

**SEMESTER-8**

Code No.	Course title	L	T	P	M	C
<b>THEORY</b>						
	TOTAL QUALITY MANAGEMENT	3	0	0	100	3
	ELECTIVE –III	3	0	0	100	3
	ELECTIVE –IV	3	0	0	100	3
	PROJECT WORK	0	0	12	100	6
	Total	9	0	12	400	15

**ELECTIVES - 8**

Code No.	Course title	L	T	P	M	C
1	ALTERNATIVE ENERGY SOURCES	3	0	0	100	3
2	CRYOGENIC ENGINEERING	3	0	0	100	3
3	NUCLEAR ENGINEERING	3	0	0	100	3
4	ENERGY CONSERVATION AND MANAGEMENT	3	0	0	100	3
5	PRODUCT DESIGN, DEVELOPMENT AND LIFE CYCLE MANAGEMENT	3	0	0	100	3
6	ENTREPRENEURSHIP DEVELOPMENT	3	0	0	100	3
7	ENTERPRISE RESOURCE PLANNING	3	0	0	100	3
8	PRODUCTION PLANNING & COST ESTIMATION	3	0	0	100	3
9	MAINTENANCE ENGINEERING	3	0	0	100	3
10	INDUSTRIAL SAFETY	3	0	0	100	3
11	PROFESIONAL ETHICS & HUMAN VALUES	3	0	0	100	3
12	RAPID PROTOTYPING, TOOLING AND REENGINEERING	3	0	0	100	3
13	SIX SIGMA AND LEAN MANUFACTURING	3	0	0	100	3
14	PROJECT MANAGEMENT	3	0	0	100	3
15	LOGISTICS AND SUPPLY CHAIN MANAGEMENT	3	0	0	100	3

**REGULATION 2008: B.E.MECHANICAL ENGINEERING SYLLABUS  
SEMESTER-8**

	<b>TOTAL QUALITY MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.						
<b>UNIT II</b>	<b>TQM PRINCIPLES</b>					<b>9</b>
Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.						
<b>UNIT III</b>	<b>TQM TOOLS &amp; TECHNIQUES I</b>					<b>9</b>
The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.						
<b>UNIT VI</b>	<b>TQM TOOLS &amp; TECHNIQUES II</b>					<b>9</b>
Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.						
<b>UNIT V</b>	<b>QUALITY SYSTEMS</b>					<b>9</b>
Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1.	Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education Asia, III Ed, Indian Reprint , 2006.					
<b>REFERENCES:</b>						
1	James R. Evans and William M. Lindsay, “The Management and Control of Quality”, (6 <sup>th</sup> Edition), South-Western (Thomson Learning), 2005.					
2	Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.					
3	Subburaj R., “Total Quality Management”, Tata McGraw-Hill Education Private Ltd, 2005					
4	Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd., 2006.					
5	Janakiraman,B and Gopal, R.K, “Total Quality Management – Text and Cases”, Prentice Hall (India) Pvt. Ltd., 2006.					

## **PROJECT WORK - Phase - II**

8. The students are expected to get formed into a team of convenient groups of not more than 4 members on a project.
9. Every project team shall have a guide who is the member of the faculty of the institution. Identification of student group and their faculty guide has to be completed within the first two weeks from the day of beginning of the semester.
10. The group has to identify and select the problem to be addressed as their project work; make through literature survey and finalize a comprehensive aim and scope of their work to be done.
11. No change of guide or team members will be permitted after one month (unless the faculty or student has left the college). Head of the department is made responsible to ensure this.
12. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, for library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project.
13. The progress of the project is to be evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department.
14. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be typewritten form as specified in the guidelines of university.
15. The project work is evaluated jointly by external and internal examiners constituted by the University based on oral presentation and the project report.

