ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

REGULATIONS 2017

M.E. INDUSTRIAL ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS):

I. To prepare the students with scientific, mathematical and engineering fundamentals required to excel in the field of industrial engineering.
II. To prepare the students to excel in research in India/abroad through global, rigorous post graduate education.
III. To provide the students with in depth research based knowledge in Industrial engineering to recognize, comprehend, analyze and to solve complex real life problems.
IV. To inculcate the students with the competencies to work well in local and international team environments, communication skills, professional and ethical attitude.
V. Graduates will continue to engage in life-long learning, understanding and applying knowledge and ideas of Industrial Engineering in allied disciplines.

PROGRAMME OUTCOMES :

On successful completion of the programme,

1. Graduates will demonstrate the knowledge of mathematics, science and engineering.
2. Graduates will be able to Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions.
3. Graduates will demonstrate an ability to design a system, component or process as per the needs and specifications.
4. Graduates will demonstrate an ability to use research methods including design of experiments, analysis and synthesis of the information to provide valid conclusions.
5. Graduates will demonstrate the techniques, skills, and modern engineering tools necessary for industrial engineering practice.
6. Graduates will demonstrate the knowledge of professional and ethical responsibility.
7. Graduates will demonstrate an ability to function effectively as an individual member or a leader in diverse teams, and in multidisciplinary activities.
8. Graduates will be able to communicate effectively in oral and written form.
9. Graduates will demonstrate an ability to apply project, financial management principles and techniques individually/collaboratively in project planning, implementation and control
10. Graduates will engage in independent and life-long learning for personal and societal development.

PEO/PO Mapping

Programme Educational Objectives	Programme Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
I	✓	✓	✓		✓				✓	
II				✓	✓				✓	✓
III		✓	✓	✓	✓			✓	✓	✓
IV						✓	✓	✓		
V			✓				✓			✓

Semester Course wise PO mapping

		Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
YEAR 1	SEM 1	Applied Probability and Statistics	✓	✓	✓		✓				✓	✓
		Work System Design		✓	✓				✓			
		Operations Research	✓		✓							
		Operations Management	✓	✓		✓	✓				✓	
		Facilities Design		✓	✓	✓	✓					
		Work System Design Laboratory		✓			✓		✓	✓		
	SEM 2	Manufacturing Systems and Models		✓	✓	✓						
		Systems and Simulation	✓	✓	✓		✓				✓	
		Statistical Quality Control	✓	✓	✓	✓	✓			✓		
		Logistics and Supply Chain Management		✓		✓	✓					
		Computer Applications Laboratory	✓	✓	✓	✓	✓			✓		✓
YEAR 2	SEM 3	Design of Experiments and Taguchi Methods	✓	✓	✓	✓	✓					
		Project Work Phase I	✓	✓	✓	✓	✓	✓		✓	✓	✓
	SEM 4	Project Work Phase II	✓	✓	✓	✓	✓	✓		✓	✓	✓

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REGULATIONS 2017

M.E. INDUSTRIAL ENGINEERING

CHOICE BASED CREDIT SYSTEMS
I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA5160	Applied Probability and Statistics	FC	4	4	0	0	4
2.	IL5101	Work System Design	PC	3	3	0	0	3
3.	IL5102	Operations Research	PC	4	4	0	0	4
4.	IL5103	Operations Management	PC	4	4	0	0	4
5.	IL5104	Facilities Design	PC	3	3	0	0	3
6.		Professional Elective I	PE	3	3	0	0	3
PRACTICAL								
7.	IL5111	Work System Design Laboratory	PC	2	0	0	2	1
8.	IL5112	Technical Seminar - I	EEC	2	0	0	2	1
			TOTAL	**25**	**21**	**0**	**4**	**23**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL5201	Manufacturing Systems and Models	PC	3	3	0	0	3
2.	IL5202	Systems and Simulation	PC	3	3	0	0	3
3.	IL5203	Statistical Quality Control	PC	4	4	0	0	4
4.	IL5204	Logistics and Supply Chain Management	PC	3	3	0	0	3
5.		Professional Elective II	PE	3	3	0	0	3
6.		Professional Elective III	PE	3	3	0	0	3
PRACTICAL								
7.	IL5211	Computer Applications Laboratory	PC	2	0	0	2	1
8.	IL5212	Technical Seminar - II	EEC	2	0	0	2	1
			TOTAL	**23**	**19**	**0**	**4**	**21**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL5301	Design of Experiments and Taguchi Methods	PC	4	4	0	0	4
2.		Professional Elective IV	PE	3	3	0	0	3
3.		Professional Elective V	PE	3	3	0	0	3
PRACTICAL								
4.	IL5311	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL CREDITS	**22**	**10**	**0**	**12**	**16**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	IL5411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL CREDITS	**24**	**0**	**0**	**24**	**12**

FOUNDATION COURSES (FC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA5160	Applied Probability and Statistics	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL5101	Work System Design	PC	3	3	0	0	3
2.	IL5102	Operations Research	PC	4	4	0	0	4
3.	IL5103	Operations Management	PC	4	4	0	0	4
4.	IL5104	Facilities Design	PC	3	3	0	0	3
5.	IL5111	Work System Design Laboratory	PC	2	0	0	2	1
6.	IL5201	Manufacturing Systems and Models	PC	3	3	0	0	3
7.	IL5202	Systems and Simulation	PC	3	3	0	0	3
8.	IL5203	Statistical Quality Control	PC	4	4	0	0	4
9.	IL5204	Logistics and Supply Chain Management	PC	3	3	0	0	3
10.	IL5211	Computer Applications Laboratory	PC	2	0	0	2	1
11.	IL5301	Design of Experiments and Taguchi Methods	PC	4	4	0	0	4

LIST OF ELECTIVES FOR M.E. INDUSTRIAL ENGINEERING

SEMESTER I (Elective I)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL5001	Scheduling Algorithms	PE	3	3	0	0	3
2.	IL5002	Product Innovation and Development	PE	3	3	0	0	3
3.	IL5003	Productivity Management and Re-Engineering	PE	3	3	0	0	3
4.	IL5004	Total Quality Management	PE	3	3	0	0	3
5.	IL5071	Human Factors in Engineering	PE	3	3	0	0	3

SEMESTER II (Elective II & III)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL5005	Software Quality Engineering	PE	3	3	0	0	3
2.	IL5006	Engineering Economics and Costing	PE	3	3	0	0	3
3.	IL5007	Lean Six-Sigma	PE	3	3	0	0	3
4.	IL5008	Decision Support and Intelligent Systems	PE	3	3	0	0	3
5.	IL5009	Design and Analysis of Algorithms	PE	3	3	0	0	3
6.	IL5010	Applied Object Oriented Programming	PE	3	3	0	0	3
7.	IL5011	Management Accounting and Financial Management	PE	3	3	0	0	3
8.	IL5012	Industrial Automation	PE	3	3	0	0	3
9.	IL5013	Optimization Techniques	PE	3	3	0	0	3
10.	CM5094	Project Management	PE	3	3	0	0	3

SEMESTER III (Elective IV & V)

SL. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL5014	Business Excellence Models	PE	3	3	0	0	3
2.	IL5015	Systems Science and Engineering	PE	3	3	0	0	3
3.	IL5016	Industrial Safety and Hygiene	PE	3	3	0	0	3
4.	IL5017	Services Operations Management	PE	3	3	0	0	3
5.	IL5018	Multivariate Data Analysis	PE	3	3	0	0	3
6.	IL5091	Data Analytics	PE	3	3	0	0	3
7.	IL5019	Systems Analysis and Design	PE	3	3	0	0	3
8.	IL5020	Cellular Manufacturing Systems	PE	3	3	0	0	3
9.	IL5021	Reliability Engineering Models	PE	3	3	0	0	3
10.	IS5091	Maintainability Engineering	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL5112	Technical Seminar - I	EEC	2	0	0	2	1
2.	IL5212	Technical Seminar - II	EEC	2	0	0	2	1
3.	IL5311	Project Work Phase I	EEC	12	0	0	12	6
4.	IL5411	Project Work Phase II	EEC	24	0	0	24	12

MA5160 APPLIED PROBABILITY AND STATISTICS L T P C
4 0 0 4

OBJECTIVES :

This course is designed to provide the solid foundation on topics in applied probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis and multivariate analysis.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – Axioms of probability – Conditional probability – Baye's theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT III ESTIMATION THEORY 12

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines.

