ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
REGULATIONS – 2015
CHOICE BASED CREDIT SYSTEM
M.E. QUALITY ENGINEERING AND MANAGEMENT (FT & PT)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

I. To prepare students to excel in research or to succeed in Quality engineering and Management profession through global, rigorous post graduate education.

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve quality engineering problems

III. To train students with good scientific and engineering knowledge so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.

IV. To inculcate students in professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate quality engineering issues to broader social context.

V. To provide student with an academic environment aware of excellence, leadership, written ethical codes and guidelines, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):
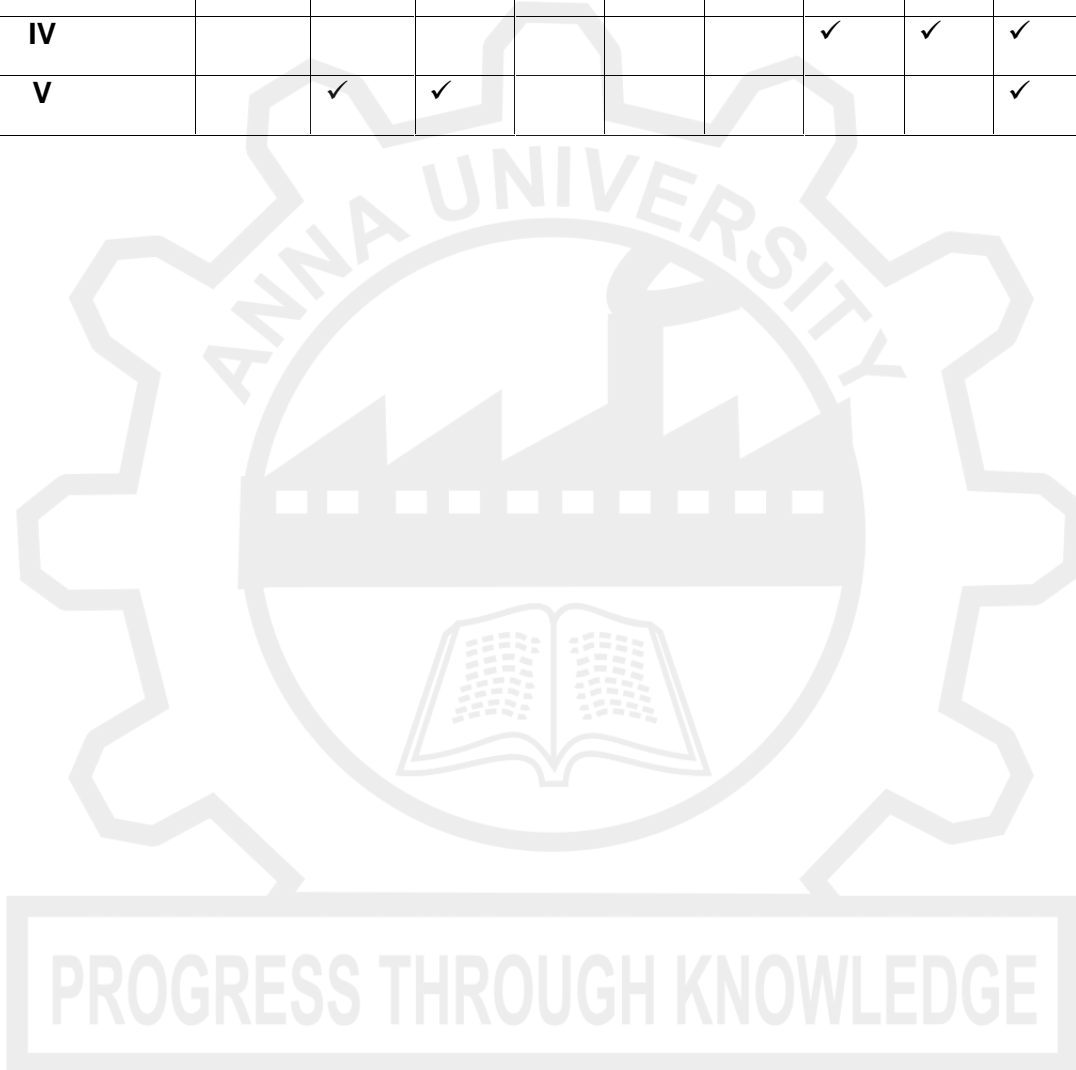
On successful completion of the programme,

