UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY : : CHENNAI 600 025

REGULATIONS - 2013

M.E. QUALITY ENGINEERING AND MANAGEMENT (FT & PT)

I TO IV SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	QE8101	Applied Operations Research	3	1	0	4
2.	QE8102	Dimensional Metrology and Inspection	3	0	0	3
3.	QE8103	Manufacturing Systems and Processes	3	0	0	3
4.	MA8160	Probability and Statistical Methods	3	1	0	4
5.	QE8151	Total Quality Management	3	0	0	3
6.		Elective I	3	0	0	3
		TOTAL	**18**	**2**	**0**	**20**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	QE8201	Quality by Design	3	1	0	4
2.	QE8202	Statistical Quality Control	3	0	0	3
3.	QE8251	Software Quality Engineering	3	0	0	3
4.		Elective II	3	0	0	3
5.		Elective III	3	0	0	3
6.		Elective IV	3	0	0	3
PRACTICAL						
7.	QE8211	Quality System Design Project	0	0	0	2
		TOTAL	**18**	**1**	**0**	**21**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1		Elective V	3	0	0	3
2		Elective VI	3	0	0	3
3		Elective VII	3	0	0	3
PRACTICAL						
4	QE8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	QE8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 68

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ELECTIVES FOR M.E. QUALITY ENGINEERING & MANAGEMENT

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	QE8001	Engineering Economics	3	0	0	3
2.	QE8002	Maintenance Engineering and Management	3	0	0	3
3.	QE8003	Operations Scheduling	3	0	0	3
4.	QE8004	Production and Inventory management	3	0	0	3
5.	QE8005	Software Process Measurement and Analysis	3	0	0	3
6.	QE8053	Supply Chain Management	3	0	0	3
7.	QE8252	Discrete System Simulation	3	0	0	3
8.	IL8071	Applied Object Oriented Programming	3	0	0	3
9.	IL8072	Business Excellence Models	3	0	0	3
10	IL8073	Data Analysis Techniques	3	0	0	3
11	IL8074	Decision Support Systems	3	0	0	3
12	IL8075	Industrial Safety and Hygiene	3	0	0	3
13	IL8076	Lean Manufacturing and Six Sigma	3	0	0	3
14	IL8077	Logistics and Distribution Management	3	0	0	3
15	IL8078	Management Accounting and Financial Management	3	0	0	3
16	IL8079	Multi Variate Data Analysis	3	0	0	3
17	IL8080	Productivity Management and Re-Engineering	3	0	0	3
18	IL8081	Project Management	3	0	0	3
19	IL8082	Reliability Engineering	3	0	0	3
20	IL8083	Services Operations Management	3	0	0	3
21	IL8084	Systems Analysis and Design	3	0	0	3
22	IL8085	Technology Management	3	0	0	3
23	IL8151	Facilities Design	3	0	0	3
24	QE8071	Materials Management	3	0	0	3
25	QE8072	Product Innovation and Development	3	0	0	3

UNIVERSITY DEPARTMENTS

ANNA UNIVERSITY, CHENNAI

REGULATIONS - 2013

M.E. QUALITY ENGINEERING & MANAGEMENT (PART TIME)

I TO VI SEMESTERS CURRICULUM AND SYLLABUS

SEMESTER I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	MA8160	Probability and Statistical Methods	3	1	0	4
2	QE8103	Manufacturing Systems and Processes	3	0	0	3
3	QE8151	Total Quality Management	3	0	0	3
		TOTAL	**9**	**1**	**0**	**10**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	QE8202	Statistical Quality Control	3	0	0	3
2	QE8102	Dimensional Metrology and Inspection	3	0	0	3
3	QE8251	Software Quality Engineering	3	0	0	3
		TOTAL	**9**	**0**	**0**	**9**

SEMESTER III

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1	QE8101	Applied Operations Research	3	1	0	4
2	QE8201	Quality By Design	3	1	0	4
3		Elective I	3	0	0	3
		TOTAL	**9**	**2**	**0**	**11**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1		Elective II	3	0	0	3
2		Elective III	3	0	0	3
3		Elective IV	3	0	0	3
PRACTICAL						
4	QE8211	Quality System Design Project	0	0	0	2
		TOTAL	**9**	**0**	**0**	**11**

SEMESTER V

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1		Elective V	3	0	0	3
2		Elective VI	3	0	0	3
3		Elective VII	3	0	0	3
PRACTICAL						
4	QE8311	Project Work Phase I	0	0	12	6
		TOTAL	**9**	**0**	**12**	**15**

