# Shri Guru Gobind Singhji Institute of Engineering and Technology Nanded

**Department of Production Engineering**
**B. Tech. (Production) Curriculum Structure**
**Academic year 2021-22 onwards**
**B. Tech Final Year**

## Programme Educational Objectives (PEOs)

**PEO 1** Provide knowledge and skills of broad spectrum of manufacturing processes.

**PEO 2** Develop capabilities of Product Design and Analysis through learning opportunities to work with up- to-date platforms in CAD/CAM/CAE.

**PEO 3** Provides students with requisite philosophies, tools and techniques of operations management for becoming key players in any business organization.

**PEO 4** Encourage students to acquire knowledge application aptitude for basic sciences, environmental issues, analytical abilities, self-initiated learning, out of box thinking, soft skills, professional skills, leadership qualities and work in team.

**PEO 5** Develop/Provide foundation for taking up a higher studies, entrepreneurship, and administrative services in India and abroad.

## Programme Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

## Programme Specific Outcomes (PSOs)

### B. Tech Production Engineering

**PSO 1** Apply principles of engineering, basic science, and mathematics to model, analyze, design production systems and processes.

**PSO 2** Plan, operate, control, maintain and improve production systems, components, and processes.

**PSO 3** Be prepared to work professionally as production/mechanical engineer.

**Correlation Matrix (Correlation between the PEOs and the POs)**

| PO/PSO ➡ <br> ⬇ PEO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | √ | | √ | √ | | | | | | | | √ | √ | √ | √ |
| II | | | √ | √ | √ | | | | | | | √ | √ | √ | √ |
| III | | | √ | √ | | | | | √ | | √ | | √ | | √ |
| IV | | | | | | √ | | √ | √ | √ | √ | √ | | | √ |
| V | | | | | | √ | √ | √ | √ | √ | √ | √ | | | √ |
| Note: The cells filled in with √ indicate the fulfillment/correlation of the concerned PEO with the PO. | | | | | | | | | | | | | | | |

**Shri Guru Gobind Singhji Institute of Engineering and Technology, Vishnupuri, Nanded**

**DEPARTMENT OF PRODUCTION ENGINEERING**

## Curriculum Structure of B. Tech.
## (With effective from 2021-2022)

| **Semester I** | | | | | | |
|---|---|---|---|---|---|---|
| **Course Code** | **Name of the course** | **L** | **T** | **P** | **Credits** **Th** | **Pr** |
| PCC-PE401 | Operations and Materials Management | 03 | -- | 02 | 03 | 01 |
| PCC-PE402 | Productivity Improvement Techniques | 03 | -- | 02 | 03 | 01 |
| PCC-PE403 | Tools for Six Sigma Quality | 03 | -- | 02 | 03 | 01 |
| PCC-PE404 | CAD/CAM and Robotics | 03 | -- | 02 | 03 | 01 |
| PCC-PE405 | Advanced Manufacturing Processes | 03 | -- | 02 | 03 | 01 |
| PEC-PE4**/ OEC-PE413/ HMC 471 | Elective- III | 03 | -- | 02 | 03 | 01 |
| | **Total** | **18** | -- | **12** | **24** | |
| **Semester II** | | | | | | |
| **Course Code** | **Name of the course** | **L** | **T** | **P** | **Credits** **Th** | **Pr** |
| SII-PE421 | In-plant Training* | -- | -- | -- | -- | 02 |
| PRJ-PE422 | Project | -- | -- | 28 | -- | 12 |
| | **Total** | -- | -- | **28** | **14** | |

L-No of Lecture Hours/week, T- No. of Tutorials Hours/ week, P- No. of Practical Hours/week

| **B.Tech.(PROD)** | **Contact Hours** | **Credits** |
|---|---|---|
| TOTAL | 58 | 38 |

## List of courses in Electives**

| **Elective-III** | |
|---|---|
| **Course Code** | **Name of Subject** |
| PEC-PE406 | Costing & Estimation |
| PEC-PE407 | Project Management |
| PEC-PE408 | Elements of PLM |
| PEC-PE409 | Introduction to Industry 4.0 |
| PEC-PE410 | Marketing Management |
| PEC-PE411 | Product life Testing |
| HMC 471 | Employability Skills (T-04, T-00, P-00, Cr.-4) |
| OEC-PE413 | Industrial Relations & Entrepreneurship Development (***Institute Open Elective)*** |