1. Graduates will demonstrate knowledge of mathematics, science and engineering.

2. Graduates will demonstrate an ability to identify, formulate and solve engineering problems.

3. Graduate will demonstrate an ability to design and conduct experiments, analyze and interpret data.

4. Graduates will demonstrate an ability to design a system, component or process as per needs and specifications.

5. Graduates will demonstrate an ability to visualize and work on multidisciplinary tasks.

6. Graduate will demonstrate skills to use modern engineering tools, software and equipment to analyze problems.

7. Graduates will demonstrate knowledge of professional and ethical responsibilities.

8. Graduate will be able to communicate effectively in both verbal and written form.

9. Graduate will show the understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.

10. Graduate will develop confidence for self education and ability for life-long learning.

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Mapping of PEOs with POs

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

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
YEAR 1	SEM 1	Probability and Statistics	✓		✓		✓					
		Manufacturing Systems and Processes				✓	✓					
		Total Quality Management	✓									
		Operations Research	✓									
		Dimensional Metrology and Inspection	✓									
		Elective I										
		Statistical Applications and Optimization Lab										
	SEM 2	Statistical Quality Control	✓								✓	
		Quality by Design		✓	✓	✓		✓			✓	
		Software Quality Engineering	✓					✓				
		Elective II										
		Elective III										
		Elective IV										
		Quality System Design Project		✓		✓	✓	✓				
YEAR 2	SEM 3	Elective V										
		Elective VI										
		Elective VII										
		Project Work Phase I		✓		✓			✓			✓
	SEM 4	Project Work Phase II		✓		✓			✓			✓

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CURRICULA AND SYLLABI

SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IL7152	Operations Research	PC	4	4	0	0	4
2.	MA7159	Probability and Statistical Methods	FC	4	4	0	0	4
3.	QE7101	Dimensional Metrology and Inspection	PC	3	3	0	0	3
4.	QE7102	Manufacturing Processes and Systems	PC	3	3	0	0	3
5.	QE7151	Total Quality Management	PC	3	3	0	0	3
6.		Elective I	PE	3	3	0	0	3
PRACTICALS								
7.	QE7111	Statistical Applications and Optimization Lab	EEC	4	0	0	4	2
			TOTAL	24	20	0	4	22

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	QE7201	Quality by Design	PC	4	4	0	0	4
2.	QE7252	Software Quality Engineering	PC	3	3	0	0	3
3.	QE7253	Statistical Quality Control	PC	3	3	0	0	3
4.		Elective II	PE	3	3	0	0	3
5.		Elective III	PE	3	3	0	0	3
6.		Elective IV	PE	3	3	0	0	3
PRACTICALS								
7.	QE7211	Quality System Design Project	EEC	4	0	0	4	2
			TOTAL	23	19	0	4	21

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SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.		Elective V	PE	3	3	0	0	3
2.		Elective VI	PE	3	3	0	0	3
3.		Elective VII	PE	3	3	0	0	3
PRACTICALS								
4.	QE7311	Project Work Phase I	EEC	12	0	0	12	6
			TOTAL	**21**	**9**	**0**	**12**	**15**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	QE7411	Project Work Phase II	EEC	24	0	0	24	12
			TOTAL	**24**	**0**	**0**	**24**	**12**

TOTAL NO. OF CREDITS: 70

PROGRESS THROUGH KNOWLEDGE

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SEMESTER I

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA7159	Probability and Statistical Methods	FC	4	4	0	0	4
2.	QE7102	Manufacturing Processes and Systems	PC	3	3	0	0	3
3.	QE7151	Total Quality Management	PC	3	3	0	0	3
			TOTAL	10	10	0	0	10

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	QE7101	Dimensional Metrology and Inspection	PC	3	3	0	0	3
2.	QE7252	Software Quality Engineering	PC	3	3	0	0	3
3.	QE7253	Statistical Quality Control	PC	3	3	0	0	3
			TOTAL	9	9	0	4	9

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S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IL7152	Operations Research	PC	4	4	0	0	4
2.	QE7201	Quality By Design	PC	4	4	0	0	4
3.		Elective I	PE	3	3	0	0	3
PRACTICAL								
4.	QE7111	Statistical Applications and Optimization Lab	EEC	4	0	0	4	2
			TOTAL	**15**	**11**	**0**	**4**	**13**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Elective II	PE	3	3	0	0	3
2		Elective III	PE	3	3	0	0	3
3		Elective IV	PE	3	3	0	0	3
PRACTICAL								
4	QE7211	Quality System Design Project	EEC	0	0	0	0	2
			TOTAL	**9**	**9**	**0**	**0**	**11**

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1		Elective V	PE	3	3	0	0	3
2		Elective VI	PE	3	3	0	0	3
3		Elective VII	PE	3	3	0	0	3
PRACTICAL								
4	QE7311	Project Work Phase I	EEC	4	0	0	12	6
			TOTAL	**13**	**9**	**0**	**12**	**15**

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SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICAL								
1.	QE7411	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.		Manufacturing Systems and Processes	PC	3	3	0	0	3
2.		Total Quality Management	PC	3	3	0	0	3
3.		Statistical Quality Control	PC	3	3	0	0	3
4.		Dimensional Metrology and Inspection	PC	3	3	0	0	3
5.		Software Quality Engineering	PC	3	3	0	0	3
6.		Operations Research	PC	4	4	0	0	4
7.		Quality By Design	PC	4	4	0	0	4