SEMESTER VI

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
PRACTICAL						
1	QE8411	Project Work Phase II	0	0	24	12
		TOTAL	**0**	**0**	**24**	**12**

TOTAL NUMBER OF CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE: 68

ELECTIVES FOR M.E. QUALITY ENGINEERING & MANAGEMENT

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	QE8001	Engineering Economics	3	0	0	3
2.	QE8002	Maintenance Engineering and Management	3	0	0	3
3.	QE8003	Operations Scheduling	3	0	0	3
4.	QE8004	Production and Inventory management	3	0	0	3
5.	QE8005	Software Process Measurement and Analysis	3	0	0	3
6.	QE8053	Supply Chain Management	3	0	0	3
7.	QE8252	Discrete System Simulation	3	0	0	3
8.	IL8071	Applied Object Oriented Programming	3	0	0	3
9.	IL8072	Business Excellence Models	3	0	0	3
10	IL8073	Data Analysis Techniques	3	0	0	3
11	IL8074	Decision Support Systems	3	0	0	3
12	IL8075	Industrial Safety and Hygiene	3	0	0	3
13	IL8076	Lean Manufacturing and Six Sigma	3	0	0	3
14	IL8077	Logistics and Distribution Management	3	0	0	3
15	IL8078	Management Accounting and Financial Management	3	0	0	3
16	IL8079	Multi Variate Data Analysis	3	0	0	3
17	IL8080	Productivity Management and Re-Engineering	3	0	0	3
18	IL8081	Project Management	3	0	0	3
19	IL8082	Reliability Engineering	3	0	0	3
20	IL8083	Services Operations Management	3	0	0	3
21	IL8084	Systems Analysis and Design	3	0	0	3
22	IL8085	Technology Management	3	0	0	3
23	IL8151	Facilities Design	3	0	0	3
24	QE8071	Materials Management	3	0	0	3
25	QE8072	Product Innovation and Development	3	0	0	3

Attested

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QE8101 APPLIED OPERATIONS RESEARCH L T P C
3 1 0 4

OBJECTIVE:

- To learn the concepts of operations research applied in business decision making.

OUTCOME:

- To facilitate quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

UNIT I INTRODUCTION TO LINEAR PROGRAMMING (LP) 12

Introduction to applications of operations research in functional areas of management. Linear Programming-formulation, solution by graphical and simplex methods (Primal - Penalty, Two Phase), Special cases.
Dual simplex method. Principles of Duality. Sensitivity Analysis.

UNIT II LINEAR PROGRAMMING EXTENSIONS 12

Transportation Models (Minimising and Maximising Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods. Check for optimality. Solution by MODI / Stepping Stone method. Case of Degeneracy. Transhipment Models.
Assignment Models (Minimising and Maximising Problems) – Balanced and Unbalanced Problems. Solution by Hungarian and Branch and Bound Algorithms. Travelling Salesman problem. Crew Assignment Models.

UNIT III INTEGER PROGRAMMING AND GAME THEORY 12

Solution to pure and mixed integer programming problem by Branch and Bound and cutting plane algorithms.
Game Theory-Two person Zero sum games-Saddle point, Dominance Rule, Convex Linear Combination (Averages), methods of matrices, graphical and LP solutions.

UNIT IV INVENTORY MODELS, SIMULATION AND DECISION THEORY 12

Inventory Models – EOQ and EBQ Models (With and without shortages), Quantity Discount Models. Decision making under risk – Decision trees – Decision making under uncertainty. Monte-carlo simulation.

UNIT V QUEUING THEORY AND REPLACEMENT MODELS 12

Queuing Theory - single and Multi-channel models – infinite number of customers and infinite calling source.
Replacement Models-Individuals replacement Models (With and without time value of money) – Group Replacement Models.

TOTAL: 60 PERIODS

TEXTBOOKS

1. Paneerselvam R., Operations Research, Prentice Hall of India, Fourth Print, 2008.
2. N. D Vohra, Quantitative Techniques in Management,Tata Mcgraw Hill, 2010.
3. Pradeep Prabakar Pai, Operations Research - Principles and Practice, Oxford Higher Education, .