*****:** Student should register for anyone courses from the elective list provided.*

****:** In-plant Training to be completed during vacation after second year or third year and evaluation will be done at start of $8^{th}$ semester (duration of in-plant must be minimum of four weeks).*

**Open Elective/s offered by department:**

OEC-PE413 Industrial Relations & Entrepreneurship Development

## PCC-PE401 –OPERATIONS AND MATERIALS MANAGEMENT

## (CREDITS THEORY: 03, PRACTICAL: 01)

**Course code:** PCC-PE 401 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To impart knowledge of materials management and shop floor activities in the industry.
2. To reinforce analytical skills already learned and build on these skills to further increase one's "portfolio" of useful analytical tools.
3. To gain ability to recognize situations in a production system environment those suggest the use of certain quantitative methods to assist in decision making.
4. To learn how to think about, approach, analyze, and solve production system problems using both technology and people skills.
5. To increase knowledge and broaden perspective of the "industrial world" in which one will contribute his / her talent and leadership as an Industrial Engineer.

**Course Outcomes:**

At the end of course, student will be able to.

**CO1** Recognize operation strategy concept.

**CO2** Develop the material management planning for final product.

**CO3** Analyze the different push and pull production system tools.

**CO4** Implement the concept of TOC and MOST techniques.

**CO5** Understand SCM used to improve the Supply Chain performance

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | 1 | | 1 | 1 | | | | | | | 1 | 2 | |
| CO2 | 2 | 2 | 2 | | 2 | | | | | 2 | | | 2 | 2 | |
| CO3 | 2 | 1 | | | | | | | | 2 | | | 1 | 2 | |
| CO4 | 2 | 2 | 3 | | 2 | 1 | | | | 2 | | | 3 | 2 | |
| CO5 | | 1 | 1 | | 1 | | | | | 2 | | | | 3 | |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

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

**Unit-II**

**Material Planning and control:** Field and scope, materials planning, inventory types and classifications, ABC analysis, economic lot size, EOQ model, lead time management and reorder point, inventory control systems, Shop-Floor Control techniques and system, overview of MRP and MRP-II , MPS, Bill of materials, Introduction to ERP systems.

**Unit-III**

**Push and Pull Production Systems**: Introduction, capacity planning definition and its measurements. capacity planning requirements, capacity planning decisions, scheduling orders, Just in Time, KANBANs, SMED, TPS, JIDOKA, ANDONs, Kaizen, Poka Yoke, Zero defects.

**Unit-IV**

**Theory of Constraints:** Introduction, Goal and Performance measures, Synchronous manufacturing,

**Unit-V**

**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**.**

**Unit-VI**

**Supply Chain Management:** Introduction, Bull whip effect, management of supply chains, supply chain performance, supply chain drivers and obstacles, planning demand and supply in a supply chain, Role of Internet in Supply chain.

**Term Work:** It shall consist of Assignments based on

1. Operations strategy
2. Materials Planning and control
3. Pull and Push production system.
4. purchasing

Journal based on above syllabus for:

1. Materials planning and control.
2. Supply Chain Management
3. Theory of constraints

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Textbooks:**


**1.** Chary S.N., Theory and Problems in Production and Operation Management, Tata McGraw Hill, Edition 1995.


**Reference Books:**


**1.** Roberta S. Russell, Bernard W. Taylor III, "Operations Management", Wiley India, Edition 2007.

**2.** Everett E.Adam, Jr. Ronald J. Ebert, "Production and operation management Concept, Model and Behavior", Prentice Hall of India, Edition 2008.

