SGGS INSTITUTE OF ENGINEERING & TECHNOLOGY, NANDED

(An Autonomous Institute of Government of Maharashtra)

Final Year B.Tech. (Production Engineering) Curriculum Structure

w.e.f. Academic Year 2017-18

Semester VII						
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits	
					Th.	Pr.
PR401	Production & Operations Management	03	--	02	03	01
PR402	Productivity Improvement Techniques	03	--	02	03	01
PR403	Tools for Six Sigma Quality	03	--	02	03	01
PR404	CAD/CAM and Robotics	03	--	02	03	01
PR 405	Operations Research	03	--	02	03	01
PR406-PR 411	Elective - IV	03	--	02	03	01
	Total	18	--	12	24	
Semester VIII						
Course Code	Course Title	Lectures (L)	Tutorials (T)	Practical (P)	Credits	
					Th.	Pr.
PR 421	Project	-	-	06 Hrs. per batch for 09 students	-	14
PR 422	In-Plant Training (Evaluation)	-	-	-	-	02
Total			-		16	

Elective -IV (Students can register for any one from the list provided)

PR406: Costing & Estimation

PR407: Industrial management and organization

PR408: Project management

PR409: Elements of PLM

PR410: Low cost automation

PR411: Elective offered by Industry

Institute Open Elective

PRODUCTION / OPERATIONS MANAGEMENT
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 401 **Contact Hours: Th 03 T- 00 Pr. 02**

Objectives of the course:

a. To gain an understanding and in-depth knowledge of the various operations management philosophies and practices prevalent in industry.
b. To reinforce analytical skills already learned, and build on these skills to further increase ones "portfolio" of useful analytical tools.
c. To gain ability to recognize situations in a production system environment those suggest the use of certain quantitative methods to assist in decision making.
d. To learn how to think about, approach, analyse, and solve production system problems using both technology and people skills.
e. To increase knowledge and broaden perspective of the "industrial world" in which one will contribute his / her talent and leadership as an Industrial Engineer.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/ Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

Operations Strategy: Competitive priorities, Strategic decisions in operations, Strategy deployment

Push Production Systems:

i. **Resource Planning**: Overview of Material Requirement Planning (MRP), Master production schedule (MPS), Inputs to MRP, The MRP process, Lot sizing in MRP systems, MRP outputs,
ii. **Capacity Planning**: Defining and measuring capacity. Determinants of effective capacity, Capacity planning decisions, Tools for capacity planning
iii. **Shop-Floor Control**:Framework for Shop-floor Control, Basic Shop-Floor Control Concepts, Shop Floor Control Techniques, Finite Loading Using the Shop Floor Control System, Performance Measurement and Lead Time Management.

Pull Production System: Justin Time**,** KANBANs, Small lots, transfer batch, Quick setups, SMED, TPS, Production Smoothening, Quality at the source, JIDOKA, ANDONs, Supplier networks. Kaizan, Poka Yoke, Zero defects, Benefits and drawbacks of JIT

Theory of Constraints: Introduction, Goal and Performance measures, Capacity, Synchronous manufacturing, Marketing and Production.

Maynard's Operations Sequencing Technique (MOST)

Purchasing – Introduction, Bayesian Analysis, price terms, Fluctuating Prices and Purchasing, volume timing of purchases, hedging and forward buying, learning curve and price negotiations, Vendor Rating.

Supply Chain Management: The management of supply chains, Distribution, Integration, supply chain and competitive advantage, marketing and logistics interface, principles of logistics costing, lead time management, Information Technology – A supply chain enablers, Suppliers, outsourcing, Measuring supply chain performances. Warehousing, VMI, Role of Internet in Supply chain.

Term Work:

Assignments based on the each topic in above syllabus.

Text Books and References:

1. Narasimhan, Mcleavey, Billingten, Production Planning & Inventory Control, Prentice Hall of India, Edition 1997.
2. Chary S.N., Theory and Problems in Production and Operation Management, Tata McGraw Hill, Edition 1995.
3. Roberta S. Russell, Bernard W. Taylor III, Operations Management, Wiley India, Edition 2007.
4. Lee J. Krajewski, Larry P. Ritzman, Manoj K. Malhotra, Operations Management 9/E, Prentice Hall, Edition 2009.
5. Everett E.Adam,Jr. Ronald J. Ebert, Production and operation management, Prentice Hall of India, Edition 2008.
6. Joseph S. Martinich, Production and operation management, Wiley India, Edition 2008.
7. William J. V Stevenson, Operations Management, Tata McGraw Hill, Edition 2009.