REFERENCES

1. Hamdy A Taha, Introduction to Operations Research, Prentice Hall India, Seventh Edition, Third Indian Reprint 2004.
2. G. Srinivasan, Operations Research – Principles and Applications, PHI, 2007.
3. Gupta P.K, Hira D.S, Problem in Operations Research, S.Chand and Co, 2007.
4. Kalavathy S, Operations Research, Second Edition, Vikas Publishing House, 2004.
5. Frederick & Mark Hillier, Introduction to Management Science – A Modeling and case studies approach with spreadsheets, Tata Mcgraw Hill, 2005.

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QE8102 DIMENSIONAL METROLOGY AND INSPECTION L T P C
3 0 0 3

UNIT I LINEAR MEASUREMENT AND ANGULAR MEASUREMENT 12

Accuracy, Precision, Readability, Sensitivity, Linear measuring instruments - vernier – micrometer- Gauge blocks- dial indicator-comparators – Angle standards – vernier bevel protractor-sine bar – autocollimator.

UNIT II STANDARDS FOR LINEAR AND ANGULAR MEASUREMENTS 8

Shop floor standards and their calibration, light interference, Method of coincidence, Slip gauge calibration, Measurement errors, Limits, fits, Tolerance, Gauges, Gauge design.

UNIT III MEASUREMENT APPLICATION 8

Measurement of screw threads and gears – Radius measurement – surface finish measurement - Measurement of straightness-flatness-parallelism – squareness- roundness – circularity

UNIT IV MODERN CONCEPTS 8

Image processing and its application in Metrology, Co-ordinate measuring machine, Types of CMM, Probes used, Application, Non-contact CMM using Electro-optical sensors for dimensional metrology.

UNIT V MEASUREMENT SYSTEMS 9

System configuration, basic characteristics of measuring devices, Displacement, force and torque measurement, standards, Calibration, Sensors, Basic principles and concepts of temperature, Pressure and flow measurement, Destructive testing – Nondestructive testing.

TOTAL: 45 PERIODS

TEXT BOOK:

1. R.K.Jain ,Engineering metrology ,khanna publisher,2009.
2. M. Mahajan,Text book of Metrology, Dhanpat Rai & Co P Ltd ,2012

REFERENCES:

1. Galyer J.F. and Shotbolt C.R."Metrology for Engineers" ELBS, 1992.
2. Hune, K.J.Engineering Metrology, Kalyani Publishers, India, 1980.
3. Robinson, S.L. and Miller R.K. Automated Inspection and Quality Assurance, Marcel Dekker Inc.1989.

QE8103 MANUFACTURING SYSTEMS AND PROCESSES L T P C
3 1 0 4

UNIT I METAL CASTING AND FORMING PROCESS 8

Patterns – Preparation of moulds- Melting of metals- pouring of metals – defects of casting - forging – rolling - extrusion- drawing

UNIT II METAL JOINING AND MACHINING PROCESS 10

Welding – TIG – MIG – Soldering – brazing – lathe-types of lathe – different operations in lathe – milling machine – operations using milling machine – grinding machine – types of grinding machine.

UNIT III NON TRADITIONAL MACHINING TECHNIQUES 8

Electric discharge machining – wire EDM – chemical machining – elector chemical machining – ultra sonic machining – abrasive jet machining – water jet machining

UNIT IV MANUFACTURING SYSTEMS 9

Manufacturing systems – Functions – Types of production – Costs in manufacturing- Modern manufacturing systems & controls

UNIT V WORK STUDY **10**

Introduction to method study and time study.

TOTAL: 45 PERIODS

REFERENCES:

1. S.K.Hajara Choudhury, Elements of Workshop technology Volume I and II,Media promoters and publishers Pvt. Ltd, 2002.
2. P.C.Sharma,A text book of production technology, S. Chand &Co., Ltd., 1999.
3. Mikel, P.Groover, "Automation Production Systems and Computer integrated manufacturing" PHI, 1995.
4. Benjamin W. Niebel, Motion & Time Study, Richard D.Irwin Inc., 1982.

MA8160 PROBABILITY AND STATISTICAL METHODS **L T P C**
3 1 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.

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.

UNIT I ONE DIMENSIONAL RANDOM VARIABLES (9+3)

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 (9+3)

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY: (9+3)

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES: (9+3)

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: (9+3)

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

BOOKS FOR STUDY:

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.

QE8151 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

UNIT 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 TOOLS AND TECHNIQUES –1 9

Benchmarking, Information Technology, ISO 9000 Series of Quality Management Systems-Environmental Management Systems.