UNIT IV TESTING OF HYPOTHESIS 12

Sampling distributions – Type I and Type II errors – Small and large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V MULTIVARIATE ANALYSIS 12

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables

TOTAL : 60 PERIODS

OUTCOMES :

After completing this course, students should demonstrate competency in the following topics:

- Basic probability axioms and rules and the moments of discrete and continuous random variables.
- Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.
- Use statistical tests in testing hypotheses on data.
- Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multivariate normality.
- The students should have the ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

REFERENCES :

1. Dallas E. Johnson, "Applied Multivariate Methods for Data Analysis", Thomson and Duxbury press, 1998.
2. Devore, J. L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014.
3. Gupta S.C. and Kapoor V.K.," Fundamentals of Mathematical Statistics", Sultan and Sons, New Delhi, 2001.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers ", Pearson Education, Asia, 8th Edition, 2015.
5. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", 5th Edition, Pearson Education, Asia, 2002.

IL5101 **WORK SYSTEM DESIGN** **L T P C**
3 0 0 3

OBJECTIVE:

- To impart knowledge in the area of Method study and Time study so that students implement these principles and techniques to improve productivity in manufacturing and service sectors.

UNIT I METHOD STUDY **9**

Work design and Productivity – Productivity measurement - Total work content, Developing methods – operation analysis, motion & micro motion study, graphic tools.

UNIT II WORK MEASUREMENT **9**

Stop watch time study, Performance rating, allowances, standard data-machining times for basic operations, learning effect

UNIT III APPLIED WORK MEASUREMENT **9**

Methods Time Measurement (MTM) - Work sampling - Organization and Methods (O & M) - Wage incentive plans.

UNIT IV PHYSICAL ERGONOMICS **9**

Physical work load and energy expenditure, Anthropometry – measures – design procedure, Work postures-sitting, standing - measurement – ergonomic implications. design of displays and controls,

UNIT V ENVIRONMENTAL FACTORS **9**

Sources & effects of Noise - Vibration, lighting, temperature, humidity & atmosphere. Measures for monitoring, control & mitigation.

TOTAL: 45 PERIODS

OUTCOMES:

- The students should be able to measure productivity of a work system through work system design and apply various above mentioned techniques.

REFERENCES

1. Barnes, R.M. Motion and Time Study, John Wiley, 2002.
2. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., Seventh Edition, 2002
3. Introduction to work study, ILO, 3rd edition, Oxford & IBH publishing,2001
4. Martin Helander, A Guide to human factors and Ergonomics, Taylor and Francis, 2006.

IL5102 **OPERATIONS RESEARCH** **L T P C**
4 0 0 4

OBJECTIVE:

- To learn the basics of deterministic optimization tools.

UNIT I INTRODUCTION-LP **12**

Concepts of OR, development, applications, LP Definitions, assumptions, formulation, graphical method, Simplex algorithm.

UNIT II LP-EXTENSIONS **12**

Duality- primal dual relationships -Dual Simplex –- sensitivity analysis, Data Envelopment Analysis.

UNIT III NETWORKS **12**

Transportation, Assignment, Maximal flow, Shortest route, Spanning tree problems, Project Net Works.

UNIT IV DYNAMIC PROGRAMMING 12

Dynamic Programming-Concepts, formulation, recursive approach; applications

UNIT V WAITNG LINES 12

Queuing characteristics and terminology - poison and non-poison models.

TOTAL: 60 PERIODS

OUTCOMES:

- The students can solve optimization problems of deterministic nature**.**

REFERENCES

1. Don T.Phillips, A.Ravindran & James Solberg, Operations Research: Principles and practice, John Wiley, India, 2006.
2. Handy M.Taha, Operations research, an introduction, 7th edition, PHI, 2003.
3. Panneer Selvam,R Operations Research,2nd Edition, PHI 2008.
4. Srinivasan G, Operations Research Principles and Applications, ,PHI 2008

IL5103 OPERATIONS MANAGEMENT L T P C
4 0 0 4

OBJECTIVE:

- To impart knowledge in the areas of production planning and control applicable to various types of manufacturing systems.

UNIT I INTRODUCTION 6

Production Management – Input-output model, objectives, Trends and challenges, value chains, operations strategy, Technological Innovations in Manufacturing, Corporate strategic choices, Process planning and selection.

UNIT II FORECASTING: 15

Need for forecasting, the forecasting process, Forecasting methods- qualitative methods, Quantitative models-Time series forecasting models, moving averages, exponential smoothing with trend and seasonal adjustment, multi-item forecasting, Simple and multiple linear regression models, monitoring and controlling forecasts.

UNIT III INVENTORY MANAGEMENT: 15

Types of inventory, Inventory classification methods, Inventory costs Inventory models-deterministic models, probabilistic models - safety stock and reorder points – Inventory control systems.

UNIT IV PLANNING ACTIVITIES: 15

Capacity planning- short term and long term capacity, capacity of facilities, break even capacity, use of decision trees, aggregate production planning - strategies, methods, Master Production Schedule, MRP- lot sizing, MRP II, CRP, ERP.

UNIT V PRODUCTION CONTROL ACTIVITIES: 9

Production Activity Control, Just-in-time systems, Scheduling in Manufacturing, Theory of constraints and synchronous manufacturing.

TOTAL: 60 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to demonstrate the knowledge in fundamental concepts and issues of operations management in creating and enhancing firm's competitive advantages.

REFERENCES

1. Lee J.Krajewski, Larry P.Ritzman, “Operations Management”, Pearson Education, 2006.
2. Mahadevan,B. Operations- Theory & Practice, Pearson Education, 2007.
3. Panneerselvam,R. Production and operations management, PHI, 2010.
4. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington,“Production Planning and Inventory Control” , PHI, 2002.

IL5104 FACILITIES DESIGN L T P C
3 0 0 3

OBJECTIVE:

- To explain the basic principles in facilities planning, location, layout designs and materials handling systems.

UNIT I PLANT LOCATION 9

Plant location analysis – factors, costs, location decisions – single facility location models, multi facility location models- set covering problems – warehouse location problems.

UNIT II FACILITIES LAYOUT 9

Facilities requirement, need for layout study – types of layout, Designing product layout-Legal aspects in layout design.

UNIT III LAYOUT DESIGN 9

Design cycle – SLP procedure, computerized layout planning procedure – ALDEP, CORELAP, CRAFT

UNIT IV GROUP TECHNOLOGY AND LINE BALANCING 9

Group technology – Production Flow analysis (PFA), ROC (Rank Order Clustering) – Line balancing.

UNIT V MATERIALS HANDLING 9

Principles, unit load concept, material handling system design, handling equipment types, selection and specification, containers and packaging.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to analyze, design and apply layout principles for layout problems, material handling and packaging.

REFERENCES

1. James Apple, M. Plant layout and “Material Handling”, John Wiley, 1977.
2. Panneerselvam,R, “Production and Operations Management”, PHI,2007.
3. Tompkins, J.A. and J.A.White, “Facilities planning”, John Wiley, 2003.
4. Richard Francis.L. and John A.White, “Facilities Layout and location – an analytical approach”, PHI., 2002.

IL5111 WORK SYSTEM DESIGN LABORATORY L T P C
0 0 2 1

AIM:

To understand the theory better and apply in practice, practical training is given in the following areas:

LIST OF EXPERIMENTS

1. Graphic tools for method study
2. Performance rating exercise
3. Stop watch time study

4. Peg board experiment
5. Work sampling
6. MTM practice
7. Study of physical performance using tread mill and Ergo cycle
8. Physical fitness testing of individuals
9. Experiments using sound level and lux meters
10. Experiments using Ergonomics software

TOTAL: 30 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. Time study Trainer
2. Peg board
3. Stop watches
4. Tread mill
5. Ergo cycle
6. Any one Ergonomics software (Eg.: Ergomaster, Human CAD)

OUTCOMES:

- Students should able to design, analyze and apply the above mentioned techniques to measure productivity.

IL5112 TECHNICAL SEMINAR - I L T P C
0 0 2 1

OBJECTIVE:

To enrich the communication skills of the student through presentation of topics in recent advances in engineering/technology.

OUTCOME:

Students will develop skills to read, write, comprehend and present research papers.
Students shall give presentations on recent areas of research in manufacturing engineering in two cycles. Depth of understanding, coverage and quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

TOTAL: 30 PERIODS

IL5201 MANUFACTURING SYSTEMS AND MODELS L T P C
3 0 0 3

OBJECTIVES:

- To introduce the students different models used to describe the manufacturing systems and use them for effective operations of manufacturing industries.