PROFESSIONAL ELECTIVES (PE)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	CI7076	Supply Chain Management	PE	3	3	0	0	3
2.	IL7071	Applied Object Oriented Programming	PE	3	3	0	0	3
3.	IL7072	Business Excellence Models	PE	3	3	0	0	3
4.	IL7074	Data Analysis	PE	3	3	0	0	3

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No.	Code	Course Title	Category		L	T	P	C
		Techniques						
5.	IL7075	Decision Support Systems	PE	3	3	0	0	3
6.	IL7076	Engineering Economics and Costing	PE	3	3	0	0	3
7.	IL7077	Industrial Safety and Hygiene	PE	3	3	0	0	3
8.	IL7078	Lean Manufacturing and Six Sigma	PE	3	3	0	0	3
9.	IL7079	Logistics and Distribution Management	PE	3	3	0	0	3
10.	IL7080	Management Accounting and Financial Management	PE	3	3	0	0	3
11.	IL7081	Multi Variate Data Analysis	PE	3	3	0	0	3
12.	IL7082	Productivity Management and Re Engineering	PE	3	3	0	0	3
13.	IL7083	Project Management	PE	3	3	0	0	3
14.	IL7084	Reliability Engineering	PE	3	3	0	0	3
15.	IL7085	Services Operations Management	PE	3	3	0	0	3
16.	IL7086	System Analysis and Design	PE	3	3	0	0	3
17.	IL7087	Technology Management	PE	3	3	0	0	3
18.	IL7151	Facilities Design	PE	3	3	0	0	3
19.	QE7001	Maintenance Engineering and Management	PE	3	3	0	0	3
20.	QE7002	Operations Scheduling	PE	3	3	0	0	3
21.	QE7003	Production and Inventory Management	PE	3	3	0	0	3
22.	QE7004	Software Process Measurement and Analysis	PE	3	3	0	0	3
23.	QE7071	Materials Management	PE	3	3	0	0	3
24.	QE7072	Product Innovation and Development	PE	3	3	0	0	3
25.	QE7251	Discrete System Simulation	PE	3	3	0	0	3

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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

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IL7152   **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 KapoorV.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.

PROGRESS THROUGH KNOWLEDGE

QE7101   **DIMENSIONAL METROLOGY AND INSPECTION**   **L T P C**
                                                                         3 0 0 3

OBJECTIVE :
* To learn the basic concepts of Measurements and Metrology, and to get a clear Knowledge about the available Measurement systems and Instruments.

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.

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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 – sureness- 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

OUTCOME :

- This Programme provides the basic knowledge of measurements, measurement systems and measuring instruments applied in all the industries and also in business.

TEXT BOOK:

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

REFERENCES:

1. Galyer J.F. and ShotboltC.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.

QE7102   MANUFACTURING PROCESSES AND SYSTEMS   L T P C
3 0 0 3

OBJECTIVE :

- To impart the students in knowing the manufacturing systems and processes followed in all the manufacturing firms.

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.

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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.

<div align="right">TOTAL: 45 PERIODS</div>

OUTCOME :

- This course helps the students in getting knowledge of the manufacturing processes, manufacturing systems as well as work study, which forms a very important part of Production and Manufacturing.

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.

QE7151   **TOTAL QUALITY MANAGEMENT**   **L T P C**
                                                                          3 0 0 3

OBJECTIVES :

- To get a clear understanding of Total Quality Management (TQM) principles, tools and techniques.
- Also the TQM implementation has to be explained by using case studies.

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 SystemsEnvironmental Management Systems.

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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

OUTCOMES :

- After studying this subject, the students will get an idea about the practice and benefits of TQM in all the industries.

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.

QE7111	**STATISTICAL APPLICATIONS AND OPTIMIZATION 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.

1. Development of simple programs for statistical analysis: frequency distribution, Applications of Graphics.(Charts, Graphs etc.)
2. Descriptive Statistics
3. Simple and Multiple Regression
4. Use of statistical packages for factor analysis
5. Solving Linear Programming Problems
6. Solving Transportation and Assignment Models
7. Solving Network Flow Models
8. Solving Project Management Problems

TOTAL: 60 PERIODS

LABORATORY SOFTWARE REQUIREMENTS

1. TURBO C++ Software
2. LINDO Software
3. LINGO Software
4. TORA Software.
5. Excel Software

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QE7201   **QUALITY BY DESIGN**   **L T P C**
                                                                         4 0 0 4

OBJECTIVES:

- To make the students in understanding the application of Experimental design in quality control and improvement.