	<b>ALTERNATIVE ENERGY SOURCES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>SOLAR ENERGY</b>					<b>9</b>
Solar Radiation – Measurements of solar Radiation and sunshine – Solar Thermal Collectors – Flat Plate and Concentrating Collectors – Solar Applications – fundamentals of photo Voltaic Conversion – solar Cells – PV Systems – PV Applications.						
<b>UNIT II</b>	<b>WIND ENERGY</b>					<b>9</b>
Wind Data and Energy Estimation – wind Energy Conversion Systems – Wind Energy generators and its performance – Wind Energy Storage – Applications – Hybrid systems						
<b>UNIT III</b>	<b>BIO - ENERGY</b>					<b>9</b>
Biomass, Biogas, Source, Composition, Technology for utilization – Biomass direct combustion – Biomass gasifier – Biogas plant – Digesters – Ethanol production – Bio diesel production and economics						
<b>UNIT VI</b>	<b>OTEC, TIDAL, GEOTHERMAL AND HYDEL ENERGY</b>					<b>9</b>
Tidal energy – Wave energy – Data, Technology options – Open and closed OTEC Cycles – Small hydro, turbines – Geothermal energy sources, power plant and environmental issues.						
<b>UNIT V</b>	<b>NEW ENERGY SOURCES</b>					<b>9</b>
Hydrogen - generation, storage, transport and utilization – Applications - power generation, transport – Fuel cells – technologies, types – economics and the power generation.						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 1999.						
2. Kothari D.P. et. al., Renewable Energy Sources and Emerging Technologies, Prentice Hall of India Pvt. Ltd. 2008						
<b>REFERENCES:</b>						
1	Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.					
2	Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 1986					
3	G.N. Tiwari, solar Energy – Fundamentals Design, Modelling & applications, Narosa Publishing House, New Delhi, 2002.					
4	L.L. Freris, Wind Energy Conversion systems, Prentice Hall, UK, 1990.					
5	S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.					

	<b>CRYOGENIC ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>INTRODUCTION</b>						<b>8</b>
Insight on Cryogenics, Properties of Cryogenic fluids, Material properties at Cryogenic Temperatures. Applications of cryogenics in space, Food Processing, super Conductivity, Electrical Power, Biology, Medicine, Electronics and Cutting Tool Industry.							
<b>UNIT II</b>	<b>LIQUEFACTION CYCLES</b>						<b>10</b>
Carnot Liquefaction Cycle, F.O.M. and Yield of Liquefaction Cycles. Inversion Curve – Joule Thomson Effect. Linde Hampson Cycle, Precooled Linde Hampson Cycle, Claudes Cycle Dual Cycle, Helium Refrigerated Hydrogen Liquefaction Systems. Critical Components in Liquefaction Systems.							
<b>UNIT III</b>	<b>SEPARATION OF CRYOGENIC GASES</b>						<b>9</b>
Binary Mixtures, T-C and H-C Diagrams, Principle of Rectification, Rectification Column Analysis – McCabe Thiele Method. Adsorption Systems for purification.							
<b>UNIT VI</b>	<b>CRYOGENIC REFRIGERATORS</b>						<b>8</b>
Joule Thomson Cryocoolers, Stirling Cycle Refrigerators, G.M.Cryocoolers, Pulse Tube Refrigerators. Regenerators used in Cryogenic Refrigerators, Magnetic Refrigerators.							
<b>UNIT V</b>	<b>STORAGE, INSULATION AND INSTRUMENTATION</b>						<b>10</b>
Cryogenic Storage vessels, Transportation, and Transfer Lines., Thermal insulation and their performance at cryogenic temperatures, Super Insulations, Vacuum insulation, Powder insulation and Cryo-pumping. Instrumentation to measure Pressure, Flow, Level and Temperature							
					<b>Total</b>	<b>45</b>	
<b>TEXT BOOKS</b>							
1. Randali F. Barron, Cryogenic Systems, McGraw-Hill, 1985							
<b>REFERENCES:</b>							
1	Klaus D. Timmerhaus and Thomas M. Flynn, Cryogenic Process Engineering, Plenum Press, New York, 1989						
2	Scott R.B., Cryogenic Engineering, Van Nostrand and Co., 1962.						

