ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

M.E. INDUSTRIAL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. Prepare students to get competency in creating, implementing, improving and managing the financially viable/sustainable integrated socio-technical systems.

II. Prepare students to acquire necessary skills and knowledge to understand and formulate real world problems in the Industrial Engineering domain and can apply problem-solving skills to obtain valid realistic solutions.

III. Prepare students to build and lead cross-functional teams, demonstrate professional leadership upholding ethical values.

IV. Prepare students to pursue research and engage themselves in life-long learning and growth in the field of Industrial Engineering with professional and ethical responsibility in the context of technological changes

PROGRAMME OUTCOMES (POs):

On successful completion of the programme, the students will exhibit ability to:

1. apply knowledge of mathematics, science, and engineering.
2. design and improve integrated systems of people, materials, information, facilities, and technology.
3. identify, formulate, and solve industrial engineering problems.
4. design and conduct experiments, as well as analyse and interpret data.
5. function as a member of a multi-disciplinary team.
6. understand and respect professional and ethical responsibility.
7. communicate effectively both orally and in writing.
8. understand the impact of engineering solutions in a global and societal context.
9. recognize the need for, and an ability to engage in life-long learning.
10. have a knowledge of contemporary issues.
11. use updated techniques, skills and tools of industrial engineering throughout their professional careers.

Mapping of PEOs with POs

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	PROGRAMME OUTCOMES (POs)										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
I	✓	✓	✓					✓			
II			✓	✓				✓			
III					✓	✓	✓				
IV			✓	✓				✓	✓	✓	✓

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
YEAR1	Semester 1	Probability and Statistical Methods	✓		✓								
		Operations Research	✓		✓								
		Work Design and Ergonomics		✓							✓		
		Facilities Design	✓		✓								
		Production Management	✓		✓							✓	
		Elective 1											
		Work Design and Ergonomics Lab		✓			✓						
	Semester 2	Manufacturing Systems and Models	✓		✓							✓	
		Quality Engineering	✓		✓								
		Systems and Simulation			✓	✓						✓	
		Logistics and Supply Chain Management		✓	✓							✓	
		Elective 2											
		Elective 3											
		Computer Applications Lab				✓	✓						
YEAR 2	Semester 1	Robust Design	✓			✓						✓	
		Elective 4											
		Elective 5											
		Project Work Phase I			✓	✓	✓		✓	✓			
		Technical Seminar							✓	✓			
	Semester 2	Project Work Phase II			✓	✓	✓	✓	✓	✓		✓	✓

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY: : CHENNAI 600 025

REGULATIONS - 2015

M.E. INDUSTRIAL ENGINEERING (FULL TIME)

I TO IV SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER - I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL7101	Production Management	PC	3	3	0	0	3
2.	IL7102	Work Design and Ergonomics	PC	3	3	0	0	3
3.	IL7151	Facilities Design	PC	3	3	0	0	3
4.	IL7152	Operations Research	PC	4	4	0	0	4
5.	MA7159	Probability and Statistical Methods	FC	4	4	0	0	4
6.		Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	IL7111	Work Design and Ergonomics Lab	PC	2	0	0	2	1
			TOTAL	**22**	**20**	**0**	**2**	**21**

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL7201	Logistics and Supply Chain Management	PC	3	3	0	0	3
2.	IL7202	Manufacturing Systems and Models	PC	3	3	0	0	3
3.	IL7203	Systems and Simulation	PC	3	3	0	0	3
4.	QE7253	Statistical Quality Control	PC	3	3	0	0	3
5.		Elective II	PE	3	3	0	0	3
6.		Elective III	PE	3	3	0	0	3
PRACTICALS								
7.	IL7211	Computer Applications Lab	PC	4	0	0	4	2
			TOTAL	**22**	**18**	**0**	**4**	**20**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL7301	Robust Design	PC	4	4	0	0	4
2.		Elective IV	PE	3	3	0	0	3
3.		Elective V	PE	3	3	0	0	3
PRACTICALS								
4.	IL7311	Technical Seminar	EEC	2	0	0	2	1
5.	IL7312	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**24**	**10**	**0**	**14**	**17**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	IL7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS:70

FOUNDATION COURSES (FC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Probability and Statistical Methods	FC	4	4	0	0	4

PROFESSIONAL CORE (PC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Operations Research	PC	4	4	0	0	4
2.		Work Design and Ergonomics	PC	3	3	0	0	3
3.		Facilities Design	PC	3	3	0	0	3
4.		Production Management	PC	3	3	0	0	3
5.		Work Design and Ergonomics Lab	PC	2	0	0	2	1
6.		Manufacturing Systems and Models	PC	3	3	0	0	3

