Experiments	FC	4	0	0	4	4
2.	RM3151	Research Methodology and IPR	RMC	2	1	0	3	3
3.	QE3101	Measurement Systems	PCC	3	0	0	3	3
4.	QE3102	Industrial System Design	PCC	3	0	0	3	3
5.	QE3151	Quality Engineering	PCC	3	0	0	3	3
6.	QE3103	Decision Science	PCC	3	0	4	7	5
PRACTICALS								
7.	QE3111	Measurements Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**1**	**8**	**27**	**23**

SEMESTER II

S. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1.	QE3251	Lean Six Sigma	PCC	3	0	0	3	3
2.	IL3252	Reliability Engineering Models	PCC	3	0	0	3	3
3.	IL3253	Data Analytics	PCC	3	0	0	3	3
4.	QE3252	Software Quality Engineering	PCC	3	0	0	3	3
5.		Professional Elective I	PEC	3	0	0	3	3
6.		Professional Elective II	PEC	3	0	0	3	3
PRACTICALS								
7.	QE3211	System Design Laboratory	PCC	0	0	2	2	1
8.	QE3212	Technical Seminar	EEC	0	0	2	2	1
9.	IL3361	Data analytics Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**0**	**8**	**26**	**22**

SEMESTER III

S. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
THEORY								
1.		Professional Elective III	PEC	3	0	0	3	3
2.		Professional Elective IV	PEC	3	0	0	3	3
3.		Professional Elective V	PEC	3	0	0	3	3
4.		Professional Elective VI	PEC	3	0	0	3	3
PRACTICALS								
5.	QE3311	Project Work I	EEC	0	0	12	12	6
			TOTAL	**12**	**0**	**12**	**24**	**18**

SEMESTER IV

S. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
PRACTICALS								
1.	QE3411	Project Work II	EEC	0	0	24	24	12
			TOTAL	**0**	**0**	**24**	**24**	**12**

TOTAL NO. OF CREDITS: 75

FOUNDATION COURSES (FC)

S. No.	Course Code	Course Title	Periods per Week			Credits	Semester
			L	T	P		
1.	IL3151	Statistical Methods and Design of Experiments	4	0	0	4	I

PROFESSIONAL CORE COURSES (PCC)

S. No	Course Code	Course Title	Periods per Week			Credits	Semester
			L	T	P		
1.	QE3101	Measurement Systems	3	0	0	3	I
2.	QE3102	Industrial System Design	3	0	0	3	I
3.	QE3151	Quality Engineering	3	0	0	3	I
4.	QE3103	Decision Science	3	0	4	5	I
5.	QE3111	Measurements Laboratory	0	0	4	2	I
6.	QE3251	Lean Six Sigma	3	0	0	3	II
7.	IL3252	Reliability Engineering Models	3	0	0	3	II
9	IL3253	Data Analytics	3	0	0	3	II
10.	QE3252	Software Quality Engineering	3	0	0	3	II
11.	QE3211	System Design Laboratory	0	0	2	1	III
12.	IL3361	Data Analytics Laboratory	0	0	4	2	III
					TOTAL CREDITS	**31**	

RESEARCH METHODOLOGY AND IPR COURSES (RMC)

S. No	Course Code	Course Title	Periods Per Week			Credits	Semester
			L	T	P		
1.	RM3151	Research Methodology and IPR	2	1	0	3	I
					TOTAL CREDITS	3	

PROFESSIONAL ELECTIVES

S. No.	Course Code	Course Title	Category	Periods per Week			Total Contact Periods	Credits
				L	T	P		
1.	QE3001	Quality Management Systems and Auditing	PEC	3	0	0	3	3
2.	QE3051	Quality Management	PEC	3	0	0	3	3
3.	IL3051	Applied Object Oriented Programming	PEC	3	0	0	3	3
4.	IL3055	Design Thinking	PEC	3	0	0	3	3
5.	QE3002	Metrology and Inspection	PEC	3	0	0	3	3
6.	QE3003	Advanced Quality Planning and Management	PEC	3	0	0	3	3
7.	IL3251	Supply Chain Systems and Management	PEC	3	0	0	3	3
8.	IL3053	Engineering Economics and Cost Estimation	PEC	3	0	0	3	3
9.	IL3058	Industrial Scheduling Algorithms	PEC	3	0	0	3	3
10.	IL3059	Industrial Facilities Design	PEC	3	0	0	3	3
11.	IL3061	Maintainability Engineering	PEC	3	0	0	3	3
12.	IL3052	Management Accounting and Financial Management	PEC	3	0	0	3	3
13.	QE3004	Modern Manufacturing Management Concepts	PEC	3	0	0	3	3
14.	QE3005	Human Industrial Safety and Hygiene	PEC	3	0	0	3	3
15.	IL3063	Logistics and Distribution Management	PEC	3	0	0	3	3
16.	IL3057	Engineering Project Management	PEC	3	0	0	3	3
17.	IL3060	Decision Support Systems	PEC	3	0	0	3	3
18.	QE3006	Software Product Engineering and Methodologies	PEC	3	0	0	3	3
19.	IL3062	Product Design and Value Engineering	PEC	3	0	0	3	3
20.	IL3064	Artificial Intelligence and Machine Learning	PEC	3	0	0	3	3

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	Course Code	Course Title	Periods Per Week			Credits	Semester
			L	T	P		
1.	QE3212	Technical Seminar	0	0	2	1	II
2.	QE3311	Project Work I	0	0	12	6	III
3.	QE3411	Project Work II	0	0	24	12	IV
TOTAL CREDITS						**19**	

SUMMARY

	M.E. Quality Engineering and Management					
	SUBJECT AREA	CREDITS PER SEMESTER				CREDITS TOTAL
		I	II	III	IV	
1.	FC	4	0	0	0	4
2.	PCC	16	15	0	0	31
3.	PEC	0	6	12	0	18
4.	RMC	3	0	0	0	03
5.	EEC	0	1	6	12	19
6.	**TOTAL CREDIT**	**23**	**22**	**18**	**12**	**75**

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IL3151 STATISTICAL METHODS AND DESIGN OF EXPERIMENTS L T P C
4 0 0 4

COURSEOBJECTIVES:

1. To explain the basic probability and statistics concepts
2. To familiarize Hypothesis Testing and ANOVA to compute significance of factors and reach conclusions about effect of factors involved.
3. To develop factorial and fractional factorial designs for product and process optimization
4. To describe experimental design for engineering applications using orthogonal arrays and to use signal to noise ratios to illustrate robust design concepts in process optimization.
5. To impart knowledge on Response Surface Methods and Shainin design of experiments

UNIT I INTRODUCTION TO PROBABILITY AND STATISTICS 12

Basic Probability: Experiment, definition of probability, conditional probability, independent events, Bayes' rule, Bernoulli trials, Random variables, discrete random variable, , continuous random variable, Two dimensional random variables and their distribution functions, Independent random variables. Standard distributions - Binomial, Multinomial, Poisson, Uniform, exponential, Weibull, Gamma, Beta, Normal- Evaluation of statistical parameters for these distributions-Applications of these distributions- Chebyshev's theorem and central limit theorem - Basic Statistics - Linear Correlation, correlation coefficient, rank correlation coefficient, linear regression model, Bounds on probability, Chebyshev's Inequality.

UNIT II HYPOTHESIS TESTING AND SINGLE FACTOR EXPERIMENTS 12

Hypothesis- Types- Steps in Hypothesis Testing, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and Difference of standard deviations. Test of significance for small samples: t- Test for single mean, difference of means, t-test for correlation coefficients-Chi-square test for goodness of fit and independence of attributes. Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, ANCOVA, steps in experimentation, Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests. Multivariate analysis of variance (MANOVA) – One way MANOVA

UNIT III MULTIFACTOR EXPERIMENTS 12

Two and three factor full factorial experiments, Randomized block factorial design, Experiments with random factors, rules for expected mean squares, approximate F- tests. 2^K factorial Experiments, Blocking and confounding in 2^K designs. Two level Fractional factorial design, nested designs, Split plot design- Factorial MANOVA with 2 factors- Response Surface Methods

UNIT IV TAGUCHI METHODS 12

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, Multi-level experiments, Multi-response optimization

UNIT V RESPONSE SURFACE METHODS AND SHAININ DESIGN OF EXPERIMENT 12

Response Surface Designs- Designs for Fitting First-order Model -Central Composite Design (CCD)-Box–Behnken Designs - Analysis of Data from RSM Designs - Analysis of First-order Design - Analysis of Second-order Design. Basis of Shainin System -Problem Solving Algorithm-Procedure-Problem Identification Tools- Shainin Tools: Multivary analysis, Product Process Search, Component search, Paired Comparison, Modified component search, Best vs. Current comparison.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Explain principles and concepts of design of experiments and quality engineering.
CO2 Illustrate quality engineering and robust design concepts.
CO3. Develop factorial, fractional factorial and orthogonal array designs for product and process optimization
CO4. Conduct experiments and analyse data for product and process improvements
CO5. Explain principles and concepts of response surface methodology.

REFERENCES:

1.	Krishnaiah K, and Shahabudeen P, "Applied Design of Experiments and Taguchi Methods", PHI,1 st Edition, 2011.
2.	Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.
3.	NicoloBelavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
4.	Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
5.	Krishnaiah.K, Applied Statistical Quality Control and Improvement, PHI, 2014.
6.	Montgomery, D.C., Design and Analysis of Experiments, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	3	-	-	-	-
2	3	3	-	3	3	2
3	-	3	3	-	-	3
4	3	3	3	3	3	3
5	3	3	3	3	3	3
Avg.	**2.75**	**3**	**3**	**3**	**3**	**2.75**

RM3151 RESEARCH METHODOLOGY AND IPR L T P C
2 1 0 3

OBJECTIVES:

To impart knowledge on

- Formulation of research problems, design of experiment, collection of data, interpretation and presentation of result
- Intellectual property rights, patenting and licensing

UNIT I RESEARCH PROBLEM FORMULATION 9

Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9

Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9

Sampling, sampling error, measures of central tendency and variation,; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9

Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9

Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the student can

CO1: Describe different types of research; identify, review and define the research problem
CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data
CO3: Explain the process of data analysis; interpret and present the result in suitable form
CO4: Explain about Intellectual property rights, types and procedures
CO5: Execute patent filing and licensing

REFERENCES:

1. Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Soumitro Banerjee, “Research methodology for natural sciences”, IISc Press, Kolkata, 2022,
3. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007.
4. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
5. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

QE3101	MEASUREMENT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Describe the principles of ultrasonication.
2. Summarize the mechanical testing methods.
3. Refer the tribological behaviour and wear reduction methods.
4. Contrast the surface characteristics and video measurement technologies.
5. Describe the types of corrosion and test procedures.

UNIT I EFFECT OF ULTRASONICATION AND MEASUREMENT 9

Principles of ultrasonication, applications, parameters. Effect on the hardness, effect on the tensile behaviour and microstructure. Effect on the wear, Corrosion and Tribo-corrosion behaviour of ultrasonicated casted materials.

UNIT II MECHANICAL TESTING AND MEASUREMENTS 9

Introduction to mechanical behaviour, standards and procedure for the measurement of mechanical properties. Hardness: Types of hardness, Measurement of micro and bulk hardness. Measurement of tensile properties, strain hardening coefficient, fatigue properties and a fatigue life through a rotary fatigue machine. Creep measurement: Creep life characteristics using immersion creep tester.

UNIT III MEASUREMENT OF FRICTION AND WEAR BEHAVIOUR 9

Introduction to tribology: Friction, wear and lubrication. Measurement of friction and wear: Testing methods, standards, Wear and Friction Monitors, parameters, thermal expansion and wear imaging, data and image acquisition. Wear reduction methods and lubrication: Surface modification and property enhancement methods, industrial lubrication and grades.

UNIT IV SURFACE FINISH AND VIDEO MEASUREMENT SYSTEMS 9

Ideal surface, surface structure and surface roughness parameters. Roughness measurement equipment: Surface meter, grades of roughness, relating roughness parameters to engineering applications. Video measurement systems: Introduction and principles, measurement of wear depth, scratch dimensions, kerf taper angle, delamination factor and corner accuracy.

UNIT V MEASUREMENT OF CORROSION CHARACTERISTICS 9

Definition, types, standards and principles. Corrosion test procedures and equipment: Salt spray test, immersion test, electrochemical test, tribocorrosion test, cyclic corrosion test, stress corrosion cracking and high-temperature corrosion test. Corrosion rate measurements.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1. Relate the principles of ultrasonication and measure the effects of ultrasonication methods.

CO2. Experiment the mechanical testing methods and their measurement.

CO3. Outline the friction and wear behaviour of the materials and the wear reduction methods.

CO4. Describe the various surface characteristics and the video measurement methods.

CO5. Asses the corrosion characteristics and the corrosion measurement techniques.