**3.** Chary S.N., Theory and Problems in Production and Operation Management, Tata McGraw Hill, Edition 1995.

**4.** Lee J. Krajewski, Larry P. Ritzman, Manoj K. Malhotra, Operations Management 9/E, Prentice Hall, Edition 2009.

**5.** Joseph S. Martinich, Production and operation management, Wiley India, Edition 2008.
**6.** Narasimhan, Mcleavey, Billingten, Production Planning & Inventory Control, Prentice Hall of India, Edition 1997.
**7.** Jacobs, C.A.," Production and Operations Management", Tata Mc Graw-Hill.1999.
**8.** Ramamurthy., "Production and Operations management", Tata Mc Graw-Hill.

## PCC-PE402– PRODUCTIVITY IMPROVEMENT TECHNIQUES

## (CREDITS THEORY: 03, PRACTICAL: 01)

**Course code:** PCC-PE402 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To impart the productivity improvement techniques for an industry.
2. To familiarize the use and applications of method study and work measurement techniques.
3. To motivate students for learning decision making techniques.

**Course Outcomes:**

At the end of course, student will be able to;

**CO 1** Apply basic concepts of productivity and quality of life.
**CO 2** Recognize the impact of human factor at workplace for productivity improvement.
**CO 3** Calculate productivity of an industry.
**CO 4** Apply ergonomics in designing of different products for human comfort at workplace.
**CO 5** Learn to implement method study technique in industries.
**CO 6** Evaluate the percentage utilization of manpower and machines in industries.
**CO 7** Estimate time standards for different processes.

### Articulation Matrix

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | | | | 2 | | 2 | | | | | | 2 | 2 | | |
| CO2 | | 2 | 2 | | | | | | 2 | | | | 1 | 2 | |
| CO3 | 2 | 2 | | 2 | | | | | | | 2 | | 1 | 3 | 2 |
| CO4 | | | 1 | | 2 | | | 2 | 2 | | | | 1 | 2 | 3 |
| CO5 | 3 | 1 | 2 | 2 | 1 | | | | | | | | | 3 | |
| CO6 | 1 | | | | | 2 | | | 2 | 2 | 1 | | | 3 | 1 |
| CO7 | 2 | 2 | | | | | | | | | | | | 2 | 2 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**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.

**Unit-II**

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

**Unit-III**

**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 workplace layout, Therbligs, SIMO chart.

**Unit-IV**

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

**Unit-V**

**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.

**Unit-VI**

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

**Term Work:** It shall consist of

1. At least eight assignments based on the syllabus.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**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 Eastern).
3. Work Study - R.M. Currie &Faraday. (ELBS Pitman).
4. Productivity management - Concepts & Techniques- S.C.Sawhney
5. Hand Book of Industrial Engineering – Irson & Grant..

## PCC-PE403– TOOLS FOR SIX SIGMA QUALITY

## (CREDITS THEORY: 03, PRACTICAL: 01)

**Course code:** PCC-PE403 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To understand fundamentals of Six Sigma, philosophy.
2. To study DMAIC methodology for Six Sigma.
3. To understand graphical tools, quality related costs for project evaluation.
4. To study Process Mapping, HT, ANOVA, for Six Sigma quality.
5. To study DOE, Robust Design, RSM for optimization.
6. To study the tools employed for DFSS.

**Course Outcomes:**

At the end of course, student will be able to.

**CO1** Understand History, Concepts, Definitions, Levels of Six Sigma, Characteristics, and objectives of Six Sigma.

**CO2** learn Road map for six sigma, DMAIC methodology.

**CO3** Use graphical tools, process mapping, FMEA, Ishikawa diagram.

**CO4** Solve numerical based on CI, ANOVA, HT, Correlation and Regression, cost of poor quality, identify prioritize and select six sigma projects.

**CO5** Solve numerical for parameter optimization using concepts of DOE, Robust design, Response plots, O.A., S/N ratios.