UNIT IV TOOLS AND TECHNIQUES- 2 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

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.

QE8201 QUALITY BY DESIGN L T P C
3 1 0 4

UNIT I INTRODUCTION 6

Perception of quality, Taguchi’s definition of quality – quality loss function, Planning of experiments, design principles, terminology, normal probability plot, Analysis of variance, Linear regression models.

UNIT II FACTORIAL EXPERIMENTS 12

Design and analysis of single factor and multi-factor experiments, tests on means, EMS rules.

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UNIT III SPECIAL DESIGNS 12

2^K Factorial designs, Fractional factorial designs, Nested designs, Blocking and Confounding.

UNIT IV ORTHOGONAL EXPERIMENTS 9

Selection of orthogonal arrays (OA's), OA designs, conduct of OA experiments, data collection and analysis of simple experiments, Modification of orthogonal arrays.

UNIT V ROBUST DESIGN 6

Variability due to noise factors, Product and process design, Principles of robust design, objective functions in robust design - S/N ratios , Inner and outer OA experiments, optimization using S/N ratios, fraction defective analysis, case studies.

T=15, TOTAL: 60 PERIODS

REFERENCES:

1. Krishnaiah, K. and Shahabudeen, P. Applied Design of Experiments and Taguchi Methods, PHI learning private Ltd., 2012.
2. D.C.Montgomery, "Design and analysis of experiments", John Wiley, Eighth Edition, 2012.
3. Nicolo Belavendram, "Quality by design" Taguchi techniques for Industrial experimentation, Prentice Hall, 1999.

QE8202 STATISTICAL QUALITY CONTROL L T P C

3 0 0 3

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 charts for variables- $\overline{X}$, 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, $\overline{X}$ - 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

REFERENCES:

1. Douglas C Montgomery, Introduction to Statistical Quality Control, John Wiley, Seventh Edition, 2012.
2. Grant E.L. and Leavensworth, Statistical Quality Control, TMH, 2000.
3. IS 2500 Standard sampling plans

QE8251 SOFTWARE QUALITY ENGINEERING L T P C
3 0 0 3

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

TEXT BOOK

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.

QE8001 ENGINEERING ECONOMICS L T P C
3 0 0 3

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 10

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 10

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 07

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

UNIT V NATIONAL INCOME AND POLICY 08

National Income – Accounting – Consumption and investment – Business Cycle and unemployment – Inflation and deflation, Balance of Payments – Monetary and Fiscal policies.

TOTAL: 45 PERIODS

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.

QE8002 MAINTENANCE ENGINEERING AND MANAGEMENT L T P C

3 0 0 3

UNIT I INTRODUCTION 6

Maintenance definition – Maintenance objectives and Scope – Challenges and functions of Maintenance management – Tero technology – Maintenance costs.

UNIT II MAINTENANCE MODELS 12

Maintenance policies – Imperfect maintenance – Preventive & break down maintenance – PM schedule and product characteristics – Inspection decisions: Maximizing profit – Minimizing downtime – Replacement models.

UNIT III MAINTENANCE LOGISTICS 11

Maintenance Crew size – Human factors –Resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spares control.

UNIT IV MAINTENANCE QUALITY 8

Five Zero concept –FMECA – Maintainability prediction– Design for maintainability – Reliability Centered Maintenance.

UNIT IV TOTAL PRODUCTIVE MAINTENANCE 8

TPM fundamentals – Chronic and sporadic losses – Six big losses – OEE as a measure – TPM pillars– Autonomous maintenance –TPM implementation.

TOTAL: 45 PERIODS

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.

QE8003 OPERATIONS SCHEDULING L T P C
3 0 0 3

UNIT I SCHEDULING BASICS 9

Scheduling theory and function – Sequencing objectives – Performance measures– Dominant schedules – SPT, EDD, WSPT sequences – Sequencing Theorems.

UNIT II SINGLE MACHINE MODEL 9

Pure sequencing –Minimizing $\overline{T}$, $\overline{F}$ – Hodgson's algorithm – Smith's rule – WI algorithm – Dynamic programming – Branch and Bound – Non simultaneous arrivals –Dependent jobs – Sequence dependent set up times.

UNIT III PARALLEL MACHINE MODEL 9

Minimizing makespan: McNaughton's algorithm – Heuristic procedures – Minimizing $\overline{F_w}$: H_1 & H_m heuristics – Hu's algorithm – Muntz Coffman algorithm.