7.		Statistical Quality Control	PC	3	3	0	0	3
8.		Systems and Simulation	PC	3	3	0	0	3
9.		Logistics and Supply Chain Management	PC	3	3	0	0	3
10.		Computer Applications Lab	PC	4	0	0	4	2
11.		Robust Design	PC	4	4	0	0	4

PROFESSIONAL ELECTIVES (PE)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL7001	Advanced Optimization Techniques	PE	3	3	0	0	3
2.	IL7002	Design and Analysis of Algorithms	PE	3	3	0	0	3
3.	IL7003	Human Factors Engineering	PE	3	3	0	0	3
4.	IL7004	Knowledge Management and Engineering	PE	3	3	0	0	3
5.	IL7005	Maintainability Engineering	PE	3	3	0	0	3
6.	IL7006	Manufacturing Automation	PE	3	3	0	0	3
7.	IL7007	Scheduling Algorithms	PE	3	3	0	0	3
8.	IL7008	Systems Science and Engineering	PE	3	3	0	0	3
9.	IL7071	Applied Object Oriented Programming	PE	3	3	0	0	3
10.	IL7072	Business Excellence Models	PE	3	3	0	0	3
11.	IL7073	Cellular Manufacturing Systems	PE	3	3	0	0	3
12.	IL7074	Data Analysis Techniques	PE	3	3	0	0	3
13.	IL7075	Decision Support Systems	PE	3	3	0	0	3
14.	IL7076	Engineering Economics and Costing	PE	3	3	0	0	3
15.	IL7077	Industrial Safety and Hygiene	PE	3	3	0	0	3
16.	IL7078	Lean Manufacturing and Six Sigma	PE	3	3	0	0	3
17.	IL7079	Logistics and Distribution	PE	3	3	0	0	3

		Management						
18.	IL7080	Management Accounting and Financial Management	PE	3	3	0	0	3
19.	IL7081	Multi Variate Data Analysis	PE	3	3	0	0	3
20.	IL7082	Productivity Management and Re Engineering	PE	3	3	0	0	3
21.	IL7083	Project Management	PE	3	3	0	0	3
22.	IL7084	Reliability Engineering	PE	3	3	0	0	3
23.	IL7085	Services Operations Management	PE	3	3	0	0	3
24.	IL7086	Systems Analysis and Design	PE	3	3	0	0	3
25.	IL7087	Technology Management	PE	3	3	0	0	3
26.	QE7072	Product Innovation and Development	PE	3	3	0	0	3
27.	QE7151	Total Quality Management	PE	3	3	0	0	3
28.	QE7252	Software Quality Engineering	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.		Technical Seminar	EEC	2	0	0	2	1
2.		Project Work Phase I	EEC	12	0	0	12	6
3.		Project Work Phase II	EEC	24	0	0	24	12

IL 7101 **PRODUCTION MANAGEMENT** **L T P C**
3 0 0 3

OBJECTIVE:

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

UNIT I INTRODUCTION: 5

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: 10

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: 10

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: 10

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: 10

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

TOTAL: 45 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 a firm's competitive advantages.

REFERENCES:

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

IL7102 **WORK DESIGN AND ERGONOMICS** **L T P C**
3 0 0 3

OBJECTIVE :

- To impart knowledge in the area of Method study and Time study so that students can 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. Benjamin W.Niebel, Motion and Time Study, Richard, D. Irwin Inc., Seventh Edition, 2002
2. Barnes, R.M. Motion and Time Study, John Wiley, 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.

IL 7151	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 problem – 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 must analyse, design and apply layout principles for layout product, material handling and packaging.

REFERENCES

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

IL 7152	OPERATIONS RESEARCH	L	T	P	C
		4	0	0	4

OBJECTIVE :

- To learn the basics of deterministic optimization tools.

UNIT I INTRODUCTION-LP 9

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

UNIT II LP-EXTENSIONS 9

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

UNIT III NETWORKS 9

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

UNIT IV DYNAMIC PROGRAMMING 9

Dynamic Programming-Concepts, formulation, recursive approach; applications

UNIT V WAITNG LINES AND GAME THEORY 9

Queuing characteristics and terminology, Poisson and non-Poisson models. Introduction to Game Theory

TOTAL: 60 PERIODS

OUTCOME:

- The students can solve optimization problems of deterministic nature

REFERENCES:

1. Handy M.Taha, Operations research, an introduction, 7th edition, PHI, 2003.
2. Don T.Phillips, A.Ravindran & James Solberg, Operations Research: Principles and practice, John Wiley, India, 2006.
3. G Srinivasan (2010) Operations Research – Principles and Applications (Second Edition), Prentice Hall of India (P) Ltd, New Delhi.
4. Panneer Selvam,R Operations Research,2nd Edition, PHI 2008.