Course Outcomes:

After completion of this course a student should be able to:

1. Recognize operation strategy concept.
2. Develop the material requirement planning for end product.

3. Analysis the different capacity planning technical tools.
4. Explain the shop floor control techniques.
5. Acquire knowledge of how good supply chain management can be a competitive advantage.
6. Summarize various drivers of the supply chain that may be used to improve the supply chain performance

PRODUCTIVITY IMPROVEMENT TECHNIQUES
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 402 **Contact Hours: Th. 03 T- 00 Pr. 02**

Objective of the course: The main objective of this subject is to make student aware of various basic techniques related to improvement of productivity of an industry. Use and application of method study and work measurement both techniques of work-study will be focus of this course.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/ Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course contents:

Introduction to Work Study: Definition: Purpose of study, objectives, brief history and evolution, work study and productivity, human factor in application of work study, scope, applications, relationship, between Productivity & standard of living, basic work content, excess work content Management, techniques to reduce excess work content due to product process and ineffective time in control of workers and Management.

Ergonomics: Introduction, Principles, Work system design, Man-machine system, Human behaviour and equipment design, Tools, Techniques and applications, Effect of environment on performance of worker, working conditions, prevention accidents and hazards, lighting, ventilation etc.

Method Study: Definition, Concept, Objectives and Procedure of method study, Flow and handling of materials; Process chart symbols, recording techniques like Flow process charts, Operation, Flow and Two handed Process charts, Flow diagram, String diagram, Multiple Activity chart, travel chart, Operation Analysis, Analysis of motion, analysis and critical

examination of existing methods and development of improved methods, Motion economy, Design of work place layout, Therbligs, SIMO chart.

Work Measurement: Definition, significance of work measurement; origin, development and procedure of work measurement, introduction to various work measurement techniques.

Time Study and Other Works Measurement Techniques: Time study: definition, equipment for basic time study, time study forms and other equipment. Steps in use of techniques of time study; selecting the job, breaking the job into elements, approach to the worker, the elements, timing each element, Maynard Operation Sequencing Technique (MOST),Average and qualified worker, rating procedures, criteria affecting the choice of rating procedures, continuous timing, fly back timing, accumulative timing; standard ratings, comparison of observed and standard ratings, factors affecting the rate of working, scales of rating, rating factors, recording the rating, summarizing the study, allowances, calculation and application of allowances. Work sampling and production studies; General study of standard data & PTS**.** Introduction to standard data and synthetic time standards, special timing devices and equipment, introduction of work study in an organization, introductory idea about incentives, problems in India in increasing productivity through work study and wage incentives.

Use of the time Standards: Define work covered by allowance time, work specification, work unit, programme planning & utilization of plant &labour, estimation, standard costing, budgetary control & incentive schemes.

Term Work:

Minimum Eight assignments based on the above syllabus.

Reference Books:

1. Introduction to work study – ILO, George Kanawaty, International Labour Office, 4th edition
2. Motion & Time study Design & Measurement of Work - Ralph Barnes (Wiley
3. Eastern).
4. Work Study - R.M. Currie &Faraday. (ELBS Pitman).
5. Hand Book of Industrial Engineering – Irson & Grant.
6. Productivity management - Concepts & Techniques- S.C.Sawhney.

Course Outcomes

After completion of this course a student should be able to:

1. Apply basic concept s of productivity and quality of life.

2. Recognize the impact of human factor at workplace for productivity improvement.
3. Calculate productivity of any industry.
4. Apply ergonomics in designing of different products for human comfort at work place.
5. Understand how to implement method study technique in industries.
6. Evaluate the percentage utilization of man power and machines in industries
7. Evaluate time standards for different processes.

TOOLS FOR SIX SIGMA QUALITY
(CREDITS FORTHEORY-03, PRACTICAL-01)

Course Code: PR 403 **Contact Hours: Th. -03, Pr. -02**

Course Objective

a. To understand fundamentals of Six Sigma.
b. To study DMAIC methodology for Six Sigma.
c. To study graphical tools, quality related costs for project evaluation.
d. To study Process Mapping, HT, ANOVA, for Six Sigma quality.
e. To study DOE, Robust Design, RSM for optimization.
f. To study the tools employed for DFSS.

Evaluation Scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term Work	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

Overview: Introduction, History, Definitions, Levels of Six Sigma, Characteristics and Objectives of Six Sigma, Road map for six sigma using DMAIC methodology.

Tools for Define Phase:

Introduction, check list for define stage.

Six Sigma project: Project organization, Selection and definition. Project prioritization matrix and project charter, Criteria for selecting a project,

Assessment of Quality Cost: Objectives, Cost of poor quality, Quality cost classification, Analysis of quality cost, hidden quality costs, Economic models of quality cost, guidelines to establish and cut down quality cost.

Tools for Measure Phase:

Introduction, check list for measure stage.