UNIT I INTRODUCTION 5

Manufacturing systems – types and concepts, manufacturing automation - Performance measures – types and uses of manufacturing models.

UNIT II FOCUSSED FACTORIES 9

GT/CMS, FMS planning, design and control. Process planning – variant and generative approaches of CAPP, general serial systems – analysis of paced and unplaced lines.

UNIT III LEAN SYSTEMS 9

Characteristics of Lean systems for services and Manufacturing, Pull method of work flow, Small lot sizes, Kanban system, Value stream mapping, JIT

UNIT IV QUEUING MODELS OF MANUFACTURING 10

Basic Queuing models, Queuing networks, application of queuing models for AMS.

UNIT V MARKOV AND PETRINET MODELS OF MANUFACTURING 12

Stochastic processes in manufacturing, discrete and continuous time Markov chain models. Concepts of Petri nets, ET0PN and GSPN models.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to apply the principles behind focused factory, Markovand petrinet Models, Queuing models, lean system to modern manufacturing systems.

REFERENCES

1. Lee J. Krajewski, Operations Management – Processes and Value Chains, Pearson, 2008.
2. Nicolas, J.M, Competitive manufacturing management - continuous improvement, lean production, and customer focused quality, McGraw-Hill, NY, 2001.
3. Ronald G.Askin, Charles R. Standridge, modeling and analysis of manufacturing systems, John wiley &sons,Inc ,2000.
4. Ronald G.Askin, Jeffery B. Goldberg, Design and Analysis of Lean Production Systems John Wiley & sons, Inc ,2002.
5. Viswanadam, N and Narahari, Y., Performance modeling of automated manufacturing systems, PHI, New Delhi, 1996.

IL5202 SYSTEMS AND SIMULATION L T P C

3 0 0 3

OBJECTIVES:

- To cover various aspects of discrete dynamic, stochastic systems modeling and conducting experiments with those models on a computer.

UNIT I INTRODUCTION 6

Systems, modeling, general systems theory, concept of simulation, simulation as a decision making tool, types of simulation.

UNIT II RANDOM NUMBERS AND VARIATES 6

Pseudo random numbers, methods of generating random variates, testing of random numbers and variates.

UNIT III DESIGN OF SIMULATION EXPERIMENTS 9

Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.

UNIT IV SIMULATION LANGUAGES 12

Comparison and selection of simulation languages, study of any one simulation language.

UNIT V APPLICATIONS 12

Development of simulation models using the simulation language studied for systems like, queuing systems, production systems, inventory systems, maintenance and replacement systems, investment analysis and network.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to analyze, models and simulate experiments to meet real world systems and evaluate the performance**.**

REFERENCES

1. Jerry Banks and John S.Carson, Barry L Nelson, David M.Nicol, P.Shahabudeen, Discrete event system simulation, Pearson Education, 2007.
2. Law A.M, Simulation Modelling and Analysis, Tata Mc Graw Hill,2008

3. Tayfur Altiok, Benjamin Melamed, Simulation Modeling and Analysis with ARENA, Elsevier, 2007.
4. Thomas J.Schriber, Simulation using GPSS, John Wiley, 1991

IL5203 STATISTICAL QUALITY CONTROL L T P C
4 0 0 4

OBJECTIVES:

- To facilitate the students in knowing the application of statistical techniques in Quality control and assurance.

UNIT I INTRODUCTION 9

Statistical concepts for quality- Fundamentals of quality- history, Quality definitions, Quality dimensions, Quality terminology- Inspection, Quality control, SQC, Quality Assurance, Quality planning- policies & objectives, Quality costs – Economics of quality, Quality loss function, Quality Vs productivity, Quality Vs reliability.

UNIT II STATISTICAL PROCESS CONTROL 15

Process variation, Control charts for variables- $\overline{X}$, R and S charts- preliminary decisions, computation of control limits, Construction and interpretation, Relation between process in control and specification limits, modified and warning control limits, O.C. curve for $\overline{X}$ chart, Control procedure, adjustment for trend in process mean.

UNIT III SPECIAL CONTROL PROCEDURES 15

Control charts for attributes- p, np, c and u charts, demerits control chart, O.C curve for p-chart, Control charts for individual measurements- X-chart, moving average and moving range charts, cumulative-sum and exponentially weighted moving average control charts, multi-vari chart.

UNIT IV PROCESS AND MEASUREMENT SYSTEM CAPABILITY 9

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

UNIT V ACCEPTANCE SAMPLING 12

Acceptance sampling, Economics of sampling, Single sampling plan for attributes- O.C. curve, design, double sampling- O.C. curve, multiple and sequential sampling plans, sampling plans for variables, MIL-STD-105E and MIL-STD-414 & IS2500 standards.

TOTAL: 60 PERIODS

OUTCOMES:

- Control the quality of processes using contro charts for variables in manufacturing industries**.**
- Control the occurrence of defective product and the defects in manufacturing companies.
- Control the occurrence of defects in service.

REFERENCES

1. Douglas C Montgomery, Introduction to Statistical Quality Control, Sixth Edition,John Wiley & sons, Inc., 2009. IS 2500 Standard sampling plans
2. E.L. Grant and R.S. Leavenworth, Statistical Quality Control, Seventh Edition,TMH, 2000.
3. IS 2500 Standard Sampling plans.
4. K.Krishnaiah, Applied Statistical Quality Control and Improvement, PHI, 2014.

IL5204 LOGISTICS AND SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To impart the fundamental knowledge in logistics and supply chain management.

UNIT I INTRODUCTION 9

Definition of Logistics and SCM: Evolution, Scope, Importance - Supply chain stages and decision phases process view of a supply chain - Supply chain flows- Examples of supply chains- Competitive and supply chain strategies- Achieving strategic fit- Expanding strategic scope- Drivers of supply chain performance- Framework for structuring drivers -Obstacles to achieving fit.

UNIT II LOGISTICS MANAGEMENT 9

Factors – Modes of Transportation - Design options for Transportation Networks - Routing and Scheduling – Inbound and outbou006Ed logistics- Reverse Logistics – 3PL- 4PL- Global Logistics -Integrated Logistics Concepts - Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis

UNIT III SUPPLY CHAIN NETWORK DESIGN 9

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions

UNIT IV SOURCING AND REVENUE MANAGEMENT IN SUPPLY CHAIN 9

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

UNIT V COORDINATION AND INFORMATION TECHNOLOGY IN SUPPLY CHAIN 9

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work- E Business and SCM. Metrics for SC performance – Case Analysis

TOTAL: 45 PERIODS

OUTCOMES:

- The students should apply information, demand forecasting, inventory management, transportation, warehousing & distribution, protective packaging, order processing, material handling,purchasing & sourcing management techniques to manufacturing systems.

REFERENCES:

1. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, Logistics, PHI 2010
2. G. Srinivasan(2010) Quantitative Models in Operations and Supply Chain Management, PHI, Learning (P) Ltd, New Delhi.
3. Jeremy F.Shapiro ,Modeling the supply chain, Thomson Duxbury, 2002
4. Sople Vinod V, Logistics Management , Pearson Education, 2010.
5. Sunil Chopra , Peter Meindl and Kalra Supply Chain Management, Strategy, Planning, and operation, Pearson Education, 2011

IL5211 COMPUTER APPLICATIONS LABORATORY L T P C
0 0 2 1

OBJECTIVES :

- To understand the theory better and apply in practice, practical training is given in the following areas.
    - Development of Simple Programs for Statistical analysis: Frequency distribution, Applications of Graphics. (Charts, Graphs etc).
    - Programs for OR applications like Initial solution of Transportation Problems, Net Works etc
    - Solving optimization problems using software packages like LINDO, LINGO, TORA.Excel Solver.
    - Development of Random number generator, Testing of random number generator. Non-uniform Random varieties generation and testing.Single server Queuing simulation, Case Studies
    - Program for Simulation of Single server Queueing System – Use of Simulation software. Case studies.

TOTAL: 30 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

1. TURBO C++ Software
2. LINDO Software
3. LINGO Software
4. TORA Software
5. GPSS Software
6. MS EXCEL

IL5212 TECHNICAL SEMINAR-II L T P C
0 0 2 1

OBJECTIVE:

To enrich the communication skills of the student through presentation of topics in recent advances in engineering/technology

OUTCOME:

Students will develop skills to read, write, comprehend and present research papers.
Students shall give presentations on recent areas of research in manufacturing engineering in two cycles. Depth of understanding, coverage, quality of presentation material (PPT/OHP) and communication skill of the student will be taken as measures for evaluation.