**CO6** Design a product using concept of QFD, and House of Quality

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | | | | | 2 | | | | 2 | | | 1 | 3 | 2 |
| CO2 | 2 | 2 | 2 | 2 | 2 | | | | 2 | 1 | | | 2 | 3 | 2 |
| CO3 | 2 | 2 | 1 | | 2 | | | | | | | | 1 | 2 | 1 |
| CO4 | 3 | 2 | 2 | 2 | 2 | | | | | | | | 1 | 2 | 2 |
| CO5 | 3 | 2 | 2 | 3 | 2 | | | | | | | | 1 | 2 | 1 |
| CO6 | | | 2 | 2 | 2 | | | | 2 | | | | | 2 | 2 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

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

**Unit-II**

**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.

**Unit-III**

**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-vary chart etc. Statistics for six sigma; DPO and DPMO, Sigma level, Throughput Yield, Rolled Throughput Yield, Normalized 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.

**Unit-IV**

**Tools for Analyze Phase:** Introduction, Checkpoints for completion of analyze phase. FMEA, Hypothesis Testing, Confidence Intervals, ANOVA, Correlation and Regression.

**Unit-V**

**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.

**Unit-VI**

**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.

**Unit-VII**

**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:** It shall consist of

1. Minimum of six assignments based on the syllabus.
2. Subject seminar: Based on case studies, methodologies, and advances in the area of Six Sigma implementation reported in literature.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Reference 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.
3. Fundamentals of Quality Control and Improvement – Amitava Mitra, Pearson Education Inc.
4. Taguchi Techniques for quality engineering - Philip J. Ross - McGraw Hill Ltd.
5. QFD linking a company with its customers- Ronald G. Day. - McGraw Hill Ltd.

## PCC-PE404– CAD/CAM & ROBOTICS

## (CREDITS THEORY: 03, PRACTICAL: 01)

**Course code:** PCC-PE404 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To learn basics of CAD and CAD Software
2. To learn CAM and NC, Part Programming, Computer Assisted Part Programming
3. To be familiar with the concepts like Group technology (GT), Flexible manufacturing systems (FMS), CAPP etc.
4. To understand robotics, nomenclature, and its applications.

**Course Outcomes:**

At the end of course, student will be able to.

**CO1** Learn CAD hardware and software for variety of applications.

**CO2** Compare different alternative facilities in CAD software.

**CO3** Implement the NC part programming and its application.

**CO4** Understand the different concepts in manufacturing system and its application for industrial automation.

**CO5** Describe the robot and its different industrial applications.

**Articulation Matrix**

| ➡ PO/PSO ⬇CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 1 | 2 | | | | | | | 1 | | 2 |
| CO2 | | 1 | | | 3 | | | | | | | | 1 | | 1 |
| CO3 | 1 | 1 | | | 2 | | | | | | | | 1 | 1 | 2 |
| CO4 | 1 | | | | 1 | | | | | | | | 1 | 1 | 2 |
| CO5 | 1 | 1 | | | 1 | | | | | | | | 1 | 1 | 1 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

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

**Unit-II**

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

**Unit-III**

**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.

**Unit-IV**

**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

**Unit-V**

**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

**Unit-VI**

**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.

**Unit-VI**

**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, Various teaching method, Task programming, Survey of Robot level programming languages, A Robot program as a Path in space, Motion interpolation, WAIT, SIGNAL and DELAY commands, Branching, Robot language structure, Various textual robot, Languages such as VAL II, RAIL, AML and their features, Typical programming examples such as palletizing, Loading a machine etc.

**Term Work:** It shall consist of

1. Assembly and drafting in CAD software.
2. Demonstration on CNC machines.
3. job using part programming on CNC machine.
4. Practical's on robot programming and Applications

**Practical Examination:**

It shall consist of oral/practical examination based on the above syllabus and term work.

**Reference Books:**


1. "Automation, Production Systems and Computer Integrated Manufacturing", Mikel P. Groover, Pearson Education Pte. Ltd, Delhi
2. ."CAD/CAM and Automation", Farazdak Haidari, 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.

## PCC-PE405– ADVANCED MANUFACTURING PROCESSES

## (CREDITS THEORY: 03, PRACTICAL: 01)

**Course code:** PCC-PE405 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To understand the details of advance manufacturing theory and practices.
2. To study the details of advanced manufacturing processes.
3. To elaborate the details of advanced metal forming processes
4. To study the details of advanced welding processes.
5. To study the details of advanced foundry processes.