Graphical Tools: Check sheets, concentration diagrams, histograms, pareto charts, ishikawa diagram, scatter plots, Box Plot, individual value plots, steam and leaf plots, marginal plots, pie charts, run charts, multi-vari chart etc.

Statistics for six sigma; DPO and DPMO, Sigma level, Throughput Yield, Rolled Throughput Yield, Normalised Yield

Current Process Mapping: Flow process charts, value stream mapping, Relational process map (RPM), SIPOC diagram, cause and effects matrix.

Validating the measurement study, Process Capability and evaluation of sigma level.

Tools for Analyze Phase:

Introduction, Checkpoints for completion of analyze phase.

FMEA, Hypothesis Testing, Confidence Intervals, ANOVA, Correlation and Regression.

Tools for Improve Phase:

Introduction, Checkpoints for completion of improve phase.

Design of Experiments (DOE)**:** Screen Potential Causes, Significance of DOE. Terminology: Factors and Output, Main Effects, Interactions, Factors levels, Degrees of Freedom etc. Introduction to Factorial Design- Full and Fractional Factorial, Main Effects Plot, Interactions Plot, Pareto with Confidence Intervals, significance of Standardized effect.

Robust design: Loss function, Taguchi's recommended design techniques, O. A., Linear graphs, S/N ratios, parameter design, inner and outer arrays design.

Response Surface Designs.

Control Phase:
Introduction, Checkpoints for completion of control phase.
Operating characteristic of control charts, stability and capability of process, guidelines for selection of control charts.

Design for Six Sigma (DFSS):
The need for DFSS, the road map, VOC, K. J. diagrams, Kano Model, Capability Growth Index (CGI), statistical tolerancing, Quality Function Development**:** Concept, definition, QFD process, Deployment matrix at product, part, and process level, QFD matrix concept, House of quality.

Term Work:

The Term Work shall consist of;

1. Minimum of six assignments based on above topics in Course Contents.

2. Subject seminar:

Based on case studies, methodologies and advances in the area of Six Sigma implementation reported in literature.

References Books:

1. Six Sigma for business excellence - Urdhwarshe H., Pearson Education Inc. south Asia.

2. An introduction to Six Sigma and Process Improvement - J R Evans and W M Lindsay., Thomson South-western.

2. Fundamentals of Quality Control and Improvement – Amitava Mitra, Pearson Education Inc.

3. Taguchi Techniques for quality engineering - Philip J. Ross - McGraw Hill Ltd.

4. QFD linking a company with its customers- Ronald G. Day. - McGraw Hill Ltd.

Course Outcomes:

After completion of this course a student should be able to;

1. Interpret History, Concepts, Definitions, Levels of Six Sigma, Characteristics and objectives of Six Sigma.
2. Interpret Road map for six sigma, DMAIC methodology.
3. Interpret and use graphical tools, process mapping, FMEA, Ishikawa diagram.
4. Solve numerical based on the cost of poor quality, Identify prioritize and select six sigma projects.
5. Solve numerical based on CI, ANOVA, HT, Correlation and Regression.
6. Solve numerical for parameter optimization using concepts of DOE, Robust design, Response plots, O.A., S/N ratios.
7. Solve a case example for designing a product using concept of QFD, and House of Quality.

CAD/CAM & ROBOTICS

(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 404 **Contact Hours: Th. 03 T- 00 Pr. 02**

Objectives of the course:

a. To learn basics of CAD and CAD Software

b. To learn introduction to CAM and NC, Part Programming, Computer Assisted Part Programming

c. To be familiar with the concepts like Group technology (GT), Flexible manufacturing systems (FMS), CAPP etc.

d. To aware about the robotics, nomenclature and its applications.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/ Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

1. **Introduction**

   CAD, CAE and CAM, History, Scope, Need and Necessity, Applications, Hardware & software facilities in CAD.

2. **Mathematical aspects**

   Vector algebra in CAD modelling, 2D transformation-scaling, translation, rotation etc.

3. **Computational geometry-**

Different types of curves & surfaces and their representation schemes, Geometric modelling- Classification, wire frame, surface and solid modelling, advantages and disadvantages, CSG, B-Rep and FBM, drafting and assembly in various CAD software-part and assembly design in software like UGNX/CATIA ,Solid Edge etc. Database Exchange in CAD/CAM Software.