REFERENCES:

1. Kyriakos Komvopoulos, “Mechanical Testing of Engineering Materials”, 2nd edition 2017.
2. Ernest Rabinowicz, Friction and Wear of Materials, 2nd edition, ISBN: 978-0-471-83084-9, Wiley Publisher, 2013.
3. E. McCafferty, Introduction to Corrosion Science, Springer Science & Business Media, 04-Jan-2010.
4. Hein eloper and Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000.
5. Friction, Wear, Lubrication A Textbook in Tribology, 2nd edition by Kenneth C Ludema, and Layo Ajayi, 2019.
6. Emanuele Trucco, and Alessandro Verri, “Introductory Techniques for 3D Computer Vision”, 1st Edition, 2009.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	3	2	3	-	1	2
2	3	3	3	2	2	2
3	3	2	3	-	-	2
4	3	3	3	2	3	2
5	3	3	3	2	-	2
Avg	3	2.6	3	2	2	2

QE3102 **INDUSTRIAL SYSTEM DESIGN** **L T P C**

3 0 0 3

COURSEOBJECTIVES:

1. To learn the work study and ergonomic principles to design workplaces for the improvement of human performance
2. To Understand the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.
3. To gain knowledge on the basic principles in facilities planning and plant location
4. To teach analytical skills and problem-solving tools to the analysis of the operations problems
5. To calculate the plant capacity and exercise control on production. Also, to learn JIT implementation and control procedures

UNIT I WORK SYSTEM DESIGN AND ERGONOMICS 9

Concepts of Industrial Engineering - History and development of Industrial Engineering - Productivity – Factors affecting Productivity -Productivity measures- Objectives of Work Study – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Time Study –Work sampling- Ergonomics and its areas of application in the work system - Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing.

UNIT II PRODUCT, PROCESS CAPACITY DESIGN 9

Product Development; Product Design Tools; Design of Services; Process Design: Types of Process, Modern Production Technologies; Process Reengineering, Capacity Management; Economies and Diseconomies of Scale and Learning Curve; Capacity Strategies; Decision Trees

UNIT III PLANT LOCATION AND LAYOUT 9

Location Strategy and its Importance; Factors influencing Plant location; Location Selection Models – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Systematic Layout Procedure –Computerized Layout Planning Methods- Line Balancing methods.

UNIT IV PRODUCTION PLANNING

Forecasting of Demand- Qualitative and Quantitative Forecasting Methods- Forecast Accuracy Measures - Systems Aggregate Planning and its Process; Master Scheduling; Material Resources Planning; Manufacturing Resource Planning; Inventory Management: Basic Economic Order Quantity (EOQ) Model; Quantity Discount Models; Selective Inventory Control.

UNIT V PRODUCTION CONTROL 9

Production Control Activities- Operations Scheduling- Objectives of Scheduling - Scope of Scheduling – Objective Measures- Sequencing problem -Priority Rules – Flow shop scheduling - Job Shop scheduling - Synchronous Manufacturing- Just in Time (JIT) Manufacturing System- Basics of ERP and SCM.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Apply a Method Study and time study to improve the efficiency of the system.

CO2. Apply the techniques to forecast demand for Production and Service Systems

CO3. Examine appropriate location models for various facility types and design various facility layouts

CO4. Analyze and Assess Aggregate Planning strategies and Material Requirement Plan.

CO5. Apply scheduling Concepts for improving System Performance.

REFERENCES:

1. O.P.Khanna, 2018, Industrial Engineering and Management, Dhanpat Rai Publications
2. Martand Telsang,2006, Industrial Engineering and Production Management, S. Chand and Company
3. Ravi Shankar, 2009, Industrial Engineering and Management, Galgotia Publications & Private Limited

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	-	3	-	-	-	-
2	3	-	-	3	1	-
3	2	3	2	-	1	2
4	2	3	2	-	1	2
5	-	3	-	-	1	-
Avg	2.33	3	2	3	1	2

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

QE3151	QUALITY ENGINEERING	L T P C
		3 0 0 3

COURSEOBJECTIVES:

1. To develop a clear knowledge in the basics of various quality concepts.
2. To Facilitate the students in understanding the application of control charts and its techniques.
3. To develop the special control procedures for service and process-oriented industries.
4. To analyze and understand the process capability study.
5. To develop the acceptance sampling procedures for incoming raw material.

UNIT I INTRODUCTION 9

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

UNIT II QUALITY CONTROL CHARTS 9

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

UNIT III SPECIAL CONTROL PROCEDURES 9

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

UNIT IV STATISTICAL PROCESS CONTROL 9

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

UNIT V ACCEPTANCE SAMPLING 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

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

REFERENCES:

CO1. Douglus C. Montgomery, “Introduction to Statistical Quality Control”, Wiley-India, Eighth Edition, 2019

CO2. Krishnaiah K.,” Applied Statistical Quality Control and Improvement”, PHI, 2014.

CO3. AmitavaMitra, “Fundamentals of Quality Control and Improvement”, Wiley, Fourth Edition, 2015.

CO4. Dale H. Besterfield, Quality Control, Pearson Education Asia, 10 th Edition, 2018.

CO5. Eugene L. Grant and Richard S. Leaven Worth, “Statistical Quality Control”, McGraw-Hill Education, Seventh Edition, 2000.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	-	3	3	3	-	2
2	-	3	3	3	-	2
3	-	3	3	3	-	2
4	3	2	3	-	-	2
5	3	2	3	-	3	-
Avg	3	2.6	3	3	3	2

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

Attested

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QE3103	DECISION SCIENCE	L T P C
		3 0 4 5

COURSE OBJECTIVES:

1. To provide knowledge of optimization techniques and approaches.
2. To enable students to formulate real-world problems as mathematical programming models.
3. To develop students' mathematical, computational, and communication skills required for the practical application of Operations Research.
4. To gain knowledge and skills in solving decision-making and game theory models
5. To understand issues in project management and manage project activities effectively
6. To understand basic working of simulation model

UNIT I LINEAR PROGRAMMING 9

Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two phase method – Big M method

UNIT II NETWORK ANALYSIS 9

Transportation problems: Northwest corner rule, least cost method, Vogel's approximation method - stepping stone method - MODI method – Unbalanced transportation – Assignment problem – Hungarian algorithm. TSP- Solving using Hungarian Algorithm- Applications of TSP to other engineering problems

UNIT III DECISION THEORY AND GAME THEORY 9

. Decision Theory- Decision under certainty-Decision under Risk-Decision under uncertainty – Decision Tree- Game theory – Two person zero sum games – Graphical solution Algebraic solution – Linear Programming solution

UNIT IV QUEUING THEORY 9

Queuing Terminology- Single Server Queuing Models- Multi-Server Queuing Model- Calling Source population –Limited and Unlimited- Variations in Queue Length - Limited and Unlimited

UNIT V SIMULATION 9

Systems – Modelling – Types – Systems components – Simulation basics- Basic Steps in Simulation- Random numbers – Methods of generation- Random variates- Testing of random numbers- Monte Carlo Simulation

TOTAL: 45 PERIODS

LABORATORY EXPERIMENTS

The following problems are solved using Operation Research software packages and 'C++' programming language.

1. LP problems and Sensitive Analysis
2. Solving LPP using Excel
3. Transportation problems

4. Assignment problems
5. Waiting line problems single server
6. Waiting Line problems Multiple Server
7. Random Number Generation
8. Testing of Random of Generations
9. Monte Carlo Simulation

TOTAL:30PERIODS

SOFTWARE REQUIRED

1. MS EXCEL
2. TORA & LINDO/GOOGLE OR TOOLS
3. Dev C++
4. Simulation Packages

COURSE OUTCOMES:

The students will be able to

CO1. Convert an abstract real-world problem to an optimization model.

CO2. Make decision under risk and uncertainty

CO2. Identify critical activities and expedite project effectively

CO3. Identify a suitable queuing model for a problem and solve it

CO4. Build a simulation model for an engineering problem.

REFERENCES:

1. Hamdy A Taha, “Operations Research – An Introduction”, Pearson, 2017.
2. Philips, Ravindran and Solberg, “Operations Research principle and practise”, John Wiley, 2007.
3. Ronald L Rardin, “Optimisation in Operations Research”, Pearson, 2018.
4. Panneerselvam R, “Operations Research”, PHI, 2009
5. Srinivasan G., “Operations Research Principles and Applications”, PHI, 2017

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	2	-	3	-	2	-
2	-	3	3	3	-	2
3	-	3	3	-	-	2
4	3	-	3	3	2	-
5	3	-	3	-	-	-
Avg	3	3	3	3	2	2

QE3111	MEASUREMENT LABORATORY	L T P C 0 0 4 2

COURSE OBJECTIVES:

1. Describe the effect of ultrasonication on squeeze-casted materials.
2. Correlate heat treatment and its effects on materials.
3. Develop specimens, analysis microstructure, physical, and mechanical properties.
4. Use of tribological tests to evaluate wear and friction in various conditions.
5. Contrast the various corrosion tests and examine the surface of different materials.

List of Experiments

1) Effect of ultrasonication on the properties of squeeze casted materials.
2) Influence of heat treatment conditions on the hardness of the Al/Mg composites.
3) Specimen preparation and analysis of microstructure.
4) Measurement of physical and mechanical properties.
5) Determination of friction and wear characteristics using linear reciprocating wear tester.
6) Perform high temperature wear test using pin-on-disc tribometer and analyse the surface temperature distributions.
7) Measure the wear and scratch dimensions on the sample surface using video measuring machine.
8) Examine the electrochemical and tribocorrosion behaviour of Al/Mg test samples.
9) Calculate the salt spray and immersion corrosion rate on the magnesium samples.
10) Determine the compression strength of the copper samples fabricated through powder metallurgy route.

List of Equipment

1) Ultrasonication assisted squeeze casting setup.
2) (a) Muffle furnace with controlled environment (b) Vicker hardness tester.
3) (a) Abrasive cutter (b) Slow speed cutter (c) Moulding machine (d) Polishing machine (e) In-situ metallography kit (f) Optical microscope (g) Portable vision measurement system.
4) (a) Solid material density kit (b) Vicker hardness tester (c) Servo controlled universal testing machine (d) Rotary fatigue testing machine.
5) (a) Linear reciprocating wear tester (b) Weighing balance.

6) (a) Pin-on-disc tribometer with heating chamber (b) Weighing balance (c) Thermal image scanner.
7) (a) Linear reciprocating wear tester (b) Coating thickness measurement apparatus (c) Video measuring machine.
8) (a) Electrochemical workstation (b) Tribocorrosion setup (c) Weighing balance.
9) (a) Salt spray corrosion chamber setup (b) Immersion setup (c) Weighing balance.
10) (a) Planetary ball mill (b) Powder compaction machine (c) Microwave furnace (d) Servo controlled universal testing machine.

TOTAL: 60 PERIODS

COURSE OUTCOMES

The students will be able to

CO1. Examine the effects of ultrasonication on squeeze casted materials.

CO2. Perform the heat treatment on materials to assess the thermal effects.

CO3. Prepare a specimen and perform microstructural, physical, and mechanical test.

CO4. Conduct tribological test under various conditions and determine wear and friction.

CO5. Assess the corrosion behaviour of different materials using various test procedures.

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	3	2	3	-	-	2
2	3	2	3	-	-	2
3	3	2	2	-	3	2
4	3	2	3	2	3	2
5	3	2	3	2	-	2
Avg	3	2	3	2	3	2

QE3251	LEAN SIX SIGMA	L T P C
		3 0 0 3

COURSE OBJECTIVES

1. To understand Lean production principles, eliminate waste, and improve efficiency through case studies.
2. To learn steps for Value Stream Mapping, apply Lean metrics, and implement improvements in value streams.
3. To explore Six Sigma's relationship with Lean Manufacturing, cultural changes, quality assessment, and cost implications.
4. To gain knowledge of various Six Sigma tools and techniques for problem-solving and project management.
5. To evaluate Six Sigma quality economics, focus on continuous improvement using Lean principles, Kaizen, and 5S methodologies.

UNIT I LEAN MANUFACTURING 9

Evolution of Mass production, Traditional versus Mass production, Evolution of Toyota (Lean) Production System, Business Dynamics of Lean production, Principles of Lean production – Value, Value stream, Flow, Pull, Perfection- 3Ms – Muda, Mura, Muri, 7 Wastes in Manufacturing, Lean Tools to eliminate Muda - 5S, Standardised work, TPM, SMED, Jidoka – Poka Yoke, JIT, Heijunka, Kanban, One piece production, Case studies.

UNIT II VALUE STREAM MAPPING 9

Need for Value Stream mapping; Steps involved in Value stream mapping – Choose value stream – PQ and PR analysis, Current State map, Lean Metrics, Future State Map, Kaizen plans; Lean implementation - Cultural change, Hoshin planning; Lean in the Supply chain.

UNIT III SIX SIGMA 9

Six sigma - lean manufacturing and six sigma- six sigma and process tolerance – Six sigma and cultural changes – six sigma capability – six sigma need assessments - implications of quality levels, Cost of Poor Quality (COPQ)

UNIT IV SIX SIGMA SCOPE OF TOOLS AND TECHNIQUES 9

Tools for definition – IPO diagram, SIPOC diagram, Flow diagram, CTQ Tree, Project Charter – Tools for measurement – Check sheets, Histograms, Run Charts, Scatter Diagrams, Cause and effect diagram, Pareto charts, Control charts, Flow process charts, Process Capability Measurement, Tools for analysis – Process Mapping, Regression analysis, RU/CS analysis, SWOT, PESTLE, Five Whys, interrelationship diagram, overall equipment effectiveness, TRIZ innovative problem solving – Tools for improvement – Affinity diagram, Normal group technique, SMED, 5S, mistake proofing, Value stream Mapping, forced field analysis – Tools for control – Gantt chart, Activity network diagram, Radar chart, PDCA cycle, Milestone tracker diagram, Earned value management.