**Course Outcomes:**

At the end of course, student will be able to;

**CO 1** Understand the advanced manufacturing processes.
**CO 2** Suggest the suitable advanced casting processes.
**CO 3** Select proper methodology for advanced welding processes.
**CO 4** Work with different advanced metal forming processes.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | | | | 2 | | | | | | | 1 | 2 | 3 | |
| CO2 | 3 | | 2 | | | | | | | | | | 2 | 2 | |
| CO3 | 2 | 2 | 2 | | | | | | | | | | 1 | 2 | |
| CO4 | 2 | | | | | | | | | | | | 1 | 2 | |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Advanced Machining processes:** Introduction, Process principle, Material removal mechanism, Parametric analysis and applications of the processes such as AJM, USM, WJM, AWJM, ECM, EDM, EBM, LBM processes.

**Unit-II**

**Advanced casting processes:** Metal mould casting, continuous casting, squeeze casting, vacuum mould casting, Evaporative pattern casting, Ceramic cell casting.

**Unit-III**

**Advanced welding processes: D**etails of Electron beam welding (EBM), Laser beam welding (LBM), Ultrasonic welding (USW).

**Unit-IV**

**Advanced metal forming processes:** Details of high energy rate forming (HERF) process Electro-magnetic forming, explosive forming, Electro-hydraulic forming, stretch forming, Contour roll forming.

**Term Work:** It shall consist of

1. Practical's and Assignments based on above syllabus.
2. Demonstration of manufacturing machines.
3. At least one job on the different machine,

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Reference Books:**


1. "Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
2. "Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.
3. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0-8247-7352-7).

## PEC-PE406– COSTING AND ESTIMATION

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE406 (L- 03, T- 0, P 02)

**Course Objectives:**

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

**Course Outcomes:**

At the end of course, student will be able to;

**CO 1** Compute different costs considering several overheads like factory, office, selling and distribution.

**CO 2** Learn the basic concepts of cost, estimation, and depreciation fund calculation.

**CO 3** Compute costs for various manufacturing processes like forging, welding, foundry etc.

**CO 4** Understand the process of job costing, activity-based costing, cost accounting and budgetary control.

**CO 5** Interpret during decision making, the concepts of CVP analysis, cost control techniques including time value of money.

**CO 6** Implement the basics of engineering economics and financial management for profit making by the organization.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | | 2 | | | 3 | 1 | | | | | | | | 3 |
| CO2 | | 3 | | 2 | | | | | | | | | 2 | 1 | 3 |
| CO3 | 1 | 3 | 1 | 2 | | | | | | | | | 2 | 1 | 3 |
| CO4 | 3 | 3 | 2 | 1 | 1 | | | | | | | | 2 | 1 | 3 |
| CO5 | 1 | 3 | | | | | | | | | | | 2 | 1 | 3 |
| CO6 | 2 | 3 | | | | | | 1 | | | | | 2 | 1 | 3 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Cost:** Cost concepts and terminology, Costing, Types of costing: Job costing, Process costing, Marginal and Operating costing, Cost estimation fundamentals

**Unit-II**

**Equivalence and cost control:** Time value of money- compound interest, uniform annual amount, Cost comparisons- with equal and unequal duration

**Unit-III**

**Depreciation:** Depreciation fund and its calculation and CVP analysis.

**Unit-IV**

**Cost estimation for various manufacturing process:** machining, sheet metal working, forging, welding, and foundry

**Unit-V**

Cost allocation and Activity-Based costing

**Unit-VI**

**Cost accounting:** Introduction**,** cost control and cost reduction, Standard costing and variance analysis, Elements of Economics, Financial Management

**Unit-VII**

**Tools for planning and control:** Budgets

**Term Work:** It shall consist of

1. Practical's and Assignments based on syllabus
2. Assignments based on spreadsheet-based exercises) based on syllabus.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Textbooks:**


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.

## PEC-PE407– PROJECT MANAGEMENT

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE407 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. Understand the basic concepts of project management.
2. Appraise the project using appropriate appraisal techniques.
3. Design and implement project by considering risk and its evaluation.
4. Learn the process project planning and execution.
5. To learn use of basic software tools in project management.