UNIT IV FLOW SHOP MODEL 9

Johnson's algorithm – Campbell Dudek Smith algorithm – Palmer's method – Mitten's algorithm – Ignall Schrage algorithm - Despatch index heuristic.

UNIT V JOB SHOP MODEL 9

Graphical representation – Jackson's algorithm – Semi-active schedule – Active schedule – Non delay schedule – Dispatching rules – Heuristic schedule generation.

TOTAL: 45 PERIODS

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.

QE8004 PRODUCTION AND INVENTORY MANAGEMENT L T P C
3 0 0 3

UNIT I PROCESS MANAGEMENT 5

Operations strategy, types of processes, process management – outsourcing, make-buy decision, process re-engineering

UNIT II FORECASTING 10

Purpose and application of forecasts, types of forecasts, Delphi & Market surveys, Moving average and exponential smoothing methods, Linear Regression, monitoring of forecasts.

UNIT III PRODUCTION PLANNING 10

Aggregate planning problem, costs, strategies, graphical and tabular methods, transportation and linear programming methods, MRP, MRPII, CRP, ERP.

UNIT IV PRODUCTION CONTROL 10

Capacity planning and control, production activity control, JIT, flow shop & Job shop scheduling basic models.

UNIT V INVENTOTY MANAGEMENT 10

Inventory classification and analysis, Basic inventory systems, deterministic and probability models.

TOTAL: 45 PERIODS

Attested

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REFERENCES:

1. Lee J.Krajewsky and Larry P.Ritzman , “Operations Management”, PHI, 2003.
2. R.Pannerselvam, “Production and Operations Management”, PHI, 2007.
3. Seetharama L., Narasimhan, Dennis W.McLeavy and Peter J.Brillington, Production Planning and Inventory Control,” PHI, 1997.
4. Mahadevan, B. Operations- Theory & Practice, Pearson Education, 2007.

QE8005 SOFTWARE PROCESS MEASUREMENT AND ANALYSIS

L	T	P	C
3	0	0	3

UNIT I SOFTWARE MEASURES AND METRICS **10**

Measurement theory- Categories of data (Nominal data, Ordinal data, Absolute data (Attribute), Interval data, Ratio data (Continuous Data) - Aspects of Data Quality (correctness, Accuracy, precision, Consistency, Completeness, repeatability) - Base Measures (Size, Cost, Effort, Schedule, Defects, Resources and Changes), Product & Process Metrics.

UNIT II METRICS FRAMEWORK **10**

Goal Question Indicator Metric (GQ (I) M) Framework- Data Collection & Analysis Plan- Data Collection Systems, Data Validation, Management by Metrics- Key Metrics for each project type

UNIT III ANALYSIS AND IMPROVEMENTS **12**

Arriving Organizational capability baselines , Arriving Organization Norms – COQ, Productivity, Effort distribution , Phase wise Defect distribution - Using the baselines for Estimation and planning - continual improvement ,Corrective and Preventive actions

UNIT IV ESTIMATION MODELS **8**

Types of Estimation – Effort estimation models – COCOMO-FPA-SLIM

UNIT V PREDICTION MODELS **5**

Product Quality Prediction Models- Raleigh model, Exponential model

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Norman E-Fenton and Share Lawrence Pflieger, Software Metrics, International Thomson Computer Press, 1997

REFERENCES:

1. Metrics and Models in Software Quality Engineering, Stephen H. Kan Pearson Education, 2006.
2. Applied Software Measurements: Global Analysis of Productivity and Quality by Capers Jones, McGraw-Hill Professional, 2008
3. Roger S. Pressman Software Engineering: A Practitioners Approach McGraw- Hill International Edition, 6th Edition, 2006
4. http://www.sei.cmu.edu/

QE8053 SUPPLY CHAIN MANAGEMENT

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UNIT I INTRODUCTION TO SUPPLY CHAIN MANAGEMENT **8**

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.

Case discussions.

UNIT II DESIGNING THE SUPPLY CHAIN NETWORK 9

Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions. Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees.

UNIT III SOURCING, TRANSPORTATION AND PRICING 10

Role of sourcing, supplier – scoring and assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

UNIT IV COORDINATION AND TECHNOLOGY 10

Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships. The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business
framework, E-business in practice. Case discussion.