UNIT V EVALUATION AND CONTINUOUS IMPROVEMENT METHODS 9

Evaluation strategy – the economics of six sigma quality, Return on six Sigma (ROSS), ROI, poor project estimates – continuous improvement – lean manufacturing – value, customer focus, Perfection, focus on waste, overproduction – waiting, inventory in process (IIP), processing waste, transportation, motion, making defective products, underutilizing people – Kaizen – 5S

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Demonstrate understanding of Lean production principles, waste identification, and efficiency improvement.

CO2. Apply Value Stream Mapping steps and Lean metrics to enhance organizational performance.

CO3. Analyze the relationship between Six Sigma and Lean Manufacturing, evaluate cultural changes, quality levels, and cost implications.

CO4. Acquire knowledge of Six Sigma tools and techniques for effective problem-solving and project management.

CO5. Evaluate Six Sigma quality economics and demonstrate commitment to continuous improvement through Lean principles, Kaizen, 5S methodologies, and customer focus.

REFERENCES:

1. Michael L.George, David Rownalds, Bill Kastle, What is Lean Six Sigma, McGraw – Hill 2003
2. Thomas Pyzdek, The Six Sigma Handbook, McGraw-Hill,2000
3. Fred Soleimannejed , Six Sigma, Basic Steps and Implementation, AuthorHouse, 2004
4. Forrest W. Breyfogle, III, James M. Cupello, Becki Meadows, Managing Six Sigma:A Practical Guide to Understanding, Assessing, and Implementing the Strategy That Yields Bottom-Line Success, John Wiley & Sons, 2000
5. James P. Womack, Daniel T.Jones, Lean Thinking, Free Press Business, 2003

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	-	3	3	-	-	2
2	-	3	3	-	-	2
3	2	3	3	-	-	2
4	3	-	3	2	3	2
5	2	-	3	2	3	2
Avg	**2.33**	**3**	**3**	**2**	**3**	**2**

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

IL3252 RELIABILITY ENGINEERING MODELS L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To gain basic understanding on Reliability studies
2. To impart knowledge on the failure data analysis
3. To gain understanding of reliability prediction methods of various structures
4. To impart knowledge on reliability testing and monitoring methods
5. To provide understanding of maintainability/availability/replacement models

UNIT I RELIABILITY CONCEPT 9

Reliability definitions – Quality vs. Reliability - Reliability measures – f(t), F(t) , R(t) functions – Central tendency of failure time distributions – Design life - Mortality graph - A priori and A posteriori probabilities of failure – Component Mortality – Exponential relia/bility function – Useful life.

UNIT II LIFE DATA ANALYSIS 9

Failure data taxonomy – Empirical methods for Ungrouped, Grouped, Complete, Censored data – Failure time distributions - Survival graphs – Bartlett's Test – Kolmogorov Smirnov Test – Chi square goodness of fit Test – Hazard Plotting: Exponential, Weibull distributions: Smith's improved estimate.

UNIT III SYSTEM RELIABILITY EVALUATION 9

Series and Parallel structures – Parallel Redundancy – m/n System – Standby System – Complex structures: Baye's decomposition method: Different structures - Cut and Ties sets Method – Fault Tree Analysis – Human Reliability.

UNIT IV RELIABILITY MANAGEMENT 9

Life Testing: Failure terminated test – Time terminated test – Determination of Upper and Lower MTBFs – Sequential Reliability Testing – Reliability Allocation – Reliability Growth Monitoring: Duane Model - Replacement decisions: Deterministic and Stochastic models – Economic life.

UNIT V MAINTAINABILITY AND AVAILABILITY 9

Analysis of Downtime – Repair time distributions: Exponential, Lognormal – Maintainability measures – Maintainability prediction – Design for optimum maintainability – Spare parts control - Availability measures: Inherent, Achieved, Operational, Point and Interval Availability – System Availability – Optimal Inspection models: Minimize downtime, maximize profit.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamental theory in Reliability Engineering
CO2: Analyse the failure time data and determine the fitness of the data into theoretical distributions
CO3: Estimate system reliability of standard/complex configurations
CO4: Apply reliability allocation, growth monitoring and life testing models
CO5: Demonstrate Maintainability and Availability of system

REFERENCES:

1. Patrick D.T. O'Connor and Andre Kleyner, "Practical Reliability Engineering", Fifth Edition, John Wiley & Sons, New York, 2012.
2. Andrew K.S.Jardine and Albert H.C.Tsang, "Maintenance, Replacement and Reliability: Theory and Applications", Taylor & Francis, 2013.
3. Charles Ebeling, "An Introduction to Reliability and Maintainability Engineering", Tata McGraw Hill, 2007.

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

CO	PO			PSO's		
	1	2	3	1	2	3
CO1	1	1	-	-	-	2
CO2	1	2	-	1	1	-
CO3	2	3	3	2	1	-
CO4	1	2	1	1	2	-
CO5	1	2	1	1	2	-
AVG	1.2	2	1.3	1.25	1.5	2

Attested

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IL3253	DATA ANALYTICS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1 To extract the knowledge on the applications of multivariate statistical analysis.
2 To understand the simple regression, multiple regression and correlation procedures.
3 To apply the factor analysis in real life applications and principal component analysis effectively for data exploration and data dimension reduction.
4 To classify and implement the discriminant analysis to various cases.
5 To find groupings and associations using cluster analysis.

UNIT I MULTIVARIATE METHODS 9

Review of basic matrix operations and random vectors, Properties of Eigen values and Eigen vectors. An overview of multivariate methods - Basic Multivariate Statistics - Mean, Variance, Covariance and Correlation, Multivariate normal distribution.

UNIT II REGRESSION ANALYSIS 9

Inferences about population parameters - Simple Regression, and Correlation – Estimation using the regression line, correlation analysis, Multiple Regression– Logistic Regression - Canonical Correlation Analysis - Multivariate analysis of variance (MANOVA) – Conjoint Analysis – Choice based conjoint (CBC), Adaptive CBC.

UNIT III FACTOR ANALYSIS 9

Principal components analysis – Objectives, estimation of principal components, testing for independence of variables, Factor analysis model – Method of estimation – Factor rotation – Factor Scores - EFA - CFA - Path analysis and Path Diagrams, Software tools for development – SEM and ISM.

UNIT IV DISCRIMINANT ANALYSIS 9

Discriminant analysis – Classification with two multi-Variate normal populations- Evaluating classification function – Classification with several populations – Fishers Method for Discriminating among several Populations.

UNIT V CLUSTER ANALYSIS 9

Cluster analysis – Clustering methods, Hierarchical clustering methods – Single Linkage, Complete Linkage, Average Linkage, Ward's Hierarchical Clustering Method, Non-Hierarchical Clustering methods - K-means Method, Validation and profiling of clusters – Multi-Dimensional Scaling.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Predict the values of one or more variables on the basis of observations on the other variables.
CO2 Synthesize the specific statistical hypotheses, in terms of the parameters of multivariate populations.
CO3 Construct data reduction or structural simplification as simply as possible without sacrificing valuable information and will make interpretation easier.
CO4 Apply to sort and group the "similar" objects or variables are created, based upon measured characteristics.
CO5 Prepare to understand appropriate use of clustering methods.

REFERENCES:

1 Dallas E Johnson, Applied Multivariate methods for data analysis, Duxbury Press(1998).

2 Brian S. Everitt and Graham Dunn, Applied Multivariate Analysis, Second edition, Arnold press, (2001).

3 Joseph F. Hair, Jr. William C. Black Barry J. Babin, Rolph E. Anderson, Multivariate Data Analysis, Pearson Edition, (2010).

4 Richard I Levin, Statistics for Management, PHI (2000).

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	2	-	-	-	-	-
2	-	2	-	-	-	-
3	-	-	2	-	-	-
4	-	-	-	2	-	-
5	1	-	-		-	-
Avg	1.5	2	2	2	-	-

Attested

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QE3252	SOFTWARE QUALITY ENGINEERING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To study the basic principles and concepts of software quality
2. To effective designing, analyzing and developing the software engineering activities
3. To gain knowledge on software quality assurance and risk management
4. To analyze the principles and applications of software quality management tools
5. To gain knowledge about software quality standards

UNIT I SOFTWARE QUALITY **9**

Definition of Software Quality, Quality Planning, Quality system – Quality Control Vs Quality Assurance – Product life cycle – Project life cycle models- Agile-Scrum

UNIT II SOFTWARE ENGINEERING ACTIVITIES **9**

Estimation, Software requirements gathering, Analysis, Architecture, Design, development

UNIT III SUPPORTING ACTIVITIES **9**

Metrics, Reviews –Software Configuration Management **(**SCM) – Software quality assurance and risk management.

UNIT IV SOFTWARE TESTING & MAINTENANCE **9**

Definition and Objectives software testing strategies- Software test Classifications- White & Black box testing process-Test case design-Automated Testing-Alpha and Beta site Testing programs. Activities - Maintenance Phase – Issues - Configuration management- Skillsets, Estimative, Geographically Distributed Teams – Metrics - Maintenance Phase

UNIT V QUALITY ASSURANCE MODELS **9**

Software Quality Standards, ISO systems– CMM, Capability Maturity Model Integration (CMMI) – P-CMM – Case study_ Industry Specific Quality Models(Hippa.Sas)

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand the basic principles and concepts in software quality
CO2. Effectively design, analyze and develop software engineering activities
CO3. Gain knowledge on software quality assurance and risk management
CO4. Understand the principles and applications of software quality management tools
CO5. Gain knowledge about software quality standards

REFERENCES:

1. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 2003.
2. Metrics and Models in Software Quality Engineering, Stephen, Stephen H. Kan, Pearson education, 2006, Low price edition.
3. Norman E – Fenton and Share Lawrence P flieger, Software metrics , International Thomson Computer press , 1997.
4. Ramesh Gopalswamy, Managing global Projects ; Tata McGraw Hill, 2002
5. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman McGraw – Hill International Edition, 6th Edition, 2006.

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	3	2	2	-	-	2
2	2	2	1	-	-	1
3	-	-	2	-	-	1
4	-	-	-	3	-	-
5	-	-	-	2	-	-
Avg	2.5	2	1.6	2.5	-	1.3

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

Attested

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QE3211	SYSTEM DESIGN LABORATORY	L T P C
		0 0 2 1

COURSE OBJECTIVES:

1. To prioritize the alternate, modify and propose the new methods
2. To develop the graphical tools of method study.
3. To infer the work performance measurement tools.
4. To relate the software products in work measurement and set time standards.
5. To collaborate the students in physical fitness test.

LIST OF EXPERIMENTS

1. Peg Board Experiment.
2. Stopwatch time study.
3. Performance rating exercise.
4. Work sampling and Graphic tools for method study.
5. Effect of speed of walking on treadmill using least rate and energy expenditure.
6. Effect of work load least rate using Ergo cycle.
7. Evaluation of physical fitness using step test.

LABORATORY EQUIPMENTS REQUIREMENTS

1. Time study Trainer.
2. Peg board.
3. Stop watches.
4. Tread mill.
5. Ergo cycle.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1: Apply the method study tools to record the existing methodology.

CO2: Design a better work place using method study tools.

CO3: Set time standards using work measurement techniques.

CO4: Develop time standards using software's

CO5: Conduct experiments for physical fitness using appropriate equipment.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	2	3	-	-	-
2	-	-	2	-	3	-
3	2	2	3	-	-	-
4	-	-	-	-	-	2
5	2	-	2	-	-	
Avg	**2**	**2**	**2.5**	**-**	**3**	**2**

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

Attested

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QE3212	TECHNICAL SEMINAR	L T P C
		0 0 2 1

COURSE OBJECTIVES:

1. To develop journal paper reading and understanding skill.
2. To improve communication and presentation skill of students
3. To enhance critical thinking and analysis.
4. To improve communication and public speaking skills.
5. To explore emerging technologies and trends.

GUIDELINES:

- The students are expected to make a presentation on the state of research on a particular topic based on current journal publications in that topic.
- A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.
- Students are encouraged to use various teaching aids such as overhead projectors, power point presentation and demonstrative models.

COURSE OUTCOMES:

The students will be able to

CO1: Select the method, analysis and optimize the given problem through research articles.
CO2: Develop the communication and presentation skills.
CO3: Enhance critical thinking and analysis.
CO4: Improve the public speaking skills.
CO5: Get an exposure to the emerging technologies and trends.

TOTAL: 30 PERIODS

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	3	-	-	2	-	-
2	3	-	-	-	2	-
3	-	2	-	-	-	2
4	-	3	-	-	-	2
5	-	-	-	2	2	
Avg	**3**	**2.5**	**-**	**2**	**2**	**2**

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IL3361 **DATA ANALYTICS LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

1. To get hands on training and exposure on descriptive and Inferential statistics, Hypothesis testing, Regression and Correlation Analysis.
2. To get hands on training and exposure on Factor Analysis, Discriminant Analysis and Cluster Analysis.
3. To get hands on training and exposure to techniques on Single factor experiments, Factorial experiments and 2k design.
4. To get hands on training and exposure on design and Analysis of Taguchi's DOE
5. To get hands on training on Response Surface Methodology and MANOVA.