MA7159	PROBABILITY AND STATISTICAL METHODS	L	T	P	C
		4	0	0	4

OBJECTIVE:

- To introduce the basic concepts of one dimensional and two dimensional Random Variables.
- To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 12

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions 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 HYPOTHESES: 12

Sampling distributions - Type I and Type II errors - 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:

- The course aims at providing the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems.

TEXTBOOKS:

1 Jay L. Devore, “Probability and statistics for Engineering and the Sciences”, Thomson and Duxbury, Singapore, 2002.
2. Richard Johnson. ”Miller & Freund’s Probability and Statistics for Engineer”, Prentice – Hall of India, Private Ltd., New Delhi, Seventh Edition, 2007.
3. Richard A. Johnson and Dean W. Wichern, “Applied Multivariate Statistical Analysis”, Pearson Education, Asia, Fifth Edition, 2002.

REFERENCES:

1. Gupta S.C. and Kapoor V.K. ”Fundamentals of Mathematical Statistics”, Sultan and Sons, New Delhi, 2001.
2. Dallas E Johnson et al., “Applied multivariate methods for data analysis”, Thomson and Duxbury press, Singapore, 1998.

IL7111 WORK DESIGN AND ERGONOMICS LAB

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:

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, analyse and apply the above mentioned techniques to measure productivity

IL7201 LOGISTICS AND SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVE:

- 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 outbound 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. Supply Chain Management, Strategy, Planning, and operation – Sunil Chopra , Peter Meindl and Kalra , Pearson Education, 2011
2. A. Ravi Ravindran, Donald P. Warsing, Jr (2012) Supply Chain Engineering: Models and Applications, CRC Press.
3. G Srinivasan (2010) Quantitative Models in Operations and Supply Chain Management, PHI Learning (P) Ltd, New Delhi
4. David J.Bloomberg, Stephen Lemay and Joe B.Hanna, Logistics, PHI 2010
5. Sople Vinod V, Logistics Management , Pearson Education, 2010.

IL7202 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 of 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, ETPN and GSPN models.

TOTAL: 45 PERIODS

OUTCOMES:

- The Student must be able to apply the principles behind focused factory, Markov and Petrinet Models, Queuing models, lean system to model modern manufacturing systems

REFERENCES:

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

IL7203 SYSTEMS AND SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVE:

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

UNIT I INTRODUCTION 3

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

UNIT II RANDOM NUMBERS AND VARIATES 5

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

UNIT III DESIGN OF SIMULATION EXPERIMENTS 8

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 14

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

UNIT V CASE STUDIES / MINI PROJECT 15

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:

- Will be able to analyse, models and simulate experiments to meet real world system 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. Thomas J.Schriber, Simulation using GPSS, John Wiley, 1991
4. Tayfur Altiok, Benjamin Melamed, Simulation Modeling and Analysis with ARENA,Elsevier, 2007.

QE7253 STATISTICAL QUALITY CONTROL L T P C

3 0 0 3

OBJECTIVES :

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

UNIT I INTRODUCTION 7

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

UNIT II CONTROL CHARTS 12

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

UNIT III SPECIAL CONTROL PROCEDURES 8

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 8

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

UNIT V ACCEPTANCE SAMPLING 10

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

OUTCOMES :

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

REFERENCES:

1. K Krishnaiah, Applied Statistical Quality control and Improvement, PHI, 2014.
2. Douglas C Montgomery, Introduction to Statistical Quality Control, John Wiley, Seventh Edition, 2012.
3. Grant E.L. and Leavensworth, Statistical Quality Control, TMH, 2000.
4. IS 2500 Standard sampling plans

IL 7211	COMPUTER APPLICATIONS LAB	L	T	P	C
		0	0	4	2

OBJECTIVES:

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

UNIT I 12

Development of Simple Programs for Statistical analysis: Frequency distribution, Applications of Graphics. (Charts, Graphs etc).

UNIT II 12

Programs for OR applications like Initial solution of Transportation Problems, Net Works etc

UNIT III 12

Solving optimization problems using software packages like LINDO, LINGO, TORA.
Excel Solver.