	<b>NUCLEAR ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>NUCLEAR PHYSICS</b>					<b>7</b>
Nuclear model of an atom-Equivalence of mass and energy-binding- radio activity-half life- neutron interactions-cross sections.						
<b>UNIT II</b>	<b>NUCLEAR REACTIONS AND REACTION MATERIALS</b>					<b>9</b>
Mechanism of nuclear fission and fusion- radio activity- chain reactions-critical mass and composition-nuclear fuel cycles and its characteristics-uranium production and purification- Zirconium, thorium, beryllium.						
<b>UNIT III</b>	<b>REPROCESSING</b>					<b>9</b>
Reprocessing: nuclear fuel cycles-spent fuel characteristics-role of solvent extraction in reprocessing-solvent extraction equipment						
<b>UNIT VI</b>	<b>NUCLEAR REACTOR</b>					<b>11</b>
Nuclear reactors: types of fast breeding reactors-design and construction of fast breeding reactors-heat transfer techniques in nuclear reactors- reactor shielding. Fusion reactors.						
<b>UNIT V</b>	<b>SAFETY AND DISPOSAL</b>					<b>9</b>
Safety and disposal: Nuclear plant safety - safety systems-changes and consequences of accident-criteria for safety-nuclear waste-types of waste and its disposal-radiation hazards and their prevention-weapons proliferation.						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1. P. K. Nag, Power plant Engineering - steam & nuclear, Tata Mc Graw Hill						
<b>REFERENCES:</b>						
1	Collier J.G., and Hewitt G.F, "Introduction to Nuclear power", Hemisphere publishing, New York. 1987					
2	Wakil M.M.El., "Power Plant Technology" – McGraw-Hill International, 1984.					
3	Lipschutz R.D "Radioactive Waste-Politics, Technology and Risk", Ballingor, Cambridge, 1980					
	Thomas J.Cannoly, "Fundamentals of nuclear Engineering" John Wiley 1978.					

	<b>ENERGY CONSERVATION AND MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>IMPORTANCE OF ENERGY CONSERVATION AND MANAGEMENT</b>						<b>8</b>
World, national Energy consumption – environmental aspects – Energy prices, policies – Energy auditing: methodology, analysis, energy accounting – Measurements – Thermal and Electrical.							
<b>UNIT II</b>	<b>ELECTRICAL SYSTEMS</b>						<b>12</b>
AC / DC current systems, Demand control, power factor correction, load management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control – Lighting : lighting levels, efficient options, day lighting, timers, Energy efficient windows – electrical distribution systems – Transformers – Power quality – harmonic distortion.							
<b>UNIT III</b>	<b>THERMAL SYSTEMS</b>						<b>10</b>
Boiler – efficiency testing, excess air control, Steam distribution & use – steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking – concept of pinch, target settling, problem table approach							
<b>UNIT VI</b>	<b>ENERGY CONSERVATION</b>						<b>8</b>
Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems – Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.							
<b>UNIT V</b>	<b>ENERGY MANAGEMENT, ECONOMICS</b>						<b>7</b>
Energy resource management – Energy Management information systems – Computerized energy management – Energy economics – discount rate, payback period, internal rate of Return, life cycle costing – Financing energy conservation Projects.							
					<b>Total</b>		<b>45</b>
<b>TEXT BOOK:</b>							
1. L.C. Witte, P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.							
2. O. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.							
<b>REFERENCES:</b>							
1	I.G.C. Dryden, “The Efficient Use of Energy” Butterworths, London, 1982						
2	W.C. turner, “Energy Management Hand book” Wiley, New York, 1982.						
3	W.R. Murphy and G. Mc KAY “Energy Management” Butterworths, London 1987						

	<b>PRODUCT DESIGN, DEVELOPMENT AND LIFE CYCLE MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>9</b>
Product Development process – Product development organizations, Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs. Product life cycle management - concepts, benefits, value addition to customer. Life cycle models- creation of projects and roles, users and project management, system administration, access control and its use in life cycle.						
<b>UNIT II</b>	<b>PRODUCT SPECIFICATIONS</b>					<b>9</b>
Establishing the product specifications– Target specifications – Refining specifications, concept generation-Clarify the problem – Search internally – Search externally – Explore systematically.						
<b>UNIT III</b>	<b>PRODUCT ARCHITECTURE</b>					<b>9</b>
Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.						
<b>UNIT VI</b>	<b>INDUSTRIAL DESIGN</b>					<b>9</b>
Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for manufacturing- cost considerations, Impact of DFM decisions on other factors.						
<b>UNIT V</b>	<b>PRINCIPLES OF PROTOTYPING AND ECONOMIC ANALYSIS</b>					<b>9</b>
Principles of prototyping – Planning for prototypes, economics of product development projects, Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1. Karal, T.Ulrich steven D.Eppinger, Product Design and Development, McGraw Hill, International Editions, 2003						
<b>REFERENCES:</b>						
1	S.Rosenthal, Effective Product Design and Development, Irwin, 1992.					
2	Charles Gevirtz Developing New products with TQM, McGraw Hill International Editions, 1994.					