LABORATORY EXPERIMENTS

Students will perform analysis of data in the following topics using Python and Data Analysis package

1. Statistical analysis: Descriptive Statistics • Inferential statistics
2. Testing of Hypothesis
3. Linear Regression and Correlation
4. Discriminant analysis
5. Control charts
6. Process capability
7. Single Factor Experiments
8. Factorial experiments
9. 2^k Design
10. Analysis of Variance (ANOVA)
11. Taguchi Design of Experiments
12. Factor analysis
13. Cluster Analysis
14. Response Surface Method
15. MANOVA

TOTAL:60 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1: Compute descriptive and inferential statistics, Hypothesis testing, Regression and Correlation Analysis for a given data

CO2: Perform Factor Analysis, Discriminant Analysis, Cluster Analysis and develop Process control.

CO3: Perform DOE (Single, Factorial and 2k design) for a given data software.

CO4: Perform Taguchi Design

CO5: Perform Response Surface Methodology and MANOVA for a given data

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	3	1	2	-	2
2	2	3	1	1	-	-
3	2	3	1	-	-	-
4	-	3	1	2	-	2
5	2	3	1	-	-	2
Avg	2	3	1	1.6	-	2

QE3311 **PROJECT WORK I** **L T P C**

0 0 12 6

COURSE OBJECTIVE:

1. To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature.
2. To evaluate literature study for analysis review of literature
3. To develop the methodology to solve the identified problem
4. To Conceptualizing a project design
5. To train the students in preparing project reports and to face reviews and viva-voce examination

SYLLABUS:

The student individually works on a specific topic approved by faculty member who is familiar in this area of interest. The student can select any topic which is relevant to his/her specialization of the programme. The topic may be experimental or analytical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work.

TOTAL: 180 PERIODS

COURSE OUTCOME:

- Understand the current need of the society through detailed review of literature.
- Analyze the methodology of literature reviews to solve the identified problem.
- At the end of the course the students will have a clear idea of his/her area of work and they are in a position to carry out the remaining phase II work in a systematic way.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	3	1	2	-	2
2	3	3	1	1	-	-
3	2	3	1	-	2	-
4	-	2	2	2	-	2
5	2	3	1	-	-	2
Avg	2.25	2.8	1.2	1.6	2	2

QE3411 **PROJECT WORK II** **L T P C**

0 0 24 12

COURSE OBJECTIVE:

1. To solve the identified problem based on the formulated methodology.
2. To constructing an instrument for data collection.
3. To writing a project proposal.
4. To processing and displaying the data.
5. To develop skills to analyze and discuss the test results, and make conclusions

SYLLABUS:

The student shall continue (or take up a new) the phase I work on the selected topic as per the formulated methodology. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.

TOTAL: 180 PERIODS

COURSE OUTCOME:

- Understand the constructing an instrument for data collection
- Writing a project proposal and displaying the data
- On completion of the project work students will be in a position to take up any challenging practical problem and find better solutions.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	3	1	2	-	2
2	3	3	1	1	-	-
3	2	3	1	-	2	-
4	-	2	2	2	-	2
5	2	3	1	-	-	2
Avg	2.25	2.8	1.2	1.6	2	2

Attested

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QE3001	QUALITY MANAGEMENT SYSTEMS AND AUDITING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To develop and implement a comprehensive quality management system
2. To optimize machine effectiveness and reliability
3. To evaluate audit plan documents
4. To analyze corrective action responses and their adequacy
5. To apply the process of auditing

UNIT I QUALITY MANAGEMENT SYSTEMS AND AWARD 9

ISO 9000 Series – ISO 9000: 2015 – ISO 9000 Vs Baldrige award – Malcolm Baldrige National Quality award - Environmental Management Systems– Business Process Re – engineering - Building and sustaining Quality

UNIT II TOTAL PRODUCTIVE MAINTENANCE (TPM) 9

Objectives of TPM – Elimination of Wastes by TPM – Equipment Maintenance Techniques – Benefits of TPM – Performance Measures of Maintenance System – Pillars of TPM – Stages of Implementation of TPM – Reliability – Failure Modes and Effects analysis (FMEA)

UNIT III METHODS IN AUDITING 9

Brief history of auditing – General model of auditing – The compliance audit – Performance audit – Product audits – Process audits – System audits – Audit defined – Management principles.

UNIT IV AUDIT PROGRAM MANAGER AND PREPARATION 9

Accountability – Resources for audit program – Phases of audit – The audit team – Second rule of auditing – Authority – Requirements – Understand the process – Audit Plan – Evaluate documents.

UNIT V PERFORMANCE AND REPORTING 9

Opening meeting – Gather the facts – Tracing – Interviews – Interview Techniques – Perceptions – Team meetings – Daily briefings – Onward – Report Characteristics – Pain and pleasure – Findings– Preparing the finding sheets – Recommendations – Exit meeting – Formal report – Report distribution - Closure phase – Remedial action – Corrective action – Corrective action response – Adequacy of the response – Records – An Example Procedure- the process approach – Auditing process-based Quality Management System – Audit program management – The process of Auditing – Audit reporting phase – Audit closure phase

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Comprehensive Quality Management System
CO2. Machine effectiveness and Reliability
CO3. Evaluate the documents for audit plan
CO4. Analysing the Corrective action response and adequacy of the response
CO5. Applying the process of auditing

REFERENCES:

1. Daniel Galin, Software Quality Assurance – from Theory to Implementation, Pearson Education, 2009.
2. Yogesh Singh, "SoftwareTesting", Cambridge University Press, 2012.
3. AdityaMathur, Foundations of Software Testing, Pearson Education, 2008.
4. Bester field, D.H., Carol Bester field, G.H.,Mary Bester filed - - sacre, “Total Quality Management”, Pearson Education, INC, third edition (Revised) (2012)
5. Panneerselvam.R and SivaSankaran.P,”Quality Management”, PHI Learning, New Delhi – 2014.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	2	2	-	2	-	1
2	-	1	-	-	-	-
3	-	-	-	-	-	-
4	-	-	-	-	-	-
5	-	-	-	-	-	-
Avg	2	1.5	-	2	-	1

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

Attested

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QE3051	QUALITY MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To Summarize the Overview of Quality
2. To Illustrate the essentials of Quality
3. To Understand and apply Selected Quality Improvement techniques
4. To gain knowledge on research and development (R&D) certification standards
5. To Develop comprehensive knowledge of Quality Management Systems and awards

UNIT I INTRODUCTION 9

History of Quality – Objectives and Importance of Quality Management – Contributions of Quality Gurus- Quality Information System – Strategy Development and Deployment –Need for Quality Approach to Strategy – Definition of Quality and its types –Distinction between product quality and service quality – TQM Framework- Barriers to TQM– Benefits of TQM.

UNIT II ESSENTIALS OF QUALITY MANAGEMENT 9

Leadership-Desirable Qualities of a Leader-Role of Leaders in Quality improvement; Customer focus – Steps of developing customer focus – Customer and management–Factors affecting customer satisfaction–Importance of customer retention – Employee Involvement - Motivation-Empowerment-Teams-Rewards and Recognition-Performance appraisal-Quality circles.

UNIT III QUALITY IMPROVEMENT TECHNIQUES 9

Continuousprocessimprovement-TheJuranTrilogy-Improvementstrategies-ThePDSACycle-Kaizen-Six Sigma-Bench Marking–Cost of Quality–Quality Function Deployment (QFD) –The role of Information Technology in Quality improvement.

UNIT IV RESEARCH AND DEVELOPMENT STANDARDS 9

Industrial Automation and Control Systems Security (IEC 62443) -(ISO 31000:2018) Risk Management - Association of Clinical Research Professionals (ACRP) - National Institute of Standards and Technology (NIST) - Good Laboratory Practice (GLP) - Good Clinical Practice (GCP) - ISO/IEC 17025:2017 - General Requirements for the Competence of Testing and Calibration Laboratories - Research Excellence Framework (REF) – Intellectual Property (IP) standards.

UNIT V QUALITY MANAGEMENT SYSTEMS AND AWARD 9

ISO 9000 Series – ISO 9001: 2015 – ISO 9000 Vs Baldrige Award – Malcolm Baldrige National Quality Award- Rajiv Gandhi National Quality Award - Quality 5 STAR rating system-ISO 13485:2016 - Medical Devices Quality Management System – ENVIRONMENTAL MANAGEMENT SYSTEM (EMS):Introduction—ISO 14000 Series Standards (ISO 14001, 14004, 14031, 19011) —IATF 16949 Automotive Quality Management System – Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Recognition of the importance of Quality
CO2. Acquiring Essentials of Quality
CO3. Application of Quality Improvement tools
CO4. Research and Development standards
CO5. Comprehensive Quality Management System

REFERENCES:

1. DaleH.Besterfiled,CarolB.Michna, GlenH.Besterfield, Mary B.Sacre, Hemant Urdh wareshe and Rashm iUrdhwareshe, "Total Quality Management", Pearson Education Asia,Revised Third Edition,IndianReprint,Sixth Impression,2013
2. K.Krishnaiah,"Applied Statistical Quality Control and Improvement", PHI Learning, New Delhi–2014
3. Panneerselvam. RandSiva Sankaran. P," Quality Management", PHI Learning, New Delhi–2014
4. Summers,C.S., Quality Management: Creating and Sustaining Organization effectiveness Prentice– Hall of India, New Delhi,2005.
5. Dinesh Kumar Khamari, Quality Management System Manual IATF 16949: 2016., 2020.
6. Research and Development Evaluation in the Aerospace and Defense Industry & quot; by Matthew Z. Liberatore and Brian J. Lunday
7. ISO 13485:2016 - A Complete Guide to Quality Management in the Medical Device Industry" by Itay Abuhav
8. Good Laboratory Practice: A Question & Answer Reference Guide" by David S. Loseke
9. ISO 9001:2015 for Small Businesses & quot; by Ray Tricker

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	-	3	-	-	-	-
2	-	-	-	-	-	3
3	3	-	-	-	3	-
4	-	2	-	-	3	2
5	-	-	3	-		3
Avg	3	2.5	3	-	3	2.6

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

IL3051 APPLIED OBJECT ORIENTED PROGRAMMING L T P C

3 0 0 3

COURSEOBJECTIVES:

1. To understand the basic syntax of c++ programs and to write simple programs
2. To understand OOP concepts and use those concepts in programming
3. To create class in C++ Program
4. To derive a class from base class in c++ program
5. To apply C++ concepts in Industrial Problems

UNIT I C++ Basics 9

Expression and statements, operators, precedence, type conversion, control statements, loops, Arrays structures, functions, argument passing, reference argument, overloaded function. Writing Simple programs - Understanding the Syntax - Troubleshooting Methods.

UNIT II FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 9

Elements of OOP, classes, subjects, messaging, inheritance, polymorphism, OOP paradigm versus procedural paradigm, object-oriented design. Use OOPs concepts to write programs for small IE problems.

UNIT III C++ CLASS 9

Definition, class objects, member functions, class argument, operator overloading, user defined conversions. Application Programs using Classes

UNIT IV CLASS DERIVATION 9

Derivation specification, public and private base classes, standard conversions under derivation, class scope, initialization and assignment under derivation. Write Programs that are derived from base class.

UNIT V CONSTRUCTORS, DESTRUCTORS AND FILE HANDLING 9

Constructors - Copy Constructor – Destructors -Default Constructors - Private Destructor-Exception Handling - Catching Base and Derived Classes as Exceptions-Catch block and type conversion - Exception Handling and Object Destruction-File Handling through C++ Classes- Read/Write Class Objects from/to File in C++

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Create and execute simple C++ programs.
CO2. Use object oriented programming Concepts in programming.
CO3. Create class in C++ program.
CO4. Derive a class from the basic class.
CO5. Create and execute program for solving the industrial problems.

REFERENCES:

1. E.Balagurusamy, Object oriented programming with C ++,Tata Mc Graw Hill, 2020
2. NabajyotiBarkakati,Object Oriented Programming in C++, Prentice Hall of India, 2001
3. Robert Lafore, “Object oriented programming in C++”, Sam Publishing, 2002
4. R.S.Salaria, Mastering Object Oriented Programming with C++, Khanna Publishers, 2016
5. Stanley B Lippman, Josee Lajoie, C++ Primer, Addison – Wesley Pub. Co., 2017

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

	POs			PSO's		
CO's	**1**	**2**	**3**	**1**	**2**	**3**
CO1	2	3	1	2	-	2
CO2	2	3	1	1	-	-
CO3	2	3	1	-	-	-
CO4	-	3	1	2	-	2
CO5	2	3	1	-	-	2
Avg	2	3	1	1.6	-	2

Attested

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IL3055	DESIGN THINKING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To explain the concept of design thinking for product and service development
2. To explain the fundamental concept of innovation and design thinking
3. To discuss the methods of implementing design thinking in the real world.
4. To acquire the skills to create technical drawings for design ideas.
5. To participate in a design thinking workshop to gain training and practical experience in applying design thinking principles.