UNIT I   INTRODUCTION   **9+3**
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   **15+3**
Design and analysis of single factor and multi-factor experiments, tests on means, EMS rules.

UNIT III   SPECIAL DESIGNS   **15+3**
2^K Factorial designs, Fractional factorial designs, Nested designs, Blocking and Confounding.

UNIT IV   ORTHOGONAL EXPERIMENTS   **9+3**
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   **12 +3**
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

OUTCOMES :

- The concepts of statistically designed experiments applied in industries to control and improve Quality can be well understood after studying this subject.

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. NicoloBelavendram, "Quality by design" Taguchi techniques for Industrial experimentation, Prentice Hall, 1999.

PROGRESS THROUGH KNOWLEDGE

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.

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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.

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. GordanSchulmeyer. G. and James .L. McHanus , 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.

PROGRESS THROUGH KNOWLEDGE

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 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, 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

QE7311	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.

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QE7411	**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.

CI7076	**SUPPLY CHAIN MANAGEMENT**	L	T	P	C
		3	0	0	3

OBJECTIVES :
- To help the students in knowing the concepts of Supply chain management, its importance, applications and the applications of various techniques in optimizing the supply chain network.

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, theE-Business framework, E-business in practice.Case discussion.

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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

OUTCOMES:

- After studying this subject, the students will get a clear understanding of the supply chain management concepts applied in business as well as production and manufacturing industries.

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 SimchiLevi,PhilipKaminsky and Edith Simchi Levi, Designing and Managing the Supply Chain, McGraw Hill, 2009.

IL7071	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.

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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. NabajyotiBarkakati, 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

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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, 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.

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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 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

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

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.

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IL7078   **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
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, 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, Infrastructure tools, structure of transforming event, 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 and effect diagram, FMEA, IDEA – generating and organizing tools – Brainstorming, Nominal group technique, Motivating; Cause and 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, set up time reduction (SMED), TPM, DOE and the pull system. Control charts – 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, QFD, 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, 2010.
2. Jean-Paul Rodrigue, Claude Comtois and Brian Slack, "The geography of transport systems", Routledge, 2009.

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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.

UNITIII   **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).

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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 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.

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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.

IL7083   **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.

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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

TEXT BOOKS:

1. R.Panneerselvam,P. Senthil Kumar, Project Management, PHI, 2010.
2. ArunKanada, 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.

IL7084	**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.

IL7085   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 McGraw Hill India, 2006.
2. Haksever C, Render B, Russell RA and Murdick RG ,Service Management and Operations, Prentice Hall International, USA, 2000

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IL7086   **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

PROGRESS THROUGH KNOWLEDGE

IL7151   **FACILITIES DESIGN**   **L T P C**
                                                                    3 0 0 3

OBJECTIVES:
- To explain the basic principles in facilities planning, location, layout designs and material andling 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.

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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

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

QE7001   **MAINTENANCE ENGINEERING AND MANAGEMENT**   L T P C
                                                                         3 0 0 3

OBJECTIVES :
- To get a clear knowledge about the Maintenance engineering and Management techniques practiced in industries.

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 – condition based monitoring.

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.

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UNIT IV   MAINTENANCE QUALITY   8
Five Zero concept –FMECA – Maintainability prediction– Design for maintainability – Reliability Centered Maintenance.

UNIT V   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

OUTCOMES :
- The concept of Maintenance, Maintainability, Availability, and Reliability can be known while studying this subject.

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

QE7002	OPERATIONS SCHEDULING	L T P C
		3 0 0 3

OBJECTIVES :
- To give knowledge to students about the Scheduling techniques, algorithms, and Heuristics that are applied for operations management.

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 T ,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 make span: McNaughton's algorithm – Heuristic procedures – Minimizing Fw: 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

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OUTCOMES:
- The concepts of scheduling and sequencing applied in operations management can be get cleared by this subject.

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.

QE7003   PRODUCTION AND INVENTORY MANAGEMENT   L T P C
                                                              3 0 0 3

OBJECTIVES :
- To gain knowledge in the area of Production and Inventory management through variouys tools and techniques.

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

OUTCOMES:
- The Product and Inventory management techniques like Forecasting, MRP, ERP, JIT, etc. can be better known after studying this course.

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.

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QE7004　　　　**SOFTWARE PROCESS MEASUREMENT AND ANALYSIS**　　　**L T P C**
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　3 0 0 3

OBJECTIVES :

- To facilitate the students in knowing the concepts of Software measurements, metrics, and analysis.

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

OUTCOMES :

- The basic measurement techniques, metrics and analyses in software industry can be understood by this course.

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/

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QE7071   **MATERIALS MANAGEMENT**   **L T P C**
                                                                       3 0 0 3

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

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

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.

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.

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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.

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.

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.

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QE7251   **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.

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

OUTCOMES :
Students will:

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

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.

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