UNIT IV 12

Development of Random number generator, Testing of random number generator. Non-uniform Random varieties generation and testing. Single server Queuing simulation, Case Studies

UNIT V **12**

Program for Simulation of Single server Queuing System – Use of Simulation software. Case studies.

TOTAL: 60 PERIODS

LABORATORY EQUIPMENTS REQUIREMENTS

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

OUTCOMES:

- Due to the practical exposure, to the theoretical knowledge gained earlier, the students are capable of selecting to right tool to solve optimization problems.

IL 7301	ROBUST DESIGN	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:

- 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. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
4. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.
5. Montgomery, D.C., Design and Analysis of Experiments, Minitab Manual, John Wiley and Sons, Seventh edition, 2010.

IL7311	TECHNICAL SEMINAR	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To enhance the students in the technical writing and communication.

OUTCOMES:

- This will help the students to get confidence in facing interview process and enhance employment opportunity.

IL 7312	PROJECT WORK PHASE I	L	T	P	C
		0	0	12	6

OBJECTIVES:

- To apply the principles or techniques the students have learnt to a new or existing problem situations leading to a solutions.

OUTCOMES:

- This will help the students in real time problem identification, critical examination, solution development and presentation of results in the form of report.

IL7411	PROJECT WORK PHASE II	L	T	P	C
		0	0	24	12

OBJECTIVES:

- To apply the principles or techniques the students have learnt to a new or existing problem situations leading to a solutions.

OUTCOMES:

- This will help the students in real time problem identification, critical+ examination, solution development and presentation of results in the form of report.

IL 7001 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

OBJECTIVES :

- Understand the nonlinear problem.
- 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 COMPLEXITY OF ALGORITHMS **5**

Classes P and NP, Polynomial time reductions, Introduction to NP- Hard problems,

UNIT V NON-TRADITIONAL OPTIMIZATION **10**

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

IL7002 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

UNIT I INTRODUCTION: 5

Algorithms, basic steps in development.

UNIT II REVIEW OF THE STRUCTURED LANGUAGES 10

C++ Basics, Expression, operators, control statements, structures, multi-dimensional array, functions, arguments, overload function.

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

IL7003 HUMAN FACTORS ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To explain the general principles that govern the interaction of human and their working environment for improving worker performance and safety.

UNIT I PHYSIOLOGICAL PERFORMANCE 10

Factors affecting physiological performance, physical work load and energy expenditure, heat stress, manual lifting, shift work

UNIT II WORK SPACE DESIGN 10

Anthropometry, Workspace designs for standing and seated workers, arrangement of components within a physical space, interpersonal aspect of workplace design.

UNIT III DESIGN OF EQUIPMENT 10

Ergonomic factors to be considered in the design of displays and control, design for maintainability, design of human computer interaction.

UNIT IV COGNITIVE ERGONOMICS 5

Information Theory, Information processing, signal detection theory, Human response, human errors, cognitive task analysis.

UNIT V DESIGN OF ENVIRONMENT 10

Vision and Illumination design – Noice and Vibration

TOTAL: 45 PERIODS

OUTCOMES:

- The students will get knowledge on human factor issues in the design of workplace layout.

REFERENCES:

1. Martin Helander, A guide to Human Factors and Ergonomics, 2nd Edition, CRC, Taylor & Francis Group 2006.
2. Bridger, R.S., Introduction to Ergonomics, McGraw Hill, 1995.
3. MeCormik, J., Human Factors Engineering and Design, McGraw Hill, 1992.

IL 7004 KNOWLEDGE ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study and understand the concept of knowledge models, management and its implementations.

UNIT I INTRODUCTION 9

The value of Knowledge – Knowledge Engineering Basics – Knowledge Economy – The Task and Organizational Content – Knowledge Management – Knowledge Management Ontology.

UNIT II KNOWLEDGE MODELS 9

Knowledge Model Components – Template Knowledge Models –Reflective Knowledge Models– Knowledge Model Construction – Types of Knowledge Models.

UNIT III TECHNIQUES OF KNOWLEDGE MANAGEMENT 9

Knowledge Elicitation Techniques – Modeling Communication Aspects – Knowledge Management and Organizational Learning.

UNIT IV KNOWLEDGE SYSTEM IMPLEMENTATION 9

Case Studies – Designing Knowledge Systems – Knowledge Codification – Testing and Deployment – Knowledge Transfer and Knowledge Sharing – Knowledge System Implementation.