UNIT I UNDERSTANDING DESIGN THINKING **9**

Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – Minimum Viable Products (MVP) or Prototyping

UNIT II TOOLS FOR DESIGN THINKING **9**

Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design

UNIT III DESIGN THINKING IN IT DESIGN **9**

Thinking to Business Process modelling – Agile in Virtual collaboration environment – Scenario based Prototyping

UNIT IV DESIGN THINKING FOR STRATEGIC INNOVATIONS **9**

Growth – Story telling representation – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.

UNIT V DESIGN THINKING WORKSHOP **9**

Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test

TOTAL:45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Appreciate various design process procedure
CO2. Generate and develop design ideas through different technique
CO3. Identify the significance of reverse Engineering to Understand products
CO4. Draw technical drawing for design ideas
CO5. To get training in design thinking workshop

REFERENCES:

1. Daniel Ling “Complete Design Thinking Guide for Successful Professionals”, Emerge Creatives Group LLP, Print ISBN: 978-981-09-5564-9.
2. A.K. Chitale and R.C. Gupta, “ Product Design and Manufacturing”, Prentice Hall
3. Michael Lewrick, Patrick Link, Larry Leifer, “The Design Thinking Playbook: Mindful Digital Transformation of Teams, Products, Services, Businesses and Ecosystems”, John Wiley & Sons, 2020.
4. John.R.Karsnitz, Stephen O’Brien and John P. Hutchinson, “Engineering Design”, Cengage learning (International edition) Second Edition, 2013.

5. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
6. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011
7. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.
8. Yousef Haik and Tamer M.Shahin, “Engineering Design Process”, Cengage Learning, Second Edition, 2011.
9. Jeanne Liedtka , Andrew King , Kevin Bennett” Solving Problems with Design Thinking - Ten Stories of What Works “,Columbia Business School Publishing,2013 .

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	2	-	3	2	2	2
2	2	3	3	-	2	2
3	2	-	3	2	2	2
4	2	3	3	2	-	-
5	2	-	3	-	-	-
Avg	**2**	**3**	**3**	**2**	**2**	**2**

Attested

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QE3002	METROLOGY AND INSPECTION	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To learn basic concepts of the metrology and importance of measurements.
2. To teach measurement of linear and angular dimensions assembly and tolerances.
3. To study the computer aided inspection methods.
4. To develop the knowledge on surface metrology.
5. To provide the knowledge on nanoscale measurements

UNIT I CONCEPTS OF METROLOGY 9

Measurement – Need, Process, Role in quality control; Factors affecting measurement - SWIPE; Errors in Measurements – Types – Control – Measurement uncertainty – Types, Estimation, Statistical analysis of measurement data, Measurement system analysis, Calibration of measuring instruments, Principle of air gauging- ISO standards. Limits, fits and tolerances- Interchangeability and selective assembly. Fundamentals of Geometric Dimensioning and Tolerancing (GD & T)- Datums, Inspection of geometric deviations.

UNIT II MEASUREMENT OF LINEAR, ANGULAR DIMENSIONS 9

Linear Measuring Instruments –Gauge blocks, Comparators -mechanical measurements using measuring microscope and Profile projector – Angular measuring instruments –. Measurements on Screw threads Measurements on Gears-Analytical measurement- Functional test on gears.

UNIT III COMPUTER AIDED INSPECTION 9

High precision measurements – interfacing – software metrology – Automated visual inspection in manufacturing, contact and non – contact type inspection methods, Electrical field techniques, radiation techniques, Laser Metrology: Laser Interferometer, Alignment Telescope, laser scanners. On-line and in–process measurements.

UNIT IV MODERN SURFACE METROLOGY 9

Measurement of Surface finish – Functionality of surfaces, Parameters, Comparative, Stylus based and Optical Measurement techniques, Filters, Introduction to 3D surface metrology- Parameters- Measuring instruments

UNIT V NANOSCALE MEASUREMENT 9

Introduction-Nanoscale Measurement Techniques:Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM),Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM),X-ray diffraction (XRD) and X-ray scattering techniques, Dynamic Light Scattering (DLS) and nanoparticle tracking analysis (NTA)- Image processing and its application in metrology.

TOTAL:45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Discuss the concepts of measurements to apply in various metrological instruments.

CO2. Apply the principle and applications of linear and angular measuring instruments, assembly and tolerances

CO3. Apply the computer aided inspection methodsfor industrial applications.

CO4. Apply the principles and advanced methods for surface metrology.

CO5. Apply the advances in nanoscale measurement of dimensions.

REFERENCES:

1. Dotson Connie, “Dimensional Metrology”, Cengage Learning, First edition, 2012.
2. Mark Curtis, Francis T. Farago, “Handbook of Dimensional Measurement”, Industrial Press, Fifth edition, 2013.
3. Marshall A. D. and Martin R. R. – ‘Computer Vision, Models and Inspection’ – World Scientific – 1998
4. AmmarGrous, J “Applied Metrology for Manufacturing Engineering”, Wiley-ISTE, 2011.
5. Shotbolt, C.S. and Galyer. J. Metrology for Engineers, Cassell Publ., Fifth Edition, 1990.
6. Salah H. R. Ali,Chapter: Advanced Measurement Techniques in Surface Metrology: Automotive Engine Metrology. Jenny Stanford Publishing (2017)
7. Raghavendra N.V. and Krishnamurthy. L., Engineering Metrology and Measurements, Oxford University Press, 2013.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
1	-	3	-	2	-	-
2	2	3	-	-	-	-
3	3	2	3	2	2	3
4	3	3	3	-	2	-
5	3	3	3	-	2	-
Avg	2.75	2.8	3	2	2	3

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

QE3003 ADVANCED QUALITY PLANNING AND MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To introduce the 8D problem-solving process, tools, and case studies to address root causes of problems.
2. To analyze and interpret various measurement aspects using MSA methods and techniques.
3. To understand APQP tools, reporting requirements, and the role of control plans in the product quality planning cycle.
4. To learn the purpose, requirements, and implementation of the PPAP process in conjunction with APQP.
5. To familiarize with quality awards and performance excellence models to drive organizational excellence.

UNIT I 8D PROBLEM SOLVING 9

Introduction to 8D problem solving process - Procedure -Tools for Finding the Root Cause - 8D Problem Solving Worksheet Case Studies.

UNIT II MEASUREMENT SYSTEM ANALYSIS (MSA) 9

Calculate, analyze, and interpret repeatability and reproducibility (gage R&R) studies, measurement correlation, capability, bias, linearity, precision, stability and accuracy, as well as related MSA quantitative and graphical methods.

UNIT III ADVANCED PRODUCT QUALITY PLANNING (APQP) 9

Overview of ISO 9001 and IATF 16964- APQP tools- Procedure -Reporting requirements specified in the Advanced Product Quality Planning and Control Plan reference manual and Control Plan Second Edition Automotive Industry Action Group[AIAG])- Critical steps in the Product Quality Planning Cycle -Role of the control plan(s).

UNIT IV PRODUCTION PART APPROVAL PROCESS (PPAP) 9

Purpose of the Production Part Approval Process (PPAP)- PPAP process requirements- Production Part Approval Process (PPAP) Manual- Service Production Part Approval Process (Service PPAP) -Implementing APQP with PPAP

UNIT V PERFORMANCE EXCELLENCE MODELS 9

Quality Awards – Criteria- Most Famous Performance Excellence Models:European Excellence Award (EFQM) - Excellence Canada - ASQ International Team Excellence Award (ITEA)-Malcolm Baldrige National Quality Award (MBNQA)-Deming Prize-Rajiv Gandhi National Quality Award.

TOTAL:45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Utilize the 8D problem-solving process, tools, and case studies to address root causes of problems.

CO2. Apply MSA methods and techniques to analyze measurement aspects effectively.

CO3. Implement APQP tools, meet reporting requirements, and utilize control plans in product quality planning.

CO4. Apply the PPAP process in conjunction with APQP for production part approval.

CO5. Familiarize with quality awards and performance excellence models to drive organizational excellence.

REFERENCES:

1. Advanced Product Quality Planning & Control Planning (APQP), Automotive Industry Action Group (AIAG),2nd Edition, 2008.
2. Ali Zarghami, Don Benbow,Introduction to 8D Problem Solving: Including Practical Applications and Examples, Quality Press,2017.
3. Gerardus Blokdy,Measurement Systems Analysis A Complete Guide , 5starcooks, 2020.
4. Production Part Approval Process (PPAP), Automotive Industry Action Group (AIAG),4th Edition, 2006

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	3	-	1	-	-	-
2	-	3	1	-	-	-
3	-	3	1	-	1	-
4	-	3	1	-	1	-
5	-	-	1	3	1	-
Avg	**3**	**3**	**1**	**3**	**1**	**-**

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

Attested

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IL3251 SUPPLY CHAIN SYSTEMS AND MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To describe the role and drivers of and supply chain management in achieving competitiveness.
2. To explain about Supply Chain Network Design.
3. To illustrate about the issues related to inventory in Supply Chain.
4. To appraise about transportation and sourcing in Supply Chain.
5. To application of Information Technology and Emerging Concepts in Supply Chain.

UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT 9

Definition and Objective of Supply Chain, The importance of Supply Chain Decisions, Decision Phases in a Supply Chain, Process View of Supply Chains. Competitive and Supply Chain Strategies, Achieving Strategic fit, Expanding Strategic Scope. Drivers of Supply Chain Performance, Frame work for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing, Infrastructure, International Logistics

UNIT II DISTRIBUTION NETWORK DESIGN IN SUPPLY CHAIN 9

The Role of Distribution in the Supply Chains, Factors influencing Distribution Network design, Design Options for a Distribution Network, Online sales and the Distribution network, Distribution Networks in practice. Factors influencing network design decisions, Framework for Network design decisions, The impact of uncertainty on network design, The impact of Globalization on Supply Chain networks, Risk Management in Global Supply Chains, Discounted cash flow analysis, Evaluating Network Design Decisions

UNIT III INVENTORY IN SUPPLY CHAIN 9

The Role of Cycle inventory in a Supply Chain, Economies of Scale to Exploit Fixed costs, Managing Multi-echelon Cycle Inventory. The Role of Safety Inventory in a Supply Chain, Determining appropriate level of Safety inventory, Impact of supply Uncertainty on Safety inventory, Impact of aggregation on safety inventory, impact of replenishment policies on safety inventory, Managing Safety Inventory in a Multi-echelon Supply Chain, The Role of IT in inventory management.

UNIT IV TRANSPORTATION AND SOURCING IN SUPPLY CHAIN 9

The role of transportation in a Supply chain, Modes of transportation and their performance characteristics, Transportation infrastructure and policies, Design options for a transportation network, Trade-offs in transportation design, Tailored transportation, The role of IT in transportation, Problems. Sourcing Decisions In A Supply Chain: The role of sourcing in a supply chain, in-house or outsource, Third-and Fourth-party logistics providers, Total cost of Ownership, Supplier selection, Auctions and Negotiations, Sharing Risk and Reward in the supply chain.

UNIT V INFORMATION TECHNOLOGY IN SUPPLY CHAIN 9

The role of IT in a supply chain, The supply chain IT framework, The supply chain macro processes, Lack of Supply Chain co-ordination and the Bullwhip effect, managerial levers to achieve coordination, continuous replenishment and vendor-managed inventories, collaborative planning, forecasting and replenishment (CPFR).

TOTAL:45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand supply chain concepts, systemic and strategic role of SCM in global competitive environment.

CO2. Evaluate alternative supply and distribution network structures using optimization models.

CO3. Develop optimal inventory policies in the supply chain context.

CO4. Develop optimal sourcing and Transportation decisions in the supply chain.

CO5. Select appropriate information technology frameworks for managing supply chain processes.

REFERENCES:

1. Sunil Chopra, Peter Meindl and D.V. Kalra, “Supply Chain Management: Strategy, Planning, and Operation", Pearson Education, 2016.
2. Sarika Kulkarni & Ashok Sharma, Supply Chain Management – Creating Linkages for Faster Business Turnaround, 1st Edition, TATA Mc Graw Hill, 2004.
3. David Simchi Levi, Philip Kaminsky, Edith Simchi Levi & Ravi Shankar, Designing & Managing the Supply Chain – Concepts Strategies and Case Studies, McGraw-Hill higher education, 3rd Edition, 2008.
4. Jeremy F Shapiro, Modelling the Supply Chain, 2nd Edition, Cengage Learning,2009.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	2	3	1	2	3
1	1	2	1			
2	3	3	1	1	1	1
3	3	3	1	1	1	1
4	3	3	1	1	1	1
5	3	3	1	1	3	1
Avg.	**2.6**	**3**	**1**	**1**	**1.5**	**1**

IL3053 ENGINEERING ECONOMICS AND COST ESTIMATION L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To understand the concept of Engineering Economics and apply in the real word.
2. To gain knowledge in the field of value engineering to enable the students to estimate the costing factors
3. To understand the concept of cash flow and its methods of comparison
4. To acquire knowledge in the field of cost estimation
5. To enable the students to estimate the cost of various manufacturing processes.