	<b>ENTREPRENEURSHIP DEVELOPMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>ENTREPRENEURSHIP</b>						<b>9</b>
Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth							
<b>UNIT II</b>	<b>MOTIVATION</b>						<b>9</b>
Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Entrepreneurial skills - Self Rating, Business Game, Thematic Appreciation Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.							
<b>UNIT III</b>	<b>BUSINESS</b>						<b>9</b>
Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.							
<b>UNIT VI</b>	<b>FINANCING AND ACCOUNTING</b>						<b>9</b>
Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT / CPM – Taxation – Income Tax, Excise Duty – Sales Tax.							
<b>UNIT V</b>	<b>SUPPORT TO ENTREPRENEURS</b>						<b>9</b>
Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting							
					<b>Total</b>		<b>45</b>
<b>TEXT BOOK:</b>							
1.S.S.Khanka “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 1999							
2.Kurahko & Hodgetts, “ Enterprenuership – Theory, process and practices”, Thomson learning 6 <sup>th</sup> edition.							
<b>REFERENCES:</b>							
1	Hisrich R D and Peters M P, “Entrepreneurship” 5 <sup>th</sup> Edition Tata McGraw-Hill, 2002.						
2	Mathew J Manimala,” Enterprenuership theory at cross roads: paradigms and praxis” Dream tech 2 <sup>nd</sup> edition 2006.						
3	Mathew J Manimala,” Enterprenuership theory at cross roads: paradigms and praxis” Dream tech 2 <sup>nd</sup> edition 2006.						
4	EDII “Faulty and External Experts – A Hand Book for New Entrepreneurs” Publishers: Entrepreneurship Development” Institute of India, Ahmedabad, 1986.						

	<b>ENTERPRISE RESOURCE PLANNING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>INTRODUCTION</b>						<b>10</b>
Principle – ERP framework – Business Blue Print – Business Engineering vs Business process Re-Engineering – Tools – Languages – Value chain – Supply and Demand chain – Extended supply chain management – Dynamic Models –Process Models							
<b>UNIT II</b>	<b>TECHNOLOGY</b>						<b>10</b>
Client/Server architecture – Technology choices – Internet direction – Evaluation framework – CRM – CRM pricing – chain safety – Evaluation framework.							
<b>UNIT III</b>	<b>ARCHITECTURE</b>						<b>10</b>
Overview – Architecture – AIM – applications I– Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organisational and social issues.							
<b>UNIT IV</b>	<b>APPLICATIONS</b>						<b>7</b>
SAP, People soft, Baan and Oracle – Comparison – Oracle SCM applications - Before and after Y2K – critical issues – Training on various modules of IBCS ERP Package - Oracle ERP and MAXIMO, including ERP on the NET							
<b>UNIT V</b>	<b>PROCUREMENT ISSUES</b>						<b>8</b>
Market Trends – Outsourcing ERP – Economics – Hidden Cost Issues – ROI – Analysis of cases from five Indian Companies							
					<b>Total</b>	<b>45</b>	
<b>TEXT BOOKS</b>							
1. Vinod Kumar Garg and Venkitakrishnan N.K. “Enterprise Resource Planning – Concepts and Practice”, Prentice Hall of India Pvt. Ltd. 2008.							
<b>REFERENCES:</b>							
1	Sadagopan.S , ERP-A Managerial Perspective, Tata Mcgraw Hill, 1999.						
2	Jose Antonio Fernandez, the SAP R/3 Handbook, Tata Mcgraw Hill, 1998						
3	ERPWARE , ERP Implementation Framework, Garg & Venkitakrishnan, Prentice Hall,1999.						
4	Thomas E Vollmann and Bery Whybark , Manufacturing and Control Systems, Galgothia Publications, 1998.						
5	Rahul V. Altekar, “Enterprise Resource Planning – Theory and Practice”, Prentice Hall of India Pvt. Ltd. 2008.						