4. **Introduction to CAM**

   CAM applications and phases, benefits of CAD/CAM, NC machines, elements of NC manufacturing system, types of NC systems, reference points, NC motion control modes, steps in NC manufacturing (NC procedure), applications of NC, CNC technology, CNC controllers, features and advantages of CNC, direct numerical control (DNC), types of DNC

5. **Computer assisted part programming**

   Punched tape, tape readers, types of tape coding formats, EIA and ISO codes, NC words, NC part programming in word address format for milling, turning, etc., tool length and cutter diameter compensation, use of subroutines, do loop, macros, diameter verses radius programming, canned cycles, NC part programming using CAD/CAM, Automatically programmed tools (APT), structure of APT and statements, repetitive programming using APT

6. **Automation**

   Concepts in manufacturing systems, automation, types of automation, advantages and limitations of automation, strategies in automation, group technology (GT), merits and demerits of GT, concept of machine cell, flexible manufacturing systems (FMS), elements of FMS, work piece handling, automated guided vehicles (AGV), applications of FMS, merits and demerits of FMS, Computer integrated manufacturing (CIM), machining centers

7. **Robotics**

   Industrial robot, robot anatomy, degrees of freedom, robot drives, robot controller unit (RCU), manipulator and end effectors, industrial robot applications, robot cell layout, types of robot, robot axis and configurations, robot sensors, parameters in robot selection, engineering analysis of Industrial robots

Term work:

1. Assignments based on above syllabus
2. Assembly and drafting in CAD software
3. Demonstration on CNC machines

4. 01 job using part programming on CNC machine

Practical examination:

It shall consist of oral based on above syllabus/term work.

References:

1. "Automation, Production Systems and Computer Integrated Manufacturing", Mikel P. Groover, Pearson Education Pte. Ltd, Delhi
2. "CAD/CAM and Automation", FarazdakHaideri, Nirali Prakashan, Pune
3. "CAD/CAM", PHI -M.P. Groover and Zimmer,
4. McMahon, Chris and Jimmie Brown (2000): CAD CAM Principles, Practice and Manufacturing Management, Addison-Wesley Longman Ltd/Pearson Education Asia Ltd.

Course Outcomes:

After completion of this course a student should be able to:

1. Classify CAD hardware and software for variety of applications.
2. Compare different alternative facilities in CAD software.
3. Recognize the NC part programming and its application.
4. Interpret the different concepts in manufacturing system and its application for industrial automation.
5. Describe the robot and its different industrial applications

OPERATIONS RESEARCH
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 405 Contact Hours: Th. 03 T- 00 Pr. 02

Objectives of course:

a. The main objectives of the subject are as follows:
b. Toformulate various real life problems including use of analytic tools to evaluate the same.
c. Tosimulate solution methodology using computer tools.
d. Apply various models to the real life case studies and develop decision making skills for the same.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks

	External Viva-voce	50 Marks

Emphasize should be on significance and applications of methodologies, rather than steps involved in methodologies.

Course Contents:

1. **Introduction:** Development of OR techniques, definition, characteristics, phases in OR, limitations and applications of OR techniques.
2. **Linear Programming:** Analysis and model formulation various real life problems, Canonical and standard form of LPP, Assumptions in LP, Graphical, Simplex, Dual Simplex, Big M method,Special cases of LP solutions, Concept of Duality, Duality properties, Sensitivity analysis, Advantages and Limitations of LP models.
3. **Transportation and Assignment Models:** Assumptions in transportation model, Transportation,Transshipment, Assignment, Travelling salesman problems and their solution techniques.
4. **Integer Linear Programming:** Model formulation, Gomory's cutting plane method, Branch and Bound method, Zero-One Programming.
5. **Games theory:**Model formulation, Two person zero sum games, Max-min principle, Saddle point, Games without saddle points, Dominance property, Oddments method, Graphical method of solution, Games as LP problems.
6. **Dynamic Programming:** Model formulation, Bellman's optimality principle, Backward and forward recursions, various DP problems.
7. **Introduction to Nonlinear Programming:** Introduction,Lagrange Multipliers method, Convex Nonlinear Programming Problem, Kuhn Tucker Theory, One dimensional search – Interval halving search, Fibonacci search, Golden section search, Steepest descent method.
8. **Introduction to Queuing Theory:** Introduction and applications of queuing models, Basic structure and characteristics of queuing models, single channel queuing theory, birth-death process, finite queue variation, finite calling population variation further above model.
9. **Monte-Carlo Simulation Modeling**
10. **Sequencing Models**

Term Work: Numericals based on the above syllabus. At least 2 assignments using Microsoft Solver for LPP.

Practical examination: Oral based on the above syllabus and term work.

Course outcomes:

After completion of this course a student should be able to:

1. Conceptualize and formulate various real life problems.
2. Learn various analytical techniques to evaluate the problems.
3. Use software tool for solving LPP.
4. Generate optimal solutions for various queuing, transportation, assignment and dynamic programming problems.