UNIT I INTRODUCTION TO MANAGERIAL ECONOMICS AND DEMAND ANALYSIS 9

Definition of Managerial Economics - Nature and scope of Managerial Economics - Managerial Economics and other disciplines. Objectives of the firm - Factors influencing Managerial decisions - Basic concepts of Managerial Economics. Demand Analysis – Defining demand, Types of demand and Determinants of demand, Elasticity of demand and demand forecasting**.**

UNIT II PRODUCTION AND COST ANALYSIS 9

Production Analysis – Production function, Returns to a factor, Returns to scale, ISO quants and Least cost combination of inputs. Cost Analysis – Cost concepts, Determinants of cost, Short-run cost-output Relationship, Long-run cost output relationship, Economies and Diseconomies of scale and Estimating cost – Output Relationship.

UNIT III PRICING 9

Determinants of price – Pricing under different objectives – Pricing under different market structures – Price discrimination – Pricing of Joint products – Pricing methods in practice.

UNIT IV ESTIMATION OF MATERIAL AND LABOUR COSTS 9

Introduction to Estimation and Costing – Elements of costs – Allocation of overheads – Estimation of Material cost – Estimation of Labour cost, Indirect Expenses and Depreciation

UNIT V ESTIMATION OF OPERATIONAL COST 9

Estimation in Machine shop – Estimation in Forging shop –Estimation in welding shop.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. know about method to Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.

CO2. Calculate payback period and capitalized cost on one or more economic alternatives.

CO3. know about method to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives

CO4. Prepare the cost estimation report for any project

CO5. Learn about cost accounting, replacement analysis

REFERENCES:

1. A.RamachandraAryasri and V.V.Ramana Murthy, “Engineering Economics and Financial Accounting”, McGraw Hill Education (India), New Delhi, 2004
2. R.Paneerselvam, “Engineering Economics”, PHI, 2013
3. V.L.Mote, Samuel Paul and G.S.Gupta, “ Managerial Economics – concepts and cases”, McGraw Hill Education (India), 2017.
4. Yogesh Maheshwari, “Managerial Economics”, Third edition, PHI 2012
5. T.R.Banga and S.C.Sharma, “Mechanical Estimating and Costing”, 16th Edition, Khanna Publishers, 2012.

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

CO	PO's			PSO's		
	1	2	3	1	2	3
CO1	-	3	-	-	-	-
CO2	-	-	-	-	-	3
CO3	3	-	-	-	3	-
CO4	-	2	-	-	3	2
CO5	-	-	3	-		3
AVG	3	2.5	3	-	3	2.6

Attested

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IL3058 INDUSTRIAL SCHEDULING ALGORITHMS L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To gain the basic concepts of Sequencing and Scheduling theory.
2. To impart knowledge on the Applications of Single Machine Sequencing Algorithms
3. To gain understanding of Parallel Machine Scheduling Algorithms
4. To impart knowledge on Flow Shop Scheduling and its algorithms
5. To provide knowledge on Job Shop Scheduling and its algorithms

UNIT I SCHEDULING BASICS 9

Scheduling Background – Sequencing and Scheduling – Performance measures: Flow time – Tardiness – Weighted flow time - Priority rules: SPT, EDD, WSPT - Scheduling Theorems – Scheduling constraints – Pure Sequencing model.

UNIT II SINGLE MACHINE MODEL 9

Characteristics - Smith's rule – Hogdson's algorithm – Wilkerson Irwin algorithm – Neighbourhood Search method – Branch and Bound algorithm – Dynamic Programming method – Non simultaneous arrivals – Dependent jobs sequencing – Sequence dependent setup times.

UNIT III PARALLEL MACHINE MODEL 9

Characteristics - Preemptive jobs: McNaughton's algorithm – Non preemptive jobs: Heuristic approaches – Minimizing weighted mean flow time: H_1 and H_m heuristics – Dependent jobs: Hu's heuristic – Muntz Coffman heuristic.

UNIT IV FLOW SHOP MODEL 9

Characteristics – Johnson's Algorithm – Extension to 3 machine problem – nxm FSP: Campbell Dudek Smith algorithm – Palmer's algorithm – Gupta's algorithm – Start/Stop lags – Mitten's algorithm – Ignall Schrage algorithm – Dispatch Index heuristic.

UNIT V JOB SHOP MODEL 9

Characteristics – Graphical representation – Feasible schedule identification (Network diagram) – Semi active schedule - Active schedule – Single pass approach – Non delay schedule – Heuristic schedule generation – Dynamic job shop scheduling – Open shop – Meta heuristics applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamental theory in Sequencing and Scheduling.
CO2: Determine the sequence that minimizes a performance measure in single machine problems
CO3: Design a Parallel Machine schedule to minimize performance measures
CO4: Apply heuristics/algorithms to design a Flow shop
CO5: Demonstrate the use of heuristics for Job shop scheduling

REFERENCES:

1. Kenneth R.Baker, "Introduction to Sequencing and Scheduling", John Wiley & Sons, New York, 2000.
2. Richard W.Conway, William L.Maxwell and Louis W.Miller, "Theory of Scheduling", Dover Publications, 2003.
3. Kenneth R.Baker, Dan Trietsch, " Principles of Sequencing and Scheduling", John Wiley & Sons, New York, 2019.

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

	PO's			PSO's		
CO's	**1**	**2**	**3**	**1**	**2**	**3**
CO1	2	2				
CO2	2	2	3	3	3	
CO3	2	2	3	3	3	
CO4	2	2	3	3	3	
CO5	2	2	3	3	3	2
Avg	2	2	3	3	3	2

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

IL3059	INDUSTRIAL FACILITIES DESIGN	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To understand the basic principles in facilities planning and plant location
2. To gain knowledge on the basic principles in facility layout design decisions through proper analysis
3. To analyze various modern trends while designing a layout using computerized algorithms
4. To understand the basic principles of group technology and develop knowledge in line balancing concepts to implement improved system
5. To understand basic principles in designing, measuring and analyzing material flow to improve the efficiency of the system

UNIT I PLANT LOCATION **9**

Plant location analysis – factors, costs, location decisions – Single facility location models, Multi facility location models - Mini-sum model - Mini-max model - Gravity location models, Brown & Gibbs model - Multi Criteria location problems - P median model - Developing facilities planning strategies- Examples of inadequate planning

UNIT II FACILITIES LAYOUT DESIGN **9**

Facilities requirement, need for layout study – types of layout - Factors affecting plant layout - P-Q chart - Systematic layout planning - Information gathering, Flow & Activity analysis, Relationship diagram, Space Constraint – OSHA, ADA regulations in facility design

UNIT III LAYOUT PLANNING ALGORITHMS **9**

Computerized layout planning procedure – ALDEP, CORELAP, CRAFT – Trends in computerized layout - Layout software

UNIT IV GROUP TECHNOLOGY & LINE BALANCING **9**

Group technology – OPTIZ classification system - Production Flow analysis , Rank Order Clustering I & II - Product oriented layout- assumptions and types, Assembly line balancing – Objectives, Line balancing techniques – LCR, KWM, RPW, COMSOAL - Introduction to Multi-model assembly line - Mixed model assembly line balancing

UNIT V MATERIALS HANDLING **9**

Concept of material handling – Principles - Material handling system design – Models for material handling system design- Classification of material handling equipments, AGV – types, Conveyors – types of conveyors – Palletizers – Warehouse material handling devices - Equipment selection & specification, Packaging – Types & Functions

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Interpret appropriate location models for various facility types
CO2. Examine different type of design and analyze various facility layouts
CO3. Analyze and apply various computerized techniques while designing a layout
CO4. Predict a strategy to level the workload across all the workstations
CO5. Estimate smooth and cost effective system in the material handling process

REFERENCES:

1. Tompkins, J.A. and White J A et al., “Facilities planning”, Fourth edition, John Wiley & Sons, 2010.
2. SundereshS.Heragu, “Facilities Design”, Fourth edition, CRC Press, 2016.
3. Krajewski. J and Ritzman, “Operations management – Strategy and Analysis”, Addison – Wesley publishing company, 5th edition, 1999.
4. Pannerselvam.R, “Production and Operations Management”, PHI, 2017.
5. Richard Francis. L. and John A. White, “Facilities Layout and location - an analytical approach”, Second edition, PHI., 2002.
6. James, Apple, “Material Handling System Design”, Ronald Press, 1980.

CO’s - PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	2	3	1	2	3
1	-	2	2	3	3	-
2	-	1	-	2	-	-
3	-	3	1	3	2	3
4	-	3	2	3	3	-
5	-	2	1	2	3	-
Avg.	-	2.2	1.5	2.6	2.75	3

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

IL3061	MAINTAINABILITY ENGINEERING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. To understand basic maintenance concepts and latest trends
2. To know various maintenance policies for maximizing the profit.
3. To diagnose and analyse maintenance problems.
4. To know effective spare parts management strategies
5. To learn strategies for improving the overall Equipment Effectiveness.

UNIT I MAINTENANCE CONCEPT **9**

Maintenance definition – Maintenance objectives - Maintenance challenges – Tero Technology Maintenance costs - Scope of maintenance department. –Latest Trends in Maintenance- Computerized Maintenance Management Software (CMMS)- Role of IoT in Maintenance- Digital Twins in Maintenance.

UNIT II MAINTENANCE MODELS **9**

Proactive/reactive maintenance - Maintenance policies – Imperfect maintenance Preventive / breakdown maintenance – Optimal PM schedule and product characteristics – Inspection decisions - Maximizing profit - Minimizing downtime – Replacement decisions.

UNIT III MAINTENANCE QUALITY **9**

Five zero concept – FMEA- FMECA – Root cause analysis – Repair time distribution – Analysis of downtime – Maintainability prediction – Design for maintainability – Reliability Centered Maintenance.

UNIT IV MAINTENANCE MANAGEMENT **9**

Human factors – Maintenance staffing - Learning curves – Simulation – Optimal size of service facility – Optimal repair effort – Spare parts management – Maintenance planning – Maintenance scheduling.

UNIT V TOTAL PRODUCTIVE MAINTENANCE **9**

TPM philosophy – Chronic and sporadic losses – Equipment defects – Six major losses – Overall equipment effectiveness –TPM pillars –Autonomous maintenance.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Describe basic maintenance concepts and latest trends in maintenance
CO2. Extract maintenance policies for maximizing the profit.
CO3. Diagnosis of maintenance problems.
CO4. Improve uptime of machines by effective spare parts management.
CO5. Improve the overall Equipment Effectiveness.

REFERENCES:

1. Andrew K.S.Jardine& Albert H.C. Tsang, “Maintenance, Replacement and Reliability-Theory and Applications” Taylor and Francis, 2021.
2. Mishra R C and Pathak K., “Maintenance Engineering and Management”, PHI,2012
3. BikasBadhury& S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2008.
4. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.
5. Matthew P. Stephens, “Productivity and Reliability-Based Maintenance Management”, Purdue University Press, 2010

CO’s - PO’s & PSO’s MAPPING

	PO’s			PSO’s		
CO’s	**1**	**2**	**3**	**1**	**2**	**3**
CO1	1	-	1	-	2	-
CO2	1	-	1	-	2	-
CO3	1	-	1	-	2	-
CO4	1	-	1	-	2	-
CO5	1	-	1	-	2	-
Avg	1	-	1	-	2	-

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

IL3052	MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. Understanding the Basics of accounting and recording of transactions
2. Evaluating P&L statements, Balance sheets and other accounting statements.
3. Learn and apply the various cost accounting methods.
4. Study the various cost control procedures.
5. Sketch and prepare a budget and make investment decisions.

UNIT I INTRODUCTION 9

Basics of accounting – Management Accounting – Financial accounting – cost accounting – comparison of financial accounting, cost accounting and management accounting – generally accepted accounting principles – Accounting standards – Accounting cycle-Recording of transactions: journalizing, ledger posting, preparation of Trial Balance- Introduction to Financial Institution.

UNIT II FINANCIAL ACCOUNTING 9

Preparation of Companies Financial Statements - Salient features of Balance Sheet and Profit and Loss statement, cash flow and Fund flow Analysis (Elementary), ratio analysis.

UNIT III COST ACCOUNTING 9

Cost accounting systems: Job Costing, process costing, allocation of overheads, Activity based costing, variance analysis–marginal costing–Break even analysis.

UNIT IV BUDGETING 9

Requirements for a sound budget, fixed budget – preparation of sales and production budget, flexible budgets, zero based budgets and budgetary control.

UNIT V FINANCIAL MANAGEMENT 9

Investment decisions – Investment appraisal techniques – payback period method, accounting rate of return, net present value method, internal rate of return and profitability index method-cost of capital.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Analyse the financial transaction and prepare the Trail Balance

CO2. Evaluate the financial statements.

CO3. Ability to apply the management and cost accounting techniques for decision making.

CO4. Construct andanalyse a various types of budget

CO5. Examine investment decision based on capital budgeting techniques.

REFERENCES:

1. Narayanaswamy R 2014, Finanacial Accounting – A Managerial Perspective, 5th Ed, Prentice Hall of India.
2. Bhattacharyya, Asish K. Principles And Practice Of Cost Accounting, 3rd Edition, 2004.
3. I M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th Edition, 2018.
4. M.Y. Khan & P.K. Jain, Management Accounting, Tata McGraw Hill, 8 thedtion, 2018.
5. Maheshwari SN, Maheshwari SK& Maheshwari SK An Introduction to Accountancy, 12th Ed,Vikas Pub. House. 2022.
6. Horne, J.C. Van and Wackowich. Fundamentals of Financial Management. Pearson Education, 12th Edition, 2008.