	<b>PRODUCTION PLANNING AND COST ESTIMATION</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>PRODUCTION PLANNING AND CONTROL</b>						<b>9</b>
Demand forecasting – time series forecasting models – Delphi method of forecasting, aggregate production planning, master scheduling, bill of materials and material requirement planning; order control and flow control, routing, scheduling and priority dispatching; JIT; Kanban PULL systems							
<b>UNIT II</b>	<b>ESTIMATING AND COSTING</b>						<b>5</b>
Importance and aims of Cost estimation – Functions of estimation – Costing – Importance and aims of Costing – Difference between costing and estimation – Importance of realistic estimates – Estimation procedure.							
<b>UNIT III</b>	<b>ELEMENT OF COST</b>						<b>12</b>
Introduction – Material Cost – Determination of Material Cost Labour Cost – Determination of Direct Labour Cost – Expenses – Cost of Product (Ladder of cost) – Illustrative examples. Analysis of overhead expenses – Factory expenses – Depreciation – Causes of depreciation – Methods of depreciation – Administrative expenses – Selling and Distributing expenses – Allocation of overhead expenses.							
<b>UNIT VI</b>	<b>PRODUCT COST ESTIMATION</b>						<b>10</b>
Estimation in forging shop – Losses in forging – Forging cost – Illustrative examples. Estimation in welding shop – Gas cutting – Electric welding – illustrative examples. Estimation in foundry shop – Estimation of pattern cost and casting cost – Illustrative examples							
<b>UNIT V</b>	<b>ESTIMATION OF MACHINING TIME</b>						<b>9</b>
Estimation of machining time for Lathe operations – Estimation of machining time for drilling, boring, shaping, planning, milling and grinding operations – Illustrative examples.							
					<b>Total</b>		<b>45</b>
<b>TEXT BOOK:</b>							
1. M. Adithan and B.S. Pabla, “Estimating and Costing”, Konark Publishers Pvt. Ltd. 1989.							
2. A.K. Chitale and R.C. Gupta, “Product Design and Manufacturing”, Prentice Hall Pvt. Ltd., 1997.							
<b>REFERENCES:</b>							
1	Nanua Singh, “System approach to Computer Integrated Design and Manufacturing”, John Wiley and Sons, Inc., 1996						
2	Joseph G. Monks, “Operations Management, Theory & Problems”, McGraw Hill Book Company, 1982.						
3	S.N. Chary, “Production and Operations Management,” Tata McGraw Hill, 1994.						
4	Adam & Ebert – “Production and Operations Management,” Prentice Hall of India, 1995.						
5	Banga T.R., and Sharma S.C., “Mechanical Estimation and Costing”, Khanna Publishers, 1993.						
6	Mukhopadhyay S.K. ” Production planning and Control – Text and Cases” Prentice Hall of India Pvt. Ltd. 2007.						

	<b>MAINTENANCE ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>PRINCIPLES AND PRACTICES OF MAINTENANCE PLANNING</b>						<b>10</b>
Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and benefits of sound Maintenance systems – Reliability and machine availability – MTBF, MTTR and MWT – Factors of availability – Maintenance organization – Maintenance economics.							
<b>UNIT II</b>	<b>MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE</b>						<b>9</b>
Maintenance categories – Comparative merits of each category – Preventive maintenance, maintenance schedules, repairs cycle - Principles and methods of lubrication – TPM.							
<b>UNIT III</b>	<b>CONDITION MONITORING</b>						<b>9</b>
Condition Monitoring – Cost comparison with and without CM – On-load testing and off-load testing – Methods and instruments for CM – Temperature sensitive tapes – Pistol thermometers – wear-debris analysis							
<b>UNIT VI</b>	<b>REPAIR METHODS FOR BASIC MACHINE ELEMENTS</b>						<b>10</b>
Repair methods for beds, slideways, spindles, gears, lead screws and bearings – Failure analysis – Failures and their development – Logical fault location methods – Sequential fault location							
<b>UNIT V</b>	<b>REPAIR METHODS FOR MATERIAL HANDLING EQUIPMENT</b>						<b>8</b>
Repair methods for Material handling equipment - Equipment records – Job order systems -Use of computers in maintenance.							
					<b>Total</b>		<b>45</b>
<b>TEXT BOOK:</b>							
1.Srivastava S.K., “Industrial Maintenance Management”, - S. Chand and Co., 1981							
2.Bhattacharya S.N., “Installation, Servicing and Maintenance”, S. Chand and Co., 1995							
<b>REFERENCES:</b>							
1	White E.N., “Maintenance Planning”, I Documentation, Gower Press, 1979.						
2	Mishra R.C. and Pathak K. “Maintenance Engineering and Management” Prentice Hall of India Pvt. Ltd. 2007.						
3	Garg M.R., “Industrial Maintenance”, S. Chand & Co., 1986.						
4	Higgins L.R., “Maintenance Engineering Hand book”, McGraw Hill, 5th Edition, 1988						
5	Armstrong, “Condition Monitoring”, BSIRSA, 1988.						
6	Davies, “Handbook of Condition Monitoring”, Chapman &Hall, 1996						