UNIT V ADVANCED KNOWLEDGE MANAGEMENT 9

Advanced Knowledge Modeling – Value Networks – Business Models for Knowledge Economy – UML Notations – Project Management.

TOTAL: 45 PERIODS

OUTCOMES:

- The students will be able to use Knowledge Models for System Implementation Advanced Knowledge Modeling to apply in real world.

REFERENCES:

1. Guus Schreiber, Hans Akkermans, Anjo Anjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2004.
2. Elias M.Awad & Hassan M. Ghaziri, "Knowledge Management", Pearson Education, 2004.

IL 7005	MAINTAINABILITY ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To provide maintenance concepts and maintenance policies with maintenance management tools and techniques.

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 would gain knowledge on maintenance logistics, fault diagnosis and TPM.

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.

IL 7006	MANUFACTURING 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 without and 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.

IL7007 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 7

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 10

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 8

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, analyse and implement single machine, parallel machine, flowshop, and job shop scheduling algorithms.

REFERENCE:

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.

IL7008 SYSTEMS SCIENCE AND ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- This course is intended to introduce the student to the systems engineering process used to create multidisciplinary 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.

IL 7071 APPLIED OBJECT ORIENTED PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

IL7072 BUSINESS EXCELLENCE MODELS L T P C

3 0 0 3

OBJECTIVES:

- 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/MINI PORJECTS 8

Development of business excellence model for industrial application in production systems, inventory systems, maintenance and replacement systems, supply chain management etc.

TOTAL: 45 PERIODS

OUTCOMES:

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

TEXT BOOK:

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

REFERENCES:

http://www.baldrige.nist.gov
http://www.baldrige21.com/
www.imc.org
http://www.quality.nist.gov/index.html
www.qimpro.com
www.imcrbnqa.com
www.efqm.org
www.juse.or.jp/e/deming/index.html

IL7073 CELLULAR MANUFACTURING SYSTEMS L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge on planning, design, implementation, and control of group technology and cellular manufacturing.

UNIT I INTRODUCTION 8

Group Technology – Limitations of traditional manufacturing systems – Group machining concept – principle of cellular manufacturing – Terminology associated with cellular manufacturing – characteristics and perspectives of cellular manufacturing – Areas of applications of cellular manufacturing – Benefits and limitations of cellular manufacturing

UNIT II CMS PLANNING AND DESIGN 10

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 9

Evaluation of cellular manufacturing system – production control activities and scheduling in cellular manufacturing.

UNIT V ECONOMIC OF GT/CMS 8

Characteristics of cell – Economic Justification of cellular manufacturing – Use of computer models in GT/CMS – Human aspects of GT/CMS – case studies.

TOTAL: 45 PERIODS

OUTCOME:

- The students should apply the various tools, techniques and methodology used in planning, design, implementation and control of group technology and cellular manufacturing.

REFERENCES:

1. Nagendra Parashar, B.S., “Cellular Manufacturing System: An Integrated Approach” PHI Learning, 2010.
2. Askin, R.G and Vakharia, A.J., GT planning and operation, as in Cleland, D.I and Bidananda, B (Editors),"The Automated Factory - Hand book: Technology and Management", TAB Professional & Reference Books, NY, 1990.
3. Shahrukh A.Irani, Handbook of Cellular Manufacturing Systems“, John Wiley & Sons, 1999.

IL7074	DATA ANALYSIS TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic statistical and multivariate methods.

UNIT I STATISTICAL DATA ANALYSIS 9

Data and Statistics- Review of Basic Statistical Measures-Probability Distributions-Testing of Hypotheses-Non Parametric Tests

UNIT II BASIC CONCEPTS 9

Introduction – Basic concepts – Uni-variate, Bi-variate and Multi-variate techniques – Types of multivariate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation – Approaches to multivariate model building.

UNIT III REGRESSION AND FACTOR ANALYSIS 9

Simple and Multiple Linear Regression Analysis – Introduction – Basic concepts – Multiple linear regression model – Least square estimation – Inferences from the estimated regression function – Validation of the model.

Factor Analysis: Definition – Objectives – Approaches to factor analysis – methods of estimation – Factor rotation – Factor scores - Sum of variance explained – interpretation of results.

Canonical Correlation Analysis - Objectives – Canonical variates and canonical correlation – Interpretation of variates and correlations.

UNIT IV DISCRIMINANT AND CLUSTER ANALYSIS 9

Discriminant Analysis - Basic concepts – Separation and classification of two populations - Evaluating classification functions – Validation of the model.