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Explore the feasibility of a project by applying financial and environmental criteria.

**CO2** Learn various stages of life cycle and its implementation.

**CO3** Develop skills in meeting deadlines and how milestones and a schedule are used in order to keep a project on track.

**CO4** Understand components of the critical path and they can utilize PERT analysis to plan, manage and evaluate a large project.

**CO5** Learn effective resource allocation and resource utilization using ProModel.

**CO6** Track project and control deadlines while creating Gantt and PERT chart in Microsoft Project.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| CO2 | 2 | | 2 | | | | | | | | | | 1 | 2 | |
| CO3 | 2 | 2 | | | | | | | | | | | 2 | 2 | |
| CO4 | 2 | | 3 | 3 | | | | | | | | | 1 | 2 | |
| CO5 | | | | | | | | | | | | | | | |
| CO6 | | | | | | | | | | | | | | | |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Introduction to PM:** What is a project? Evolution of project management, the need of project management, where is project management appropriate? Characteristics of projects, Characteristics of project management, Projects in contemporary organizations, Project life cycle.

**Unit-II**

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

**Unit-III**

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

**Unit-IV**

**Project Scheduling and Resource Management:** Gantt chart, Milestone chart, Network techniques: PERT and CPM, AON and AOA representation, three-time estimates, Using probability distributions for time computation, Probability of project completion, Time scale version of network, Early start and late start schedules, Resource allocation, Resource loading and levelling, Constrained resource scheduling, Multi-project scheduling and resource allocation, Crashing a project.

**Unit-V**

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

**Unit-VI**

**Computerized PM:** Computerized PMIS, choosing software for project management, using software for project management.

**Unit-VII**

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

**Term Work:** It shall consist of

1. Assignments and numerical based on 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.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Reference Books:**


1. John M. Nicholas, Project Management for Business, and technology: Principles and Practice, 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 by National Programme on Technology Enhanced Learning (NPTEL), IIT Delhi, 2005.
4. Prasanna Chandra, Projects: Preparation, Appraisal, Budgeting and Implementation, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1980.

## PEC-PE408– ELEMENTS OF PLM

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE408 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. Establishing industry partnerships that guide, support, and validate PLM research and education activities.
2. Assisting with the integration of PLM into College curricula
3. Facilitating the pursuit of PLM career opportunities
4. Serving as a knowledge base for the PLM discipline

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Understand the difference between the terms PDM and PLM.

**CO2** Demonstrate the basic components and functionality of a PLM system.

**CO3** Analyze PLM tools and techniques for application for a range of practical situations.

**CO4** Integrate the information from a variety of sources to plan and complete a project.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | | | | 2 | | | | | | 2 | 1 | | | 2 | 2 |
| CO2 | | | | | | | | | 2 | 2 | | 3 | | 3 | 1 |
| CO3 | | | | | 3 | | | | 2 | 2 | 2 | | | 2 | 2 |
| CO4 | | | | | | | | | 2 | 2 | 3 | | | 3 | 3 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Contents:**

**Unit-I**

**Introduction:** Background, Overview, Need, Benefits, and Concept of Product Life Cycle, Product life cycle management systems, Components / Elements of PLM, Emergence of PLM.

**Unit-II**

Product organizational structure, Integration of the PLM system with other applications, The PLM Strategy.

**Unit-III**

Product Data, Product and Product Data, Product Data Examples, Product Data Issues, Metadata, Product Data Models.

**Unit-IV**

**Deployment:** Problems in deployment. Stages of deployment. PLM software and tools. Product Data security.

**Unit-V**

**Understanding the product life cycle:** basic behavior of products and life cycles, phases of the product life cycle, other aspects of product life cycle, Product life cycle – data (information) management view.

**Unit-VI**

**Workflow:** Product structure, workflow, Terminologies in workflow, The Link between Product Data and Product Workflow, PLM applications, PDM applications.