	<b>INDUSTRIAL SAFETY</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>BASICS OF SAFETY ENGINEERING &amp; ACTS</b>						<b>9</b>
<p>Evolution of modern safety concept – safety audit – Concept of an accident investigation and reporting – safety performance monitoring. Acts – factories act – 1948 – Statutory authorities – inspecting staff – Tamilnadu Factories Rules 1950 under Safety and health – environment act – 1986 – Air act 1981, water act 1974 – other acts. Safety in industries – General safety concepts, machine guarding, hazards in metal removing process, welding process, cold and hot working process.</p>							
<b>UNIT II</b>	<b>OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE</b> (Basic concepts, related hazards and exposure limits)						<b>10</b>
<p>Physical Hazards – Noise, heat, recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases. Biological and Ergonomical Hazards-Basic concepts. Occupational Health-Concept and spectrum of health – functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, Preliminary Hazard Analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.</p>							
<b>UNIT III</b>	<b>FIRE ENGINEERING AND EXPLOSIVE CONTROL</b>						<b>8</b>
<p>Fire properties of solid, liquid and gases – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – Principles of explosion – Explosion Protection – Electrical Safety. Electrical Hazards – Primary and Secondary hazards – concept of earthing – protection systems – fuses, circuit breakers and over load relays – first aid.</p>							
<b>UNIT VI</b>	<b>ERGONOMICS</b>						<b>9</b>
<p>Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, a brief history of ergonomics, attempts to humanize work, modern ergonomics, future directions for ergonomics. Anatomy, Posture and Body Mechanics: Some basic body mechanics, anatomy of the spine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, behavioural aspects of posture, effectiveness and cost effectiveness. Anthropometry and its uses in ergonomics, principles of applied anthropometry in ergonomics. Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Man vs Machine – concepts of bio mechanics.</p>							
<b>UNIT V</b>	<b>SAFETY EDUCATION AND TRAINING</b>						<b>9</b>
<p>Importance of training – identification of training needs – training methods – programmes, seminars, conferences, competitions – method of promoting safe practice – motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training.</p>							
<b>Total</b>						<b>45</b>	

<b>TEXT BOOK:</b>	
1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.	
2. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.	
<b>REFERENCES:</b>	
1	The factories Act 1948, Madras Book Agency, Chennai, 2000
2	Water (Prevention and control of pollution) act 1974, Commercial Law publishers (India) Pvt. Ltd., New Delhi.
3	Air (Prevention and control of pollution) act 1981, Commercial Law Publishers (India) Pvt. Ltd., New Delhi
4	Guidelines for Hazard Evaluation Procedures, Centre for Chemical Process Safety, AIChE 1992
5	Introduction to Ergonomics, R.S. Bridger, Taylor & Francis
6	Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
7	Fordham Cooper, W., "Electrical Safety Engineering", Butter Worths and Company, London, 1986

	<b>PROFESSIONAL ETHICS AND HUMAN VALUES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>HUMAN VALUES</b>					<b>10</b>
Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality						
<b>UNIT II</b>	<b>ENGINEERING ETHICS</b>					<b>9</b>
Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action - Self-interest - customs and religion - uses of ethical theories						
<b>UNIT III</b>	<b>ENGINEERING AS SOCIAL EXPERIMENTATION</b>					<b>9</b>
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.						
<b>UNIT VI</b>	<b>SAFETY, RESPONSIBILITIES AND RIGHTS</b>					<b>9</b>
Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - the three mile island and chernobyl case studies. Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination						
<b>UNIT V</b>	<b>GLOBAL ISSUES</b>					<b>8</b>
Multinational corporations - Environmental ethics - computer ethics - weapons development - engineers as managers-consulting engineers-engineers as expert witnesses and advisors - moral leadership-sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of electronics and telecommunication engineers (IETE), India, etc.						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw-Hill, New York 1996.						
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2009.						
<b>REFERENCES:</b>						
1	Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New Jersey, 2004 (Indian Reprint now available)					
2	Charles E Harris, Michael S. Protchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Wadsworth Thompson Leatning, United States, 2000 (Indian Reprint now available)					
3	John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.					
4	Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.					