TOTAL: 30 PERIODS

IL5301 DESIGN OF EXPERIMENTS AND TAGUCHI METHODS L T P C
4 0 0 4

OBJECTIVES:

- To impart knowledge to design experiments to a problem situation using traditional experimental designs as well as Taguchi methods.
- To develop skill to conduct experiments and analyze the data to determine the optimal process parameters that optimize the process.

UNIT I EXPERIMENTAL DESIGN FUNDAMENTALS 12

Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression models.

UNIT II SINGLE FACTOR EXPERIMENTS 12

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

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.

UNIT IV SPECIAL EXPERIMENTAL DESIGNS: 12

Blocking and confounding in 2^k designs. Two level Fractional factorial design, nested designs, Split plot design, Response Surface Methods.

UNIT V 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.

TOTAL: 60 PERIODS

OUTCOMES:

- The students will be able to apply experimental techniques to practical problems to improve quality of processes/ products by optimizing the process/ product parameters.

REFERENCES

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, Eighth edition, 2012.
3. Montgomery, D.C., Design and Analysis of Experiments, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.
4. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
5. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

IL5001 SCHEDULING ALGORITHMS L T P C

3 0 0 3

OBJECTIVE:

- To impart knowledge on various scheduling algorithms applicable to single machine, parallel machines, flow shop and job shop models.

UNIT I SCHEDULING THEORY 9

Scheduling background – Scheduling function – Sequencing – Ready time – Flow time – Tardiness - Weighted flow time – Inventory – Regular measures of performance – Dominant schedules – SPT, EDD, WSPT sequences – Scheduling Theorems.

UNIT II SINGLE MACHINE SCHEDULING 9

Pure sequencing model – Hodgson's algorithm – Smith's rule – Wilkerson Irwin algorithm – Neighborhood search – Dynamic programming technique – Branch and Bound algorithm – Non simultaneous arrivals – Minimizing $\overline{T}$ and $\overline{F}$ for dependent jobs – Sequence dependent set up times.

UNIT III PARALLEL MACHINE SCHEDULING 9

Preemptive jobs: McNaughton's algorithm – Non preemptive jobs – Heuristic procedures – Minimizing $\overline{F_w}$: H_1 & H_m heuristics – Dependent jobs: Hu's algorithm – Muntz Coffman algorithm.

UNIT IV FLOW SHOP SCHEDULING 9

Characteristics – Johnson's algorithm – Extension of Johnson's rule – Campbell Dudek Smith algorithm – Palmer's method – Start lag, stop lag – Mitten's algorithm – Ignall Schrage algorithm - Despatch index heuristic.

UNIT V JOB SHOP SCHEDULING 9

Characteristics –Graphical tools – Jackson's algorithm – Feasible, Semi-active and Active schedules – Single pass approach – Non delay schedule – Priority dispatching rules – Heuristic schedule generation – Open shop scheduling.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to design, analyze and implement single machine, parallel machine, flow shop, and job shop scheduling algorithms.

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.

IL5002 PRODUCT INNOVATION AND DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:

- To get knowledge of Innovation in product design and development.

UNIT I PRODUCT DEVELOPMENT AND CONCEPT SELECTION 10

Product development process – Product development organizations- Identifying the customer needs – Establishing the product specifications – concept generation – Concept selection.

UNIT II PRODUCT ARCHITECTURE 7

Product architecture – Implication of the architecture – Establishing the architecture – Related system level design issues.

UNIT III INDUSTRIAL AND MANUFACTURING DESIGN 10

Need for industrial design – Impact of industrial design – Industrial design process. Assessing the quality of industrial design- Human Engineering consideration -Estimate the manufacturing cost – Reduce the component cost – Reduce the assembly cost – Reduce the support cost – Impact of DFM decisions on other factors

UNIT IV PROTOTYPING AND ECONOMIC ANALYSIS 9

Principles of prototyping – Planning for prototypes - Elements of economic analysis – Base case financial model – Sensitivity analysis – Influence of the quantitative factors

UNIT V MANAGING PRODUCT DEVELOPMENT PROJECTS 9

Sequential, parallel and coupled tasks - Baseline project planning – Project Budget- Project execution – Project evaluation- patents- patent search-patent laws-International code for patents.

TOTAL: 45 PERIODS

OUTCOMES:

- The need for innovation in product design and development and the technology developed can be known by this subject.

REFERENCES

1. Charles Gevirtz, Developing New products with TQM, McGraw – Hill International editions, 1994.
2. Karal .T. Ulrich, Steven D.Eppinger, Product Design and Development, McGRAW- HILL International Fifth Editions.2012.
3. Rosenthal.S, Effective product design and development, Irwin 1992.

IL5003 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To introduce the basic principles of Productivity models and the applications of Re-Engineering concepts required for various organizations.

UNIT I PRODUCTIVITY 9

Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organisation level - Productivity measurement models

UNIT II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 9

Conceptual frame work, Management by Objectives (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

UNIT III ORGANISATIONAL TRANSFORMATION 9

Elements of Organisational Transformation and Reengineering-Principles of organizational transformation and re-engineering, fundamentals of process re-engineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

UNIT IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 9

PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMICIP Model, NPRDC Model.

UNIT V RE-ENGINEERING TOOLS AND IMPLEMENTATION 9

Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Cases.

TOTAL: 45 PERIODS

OUTCOMES:

The student will be able to:

- Measure and evaluate productivity.
- Plan and implement various productivity techniques.
- Re-Engineer the process for improving the productivity.
- Implement BPR tools for improving the productivity.

REFERENCES

1. Edosomwan, J.A., "Organisational Transformation and Process Re-engineering", Library Cataloging in Pub. Data, 1996.
2. Premvrat, Sardana, G.D. and Sahay, B.S., "Productivity Management – A Systems Approach", Narosa Publishing House. New Delhi, 1998.
3. Rastogi, P.N., "Re-engineering and Re-inventing the Enterprise", Wheeler Pub. New Delhi, 1995.
4. Sumanth, D.J., 'Productivity Engineering and Management', TMH, New Delhi, 1990.

IL5004 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand the various principles, practices of TQM to achieve Quality.
- To learn the various statistical approaches for Quality control.
- To understand the TQM tools for continuous process improvement.
- To learn the importance of ISO and Quality systems.

UNITI I INTRODUCTION 9

Defining Quality, Basic approaches of TQM, Gurus of TQM - Shewart, Ronald Fisher, Deming, Juran, Feigenbaum, Ishikawa, Crosby, Taguchi – TQM Framework – Historical review, Obstacles, Benefits of TQM

UNIT II TQM PRINCIPLES 9

Leadership, Customer Satisfaction, Employee Involvement, Continuous Process Improvement, Supplier Partnership, Performance Measures, Cost of Quality.

UNITIII TOOLS AND TECHNIQUES–I 9

Benchmarking, Information Technology, Quality Management Systems and environmental management systems.

UNIT IV TOOLS AND TECHNIQUES- II 9

QFD, FMEA, Quality Circles, TPM, Traditional Quality Tools and Management tools.

UNIT V IMPLEMENTATION OF TQM 9

Steps in TQM implementation, national and international quality awards, case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- The student would be able to apply the tools and techniques of quality management to manufacturing and service processes.

REFERENCES

1. Dale H.Besterfiled, "Total Quality Management", Pearson Education Asia, (Indian reprint 2011).
2. Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, McGraw Hill, 1994
3. John Bank, The essence of Total quality management PHI 2000.
4. Masaki Imami, KAIZEN, McGraw Hill, 1986Takashi Osada, The 5S's The Asian Productivity Organization, 1991.

IL5071 HUMAN FACTORS IN ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- Studying the work procedure and understanding the relationships between the workers and working environments.
- To study the applications of ergonomic principles and physiology of workers.
- To know the concepts of personal protective equipment and its usages.
- To create the knowledge in process and equipment design in safety aspects.

UNIT I ERGONOMICS AND ANATOMY 9

Introduction to ergonomics: The focus of ergonomics**,** ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics

Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the sprine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness, research directions

UNIT II HUMAN BEHAVIOR 9

Individual differences, Factors contributing to personality, Fitting the man to the job, Influence of difference on safety, Method of measuring characteristics, Accident Proneness. Motivation, Complexity of Motivation, Job satisfaction. Management theories of motivation, Job enrichment theory. Frustration and Conflicts, Reaction to frustration, Emotion and Frustration. Attitudes-Determination of attitudes, Changing attitudes Learning, Principles of Learning, Forgetting, Motivational requirements.