COSTING AND ESTIMATION
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 406 Contact Hours: Th. 03 T- 00 Pr. 02

Objectives of course:

The main objectives of the subject are as follows:

a. Ascertainment of cost and determinationof selling price.
b. Cost control, cost reduction and ascertaining the profit of each activity
c. To provide basic knowledge of Economics and Financial Management
d. Assisting management in decision-making. Cost estimators play an important role in an organization, as they produce the majority of predictions of probable final product and process cost.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

1. Cost concepts and terminology, Costing, Types of costing: Job costing, Processcosting, Marginal and Operating costing, Cost estimation fundamentals
2. Equivalence and cost control: Time value of money- compound interest, uniform annualamount, Cost comparisons- with equal and unequal durations
3. Depreciation, Depreciation fund and its calculation and CVP analysis.
4. Cost estimation for various manufacturing process: machining, sheet metal working,forging, welding and foundry
5. Cost allocation and Activity-Based costing
6. Cost accounting, cost control and cost reduction

7. Standard costing and variance analysis
8. Elements of Economics
9. Financial Management
10. Tools for planning and control: Budgets

Term Work: Assignments (including spreadsheet based exercises) based on the above syllabus.

Text Books:

1. Cost Accounting – A managerial emphasis, Horngren, Datar and Foster; 11th ed., Pearson Education.
2. Cost and Optimization Engineering, F.C. Jelen and J.H. Black, McGraw Hill Int.
3. Mechanical Estimation and Costing, D.Kannapanet.al, TTTI, Madras.

Reference Books:

1. Mechanical Estimation and Costing, Banga Sharma
2. Mechanical Estimation and Costing, B.P. Sinha
3. J Pandey I M., Financial Management, Vikas Publication,10th Edition 2013
4. Henry M. Stenier, "Engineering economics Principles", McGraw Hill Publication

Course outcomes:

After completion of this course a student should be able to:

1. Compute different costs considering several overheads like factory, office, selling anddistribution.
2. Analyse and evaluate the basic concept of cost, estimation and depreciation fundcalculation.
3. Compute costs for various manufacturing processes like forging, welding, foundry etc.
4. Interpret the process of job costing, activity based costing, cost accounting and budgetarycontrol.
5. Exercise during decision making, the concepts of CVP analysis, cost control techniques including time value of money.
6. Implement the basics of engineering economics and financial management for profit making by the organisation.

PROJECT MANAGEMENT
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 407 Contact Hours: Th. 03 T- 00 Pr. 02

Course objectives:

a. Understand the basic concepts of project management.

b. Appraise the project using appropriate appraisal techniques.
c. Design and implement project by considering risk and its evaluation.
d. Learn the process project planning and execution.
e. To learn use of basic software tools in project management.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

Introduction to PM: What is a project? Evolution of project management, the need of projectmanagement, Where is project management appropriate? Characteristics of projects,Characteristics of project management, Projects in contemporary organizations, Project lifecycle.

Project Selection and Appraisal: Brainstorming and concept evolution, Project selection andevaluation, Selection criteria and models, Types of appraisals, SWOT analysis, Cash flowanalysis, Payback period, and Net present value.

Project Organization and Planning: Project manager, Cross-functional team,Dedicated projectorganization, Influence project organization, Matrix organization, Advantages and disadvantagesof project organizations, Selection of project organization, Work Breakdown Structure (WBS),Integration of project organization and WBS, WBS and responsibility matrix.

Project Scheduling and Resource Management: Gantt chart, Milestone chart,Networktechniques: PERT and CPM, AON and AOA representation, Three time estimates, Usingprobability distributions for time computation, Probability of project completion, Time scaleversion of network, Early start and late start schedules, Resource allocation, Resource loadingand levelling, Constrained resource scheduling, Multi-project scheduling and resource allocation,Crashing a project.

Project Risk Analysis: Identification of sources of risk, measuring risk, decision making considering risks, types of risks

Computerized PM: Computerized PMIS, Choosing software for project management, usingsoftware for project management.

Case Studies on Project Management: Modern cases in project management.

Term work:

1. Assignments and numericals based on above syllabus.
2. At least one case study on application of SWOT analysis
3. At least 2 assignments each of project scheduling and resource allocation using software tools.

Reference Books

1. **John M. Nicholas,** Project Management for Business and technology: Principles andPractice, Pearson Prentice Hall, New Delhi, 2005.
2. **Harold Kerzner,** Project Management-Case Studies, John Wiley & Sons, New Jersey, 2006.
3. **Arun Kanda and S. G. Deshmukh,** Project and Production Management, A course byNational Programme on Technology Enhanced Learning (NPTEL), IIT Delhi, 2005.
4. **Prasanna Chandra,** Projects: Preparation, Appraisal, Budgeting and Implementation, TataMcGraw Hill Publishing Company Ltd., New Delhi, 1980.