UNIT V EMERGING CONCEPTS 8

3PL- 4PL- Global Logistics -Reverse Logistics; Reasons, Activities, Role. Ware house Management-RFID Systems; Components, applications, implementation. Lean supply Chains-Sustainable supply Chains

TOTAL: 45 PERIODS

REFERENCES

1. Sunil Chopra, Peter Meindl and Kalra, Supply Chain Management, Strategy, Planning, and operation,Pearson Education, 2013.
2. Robert B Handfield, Ernest L Nichols, Jr.,Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems , Pearson Education , 2002.
3. Jeremy F.Shapiro, Modeling the supply chain, Thomson Duxbury, 2006.
4. David Simchi Levi,Philip Kaminsky and Edith Simchi Levi, Designing and Managing the Supply Chain, Mc Graw Hill, 2009.

QE8252 DISCRETE SYSTEM SIMULATION L T P C
3 0 0 3

OBJECTIVES:

- To understand the importance and advantages of applying simulation techniques for solving various problems on discrete event systems.
- To teach various random number generation techniques, its use in simulation, tests and validity of random numbers etc. development of simulation models, verification, validation and analysis.
- To understand the applications of random probability distributions in real time environments.
- Train students to solve discrete event problems through hand simulation and to develop simulation models using Extend simulation software.

OUTCOMES:

Students will:

1. Learn to simulate models matching real life scenarios and obtain superior results
2. Develop capabilities of taking up consultancy projects.

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: 5

Methods of generating random numbers, Pseudo random numbers and random variates, discrete and continuous random probability distributions, tests for random numbers.

UNIT III DESIGN OF SIMULATION: 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 SOFTWARE: 14

Study and selection of simulation languages, Use of simulation software such as GPSS, Extend, Matlab, Simulink, LabView etc., for simulation.

UNIT V CASE STUDIES IN SIMULATION: 15

Development of simulation models for queuing systems, production systems, inventory systems, Industrial scheduling problems.

TOTAL: 45 PERIODS

REFERENCES:

1. Banks, J., Nelson, B.L., Nicol, D.M., Shahabudeen .P "Discrete event system simulation", 4th edition Prentice Hall, India, 2005.
2. Kalechman, M., "Practical MATLAB® basics for engineers", CRC press, Taylor and Francis group, First Indian reprint, 2012.
3. Shannon, R.E. "systems simulation – The art and Science", Prentice Hall, 1975.
4. Schriber, T.J., "simulation using GPSS", John Wiley, 1991.
5. Law, A.M. and Kelton, W.D., "Simulation Modeling and Analysis", McGraw Hill, 2000.

IL8071 APPLIED OBJECT ORIENTED PROGRAMMING L T P C

3 0 0 3

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

REFERENCES

1. Robert Lafore, "Object oriented programming in C++", Sam Publishing, 2002.
2. E.Balagurusamy, Object oriented programming with C ++,Tata McGraw 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

Attested

DIRECTOR
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Anna University, Chennai-600 025.

IL8072 BUSINESS EXCELLENCE MODELS L T P C
3 0 0 3

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

TEXT BOOK:

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

IL8073 DATA ANALYSIS TECHNIQUES L T P C
3 0 0 3

UNIT I STATISTICAL DATA ANALYSIS 9

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

UNIT II DATA ANALYSIS I 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 DATA ANALYSIS II 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 DATA ANALYSIS III **9**

Multiple 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 DATA ANALYSIS IV **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

REFERENCES

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2010.
2. Richard A Johnson and Dean W.Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2012.
3. David R Anderson, Dennis J Sweeney and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2011.

IL8074 DECISION SUPPORT SYSTEMS **L T P C**
3 0 0 3

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

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.

IL8075 INDUSTRIAL SAFETY AND HYGIENE L T P C
3 0 0 3

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 APPRAISA LAND 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

TEXT BOOKS:

1. John. V. Grimaldi and Rollin. H Simonds, “Safety Managenent”, 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 publishing company, New Delhi, 1996.
6. John V Grimaldi, Safety Management. AITB publishers, 2003.
7. Safety Manual. EDEL engineering Consultancy, 2000.

IL8076 LEAN MANUFACTURING AND SIX SIGMA L T P C
3 0 0 3

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 LEAN SIX SIGMA APPROACH 9

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, Introduction to DMAIC tools.