UNIT III ANTHROPOMETRY AND WORK DESIGN FOR STANDING AND SEATED WORKS 9

Designing for a population of users, percentile, sources of human variability, anthropometry and its uses in ergonomics, principals of applied anthropometry in ergonomics, application of anthropometry in design, design for everyone, anthropometry and personal space, effectiveness and cost effectiveness

Fundamental aspects of standing and sitting, an ergonomics approach to work station design, design for standing workers, design for seated workers, work surface design, visual display units, guidelines for design of static work**,** effectiveness and cost effectiveness, research directions

UNIT IV MAN - MACHINE SYSTEM AND REPETITIVE WORKS AND MANUAL HANDLING TASK 9

Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine.

Ergonomics interventions in Repetitive works, handle design, key board design- measures for preventing in work related musculoskeletal disorders (WMSDs), reduction and controlling, training Anatomy and biomechanics of manual handling, prevention of manual handling injuries in the work place, design of manual handling tasks, carrying, postural stability

UNIT V HUMAN SKILL AND PERFORMANCE AND DISPLAY, CONTROLS AND VIRTUAL ENVIRONMENTS 9

A general information-processing model of the users, cognitive system, problem solving, effectiveness.

Principles for the design of visual displays- auditory displays- design of controls- combining displays and controls- virtual (synthetic) environments, research issues.

TOTAL: 45 PERIODS

OUTCOMES:

- Students can have the knowledge in work procedure and applications in hazardous workplaces.
- Students can design their own safety devices and equipment to reduce the accidents possibilities.
- Students will be able to incorporate human factors in design of Personal protective equipment.
- They know the risk factors, guide lines for safe design of man machine systems considering human factors.

REFERENCES

1. Introduction to Ergonomics, R.S. Bridger, Taylor and Francis
2. Ergonomic design for organizational effectiveness, Michael O'Neill
3. Human factors in engineering and design, MARK S.SANDERS
4. The Ergonomics manual, Dan Mc Leod, Philip Jacobs and Nancy Larson

IL5005 SOFTWARE QUALITY ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To gain knowledge in the application of Quality Engineering in software industries.

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.

UNIT II SOFTWARE ENGINEERING ACTIVITIES 9

Estimation, Software requirements gathering, Analysis, Architecture, Design, development, Testing and Maintenance.

UNIT III SUPPORTING ACTIVITIES 9

Metrics, Reviews –SCM – Software quality assurance and risk management.

UNIT IV SOFTWARE QUALITY MANAGEMENT TOOLS 9

Seven basic Quality tools – Checklist – Pareto diagram – Cause and effect diagram – Run chart – Histogram – Control chart – Scatter diagram – Poka Yoke – Statistical process control – Failure Mode and Effect Analysis – Quality Function deployment – Continuous improvement tools – Case study.

UNIT V QUALITY ASSURANCE MODELS 9

Software Quality Standards, ISO 9000 series – CMM, CMMI – P-CMM – Case study.

TOTAL: 45 PERIODS

OUTCOMES:

- The practice of Quality control and Assurance in software industries can be best understood after studying this subject.

REFERENCES

1. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 1990.
2. Gordan Schulmeyer.G. and James .L.Mc Hanus , Total Quality management for software , International Thomson Computer press , USA , 1990.
3. Metrics and Models in Software Quality Engineering, Stephen, Stephen H.Kan , Pearson education , 2006, Low price edition.
4. Norman E – Fenton and Share Lawrence P flieger , Software metrics , International Thomson Computer press , 1997.
5. Ramesh Gopalswamy, Managing global Projects; Tata Mcgraw Hill, 2002.
6. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman Mcgraw – Hill International Edition, 6th Edition, 2006.

IL5006 ENGINEERING ECONOMICS AND COSTING L T P C
3 0 0 3

OBJECTIVES:

- To study and understand the concept of Engineering Economics and apply the same in the real world.
- To gain knowledge in the field of cost estimation to enable the students to estimate the cost of various manufacturing processes.

UNIT I DEMAND ANALYSIS 9

Managerial Economics – Meaning, Nature and Scope – Managerial Economics and Business decision making – Role of Managerial Economist – Demand Analysis – Fundamental Concepts of Managerial Economics – Meaning, Determinants and Types of Demand – Elasticity of demand.

UNIT II PRODUCTION FUNCTION AND COST ANALYSIS 9

Supply: Meaning and determinants – production function- Iso-quants – Expansion path Cobb Douglas function – Cost concepts – Cost output relationship – Economies and diseconomies of scale – Cost functions- Determination of cost- Estimation of cost.

UNIT III MARKET COMPETITION AND PRICING 9

Pricing of products under different market structures – Methods of pricing – Factors affecting pricing decision – Differential pricing – Government Intervention and pricing.

UNIT IV PROFIT ANALYSIS 9

The concept of profit: Profit planning, control and measurement of profits. Profit maximization – Cost volume profit analysis – Investment Analysis.

UNIT V COSTING 9

Job costing-Process costing-Operating costing and Standard Costing (variance analysis).

TOTAL: 45 PERIODS

REFERENCES

1. Jawaharlal, Cost Accounting, Tata McGraw Hill,
2. Mote V.L., Samuel and G.S.Gupta, “Managerial Economics – Concepts and cases”, Tata McGraw Hill Publishing Coimpany Ltd, New Delhi, 1981.
3. Nag. A, :Macro Economics for Management Students” MacMillan India Ltd., New Delhi, 1999.
4. Ramachandra Aryasry A. and V.V. Ramana Murthy. “ Engineering Economics and Financial Accounting:, Tata Mc graw Hill Publishing Company Ltd., New Delhgi, 2004

IL5007 LEAN SIX-SIGMA L T P C
3 0 0 3

OBJECTIVE:

- To make the students acquire the basic knowledge in lean six-sigma and make them understand the various phases involved in the implementations.

UNIT-I INTRODUCTION TO LEAN AND SIX-SIGMA 9

Introduction to Lean- Definition, Purpose, features of Lean ; top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six-sigma, origin of six-sigma, six-sigma concept, and Critical success factors for six-sigma. Evolution of lean six-sigma, the synergy of Lean and six sigma, Definition of lean six-sigma, the principles of lean six-sigma, Scope for lean six sigma, Features of lean six-sigma, the laws of lean six-sigma, Benefits of lean six-sigma.

UNIT-II INITIATION, RESOURCE AND PROJECT SELECTION FOR LEAN SIX SIGMA 12

Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event, Launch preparation. Resource and project selection, Selection of Black belts,

Selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Balanced score card for project identification, project suitable for lean six sigma.

UNIT-III TEAM BUILDING AND THE DMAIC PROCESS 6

Predicting and improving team performance, nine team roles, Team leadership, Team building & Team exercise. DMAIC process and toll gate reviews.

UNIT-IV THE TOOLS FOR LEAN SIX- SIGMA 12

Define tools- Project Definition Form(PDF) and SIPOC; Measure tools- Process mapping, Parato chart, cause and effect matrix, FMEA, Brain-storming, NGT, Multi-voting, Cause & Effect diagram, Check sheets, Gauge R&R, Run charts, Control charts and process capability analysis; Analyze tools- scatter plots, ANOVA, Regression analysis and time trap analysis; Improve tools- Mistake proofing, KAIZEN, Reducing congestions and delays, SMED, TPM, Design of Experiments and the pull system; Control tools-SPC.

UNIT-V INSTITUTIONALIZING AND DESIGN FOR LEAN SIX-SIGMA 6

Need for institutionalizing Lean Six- Sigma, Comply, commit, embed and encode; Steps in institutionalizing the Lean Six- Sigma; Objectives of Design for Lean Six-Sigma,Improving design velocity,Reducing product line complexity, Design for Lean Six-Sigma-QFD,TRIZ, Robust design.

TOTAL: 45 PERIODS

OUTCOMES:

- To develop a comprehensive set of skills that will allow students to function effectively by using Lean six- sigma for quantitative analysis**.**

REFERENCES

1. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter solutions Using Statistical Methods, 1999.
2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003
3. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002.
4. Ronald G.Askin and Jeffrey B.Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.
5. Rother M. and hook J., Learning to See: Value Stream Mapping to add value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA.

IL5008 DECISION SUPPORT AND INTELLIGENT SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on basics of DSS and knowledge based systems**.**

UNIT I DECISION MAKING 5

Managerial decision making, system modeling and support-preview of the modeling process-phases of decision making process.