Course Outcomes:

After completion of this course a student should be able to

1. Screen the feasibility of a project by applying financial andenvironmental criteria.
2. Learn various stages of lifecycle and its implementation.
3. Develop skills in meeting deadlines and how milestones and a scheduleare used in order to keep a project on track.
4. Learn about components of the critical path and they can utilize PERTanalysis to plan, manage and evaluate a large project.
5. Learn effective resource allocation and resource utilization using ProModel.
6. Track project and control deadlines while creating Gantt and PERTchart in Microsoft Project.

ELEMENTS OF PLM
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 408 Contact Hours: Th. 03 T- 00 Pr. 02

Objectives:

a. Establishing industry partnerships that guide, support, and validate PLM research andeducation activities.
b. Assisting with the integration of PLM into College curricula
c. Facilitating the pursuit of PLM career opportunities
d. Serving as a knowledge base for the PLM discipline.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

1. Introduction: Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Product lifecycle management systems, Components / Elements of PLM, Emergence of PLM.
2. Product organizational structure, Integration of the PLM system with other applications, The PLM Strategy,
3. Product Data, Product and Product Data, Product Data Examples, Product Data Issues, Metadata, Product Data Models.
4. Deployment: Problems in deployment. Stages of deployment. PLM software and tools.Product Data security.
5. Understanding the product lifecycle: basic behavior of products and lifecycles, phases of the product lifecycle, other aspects of product lifecycle, Product lifecycle – data (information) management view.
6. Product structure, workflow, Terminologies in workflow, The Link between Product Data and Product Workflow, PLM applications, PDM applications.

Text / Reference Books:

1. Grieves, Michael, Product Lifecycle Management, McGraw-Hill, 2006. ISBN 0071452303

2. AnttiSaaksvuori, AnselmiImmonen, “Product Life Cycle Management” - Springer, 1st Edition (Nov.5, 2003)

3. Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realization, Springer Verlag, 2004. ISBN 1852338105

4. Relevant recent technical articles, research papers, key note addresses, etc.

Course Outcomes:

After completion of this course a student should be able to

1. Evaluate the difference between the terms PDM and PLM.
2. Demonstrate the basic components and functionality of a PLM system.
3. Analyse PLM tools and techniques for application in a range of practical situations.

4. Integrate and evaluate information from a variety of sources to plan and complete a project.

LOW COST AUTOMATION
(CREDITS THEORY-03, PRACTICAL-01)

Course Code: PR 409 Contact Hours: Th. 03 T- 00 Pr. 02

Objectives of course:

The main objectives of this course are:

a. Familiarize the students with the basics low cost automation
b. Basic to implement low cost automation systems.
c. Low cost automation using pneumatics and hydraulic devices.
d. Automation in assembly lines.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

Introduction to automation

Automated manufacturing systems, fixed /programmable /flexible automation, Need of automation, Basic elements of automated systems- power, program and control. Levels of automation; control systems: Continuous and discrete control; Low cost automation, Economic and social aspects of automation.

Basics of pneumatics and circuit design:

Operational principles and application, air compressors, Pneumatic cylinders and air motors, Pneumatic valves, Design of pneumatic circuits: speed control, reciprocating, synchronization and sequencing circuits. Hydro-pneumatic, Electro pneumatic Control in pneumatic systems.

Basics ofhydraulics and circuit design

Principles of hydraulics, Hydraulic fluids, Filtration technology, Hydraulic- pumps, valves, and actuators. Standards in circuit diagram representation, Power pack design layout, Basic hydraulic circuits.

Assembly automation

Types and configurations, Parts delivery at workstations-Various vibratory and non-vibratory devices for feeding, hopper feeders, rotary disc feeder, centrifugal and orientation, Product design for automated assembly.

Applications and case studies

Material handling- sorting- door opening- labeling Alignment method examples- Direction change-Automatic Screw Fastening- locking and clamping devices.

Text books:

1. Anthony Esposito, "Fluid Power with applications", Prentice Hall international, 2009.

2. Mikell P Groover, "Automation, Production System and Computer Integrated Manufacturing", Prentice Hall Publications, 2007.