Cluster Analysis – Definitions – Objectives – Similarity of measures – Hierarchical and Non – Hierarchical clustering methods – Interpretation and validation of the model.

UNIT V ADVANCED TECHNIQUES 9

Conjoint Analysis – Definitions – Basic concepts – Attributes – Preferences – Ranking of Preferences – Output of Conjoint measurements – Utility - Interpretation.

Multi Dimensional Scaling – Definitions – Objectives – Basic concepts – Scaling techniques – Attribute and Non-Attributes based MDS Techniques – Interpretation and Validation of models. Advanced Techniques – Structural Equation modeling

TOTAL: 45 PERIODS

OUTCOMES:

- The students will gain knowledge on statistical **data analysis** and interpretation which help in effective decision making.

REFERENCES

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2005.
2. Richard A Johnson and Dean W.Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2005.
3. David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2002.

IL7075 DECISION SUPPORT 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 unstructured 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.

IL7076	ENGINEERING ECONOMICS AND COSTING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To study and understand the concept of Engineering Economics and apply in the real word.
- 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 AND FORECASTING 10

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 - Demand forecasting and forecasting methods.

UNIT II PRODUCTION FUNCTION AND COST ANALYSIS 9

Supply: Meaning and determinants – production function- Isoquants – Expanstion 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

Market Structure – Various forms – Equilibrium of a firm – Perfect competition – Monopolistic competition – Oligopolistic competition – Pricing of products under different market structures – Methods of pricing – Factors affecting pricing decision – Differential pricing – Government Intervention and pricing.

UNIT IV PROFIT ANALYSIS 7

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

UNIT V COSTING 10

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

TOTAL: 45 PERIODS

OUTCOMES:

- Students will become familiar with principles of micro economics and cost estimation.
- They will be able to apply these principles to appreciate the functioning of product and input market as well as the economy.

REFERENCES:

1. A. Ramachandra Aryasry and V.V. Ramana Murthy. " Engineering Economics and Financial Accounting:, Tata Mc graw Hill Publishing Company Ltd., New Delhgi, 2004

2. V.L. Mote, Samuel and G.S.Gupta, “Managerial Economics – Concepts and cases”, Tata McGraw Hill Publishing Coimpany Ltd, New Delhi, 1981.
3. A.Nag, :Macro Economics for Management Students” MacMillan India Ltd., New Delhi, 1999.
4. Jawaharlal, Cost Accounting, Tata McGraw Hill,

IL7077 INDUSTRIAL SAFETY AND HYGIENE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on fundamentals of safety engg.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.

TEXTBOOKS:

1. John.V .Grimaldi and Rollin. H Simonds, “Safety Management”, All India traveler book seller, New Delhi – 1989.
2. Krishnan N.V, “Safety in Industry”, Jaico Publisher House, 1996.

REFERENCES:

1. Occupational Safety Manual BHEL.
2. Industrial Safety and the law by P.M.C Nair Publishers, Trivandrum.
3. Managing emergencies in industries, loss prevention of India Ltd., proceedings, 1999.
4. Safety security and Risk management by U.K singh & J.M Dewam,. A.P.H. publishing company, New Delhi, 1996.
5. Singh, U.K and Dewan, J.M., “Sagety, Security And Risk Management”, APH publishinf company, New Delhi, 1996.
6. John V Grimaldi, Safety Manageemnt. AITB publishers, 2003.
7. Safety Manual. EDEL Engineering Consultancy, 2000.

IL 7078 LEAN MANUFACTURING AND SIX SIGMA L T P C
3 0 0 3

OBJECTIVES:

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

UNIT I INTRODUCTION TO LEAN MANUFACTURING 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, critical success factors for six sigma.

UNIT II INTEGRATION AND INITIATION FOR LEAN SIX SIGMA 9

The Evolution, synergy of Lean and six sigma, Definition of lean six sigma, the principles, Scope and features of lean six sigma. The laws of lean six sigma, key elements of LSS, The LSS model and the Benefits of lean six sigma. Initiation – Top management commitment, Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition and Infrastructure tools. Structure of transforming event and Launch preparation

UNIT III RESOURCE PROJECT SELECTION AND TEAM BUILDING 9

Resource and project selection, Selection of Black belts, Training of black belts and champions, Identification of potential projects, top down (Balanced score card) and bottom up approach –Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership.