**Term Work:** It shall consist of

1. Assignments based on syllabus.
2. Case studies based on topics.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Textbooks:**

1. Relevant recent technical articles, research papers, keynote addresses, etc.

**Reference Books:**


1. Grieves, Michael, Product Life cycle Management, McGraw-Hill, 2006. ISBN 0071452303
2. Antti Saaksvuori, Ansel miImmonen, "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

## PEC-PE409– INTRODUCTION TO INDUSTRY 4.0

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE409 (L- 03, T- 0,P-02)

**Course Objectives:**

1. To study the industry 4.0 and its applications in the business world.
2. To study the automation decision making and processes.
3. To analyze the data using new business models and intelligent algorithms.
4. To drive knowledge for operationalize use by cyber physical systems.
5. To understand the manufacturing systems and industry 4.0 technologies and applications.
6. To apply the industrial 4.0 applications and case studies in industries.

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Understand the drivers and enablers of Industry 4.0

**CO2** Appreciate the smartness in Smart Factories, Smart cities, smart products, and smart services.

**CO3** Identify the various systems used in a manufacturing plant and their role in an Industry 4.0 world.

**CO4** Appreciate the power of Cloud Computing in a networked economy.

**CO5** Understand the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | | | | 1 | | | | | | | | 1 | | |
| CO2 | | | | | | 2 | 1 | | | | | | | 1 | |
| CO3 | | 2 | 1 | | | | | | | | | | 1 | 1 | 1 |
| CO4 | | | | | 2 | | | | | | 1 | | | | 1 |
| CO5 | | | | | | | | | 1 | | | 1 | | | 1 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Introduction to Industry 4.0:** The Various Industrial Revolutions, Digitalization and the Networked Economy, Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, The Journey so far: Developments in USA, Europe, China and other countries, Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

**Unit-II**

**Road to Industry 4.0**: Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities , Predictive Analytics .

**Unit-III**

**Related Disciplines, System, Technologies for enabling Industry 4.0:** Cyber physical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Mobile Computing, Related Disciplines, Cyber Security.

**Unit-IV**

**Role of data, information, knowledge, and collaboration in future organizations:** Resource-based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing, and Industry 4.0.

**Unit-V**

**Business issues in Industry 4.0:** Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era, Strategies for competing in an Industry 4.0 world.

**Term Work:** It shall consist of

1. Assignments based on syllabus.
2. At least one case study on application of industry 4.0
3. At least 2 assignments on industry 4.0 technologies and business models.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Reference Books:**


1. Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
2. Bartodziej, Christoph Jan,"The Concept Industry 4.0".
3. Klaus Schwab,"The Fourth Industrial Revolution".
4. Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

## PEC-PE410– MARKETING MANAGEMENT

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE410 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To study the principles and practices of marketing management.
2. To understand the theoretical building blocks of marketing
3. To ensure the role of marketing management in the organization engine and evolving marketing process of today.

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Understand the Segmentation, targeting, and positioning. How to assess market potential, understand and analyze customer behavior, and focus resources on specific customer segments and against specific competitors.

**CO2** To Branding and develop, measure, and capitalize on brand equity.

**CO3** To communicate the Marketing and develop an effective mix of marketing communication efforts.

**CO4** To Distribution channels. How to understand the role of distributors, retailers, and other intermediaries in delivering products, services, and information to customers.

**CO5** To Pricing. How to set prices that capitalize on value to the customer and capture value for the firm

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | | | | 2 | | | | | | 2 | | 2 | 1 | 1 |
| CO2 | | 2 | | 1 | 1 | | | 1 | 2 | | | | 1 | 2 | 1 |
| CO3 | 1 | | | | | 1 | | | | 3 | | | 2 | 2 | 2 |
| CO4 | 1 | 3 | | 2 | | | | | 3 | | | 2 | 3 | 2 | 2 |
| CO5 | | | 1 | 3 | 1 | 1 | | | | | 3 | 3 | 2 | 2 | 3 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Introduction to Marketing:** Defining Marketing, Core concepts in Marketing, Evolution of Marketing, Marketing Planning Process, Contemporary Issues and Practices.

**Unit-II**

**Scanning the Business Environment:** The value chain, Core Competencies, Strategic Planning Process, PESTEL, Competition Analysis, SWOT Analysis.