UNIT II MODELING AND ANALYSIS 12

DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development.

UNIT III KNOWLEDGE MANAGEMENT 12

Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools.

UNIT IV INTELLIGENT SYSTEMS 12

Artificial intelligence and expert systems-concepts, structure, types-knowledge acquisition and validation, knowledge representation

UNIT V IMPLEMENTATION 4

Implementation, integration and impact of management support systems.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to make decisions in the semi- structured and un- structured problem situations using systems and semantic networks.

REFERENCES

1. Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Seventh edition, 2005.
2. Elain Rich and Kevin Knight, Artificial intelligence, TMH, 2006.

IL5009 DESIGN AND ANALYSIS OF ALGORITHMS L T P C
3 0 0 3

OBJECTIVE:

- To learn the basic concepts in design and analysis of algorithms.

UNIT I INTRODUCTION: 5

Algorithms, basic steps in development.

UNIT II REVIEW OF ANY ONE OF THE STRUCTURED LANGUAGES 10

ALGOL, PL/I, Ada, Pascal, XPL

UNIT III BASIC TOOLS: 5

Top down, Structured programming, networks, data structure.

UNIT IV METHODS OF DESIGN: 10

Sub goals, hill climbing and working backward, heuristics, back track programming, Branch and bound recursion process, program testing, documentation, Meta heuristics.

UNIT V APPLICATION: 15

Development of sorting, searching, algorithms- combinatorial problems, shortest path, probabilistic algorithms.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will get the skills to design and develop algorithms for solving industrial engineering related problems.

REFERENCES

1. Dromey, “How to solve in by computers, Prentice Hall, 1982.
2. Elias Horowitz, Sartaj Sahani, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Galgotia Publications, 2003.
3. Goodman S.F. & Headtruemu, S.T.,Introduction to the design and analysis of algorithms, McGraw Gill, 2000.
4. John R Hubbard, Fundamentals of Computing with C++, , Tata Mc Graw Hill,2000.
5. Panneerselvam.R,Design and Analysis of Algorithms, Prentice Hall of India,2008.

IL5010 APPLIED OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

OBJECTIVE:

- To learn the basic concepts of object oriented programming**.**

UNIT I FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING 5

Elements of OOP, classes, subjects, messaging, inheritance, polymorphism, OOP paradigm versus procedural paradigm, object-oriented design.

UNIT II C++ Basics 15

Expression and statements, operators, precedence, type conversion, control statements, loops, Arrays structures, functions, argument passing, reference argument, overloaded function.

UNIT III C++ CLASS 5

Definition, class objects, member functions, , class argument, , operator overloading, user defined conversions.

UNIT IV CLASS DERIVATION 10

Derivation specification, public and private base classes, standard conversions under derivation, class scope, initialization and assignment under derivation.

UNIT V APPLICATION 10

OOP's applications in Industrial Engineering.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will acquire exposure in logical thinking and programming skills in solving real time problems.

REFERENCES

1. Balagurusamy E. Object oriented programming with C ++,Tata Mc Graw Hill,2003
2. Nabajyoti Barkakati,Object Oriented Programming in C++, Prentice Hall of India, 2001
3. Robert Lafore, "Object oriented programming in C++", Sam Publishing, 2002.
4. Stanley B.Lippman, C++ Printer, Addison – Wesley Pub.Co., 2003.

IL5011 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To enable students to understand the accounting procedure, interpretation of financial accounting with cost account.

UNIT I FINANCIAL ACCOUNTING 10

Trading Account, Profit and Loss Account, Balance sheet statement, Cash flow and fund flow analysis, Working capital management, Inventory valuation, Financial ratio analysis – Depreciation.

UNIT II COST ACCOUNTING 10

Cost Accounting systems: Job costing, Process costing, Allocation of Overheads, Activity based Costing, Differential and Incremental cost, Variance analysis, Software costing.

UNIT III BUDGETING 10

Requirements for a sound budget, Fixed budget – Preparation of sales and Production budget, Flexible budgets, Zero base budgeting and budgetary control.

UNIT IV FINANCIAL MANAGEMENT 10

Investment decisions – Capital investment process, Type of investment proposals, Investment appraisal techniques – Payback period method, Accounting rate of return, Net present value method, Internal rate of return and Profitability index method.

UNIT V FINANCIAL DECISIONS 5

Cost of capital – Capital structure – Dividend policy – Leasing.

TOTAL : 45 PERIODS

OUTCOMES:

- To possess the principles and techniques of accounting and managing finance in an organization.

REFERENCES

1. Bhattacharya, S.K. and John Deardon, "Accounting for management – Text and Cases", Vikas Publishing house, New Delhi, 1996.
2. Charles, T.Horn Green – "Introduction to Management Accounting", Prentice Hall, New Delhi, 1996.
3. James, C.Van Horne, "Fundamental of Financial Management", Pearson education, 12th Edition, 2002.
4. Pandey, I.M., "Financial Management", Vikas Publishing house, New Delhi, 8th Edition, 2004.

IL5012 INDUSTRIAL AUTOMATION L T P C
3 0 0 3

OBJECTIVES:

- This course introduces the fundamental concepts and elements of computer-integrated manufacturing.
- The course exposes students to various aspects of automated manufacturing such as fixed automation and programmable automation.

UNIT I AUTOMATION 5

Types of production – Functions – Automation strategies – Production economics – Costs in manufacturing – Break-even analysis.

UNIT II AUTOMATED FLOW LINES 10

Transfer mechanism - Buffer storage – Analysis of transfer lines - Automated assembly systems.

UNIT III NUMERICAL CONTROL AND ROBOTICS 10

NC-CNC – Part programming – DNC – Adaptive control – Robot anatomy – Specifications – End effectors – Sensors - Robot cell design – CAD/CAM.

UNIT IV AUTOMATED HANDLING AND STORAGE 10

Automated material handling systems – AGV- AS/RS – carousel storage – Automatic data capture – bar code technology- RFID

UNIT V MANUFACTURING SUPPORT SYSTEMS 10

Product design and CAD, CAD/CAM and CIM, Computer aided process planning- variant and generative approaches, Concurrent engineering and design for manufacture, Lean production, Agile manufacturing.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:

- Select automated equipment based on break-even quantity and compute cost per component.
- Analyze an automated flow line with buffer for its performance measures.
- Identify the elements of manufacturing automation; these include CNC, Robotics, automated assembly and material handling.
- Understand manufacturing planning and control systems.

REFERENCES

1. Mikell P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing" PHI, 2003.
2. Weatherall, "Computer Integrated Manufacturing – A total company strategy", 2nd edition, 1995.

IL5013 OPTIMIZATION TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To understand the non-linear problem.
- To know about multi-objective problem.
- To create awareness of Meta heuristic algorithms.

UNIT I INTRODUCTION 5

Classification of optimization problems, concepts of design vector, Design constraints, constrains surface, objective function surface and multi-level optimization, parametric linear programming

UNIT II DECISION ANALYSIS 10

Decision Trees, Utility theory, Game theory, Multi Objective Optimization, MCDM- Goal Programming, Analytic Hierarchy process, ANP

UNIT III NON-LINEAR OPTIMIZATION 15

Unconstrained one variable and multi variable optimization, KKT Conditions, Constrained optimization, Quadratic programming, Convex programming, Separable programming, Geometric programming, Non-Convex programming

UNIT IV NON-TRADITIONAL OPTIMIZATION -1 10

Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems, Overview of Genetic algorithms, Simulated Annealing, neural network based optimization.

UNIT V NON-TRADITIONAL OPTIMIZATION -2 5

Particle Swarm optimization, Ant Colony Optimization, Optimization of Fuzzy Systems.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will gain familiarity with some of the well-known optimization techniques and their applicability in a real setting.
- The students will gain awareness on the usefulness and limitation of optimization.

REFERENCES

1. Christos H. Papadimitriou, Kenneth Steiglitz, Combinatorial Optimization, PHI 2006
2. Fredrick S.Hillier and G.J.Liberman, "Introduction to Operations Research", McGraw Hill Inc. 1995.
3. Kalymanoy Deb, "Optimization for Engineering Design",PHI,2003
4. Ravindran – Phillips –Solberg, "Operations Research – Principles and Practice", John Wiley India, 2006.
5. Singiresu S.Rao, "Engineering optimization – Theory and practices", John Wiley and Sons, 1996.