UNIT IV THE DMAIC PROCESS AND TOOLS 9

The DMAIC Process – Toll gate reviews; The DMAIC tools; Define tools – project definition form, SIPOC Diagram. Measure tools – process mapping, lead time/Cycle time, pareto chart, cause & effect matrix, FMEA, IDEA – generating and organizing tools – Brain storming, Nominal Group technique, Multivoting; Cause & effect diagram, Data collection and accuracy tools; check sheet, Gauge R&R; Understanding and eliminating variation – Run charts, control charts, process capability analysis. Analyze tools – scatter plots, ANOVA, Regression analysis, time trap analysis. Improve tools – Mistake proofing, kaizen, Reducing congestion and delay, pooling, triaging, backup capacity, setup time reduction (SMED), TPM, DOE and the pull system. Control tools – Statistical process control.

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS 9

Institutionalizing lean six sigma – Improving Design velocity, creating cycle time base line, Valuing projects, gating the projects, reducing product line complexity, design for lean six sigma, Quality function deployment, theory of inventive problem solving (TRIZ), Robust Design – case study presentations.

TOTAL: 45 PERIODS

OUTCOMES:

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

REFERENCES:

1. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002.
2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.
3. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter solutions Using Statistical Methods, 1999.
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

IL7079	LOGISTICS AND DISTRIBUTION MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain understanding on principles and activities of logistics and Distribution Management.

UNIT I CONCEPTS OF LOGISTICS AND DISTRIBUTION 9

Introduction to logistics and distribution- Integrated logistics and the supply chain- Integrated logistics and the supply chain- Customer service and logistics- Channels of distribution - Key issues and challenges for logistics.

UNIT II PLANNING FOR LOGISTICS 9

Planning framework for logistics -Logistics processes -Supply chain segmentation- Logistics network planning - Logistics management and organization - Manufacturing and materials management

UNIT III WAREHOUSING AND STORAGE 9

Principles of warehousing Storage and handling systems (palletized and non-palletized) - Order picking and replenishment- Receiving and dispatch - Warehouse design- Warehouse management and information

UNIT IV FREIGHT TRANSPORT 9

International logistics: modal choice - Maritime transport - Air transport - Rail and intermodal transport- Road freight transport: vehicle selection, vehicle costing and planning and resourcing- International transportation systems in Global perspective.

UNIT V OPERATIONAL MANAGEMENT 9

Cost and performance monitoring- Benchmarking- Information and communication technology in supply chain- Outsourcing: services and decision criteria, the selection process - Outsourcing management- Security and safety in distribution - Logistics and the environment.

TOTAL : 45 PERIODS

OUTCOMES:

- The students will gain knowledge on importance of **logistics and distribution** and various activities performed including Warehousing, transportation and operations management.

REFERENCES:

1. Alan Rushton,Phil Croucher and Peter Baker(Eds.)The Handbook of Logistics and Distribution Management,Kogan Page,4th Edition,2010.
2. Jean-Paul Rodrigue, Claude Comtois and Brian Slack, "The geography of transport systems" (2009), New York: Routledge,.

IL7080 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.

IL7081 MULTI VARIATE 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

OUTCOMES:

- Can 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).

IL7082 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 must be able to:

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

REFERENCES:

1. Sumanth, D.J., 'Productivity Engineering and Management', TMH, New Delhi, 1990.
2. Edosomwan, J.A., "Organisational Transformation and Process Re-engineering", Library Cataloging in Pub. Data, 1996.
3. Rastogi, P.N., "Re-engineering and Re-inventing the Enterprise", Wheeler Pub. New Delhi, 1995.

4. Premvrat, Sardana, G.D. and Sahay, B.S., “Productivity Management – A Systems Approach”, Narosa Publishing House. New Delhi, 1998.

IL 7083 PROJECT MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To outline the need for Project Management
- To highlight different techniques of activity planning

UNIT I STRATEGIC MANAGEMENT AND PROJECT SELECTION 9

Project selection models, Project portfolio process, Analysis under uncertainty, Project organization**,** Matrix organization

UNIT II PROJECT PLANNING 9

Work breakdown structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation,

UNIT III PROJECT IMPLEMENTATION 12

Estimating Project Budgets, Process of cost estimation, Scheduling: Network Techniques PERT and CPM, Risk analysis using simulation, CPM- crashing a project, Resource loading, leveling, and allocation

UNIT IV MONITORING AND INFORMATION SYSTEMS 9

Information needs and the reporting process, computerized PMIS, Earned value analysis, Planning-Monitoring-Controlling cycle**,** Project control**:** types of control processes, design of control systems, control of change and scope

UNIT V PROJECT AUDITING 6

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

OUTCOMES:

- To apply project management principles in business situations to optimize time and resource utilization

TEXTBOOKS

1. R.Panneer selvam,P. Senthil Kumar, Project Management, PHI,2010
2. Arun Kanada, Project Management A life cycle approach, PHI,2011

REFERENCES:

1. Project Management – A Managerial Approach, by Jack R. Meredith, and Samuel J. Mantel Jr., John Wiley and Sons, 2006
2. Project Management – A Systems Approach to Planning, Scheduling and Controlling, by Harold Kerzner, John Wiley and Sons, 2006

IL 7084 RELIABILITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVE:

- 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.