	<b>RAPID PROTOTYPING, TOOLING AND RE-ENGINEERING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>INTRODUCTION</b>					<b>7</b>
Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Applications – Digital prototyping - Virtual prototyping						
<b>UNIT II</b>	<b>LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS</b>					<b>10</b>
Stereolithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.						
<b>UNIT III</b>	<b>POWDER BASED RAPID PROTOTYPING SYSTEMS</b>					<b>10</b>
Selective Laser Sintering, Direct Metal Laser Sintering, Three Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.						
<b>UNIT VI</b>	<b>REVERSE ENGINEERING AND CAD MODELING</b>					<b>10</b>
Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation						
<b>UNIT V</b>	<b>RAPID TOOLING</b>					<b>8</b>
Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries						
					<b>Total</b>	<b>45</b>
<b>TEXT BOOK:</b>						
1.Rapid prototyping: Principles and applications, second edition, Chua C.K., Leong K.F., and Lim C.S., World Scientific Publishers, 2003						
2. Rapid Tooling: Technologies and Industrial Applications, Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs, CRC press, 2000.						
<b>REFERENCES:</b>						
1	Rapid prototyping, Andreas Gebhardt, Hanser Gardener Publications, 2003					
2	Rapid Prototyping and Engineering applications: A tool box for prototype development, Liou W.Liou, Frank W.Liou, CRC Press, 2007.					
3	Rapid Prototyping: Theory and practice, Ali K. Kamrani, Emad Abouel Nasr, Springer, 2006					

	<b>SIX SIGMA AND LEAN MANUFACTURING</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>LEAN MANUFACTURING AND SIX SIGMA – OVERVIEW</b>						<b>2</b>
Evolution of Lean; Traditional versus Lean Manufacturing; Business of Survival and Growth; Business Model Transformation; Ford Production System; Job Shop Concepts Concept of Lean; Toyota's foray in Lean;							
<b>UNIT II</b>	<b>DESIGN - VALUE STREAM MANAGEMENT</b>						<b>12</b>
Definition; VSM Types;Product Family Selection; Value Stream Manager;Current State Map; Process Box; Value Stream Icons; 3 Ms - Muda, Mura, Muri - 7 Types of Muda; Future State Map;Value Stream Plan; Process Stability - Loss Reduction 7 Major Losses Reduction. Demand Stage :Market Dynamics; Customer Demand;PQ Analysis; PR Analysis; TAKT Time; Pitch; Finished Goods Stock; Cycle Stock; Buffer Stock; Safety Stock.							
<b>UNIT III</b>	<b>SYSTEM IMPLEMENTATION</b>						<b>12</b>
Flow Stage : Continuous Flow; Cell Layout; Line Balancing; Macro and Micro Motion Analysis; Standardised Work; Concept of Kaizen; Steps involved in Kaizen Deployment; Industrial Engineering - Concepts and Fundamentals; Kanban Concepts ; Types of Kanbans ; and Practical Application ; Concept of Pull; Changeover Time Reduction - External & Internal Single Minute Exchange of Die; Quick Die Change; Quality-Vendor,In Process and Customer Line ; Concept of PPM; Pokayoke; Prevention & Detection Types; Maintenance - Preventive, Time Based and Condition Based; Human Development for Lean (Training and Involvement through Autonomous Maintenance ) Leveling Stage of Lean Implementation : Production Leveling ; Leveling Box; Concept of Water Spider							
<b>UNIT VI</b>	<b>LEAN METRICS AND LEAN SUSTENANCE</b>						<b>7</b>
Identify Lean Metrics; Steps involved in Goal Setting; Corporate Goals; Kaizen Cloud identification in VSM ; Lean Assessment. Cultural Change; Reviews; Recognition; Improving Targets and Benchmarks;							
<b>UNIT V</b>	<b>SIX SIGMA AND DMAIC TOOLS</b>						<b>12</b>
Project charter, stakeholder analysis, SIPOC, Voice of the customer, Rolled throughput yield, KANO Models, CTQ Tree, Process Mapping Data collection, measurement system analysis, sampling plans, process capability, cost of poor quality (COPQ), FMEA Regression Analysis, cause & effect diagram, Hypothesis testing, Design of experiments, Response Surface methodology, Poka-yoke, Quality Control, Control charts.							
					<b>Total</b>	<b>45</b>	
<b>REFERENCES:</b>							
1	Keki R. Bhote, "The ultimate six sigma" , Prentice hall India						
2	Rath & Strong's Six sigma pocket guide.						
3	Don Tapping, Tom Luyster and Tom Shuker,"Value Stream Management" Productivity Press, 2002.						
4	Tom Luyster and Don Tapping, "Creating Your Lean Future State: How to Move from Seeing to Doing", Productivity Press, 2006.						
5	Mike Rother and Rick Harris, "Creating Continuous Flow", Publisher: Lean Enterprise Institute, Inc., 2001.						
6	Rick Harris, Chris Harris & Earl Wilson, "Making Materials Flow", Publisher: Lean Enterprise Institute, Inc., 2003.						