CM5094 **PROJECT MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:

- To develop the skills that professionals need to become effective project managers. With a specific focus on developing practical project management skills for the students to apply proven methodologies to projects within their individual fields.

UNIT I PROJECT SELECTION AND PROJECT ORGANISATION: 9

Project selection and nature of selection, project portfolio process, Analysis under uncertainty, Project organisation, Matrix organisation, Mixed organisational systems.

UNIT II PROJECT PLANNING: 9

Project Co-ordination, sorting out the projects, Work breakdown structure, system integration, Interface co-ordination, Project life cycle, Conflict and negotiation.

UNIT III PROJECT IMPLEMENTATION: 12

Estimating project budgets, Process of cost estimation, Scheduling : Network techniques PERT and CPM, crashing a project, Resource loading and leveling, Multiproduct scheduling and resource allocation.

UNIT IV MONITORING AND INFORMATION SYSTEMS: 9

Planning-Monitoring-Controlling cycle, Information needs and the reporting process, Computerized PMIS, Earned value analysis, Types of project control processes, control as a function of management, control of change and scope.

UNIT V PROJECT TERMINATION: 6

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

TOTAL: 45 PERIODS

OUTCOME:

Students will gain a solid understanding of current Project Management methodologies and techniques that are being applied worldwide. They will also learn relevant management skills to ensure success in working with teams and entire organization

REFERENCES

1. Cleland, D.I. and Ireland, L.R., “Project Management – Design & Implementation”, McGraw Fills, 2007
2. Kerzner, H., “Project Management – A Systems Approach Planning, Scheduling and Controlling”, John Wiley and Sons, 2009.
3. Meredith, J.R. and Mantel, Jr. S.J., “Project Management – A Managerial Approach, John Wiley and Sons, 2011

IL5014 **BUSINESS EXCELLENCE MODELS** **L T P C**
3 0 0 3

OBJECTIVE:

- To make the students to understand the business excellence models, which are applied in all aspects of business like manufacturing, software (IT) as well as service industry oriented organization like health centre, hospitality,etc.,

UNIT I BUSINESS EXCELLENCE MODELS 8

Business Excellence Concepts – Need for BE models – Pioneers in the model MBNQA , EFQM and DEMING award

UNIT II MBNQA 12

Criteria : LEADERSHIP , Strategic planning , Customer and Market focus , Measurement analysis and Knowledge Management , Human resource focus, process management , business results

UNIT III BUSINESS EXCELLENCE AWARDS IN INDIA 7

Models in Business excellence: RBNQA CII EXIM Award, Tata BE Model etc

UNIT IV IMPLEMENTING BUSINESS EXCELLENCE MODEL 10

Basic concepts – Training -Report writing – Internal audit-Report submission – Initial assessment - Site visit – Scoring – Criteria for Award, Award finalization

UNIT V CASE STUDY 8

TOTAL: 45 PERIODS

OUTCOMES:

- After studying this subject, the students will get a clear idea about the business excellence models applied in the industries.

REFERENCES

1. Mark Graham Brown, Baldrige Award Winning Quality, CRC press, 2008.
2. Web sites

IL5015 SYSTEMS SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- This course is intended to introduce the students to the systems engineering process used to create multi-disciplinary solutions to complex problems.

UNIT I SYSTEMS SCIENCE CONCEPTS 9

System as a function of system-hood and thing-hood, Systems thinking, Evolution of systems movement, Framework of deductive and inductive approaches, classification systems models, Methodological paradigms, Laws of systems science, Organized complexity, Systems simplification.

UNIT II SYSTEMS ENGINEERING PROCESSES 9

Life cycles-Phases-Steps, Formulation of Issues: Problem Identification – Scoping – Bounding, Problem definition – Identification of needs, alterables, constraints; Value System Design: Objectives and objective measures; Generation of Alternatives/ system synthesis – Identification of activities and activity measures; Functional decomposition and analysis.

UNIT III ANALYSIS OF ALTERNATIVES 9

Uncertain/ Imperfect information; Cross-impact analysis, Hierarchical inference, logical reasoning inference; Structural modeling; System Dynamics.

UNIT IV INTERPRETATION OF ALTERNATIVES AND DECISION MAKING 9

Types of decisions – descriptive, prescriptive, normative; Decision assessment efforts types – under certainty, probabilistic uncertainty, probabilistic imprecision, information imperfection, conflict and cooperation; Prescriptive normative decision assessments; Utility theory; Group decision making, Game Theory.

UNIT V SYSTEMS ENGINEERING MANAGEMENT CONCEPTS 9

Organizational structures, SE management plan; Network based systems planning and management methods; Cognitive factors in SE.

TOTAL: 45 PERIODS

OUTCOMES:

- This course will enable the students to better understand the functions, capabilities and limitations of systems engineering in the context of large developmental programs.

REFERENCES

1. Andrew P Sage and James E Armstrong, Introduction to Systems Engineering, Wiley Series, 2000.
2. George J Klir, Facets of Systems Science, Kluwer Publishers, 2001.

IL5016 INDUSTRIAL SAFETY AND HYGIENE L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on fundamentals of safety engineering and hygiene**.**

UNIT I OPERATIONAL SAFETY 9

Hot metal operation, boiler, pressure vessels – heat treatment shop – gas furnace operation – electroplating – hot bending pipes – safety in welding and cutting, Cold – metal operation – safety in machine shop – cold bending and chamfering of pipes- metal cutting – shot blasting, grinding, painting – power press and other machines. Management of toxic gases and chemicals – industrial fires and prevention – road safety – highway and urban safety – safety of sewage disposal and cleaning – control of environmental pollution – managing emergencies in industries – planning security and risk assessments, on – site and off site. Control of major industrial hazards.

UNIT II SAFETY APPRAISAL AND ANALYSIS 9

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT III 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 Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT IV 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.

UNIT V SAFETY MANAGEMENT 9

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

TOTAL: 45 PERIODS

OUTCOMES:

- The students will get awareness on safety appraisal, analysis techniques, regulations and issues in occupational health and safety manager practices in industries

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REFERENCES

1. John V Grimaldi and Rollin. H Simonds, “Safety Management”. AITB publishers, 2003.
2. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.

3. Managing emergencies in industries, loss prevention of India Ltd., proceedings, 1999
4. Occupational Safety Manual BHEL.
5. Safety Manual. EDEL Engineering Consultancy, 2000.
6. Singh, U.K and Dewan, J.M., "Sagety, Security And Risk Management", APH publishing company, New Delhi, 1996.
7. U.K singh & J.M Dewam, "Safety, security and Risk management," A.P.H. publishing company, New Delhi, 1996.

IL5017 SERVICES OPERATIONS MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To enhance the students' understanding of the nature and importance of the service sector in the economy.
- To improve the students' analytical abilities in solving problems that service managers' face.

UNIT I INTRODUCTION TO SERVICES 6

Manufacturing and Services, Definition of Service, Characteristic of Service, Nature of Services, Importance of Activity, Impact of technology

UNIT II GLOBALIZATION AND STRATEGY 7

Types of Globalized Services, Outsourcing, issues in Globalization, Service strategies

UNIT III OPERATIONS ISSUES 12

Forecasting, Inventory, capacity Planning, Scheduling

UNIT IV SERVICE QUALITY AND PRODUCTIVITY 10

Importance of Quality, Models for Service Quality, GAPS model, issues in productivity measurement, Work measurement

UNIT V TOOLS FOR SERVICES 10

Data Envelopment Analysis, Queuing models, Vehicle Routing models

TOTAL: 45 PERIODS

OUTCOMES:

- The students become effective decision maker in the management of a service organization.
- Students become aware of the environmental impacts and ethical issues involved in a service organization's actions.

REFERENCES

1. Fitzsimmons, J.A. and Fitzsimmons, M.J. Service Management, Tata Mc Graw Hill India, 2006.
2. Haksever C, Render B, Russell RA and Murdick RG ,Service Management and Operations, Prentice Hall International, USA, 2000

IL5018 MULTIVARIATE DATA ANALYSIS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on the applications of multivariate statistical analysis**.**

UNIT I REGRESSION 9

Simple Regression and Correlation – Estimation using the regression line, Correlation analysis, Multiple regression and Correlation analysis – Finding the Multiple Regression equation, Modelling techniques, Making inferences about the population parameters.

UNIT II MULTIVARIATE METHODS 9

An overview of Multivariate methods, Multivariate Normal distribution, Eigen values and Eigen vectors.