IL 7085 SERVICES OPERATIONS MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To increase students' understanding of the nature and importance of the service sector in the economy.
- To increase students' analytical abilities in solving problems that service manager's 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

IL 7086	SYSTEMS ANALYSIS AND DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give a basic knowledge and system analysis, design and 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. Analysis and Design of Information systems, Arthur M. Langer, Springer 2001
2. Systems Analysis and Design, Kendall and Kendall, Prentice hall, 2004
3. Analysis and Design of Information systems, V. Rajaraman, PHI, 2006

IL7087	TECHNOLOGY MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Study of this subject provides an understanding of the Technology Management principles to the various organizations.

UNIT I INTRODUCTION 9

Technology management - Scope, components, and overview. Technology and environment, Technology and society, Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry, The dynamics of technology change

UNIT II TECHNOLOGY FORECASTING 9

Need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

UNIT III TECHNOLOGY CHOICE AND EVALUATION 9

Issues in the development new high tech products, Methods of analyzing alternate technologies, Techno-economic feasibility studies, Need for multi-criteria considerations such as, social, environmental, and political, Analytic hierarchy method, Fuzzy multi-criteria decision making, and other methods.

UNIT IV TECHNOLOGY TRANSFER AND ACQUISITION 9

Import regulations, Implications of agreements like Uruguay Round and WTO, Bargaining process, Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions, Organisational redesign and re-engineering, Technology productivity.

UNIT V TECHNOLOGY ABSORPTION AND INNOVATION 9

Present status in India, Need for new outlook, Absorption strategies for acquired technology, creating new/improved technologies, Innovations, Technology Measurement- Technology Audit, Risk and exposure, R&D portfolio management

TOTAL:45 PERIODS

OUTCOMES:

Upon completion of the course, students will be able to

- Have clear understanding of managerial functions like planning, organizing, staffing, leading and controlling
- Have same basic knowledge on international aspect of management

REFERENCES:

1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5 . Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6.Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996
7.Richard C. Dorf, Technology Management Handbook, CRC, 1999

QE7072	PRODUCT INNOVATION AND DEVELOPMENT	L	T	P	C
		3	0	0	3

OBJECTIVES :

- 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.

TEXTBOOK :

1. Karal .T. Ulrich, Steven D.Eppinger, Product Design and Development, McGRAW- HILL International Fifth Editions.2012.

REFERENCES:

1. S.Rosenthal, Effective product design and development, Irwin 1992.
2. Charles Gevirtz, Developing New products with TQM, McGraw – Hill International editions, 1994

QE7151 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.

UNIT III TOOLSANDTECHNIQUES–1 9

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

UNIT IV TOOLS AND TECHNIQUES 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 services processes.

REFERENCES:

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

QE7252 SOFTWARE QUALITY ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES :

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

UNIT I SOFTWARE QUALITY **5**

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 **10**

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

UNIT III SUPPORTING ACTIVITIES **10**

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

UNIT IV SOFTWARE QUALITY MANAGEMENT TOOLS **10**

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 **10**

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.

TEXTBOOK

1. Software Engineering: A Practitioners Approach, 5th Edition Roger S. Pressman Mcgraw – Hill International Edition, 6th Edition, 2006.
2. Ramesh Gopalswamy , Managing global Projects ; Tata Mcgraw Hill, 2002.

REFERENCES

1. Norman E – Fenton and Share Lawrence P flieger, Software metrics, International Thomson Computer press, 1997.
2. Gordan Schulmeyer.G. and James .L.Mc Hanus , Total Quality management for software , International Thomson Computer press , USA , 1990.
3. Dunn Robert M., Software Quality: Concepts and Plans, Englewood clifts, Prentice Hall Inc., 1990.
4. Metrics and Models in Software Quality Engineering, Stephen, Stephen H.Kan, Pearson education, 2006, Low price edition.