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

	PO's			PSO's		
CO's	**1**	**2**	**3**	**1**	**2**	**3**
CO1	-	3	-	-	-	-
CO2	-	-	-	-	-	3
CO3	3	-	-	-	3	-
CO4	-	2	-	-	3	3
CO5	-	-	3	-		3
Avg	3	2.5	3	-	3	3

QE3004 MODERN MANUFACTURING MANAGEMENT CONCEPTS L T P C

3 0 0 3

COURSE OBJECTIVES:

1. Develop basic knowledge on lean manufacturing concepts.
2. Inculcate knowledge in agile manufacturing principles.
3. Solve and analyze various concepts in sustainable manufacturing.
4. Teach the tools and techniques used in sustainable manufacturing.
5. Articulate knowledge about the design, principles and challenges in industry 4.0

UNIT I LEAN MANUFACTURING 9

Introduction to Lean Manufacturing, Comparison of Mass Manufacturing and Lean Manufacturing, Lean Principles, Types of Wastes –Types of activities –Examples - Tools of Lean Manufacturing- Principle, Procedural - Lean rules - Implementation for lean systems- Leanness assessment – Indicators, methods.

UNIT II AGILE MANUFACTURING 9

Fundamentals of Agile Manufacturing, Agile Principles, Conceptual models, Product Development Strategies for agility, Developing the agile enterprise, Managing People in agile organizations, Strategic approach to agile manufacturing, Information Technology applications in Agile Manufacturing, Assessment of agility - Activity Based Costing - Case studies.

UNIT III SUSTAINABLE MANUFACTURING 9

Concepts of sustainability and sustainable development – Need for sustainable development - Components of sustainability- Social, Economic, Environmental dimensions - Linkages between technology and sustainability - Sustainable Manufacturing –Scope, Need and Benefits.

UNIT IV TOOLS AND TECHNIQUES OF SUSTAINABLE MANUFACTURING 9

Tools and Techniques of Sustainable Manufacturing – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly - Sustainable Product Development Phases. Frameworks for measuring sustainability- Indicators of sustainability – Environmental, Economic, Societal and Business indicators - Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment.

UNIT V INDUSTRY 4.0 9

Definition, Design, Principles, Challenges

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand the basic philosophies of lean manufacturing concepts

CO2. Effectively gain knowledge in agile manufacturing principles

CO3. Apply and analyze various concepts in sustainable manufacturing

CO4. Understand the tools and techniques used in sustainable manufacturing

CO5. Gain knowledge about the design, principles and challenges in Industry 4.0

REFERENCES:

1. Alasdair Gilchrist,Industry 4.0: The Industrial Internet of Things 1 st Edition,Apress,2016
2. Asefa S., "The Economics of Sustainable Development", W.E. Upjohn Institute for Employment Research, 2005.
3. Atkinson G., Dietz S., Neumayer E., — "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.
4. Lawn P., "Sustainable Development Indicators in Ecological Economics", Edward Elgar Publishing Limited.
5. Rodick, D. "Industrial Development for the 21st Century: Sustainable Development Perspectives", UN New York, 2007.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	-	1	-	-	-	-
2	-	1	2	3	-	-
3	3	1	2	3	2	2
4	2	1	2	3	2	2
5	2	1	2	3	2	-
Avg	2.6	1	2	3	2	2

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

QE3005	HUMAN INDUSTRIAL SAFETY AND HYGIENE	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1 To identify and prevent operational hazard
2 To categorize, analyze and interpret the accidents data based on various safety techniques
3 To use proper safety techniques on safety engineering and management
4 To design the system with environmental consciousness by implementing safety regulation
5 To use safety management practices in Industries

UNIT I INTRODUCTION **9**

Importance of Safety - health and environment. Health safety and environmental policy - fundamentals of safety - classification of accidents - Management's responsibility - objectives of safety management - National safety council - Employees state insurance act 1948 - approaches to prevent accidents - principles of safety management - safety organization - safety auditing - maintenance of safety - measurements of safety performance - industrial noise and noise control - Industrial Psychology - Industrial accidents and prevention. Introduction to OSHAS 18001 and OSHA.

UNIT II SAFETY APPRAISAL AND ANALYSIS **9**

Plant safety observation, inspections - Safety sampling - Safety surveys - Job safety analysis. Safety inventory system - Product safety - Permit to work systems - Safety tag systems - Loss control - Damage control and system safety - Laws and Regulation: Manufacture, Storage and Import of Hazardous Chemical (Amendment) Rules, 2000, Chemical Rules 1986, Hazardous Waste (Management, Handling and Trans boundary Movement) Rules 2008. Hazards and Risks - Hazard analysis: Inductive, deductive, FMEA and CMA. Fault tree analysis.

UNIT III SAFETY MANAGEMENT **9**

Evaluation of modern safety concepts – safety management functions – safety organization - Organization Structure, Function & Responsibilities - safety department- safety committee, safety audit – performance measurements and motivation – employee participation in safety - safety and productivity.

UNIT IV OCCUPATIONAL HEALTH **9**

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chloride, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT V SAFETY AND HEALTH REGULATIONS **9**

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Inferring safety concepts and identify, prevent operational hazard
CO2 Collect, analyze and interpret the accidents data based on various safety techniques
CO3 Implementing safety management practices in industries.
CO4 Develop proper safety techniques on safety engineering and management
CO5 Design the system with environmental consciousness by implementing safety regulation

REFERENCES:

1. Deshmukh, L.M "Industrial safety management" first edition, Tata Megraw Hill, New Delhi, 2006.
2. Jain R.K and Sunil S Rao "Industrial safety health and environment Management system, second edition, Khanna Publishers, 2008.
3. John. V. Grimaldi and Rollin. H Simonds, "Safety Management", All India traveler Book seller, New Delhi 1989.
4. John V Grimaldi, Safety Management. AITB publishers, 2003
5. Krishnan N.V, "Safety in Industry", Jaico Publisher House, 1996.
6. Singh, U.K and Dewan, J.M., "Sagety, Security and Risk Management", APH publishing company, New Delhi, 1996

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	-	2	-	-	-	-
2	2	-	-	-	-	1
3	2	-	-	-	2	-
4	-	-	-	-	-	2
5	-	-	-	-	-	-
Avg	2	2	-	3	2	1.5

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

IL3063 LOGISTICS AND DISTRIBUTION MANAGEMENT L T P C

3 0 0 3

COURSEOBJECTIVES:

1. To develop an understanding of the role of logistics in a market-oriented society Examine the major functions of logistics
2. To provide insight into Transportation Mode Selection and its cost structures
3. To impart knowledge on Packaging and Containerization
4. To familiarize Warehousing functions, types, Internal Operations

UNIT I LOGISTICS MANAGEMENT 9

Definition, Evolution, Importance. The concepts of logistics. Logistics relationships. Functional applications – Logistics Organization - Logistics in different industries -Logistics Activities: – functions, objectives, solution. Third party and fourth party logistics - Reverse Logistics - Global Logistics. Legal types - Modes of transportation –Transport mode selection –methods - Transportation Functionality and Principles; Multimodal Transport: Modal Characteristics; Modal Comparisons; Legal Classifications; International Air Transport; Air Cargo Tariff Structure; Freight: Definition, Rate; Freight Structure and Practice, Transport costs – rate profiles–transport regulations– intra and interstate transport of goods. Transport Industry in India- International Transport – Rail ways, Road transport, Ports – Transport Security - Trends in Modern Transport

UNIT II PACKAGING AND CONTAINERIZATION 9

Transportation and Packaging. Packaging and Packing: Labels, Functions of Packaging, Designs, Kinds of Packaging; Packing for Transportation and Marking: Types of Boxes, Container, Procedure, Cost, Types of Marking, Features of Marking. Containerization: Genesis, Concept, Classification, Benefits and Constraints; Inland Container Depot (ICD): Roles and Functions, CFS, Export Clearance at ICD; CONCOR; ICDs under CONCOR; Chartering: Kinds of Charter, Charter Party, and Arbitration

UNIT III WAREHOUSE FUNCTIONS AND TYPES 9

Warehouse –objectives- Functions Activities-Types- Own Warehouses- Hired Warehouses- Private Warehouses- Public Warehouses- Government Warehouses- Bonded Warehouses- Co-operative Warehouses- Distribution Warehouses- Fulfilment/ Consolidation Warehouses Warehouses Providing Value Added Services- Cross Docking and Trans-loading Warehouses- Break Bulk Warehouses- Storage Warehouses- Refrigerated Warehouses Characteristics of ideal warehouses- Warehouse Layout- Principles and Facilities Types.

UNIT IV WAREHOUSE OPERATIONS 9

Internal Operations: Measures and metrics of warehouse operations- Logistics in the warehouse- Localization of materials in a warehouse- Identification and classification of Materials and products in the warehouse- Managing the material/products turns in warehouse (FIFO/LIFO) – Problems and issues in shipment processes. Warehousing Equipment: Material Handling equipment and Systems Safety Matting, Industrial Safety Equipment- Storage types and storage unit management- Material Storage Systems - benefits – methods- Industrial Shelving, Industrial Storage Bins - Industrial Storage Cabinets - Spill Containment Systems-Industrial Waste Disposal

UNIT V EXPORT & IMPORT PROCEDURES **9**

Export & Import – Introduction, Definitions. Evolution of Export & Import. Foreign Trade-Institutional Framework and Basics-Documentation and Steps, Export–Import Strategies and Practice, Export Marketing, Business Risk Management and Coverage, Export Incentive Schemes Export Procedures and Documents, Customs Clearance of Import and Export Cargo, Methods and Instruments of Payment and Pricing Inco terms, Methods of Financing Exporters

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand the principles of logistics management
CO2. Understand the logistics role in the economy and the organization
CO3. Gain knowledge about warehouse functions and types
CO4. Understand warehouse operations
CO5. Familiarise about Export & Import Procedures in Logistics and Distribution

REFERENCES:

1 Kapoor Satish K &KansalPurva.(2003)Basics of Distribution Management: A Logistical Approach :Prentice Hall of India
2 Agrawal D K. (2007). Distribution and Logistics Management: A Strategic Marketing Approach :Macmillan publishers India.
3 Alan Ruston, Phil Crouches & Peter Baker. (2014)The Handbook of Logistics and Distribution Management. New Delhi: kogan page India.
4 Bowersox. (2000). Logistical Management: Mc-Graw Hill.

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	3	-	2	-	3	-
2	2	-	-	-	-	-
3	-	-	3	-	-	-
4	-	-	2	-	-	-
5	-	-	3	-	3	-
Avg.	2.5	-	2.5	-	3	-

IL3057 **ENGINEERING PROJECT MANAGEMENT** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

1. To know various models used in project selection.
2. To understand the project planning, and demand analysis.
3. To understand the financial analysis of the project.
4. To apply network techniques for project scheduling and resource allocation.
5. To recognize the values of project audit.

UNIT I INTRODUCTION **9**

Project Management: An Overview – Types, Characteristics of Projects – Project life cycle - Identification of investment opportunities - Screening and Selection, Project Appraisal.

UNIT II PROJECT PLANNING AND DEMAND ANALYSIS **9**

Work breakdown structure, Systems integration, Interface coordination - Market and demand analysis - market survey - demand forecasting methods - Technical analysis – manufacturing process, materials-product mix, plant location - project charts and layouts.

UNIT III FINANCIAL ANALYSIS **9**

Financial analysis – cash flows for project appraisal- Investment evaluation using capital budgeting techniques - net present value, profitability index internal rate of return, payback period, accounting rate of return - cost versus time, straight-line approximation of variation of cost with reduction in time for activities, direct and indirect costs.

UNIT IV PROJECT SCHEDULING **9**

Scheduling: Gantt chart, milestone chart, Network Techniques PERT and CPM, Crashing a project, Resource loading, leveling, and allocation – GERT - Q-GERT.

UNIT V PROJECT AUDITING **9**

Construction and use of audit report, Project audit life cycle, Essentials of audit and evaluation, Varieties of project termination, the termination process, The Final Report – A project history.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand various models used in project selection.
CO2. Acquire knowledge in project planning, and demand analysis.
CO3. Understand the financial analysis of the project.
CO4. Prepare project scheduling and resource allocation.
CO5. Understand the values of project audit.

REFERENCE:

1. Kerzner Harold, "Project Management - A Systems Approach to Planning, Scheduling and Controlling", CBS Publishers Delhi, Second edition (2002).
2. Jack R. Meredith, and Samuel J. Mantel Jr, Project Management – A Managerial Approach, John Wiley and Sons, 10th edition, 2017.
3. Weist Jerome D and Ferdinand K. Levy, "A Management Guide to PERT/CPM with GERT/PDM/DCPM and other networks", Prentice-Hall of India New Delhi, Second edition (2003).

4. Parsanna Chandra, "Project Planning, Analysis, Selection, Implementation and Review", Tata McGraw Hill, Fourth Edition (2002).
5. Srinath L.S., "PERT & CPM Principles and Applications", Affiliated East- West Press Pvt. Ltd., New Delhi, Third Edition (1993).
6. Panneerselvam .R, Senthil Kumar .P, Project Management, PHI, 2009.