UNIT III FACTOR ANALYSIS 9

Principal Component Analysis – Objectives, Estimation of principal components, Testing for independence of variables, Factor analysis model – Factor analysis equations and solution.

UNIT IV DISCRIMINANT ANALYSIS 9

Discriminant analysis – Discrimination for two multivariate normal Populations – Discriminant functions.

UNIT V CLUSTER ANALYSIS 9

Cluster analysis – Clustering methods, Multivariate analysis of Variance.

TOTAL : 45 PERIODS

OUTCOME:

- Can able to apply the multivariate,regression,factor,discriminent and cluster analysis techniques for statistical analysis.

REFERENCES

1. Dallas E Johnson, Applied Multivariate methods for data analysis, Duxbury Press(1998).
2. Richard I Levin, Statistics for Management, PHI(2000).

IL5091 DATA ANALYTICS L T P C
3 0 0 3

OBJECTIVES:

The Student should be made to:

- Be exposed to big data
- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

UNIT I INTRODUCTION TO BIG DATA 8

Introduction to Big Data Platform – Challenges of conventional systems - Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting - Modern data analytic tools, Stastical concepts: Sampling distributions, resampling, statistical inference, prediction error.

UNIT II DATA ANALYSIS 12

Regression modeling, Multivariate analysis, Bayesian modeling, inference and Bayesian networks, Support vector and kernel methods, Analysis of time series: linear systems analysis, nonlinear dynamics - Rule induction - Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, Stochastic search methods.

UNIT III MINING DATA STREAMS 8

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window - Realtime Analytics Platform(RTAP) applications - case studies - real time sentiment analysis, stock market predictions.

UNIT IV FREQUENT ITEMSETS AND CLUSTERING 9

Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K- Means – Clustering high dimensional data – CLIQUE and PROCLUS – Frequent pattern based clustering methods – Clustering in non-euclidean space – Clustering for streams and Parallelism.

UNIT V FRAMEWORKS AND VISUALIZATION 8

Map Reduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed file systems – Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications:

TOTAL : 45 PERIODS

OUTCOMES:

The student should be made to:

- Apply the statistical analysis methods.
- Compare and contrast various soft computing frameworks.
- Design distributed file systems.
- Apply Stream data model.
- Use Visualisation techniques

REFERENCES:

1. Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.
2. Bill Franks, Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics, John Wiley & sons, 2012.
3. Glenn J. Myatt, Making Sense of Data, John Wiley & Sons, 2007 Pete Warden, Big Data Glossary, O"Reilly, 2011.
4. Jiawei Han, Micheline Kamber "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
5. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.

IL5019 SYSTEMS ANALYSIS AND DESIGN L T P C

3 0 0 3

OBJECTIVES:

- To provide a basic knowledge in system analysis and design and its implementation.

UNIT I SYSTEMS ANALYSIS FUNDAMENTALS 9

Information systems analysis overview, Classification of information systems, Systems development life cycle, Role of systems analyst, and Role of case tools

UNIT II INFORMATION REQUIREMENT ANALYSIS 9

Sampling and investigating hard data, Interviewing, Using Questionnaires, Developing prototype, System requirements specification, Feasibility analysis

UNIT III ANALYSIS PROCESS 9

Data flow diagrams, Data dictionary, Process specifications, Presenting the systems proposal

UNIT IV ESSENTIALS OF DESIGN 9

Designing effective output, designing the database, designing the user interface, Designing data entry procedures

UNIT V SOFTWARE ENGINEERING AND IMPLEMENTATION 9

Quality assurance through software engineering, Implementation approaches, Implementing distributed systems, Object oriented systems analysis and design

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to design and manage information system and to apply them for business organizations.

REFERENCES

1. Arthur M. Langer, Analysis and Design of Information systems Springer 2001
2. Rajaraman,V Analysis and Design of Information systems PHI, 2006.

IL5020 CELLULAR MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVES:

- To impart knowledge on planning, design, implementation and control of Group Technology and Cellular Manufacturing.

UNIT I INTRODUCTION 5

Introduction to Group Technology, limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

UNIT II CMS PLANNING AND DESIGN 12

Problems in GT/CMS - Design of CMS – Production Flow Analysis, Optimization Models, traditional approaches and non-traditional approaches- Simulated Annealing,Genetic Algorithms,

UNIT III IMPLEMENTATION OF GT/CMS 10

Inter and intra cell layout and capacity planning. Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS. Linkages to JIT systems

UNIT IV PERFORMANCE MEASUREMENT AND CONTROL 10

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

UNIT V ECONOMIC OF GT/CMS 8

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to apply the tools, techniques and methodology used in planning, design, implementation and control of Group Technology and Cellular Manufacturing.

REFERENCES

1. Askin, R.G and Vakharia, A.J., GT planning and operation, in "The automated factory Handbook: Technology and Management", Cleland, D.I and Bidananda, B (Eds), TAB.
2. Askin, R. G. and J. B. Goldberg, Design and Operation of Lean Production Systems, John Wiley & Sons, New York, 2002.
3. Askin**,** R.G., and Strandridge**,** C.R., Modelling and Analysis of Manufacturing Systems, John Wiley and Sons. 1993.
4. Burbidge, J.L, Group Technology in Engineering Industry, Mechanical Engineering pub London, 1979.
5. Irani, S.A, Cellular Manufacturing Systems - Hand book
6. Kamrani, A.K,, Parsaei, H.R and Liles, D.H. (Eds), Planning, design and analysis of cellular Manufacturing systems, Elsevier, 1995.

IL5021 **RELIABILITY ENGINEERING MODELS** **L T P C**
3 0 0 3

OBJECTIVES:

- To impart knowledge in reliability concepts, reliability estimation methods and reliability improvement methods**.**

UNIT I RELIABILITY CONCEPTS 9

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Mortality curve – Useful life.

UNIT II LIFE DATA ANALYSIS 11

Data collection –Non Parametric methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Probability plotting – Goodness of fit tests.

UNIT III RELIABILITY ASSESSMENT 10

Different configurations – Redundancy – k out of n system – Complex systems: RBD – Baye's approach – Cut and tie sets – Fault Trees – Standby systems.

UNIT IV RELIABILITY MONITORING 8

Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability-Human reliability.

UNIT V RELIABILITY IMPROVEMENT 7

Analysis of downtime – Repair time distribution – System repair time – Maintainability prediction – Measures of maintainability – Inspection decisions –System Availability.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to conduct reliability assessment and failure analysis on any complex systems**.**

REFERENCES

1. Charles E. Ebeling, "An introduction to Reliability and Maintainability engineering", TMH, 2000.
2. Roy Billington and Ronald N. Allan, "Reliability Evaluation of Engineering Systems", Springer, 2007.

IS5091 **MAINTAINABILITY ENGINEERING** **L T P C**
3 0 0 3

OBJECTIVES:

- To enable the students know about the basic concept of maintainability engineering.
- To impart knowledge on various maintenance models, maintenance policies and replacement model of various equipment.
- To provide knowledge on logistics for the effective utilization of existing resources and facilities availability of spares parts.

UNIT I MAINTENANCE CONCEPT 6

Maintenance definition –Need for maintenance –Maintenance objectives and challenges – Tero technology – Maintenance costs - Scope of maintenance department.

UNIT II MAINTENANCE MODELS 12

Proactive/Reactive maintenance – Imperfect maintenance – Maintenance policies – PM versus b/d maintenance – PM schedule and product characteristics – Inspection models-Optimizing profit/downtime – Replacement decisions.

UNIT III MAINTENANCE LOGISTICS 11

Human factors – Maintenance staffing: Learning curves – Simulation – Maintenance resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spare parts planning.

UNIT IV MAINTENANCE QUALITY 8

Maintenance excellence –Five Zero concept –FMECA –Root cause analysis – System effectiveness – Design for maintainability – Reliability Centered Maintenance.

UNIT V TOTAL PRODUCTIVE MAINTENANCE 8

TPM features – Chronic and sporadic losses – Equipment defects – Six major losses – Overall Equipment Effectiveness – TPM pillars – Autonomous maintenance – TPM implementation

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

1. Understand the various terms and terminologies about the maintenance concept.
2. Understand the various maintenance modes and logistics meant for the execution of various services.
3. Apply their knowledge in areas where the down time, over replacement are existing and could lead to improve the productivity and quality.

REFERENCES

1. Andrew K.S.Jardine & Albert H.C.Tsang, “Maintenance, Replacement and Reliability”, Taylor and Francis, 2006.
2. Bikas Badhury & S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003.
3. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.