References:

1. Kuo .B.C, "Automatic control systems", Prentice Hall India, New Delhi, 2007.

2. Peter Rohner, "Industrial hydraulic control", Wiley Edition, 1995.

3. Mujumdar.S.R, "Pneumatic System", Tata McGraw Hill 2006.

4. HMT "Mechatronics", HMT, 2008. 5. http://www.misumi-techcentral.com/tt/en/lca/

Course Outcome:

After completion of this course a student should be able to

1. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
2. Identify, formulate, and solve engineering problems
3. Gain knowledge of contemporary issues
4. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

INDUSTRIAL MANAGEMENT AND ORGANIZATION

(Credits Theory-03, Practical-01)

Course Code: PR 410 **Contact Hours: TH- 03 T- 00 PR- 02**

Course Objective:

The objective of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

Evaluation scheme:

Theory	Mid Term Examination	30 Marks
	End Term Examination	70 Marks
Term work/Practical	Continuous Evaluation	50 Marks
	External Viva-voce	50 Marks

Course Contents:

1. Basics of management

Introduction, Definition of management, Characteristics of management, Functions of management - Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making, Principles of management – F.W.Taylor, Henry Fayol, Elton Mayo, Administration and management, Nature of management, Levels of management, Managerial skills, Managerial roles.

2. Organizational Management

Organization- Definition, Steps in organization, Types of Organization- Line, Line & Staff, Functional, Project. Departmentation- By product, By process, By function. Principles of Organization- Authority & Responsibility, Span of Control, Effective Delegation, Balance, Stability and flexibility, Communication. Forms of Ownership- Proprietorship, Partnership, Joint stock, Co-operative society, Government sector.

3. Strategic Management

Military origins of strategy, Evolution, Concept and Characteristics of strategic management, Defining strategy, Mintzberg's 5P's of strategy, Corporate, Business and Functional Levels of strategy, Strategic Management Process. Preparing an Environmental Threat and Opportunity Profile (ETOP), Industry Analysis, Porter's Five Forces Model of competition. BCG Matrix, GE 9 Cell Model-Balanced Scorecard, Generic Competitive Strategies- Low cost, Differentiation, Focus.

4. Quality Management

Definition of quality, Goalpost view of quality, Continuous improvement definition of quality, Types of quality – quality of design, Conformance and Performance, Phases of quality management, Juran's and Deming's view of quality, Quality Management Assistance Tools: Ishikawa diagram – Pareto Analysis – Pokka Yoke (Mistake Proofing), Quality circles, TQM, Kaizen, Five S (5 S), Six sigma Quality Management Standards (Introductory aspects only)- The ISO 9001:2000 Quality Management System Standard- The ISO 14001:2004 Environmental Management System Standard- ISO 27001:2005 Information Security Management System.

5. Financial Management

Financial Management- Objectives & Functions. Capital Generation & Management- Types of Capitals: Fixed & Working, Sources of raising Capital: Features of Short term, Medium Term & Long Term Sources. Budgets and accounts- Types of Budgets, Fixed & Variable Budget – Concept, Production Budget - Sample format, Labour Budget - Sample format, Profit & Loss Account & Balance Sheet - Meaning, sample format, meaning of different terms involved. Meaning & Examples of - Excise Tax, Service Tax, Income Tax, Value Added Tax, Custom Duty.

6. Management Information Systems

Concept of data and information, Characteristics of information, Types of information, Definition of MIS, Need, Purpose and Objectives, Contemporary Approaches to MIS, Components of an information system, Need to study information systems, Classification of information systems, Functional Business systems- sales & marketing, Human resources, accounting, manufacturing etc. Decision-making models, Types of decisions, Decision Support Systems, Introduction to e-commerce, types- B2B, B2C, C2B, C2C etc. Overview of ERP, Business Process Re-engineering.

7. Industrial Safety and Legislative Acts

Safety Management- Causes of accidents, Types of Industrial Accidents, Preventive measures, Safety procedures. Industrial Legislation - Necessity of Acts, Important Definitions & Main Provisions of following acts- Indian Factory Act, Workman Compensation Act, Minimum Wages Act.

Term Work:

It shall consist of assignments and case presentation based on the syllabus

Text books:

1. O. P. Khanna, “Industrial Engineering and Management”, Dhanpatrai Publications Ltd.
2. Banga, Sharma, “Industrial Organization and Management”, Khanna Publication Ltd.
3. L.C. Jhamb, Savitri Jhamb, “Industrial Management – I”, Everest Publishing House.

References:

1. Dinesh Seth and Subhash C. Rastogi, “Global Management Solutions”, Cengage Learning, Second Edition, USA.
2. B. Davis and Margrethe H. Olson, “Management Information Systems”, Mc-Graw Hill International Editions.

3. Azar Kazmi, “Strategic Management & Business Policy”, Tata McGraw Hill, New Delhi
4. Kenneth C. Laudon and Jane P. Laudon, “Management Information Systems”, Eighth Edition, Pearson Education
5. K. Shridhara Bhat, “Materials and Logistics Management”, Himalaya Publishing House.
6. M.Y. Khan and P. K. Jain, “Financial Management”, Tata McGraw Hill

Course Outcome:

After completion of this course a student should be able to

1. Get familiarized with environment related to business processes.
2. Know the management aspects of the organizations.
3. Understand importance of quality improvement techniques.
4. Appreciate need and importance of safety in industries.
5. Understand process of industrial finance and its management.
6. Know the latest trends in industrial management.