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	-	-	-	-	-	-
2	2	-	-	3	-	-
3	2	-	-	3	-	-
4	3	-	-	3	3	-
5	-	-	-	-	-	-
Avg.	2.33	-	-	3	3	-

Attested

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Centre for Academic Courses
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IL3060 **DECISION SUPPORT SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

1 To understand the fundamental terms, concepts and theories associated with the phases of Decision Support Systems.
2 To evaluate the various mathematical models, data warehousing and data mining.
3 To discuss and develop skills in the analysis, design and implementation of group support systems and knowledge management systems.
4 To analyze the expert system as a subsystem of DSS
5 To create the knowledge representation method and implement support systems.

UNIT I DECISION MAKING INTRODUCTION 9

Management Support System - Managerial decision making, System modeling and support - preview of the modeling process - phases of decision-making process - DSS Architecture, Analysis, Design, Requirements, and Validation

UNIT II MODELING AND ANALYSIS 9

DSS components - Modelling and Analysis - Database Organization and Structures, Data Warehousing, Data Marts, Business Intelligence/ Analytics, Online Analytical Processing, Data Mining - DSS development - Software tools for Development - AHP.

UNIT III KNOWLEDGE MANAGEMENT 9

Group support systems- Enterprise DSS- supply chain and DSS - Knowledge management methods - Organizational Learning and Transformation, technologies and tools.

UNIT IV KNOWLEDGE REPRESENTATION 9

Artificial intelligence and expert systems - Concepts, structure, types - Knowledge Engineering - Principle and Methods - Difficulties, methods, selection, verification and validation - Advanced Intelligent Systems.

UNIT V SUPPORT SYSTEM IMPLEMENTATION 9

Representation in logic and schemas, semantic networks, production rules and frames, inference techniques, intelligent system development, implementation and integration of management support systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1 Choose decisions in the semi structured and unstructured problem situations.
CO2 Illustrate the data warehousing and data mining principles in basic applications.
CO3 Develop a knowledge management system with simple tools and techniques.
CO4 Construct intelligent based DSS and gain knowledge on AI expert systems.
CO5 Express logical and analytical thinking in making decisions.

REFERENCES:

1 Efraim Turban and Jay E Aronson, “Decision Support and Business Intelligent Systems”, PHI, Eighth edition, 2010.
2 Gupta, J.N.D., Forgionne, G.A., and Manuel, M.T., Intelligent Decision-making Support Systems: Foundations, Applications and Challenges, Springer, 2006
3 Iantovics, B., and Kountchev, R., Advanced Intelligent Computational Technologies and Decision Support Systems, Springer, 2014
4 Kumer. K., Zindani, D. and Davim, J.P., Digital Manufacturing and Assembly Systems in Industry 4.0, CRC Press, 2019

5 Tweedale, J.W., Neves-Silva, R., Jain, L.C., Phillips-Wren, G., Watada, J., and Howlett, R.J., Intelligent Decision Technology Support in Practice, Springer, 2016
6 Valencia-Garcia, R, Paredes-Valverde, M.A., Salas-Zarate, M.P. and Alor-Hernandez, Giner., Exploring Intelligent Decision Support Systems, Springer, 2018

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

CO's	PO's			PSO's		
	1	2	3	1	2	3
1	-		1	-	-	-
2	-	2	-	-	-	-
3	2	-	-	2	1	-
4	-	-	2	-	1	-
5	-	-	2	-	2	-
Avg.	2	2	1.6	2	2	-

Attested

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QE3006 SOFTWARE PRODUCT ENGINEERING AND METHODOLOGIES L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To practice the various software modeling tools and techniques.
2. To study the various performance measurement tools and techniques.
3. To estimate time and cost of projects.
4. To select an appropriate monitoring plan.
5. To study the importance of software design and software testing

UNIT I SOFTWARE ENGINEERING AND MODELS 9

Software Development – Phases, Process Models (ISO & CMM) – Product Life Cycle – Software Life Cycle Models.

UNIT II REQUIREMENTS ANALYSIS 9

Software requirements specifications – Structured tools for Software development– Structured analysis.

UNIT III SOFTWARE COST ESTIMATION 9

Planning a Software project – Cost Estimation and models – Software configuration management plans– Project monitoring plans.

UNIT IV SOFTWARE DESIGN 9

System Design and Principles – Module level concepts – Structured design – Design methodology – Object oriented approach – Detailed design – Coding.

UNIT V SOFTWARE TESTING 9

Software testing– Functional testing – Structural testing – Testing Process – Software Quality Metrics– Software Quality Management – Software Productivity.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Practice the various software modeling tools and techniques.

CO2. Study the various performance measurement tools and techniques.

CO3. Estimate time and cost of projects.

CO4. Select appropriate monitoring plan.

CO5. Study the importance of software design and software testing.

REFERENCES:

1. Pressman R S , Software Engineering, McGraw Hill, seventh edition , 2010.
2. Mayrhausen A V, Software Engineering and Management, Academic press, 1990.
3. PankajJalote, An integrated approach to Software Engineering, Naross Publishing, 2018.
4. Somavile , Software Engineering, Addison – Wesley, 2011.
5. Stephen H. Khan, Metrics and Models and Software Quality Engineering, Addison Wesley,2002.

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	2	3	2	2	2	2
2	2	2	1	2	1	2
3	1	-	1	-	-	1
4	-	-	2	3	-	2
5	-	-	-	-	-	1
Avg	**1.67**	**2.50**	**1.50**	**2.33**	**1.50**	**1.60**

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

Attested

DIRECTOR
Centre for Academic Courses
Anna University, Chennai-600 025

IL3062	PRODUCT DESIGN AND VALUE ENGINEERING	L T P C
		3 0 0 3

COURSE OBJECTIVES:

1. Relate product development integrated with value engineering.
2. Summarize the development of new products through conceptualization, design and development phases.
3. Relate various aspects of product development with industrial design and manufacturing.
4. Describe the value of a product using tools and techniques.
5. Design products which are suitable for the needs of the society.

UNIT I VALUE ENGINEERING BASICS 9

Origin of Value Engineering, Meaning of value, Definition of Value Engineering and Value analysis, Difference between Value analysis and Value Engineering, Types of Value, function - Basic and Secondary functions, concept of cost and worth, creativity in Value Engineering.

UNIT II VALUE ENGINEERING JOB PLAN AND PROCESS 9

Seven phases of job plan, Functional Analysis and System Technique - Diagram as Value Engineering Tool, Behavioural and organizational aspects of Value Engineering, Ten principles of Value analysis, Benefits of Value Engineering.

UNIT III IDENTIFYING CUSTOMER NEEDS AND PRODUCT SPECIFICATIONS 9

Product Development process – front end process-Product development organizations. Gather raw data – Interpret raw data- organize the needs into a hierarchy –Relative importance of the needs. Specifications – Refining specifications-Quality Function Deployment (QFD)-Product Costing.

UNIT IV CONCEPT GENERATION, SELECTION AND PRODUCT ARCHITECTURE 9

The activities of concept generation, Clarify the problem – Search internally – Search externally – Explore systematically. Concept Screening – Concept scoring-Concept testing. Product architecture – Implication of architecture –Establishing the architecture – Related system level design issues. Design for Manufacture, Assembly, Maintenance and Environment

UNIT V INDUSTRIAL DESIGN, PROTOTYPING AND ECONOMICS 9

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design. Prototyping: Prototyping basics, principles of prototyping, technologies, planning for prototypes. Product development economics: Elements of economic analysis, sensitive analysis

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Understand the basic concept of product development.
CO2. Design and develop new products in a systematic manner considering the concept of value engineering.
CO3. Understand customer requirements.
CO4. Understand product architecture.
CO5. Gain knowledge and create the prototype models.

REFERENCES:

1. Charles Gevirtz, “Developing New products with TQM”, McGraw Hill, International Editions, 1994.
2. Rosenthal S, “Effective Product Design and Development”, Irwin, 1992.
3. A K Chitale and R C Gupta , “ Product Design and Manufacturing”, PHI, New Delhi, 2003
4. Karal, T.Ulrich Steven D.Eppinger, “Product Design and Development”, McGraw Hill, International Editions, 2003.
5. Mudge, Arthur E. “Value Engineering”- A systematic approach, McGraw Hill, New York, 2000.

CO’s - PO’s & PSO’s MAPPING

CO’s	PO’s			PSO’s		
	1	**2**	**3**	**1**	**2**	**3**
CO1	2	2	-	-	-	2
CO 2	2	1	2	-	1	1
CO 3	2	2	2	-	1	1
CO 4	2	2	2	-	1	1
CO 5	2	2	2	1	1	1
Avg.	2	1.8	2	0.5	1	1.2

IL3064 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To understand the concepts of supervised and unsupervised learning.
2. To analyze models such as support vector machines, kernel SVM, Naive Bayes, decision tree classifier, random forest classifier, logistic regression, K-means clustering
3. To implement and work with state-of-art tools in machine learning

UNIT I INTRODUCTION TO MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE 9

Human Learning, Types of Human Learning, Machine Learning-Types of Machine Learning - Supervised learning, Unsupervised learning, Reinforcement learning, Comparison – supervised, unsupervised, and reinforcement learning, Problems Not To Be Solved Using Machine Learning, Applications of Machine Learning, State-of-The-Art Languages/Tools In Machine Learning, Issues in Machine Learning. Preparing to Model: Introduction, Machine Learning Activities, Basic Types of Data in Machine Learning, Exploring Structure of Data, Data Quality and Remediation, Data Pre-Processing

UNIT II MODELLING , EVALUATION AND FEATURE ENGINEERING 9

Modelling and Evaluation: Introduction, Selecting a Model, Training a Model (for Supervised Learning), Model Representation and Interpretability, Evaluating Performance of a Model, Supervised learning – classification, Supervised learning – regression, Unsupervised learning – clustering, Improving Performance of a Model. Basics of Feature Engineering, Feature Transformation, Feature construction, Feature extraction, Feature Subset Selection, Issues in high-dimensional data, Key drivers of feature selection – feature relevance and redundancy, Measures of feature relevance and redundancy, Overall feature selection process, Feature Selection Approaches.

UNIT III BAYESIAN METHODS 9

Bayesian Concept Learning: Introduction, Importance, Bayes' Theorem and Concept Learning, Brute-force Bayesian algorithm, Concept of consistent learners, Bayes optimal classifier, Naïve Bayes classifier, Applications of Naïve Bayes classifier, Handling Continuous Numeric Features in Naïve Bayes Classifier, Bayesian Belief Network, Independence and conditional independence, Use of the Bayesian Belief network in machine learning.

UNIT IV SUPERVISED LEARNING- CLASSIFICATION AND REGRESSION 9

Classification- Introduction, Example of Supervised Learning, Classification Model, Classification Learning Steps, Common Classification Algorithms, k-Nearest Neighbour (KNN), Decision tree, Random forest model, Support vector machines. Regression-Introduction, Example of Regression, Common Regression Algorithms, Simple linear regression, Multiple linear regression, Assumptions in Regression Analysis, Main Problems in Regression Analysis, Improving Accuracy of the Linear Regression Model, Polynomial Regression Model, Logistic Regression, Maximum Likelihood Estimation

UNIT V UNSUPERVISED LEARNING 9

Introduction, Unsupervised vs Supervised Learning, Application of Unsupervised Learning, Clustering, Clustering as a machine learning task, Different types of clustering techniques, Partitioning methods, K-Medoids: a representative object-based technique, Hierarchical clustering, Density-based methods – DBSCAN, Finding Pattern using Association Rule, Definition of common terms, Association rule, The apriori algorithm for association rule learning, Build the apriori principle rules.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

The students will be able to

CO1. Explore and apply the fundamentals of machine learning techniques.

CO2. Understand different techniques of data pre processing.

CO3. Analyze the strength and weakness of different machine learning models to solve real world problems.

CO4. Implement and apply different supervised and unsupervised machine learning algorithms.

REFERENCES:

1. Machine Learning, Amit Kumar Das, SaikatDutt, Subramanian Chandramouli, Pearson Education India, April 2018 ISBN: 9789389588132.
2. Introduction to Machine Learning, EthemAlpaydin, 2nd Edition, 2010, PHI Publication, ISBN978-81-203-4160-9.
3. Practical data science with R, Zumel, N., & Mount J, Manning Publications, 2014, ISBN 9781617291562
4. Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithms, Nikhil Buduma, O'Reilly Publications, 2016 Edition, ISBN-13: 978-1491925614.
5. Pattern Recognition and Machine Learning, Christopher M Bishop, Springer, February 2006, ISBN-10: 0-387-31073-8, ISBN-13: 978-0387-31073-2.
6. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, and Jerome Friedman, Springer, Second Edition, April 2017, ISBN 978-0-387-84858-7

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

CO's	PO's			PSO's		
	1	**2**	**3**	**1**	**2**	**3**
1	3	-	-	-	-	-
2	-	3	3	-	2	-
3	3	-	3	-	2	3
4	3	-	3	-	2	3
5	-	-	3	-	2	3
Avg	3	3	3	-	2	3

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