	<b>PROJECT MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>
<b>UNIT I</b>	<b>STRATEGIC MANAGEMENT AND PROJECT SELECTION</b>	<b>9</b>				
Project selection models, Project portfolio process, Analysis under uncertainty, Project organization, Matrix organization						
<b>UNIT II</b>	<b>PROJECT PLANNING</b>	<b>9</b>				
Work breakdown structure, Systems integration, Interface coordination, Project life cycle, Conflict and negotiation						
<b>UNIT III</b>	<b>PROJECT IMPLEMENTATION</b>	<b>9</b>				
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						
<b>UNIT IV</b>	<b>MONITORING AND INFORMATION SYSTEMS</b>	<b>9</b>				
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						
<b>UNIT V</b>	<b>PROJECT AUDITING</b>	<b>9</b>				
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						
					<b>TOTAL</b>	<b>45</b>
<b>TEXT BOOKS</b>						
1. Panneerselvam R. and Senthilkumar P., "Project Management" PHI Learning Private Limited, 2009.						
<b>REFERENCES:</b>						
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.					
3	Larry Richman, "Project Management: Step-by-Step" PHI Learning Private Limited, 2008.					

	<b>LOGISTICS AND SUPPLY CHAIN MANAGEMENT</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>100</b>	<b>3</b>	
<b>UNIT I</b>	<b>LOGISTICS AND CUSTOMER SERVICE DIMENSION</b>						<b>9</b>
Mission of logistics management, logistics environment, Customer service and retention, Setting customer service priorities and service standards. Measuring logistics – logistics costing – customer profitability analysis							
<b>UNIT II</b>	<b>STRATEGIC FRAMEWORK AND SUPPLY CHAIN NETWORKS</b>						<b>9</b>
Objective, decision phases, process views, examples, strategic fit, supply chain drivers and metrics. Distribution networks, Facility networks and design options, Factors influencing, Models for facility location and capacity allocation, Transportation networks and design options, Evaluating network design decisions							
<b>UNIT III</b>	<b>MANAGING DEMAND AND SUPPLY IN A SUPPLY CHAIN</b>						<b>9</b>
Predictable variability in a supply chain, Economies of scale and uncertainty in a supply chain – Cycle and safety Inventory, Optimum level of product availability, Forward Buying, Multi-echelon cycle inventory							
<b>UNIT IV</b>	<b>SOURCING AND PRICING IN A SUPPLY CHAIN</b>						<b>9</b>
Cross-Functional drivers, Role of sourcing in a supply chain, Logistics providers, Procurement process, Supplier selection, Design collaboration, Role of Pricing and Revenue Management in a supply chain							
<b>UNIT V</b>	<b>INFORMATION TECHNOLOGY AND COORDINATION IN A SUPPLY CHAIN</b>						<b>9</b>
The role of IT in supply chain, The supply chain IT frame work, Customer Relationship Management, Supplier relationship management, Future of IT in supply chain, E-Business in supply chain, Bullwhip effect – Effect of lack of co-ordination in supply chain, Building strategic partnerships, CPFR							
					<b>TOTAL</b>		<b>45</b>
<b>TEXT BOOKS</b>							
1. Sunil Chopra and Peter meindl, “Supply Chain Management , Strategy, Planning, and operation”, PHI, Third edition,2007.							
2. Martin Christopher, “Logistics and supply chain management”, Pearson Education, 2001							
<b>REFERENCES:</b>							
1	Jeremy F.Shapiro, “Modeling the supply chain”, Thomson Duxbury, 2002						
2	James B.Ayers, “Handbook of Supply chain management”, St.Lucle press, 2000.						
3	Agrawal, D K, “Logistics and supply chain management” Macmillan India, 2003						