PROJECT
(CREDITS -14)

Course Code: PR 421 Contact Hours: Pr. 06 Hrs/week for a batch of 09 students

Objective of the course:

Final year project is an important component of the programme and it satisfies many programme outcomes. It can be undertaken in an industry or in the department. In case of the industry project the student is expected to work under the supervision of the engineer and try to solve industry problem. He shall report to department guide also and appraise him about the progress of project from time to time. For in house project students will work on a topic of relevance and are encouraged to implement innovative concepts leading to filing of patent. A group of 3-4 students will be allotted the project topic. The objectives of the project work are listed below:

a. To learn engineering skills and knowledge for implementation.
b. To convert concept/ideas into useful products.
c. To do innovative work leading to patent/start up.
d. To work in team for solving the problems related to society/industry

Term work:

The term work shall be a hard bound report consisting of power point slides of the presentations delivered during the semester, literature survey, preliminary project work

carried, Project work plan, data collection plan in the Industry during In-plant training, details of design and drawing, lists of components, fabrication details, etc.

The references shall form the last section. References would contain list of works (papers, books etc.) referred to in the body of the text and shall be arranged in the order in which they are cited in the text.

Evaluation:

The evaluation shall be carried out on continuous basis. There shall be two-three presentations during the semester, by the students as per the progress of the work. Each of these presentations shall be evaluated in presence of supervisor and accordingly graded.

The end-term presentation shall be in presence of panel of examiners. The end-term presentation should include; literature survey, preliminary project work carried, project work plan, time schedule, data collection plan, Industry based component, details of design and drawing, lists of components, fabrication details, etc. The student is expected to prepare a neat poster explaining salient features of his project work.

The semester presentations (continuous evaluation component) and the end-term presentation shall carry a 50% weightage each.

Course Outcomes:

At the end of course students will able to

1. Design, analyse and manufacture the machines/testing rigs/experimental setup
2. Customize/develop softwares in the relevant area.
3. Solve the problems of industry through project work.
4. Learn presentation skills and documentation

Scheme of Phase wise evaluation:

Following are the phases of evaluation of the project work:

- Identification of problem and scope of project work.
- Defining problem statement and objectives of the project work.
- Defining the roadmap to complete the project work (Methodology).
- Execution of project work.
- Outcome.
- Presentation of seminar for different phases outlined above in front of evaluation committee.

Schedule of Presentations:

Sr. No.	Presentation	Description	Scheduled in	Credit/marks
1	First	Scope and definition	Last week of January	1/05
2	Second	Methodology and objectives	End of February	1/05
3	Third	Progress of work	End of March	1/10
4	End Term	Completion and outcome	2nd / 3rd week of April	4/30
5	End term external examination		May	7/50
6	Total credits/marks			14/100

INPLANT TRAINING
(CREDITS THEORY-02)

Course Code: PR 422 **Contact Hours: Unsupervised learning**

Course Objectives:

The objectives of Implant Training are as follows.

a. To make students aware about different types of industries.
b. To make students understand the organization structure of the industry.
c. To study different processes and different machines.
d. To study the state of art technology used by reputed industries.
e. To make students understand the communication between management and employers and between managers and workers.
f. To study different welfare facilities provided by the company to their employees.
g. To get hands on experience on different machines.

Evaluation scheme:

Sr. No.	Component	Weightage (%)	Remarks
1	Continuous evaluation	50	Evaluation based on attendance to practical, performance and regular assessment.
2	End term practical examination	50	Evaluation based on performance in practical and oral examination

Every student will be undergoing in-plant training for maximum 6 weeks in one Engineering Industry immediately after SY/TYexamination and before admitted to final year B.Tech.

A student is expected to study the following aspects of the industry where he/she is undergoing inplant training.

1. Organisation structures.
2. General plant layout.
3. Machine tools.
4. Production processes, etc.

He should submit a report on training along with the diary of activities to the head of the department at the time of his admission to B.E. The report should be neatly typed on A-4 size white papers with 1.5 spacing, hard or comb bound and should bear certificate of training from the appropriate authority of the industry. The cover of comb bound copies should have transparent front cover and non-transparent plastic back cover.

The Inplant training report shall be evaluated based on a seminar by the student or internal viva conducted at the department.

Course Outcomes:

On successful completion of this course, students should be able to:

1. To increase knowledge and skill of the industrial world for practical applications.
2. Develop expertise capability of practical knowledge on the site.