UNIT III INITIATION FOR LEAN SIX SIGMA 9

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

UNIT IV PROJECT SELECTION FOR LEAN SIX SIGMA 9

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 V THE DMAIC PROCESS AND INSTITUTIONALIZING THE LSS 9

Predicting and improving team performance, Nine team roles, Team leadership, DMAIC process, Institutionalizing lean six sigma, Design for lean six sigma, Case study presentations.

TOTAL: 45 PERIODS

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.

IL8077 LOGISTICS AND DISTRIBUTION MANAGEMENT L T P C
3 0 0 3

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

REFERENCES:

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

IL8078 MANAGEMENT ACCOUNTING AND FINANCIAL MANAGEMENT L T P C

3 0 0 3

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

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.

IL8079 MULTIVARIATE DATA ANALYSIS L T P C
3 0 0 3

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

REFERENCES

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

IL8080 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING L T P C
3 0 0 3

UNIT I PRODUCTIVITY 9

Productivity Concepts – Macro and Micro factors of productivity – Dynamics of Productivity - Productivity Cycle Productivity Measurement at International, National and Organization 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 Organizational 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

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

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.

IL8081 PROJECT MANAGEMENT L T P C
3 0 0 3

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

TEXT BOOKS:

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

REFERENCES:

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

IL8082 RELIABILITY ENGINEERING L T P C
3 0 0 3

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

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.

IL8083 SERVICES OPERATIONS MANAGEMENT L T P C
3 0 0 3

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

REFERENCES:

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

IL8084 SYSTEMS ANALYSIS AND DESIGN L T P C
3 0 0 3

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

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

IL8085 TECHNOLOGY MANAGEMENT L T P C

3 0 0 3

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

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

IL8151 FACILITIES DESIGN L T P C
3 0 0 3

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-Line balancing.

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 MATERIAL HANDLING 9

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

TOTAL: 45 PERIODS

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

QE8071 MATERIALS MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To understand the importance of materials management system and its concepts

OUTCOME:

- To introduce the concepts of materials management with the emphasis on the various material planning, purchasing policies, purchasing system and the concepts of materials management.

UNIT I INTRODUCTION 9

Introduction to materials management and productivity, functions, organization structures and role of material management. Materials and profitability and Profit center concept, Contribution to profits, policy manual, internal interface, External Environment, Centralized Purchasing, Decentralization, Delegations of powers.

UNIT II MATERIAL PLANNING 9

Material Planning, definition, influencing factors, use of standard deviation, Importance of materials Research, Advantages of MIS, Techniques of Materials Intelligence, Environment Conditions, Source of information, Materials requirement planning (MRP) and Manufacturing resource Planning (MRPII) ,Evolution to ERP and Distribution Requirements Planning (DRP), Pull systems.

UNIT III PURCHASING 9

Importance and objectives of good purchasing system, Prime and organizational functions, purchasing policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing in cost reduction, negotiations and purchase, purchasing research: identification of right sources of supply, Vendor relation and selection, vendor rating and standardization, vendor certification plans, supply reliability, developing new source of supply.

UNIT IV COST REDUCTION 9

Cost control vs Cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, material holding cost, Acquisition cost, Settlement of Bills, Accounting, Audit in Materials Management, Internal Audit, Operational Audit, techniques of cost control, cost effectiveness, cost analysis for material management, material flow cost control.

UNIT V INVENTORY MANAGEMENT 9

Inventory vs Stores, Functions and types of inventory, Types of inventory control, Handling Uncertainties and safety stock, inventory build-up, EOQ for various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking policies, inventory management of perishable commodities, ABC-VED analysis, design of inventory distribution systems, spare parts inventory management, information systems for inventory management, cases studies.

TOTAL: 45 PERIODS

REFERENCES:

1. P. Gopalakrishnan, "**Purchasing and Materials Management**", 23rd Edition, Tata McGraw Hill, 2008.
2. J. R. Tony Arnold, Stephen N. Chapman, & Lloyd M. Clive, "**Introduction to Materials Management**", 7th Edition, Prentice Hall, 2011.
3. W. R. Stelzer, "**Materials Management**", PHI, 1979.
4. K. K. Ahuja, "**Materials Management**", CBS Publishers & Distributors, 2008.
5. Donald Waters, "**Inventory Control and Management**", John Wiley & Sons; 2nd Edition, 2003.
6. Ed C. Mercado, "**Hands-on Inventory Management (Series on Resource Management)**", Auerbach Publications, 2008.

QE8072 PRODUCT INNOVATION AND DEVELOPMENT L T P C

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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

TEXT BOOK :

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.