**Unit-III**

**Marketing Information System and Marketing Research:** Role of Marketing Information, System in Managerial Decision-Making Process, Components of Marketing Information systems.

**Unit-IV**

**The Marketing Research Process:** An overview, Defining the Management Decision Problem and Marketing Research Problem, Framing Research Objectives and developing the research plan, Exploratory vs. Conclusive Research.

**Unit-V**

**Consumer Behavior:** Consumer Behavior, Consumer buying process model, What Influences Consumer Behavior, Key Psychological Processes, The Buying Decision Process: The Five Stage Model, Other Theories of Consumer Decision Making

**Unit-VI**

**Industrial Buyer Behavior:** Concept of Buying Center, Industrial buying process model, Influence of Economic and Behavioral Factors, Influence of Procurement Organization, Role of Negotiation Process.

**Unit-VII**

**Generic Marketing Strategies:** Defining Market Segmentation, Bases of segmentation, Evaluation and Targeting Market Segments, Brand Positioning and Differentiation.

**Term Work:** It shall consist of

1. Assignments based on syllabus.
2. Case studies on Marketing strategies, automobile marketing plan, cosmetic products, FMCG companies etc.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Textbooks:**


1. Kotler, P., Keller, K. L., Koshy, A., & Jha, M. (2012), Marketing Management A South Asian Perspective, 14th Edition, Pearson Education, New Delhi.
2. Philip Kotler & Kevin Lane Keller, Marketing Management, Pearson, 15th Edition, 2016.
3. Ramaswamy, V. S., & Namakumari, S. (2017), Marketing Management: Indian Context with Global Perspective, McGraw hill.


**Reference Books:**


1. Jayanta Chatterjee, Shashi Shekhar Mishra, "Marketing Management-I", Management, IIT Kanpur, NPTEL,2016.
2. Alexander Cherney," Strategic Marketing Management" fifth edition, cerebellum press, USA,2014
3. Philip Kotler and Kevin Lane Keller," Marketing Management "(12th edition), Prentice Hall, USA,2006
4. Principles of Marketing, Kotler and Armstrong, Pearson, 12th edition., 2008, ISBN: 978-81- 317-1547-5

## PEC-PE411– PRODUCT LIFE TESTING

## (CREDITS THEORY-03, PRACTICAL-01)

**Course code:** PEC-PE411 (L- 03, T- 0, P- 02)

**Course Objectives:**

1. To study on the reliability engineering process on product life.
2. To learn various reliability testing on the products.
3. To understand the acceleration life tests on products.
4. The learn about product life cycle by various reliability methods.
5. To learn about the warranty analysis of the products.

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Evaluate the effective techniques to assure product reliability throughout the product life cycle.

**CO2** To select useful, pragmatic, and up-to-date reliability techniques to assure product reliability throughout the product life cycle.

**CO3** To understand the customer expectations, for building reliability into products at the design and development stage.

**CO4** To improve the reliability performance of the products at the production stage,

**CO5** To analyze the warranty data and monitoring reliability performance in the field.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | 2 | 2 | | | | | 2 | | 1 | | 2 | 3 | 2 |
| CO2 | | | | 2 | 3 | | | | | | 2 | | 3 | 2 | 3 |
| CO3 | | | 2 | | | 2 | 2 | 2 | | 3 | | | | 2 | 1 |
| CO4 | | 3 | | | 2 | | | | | | | 2 | | 2 | |
| CO5 | 2 | 2 | | 2 | | | | 2 | 1 | | | | 2 | 1 | 2 |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Reliability Engineering and Product Life Cycle:** Introduction to reliability engineering, Different phases of product life cycle, Integration of reliability engineering into the product life cycle, Reliability in the concurrent product realization process

**Unit-II**

**Reliability Planning and Specification:** Introduction, Reliability Requirements, methods of deriving the reliability requirements, Reliability Program Development, generic reliability program, considerations for developing product specific programs, and management of reliability programs. Reliability Design and Design For Six Sigma, Overview of Six Sigma, Reliability Design by the DFSS Approach.

**Unit-III**

**Accelerated Life Tests:** Introduction, Development of Test Plans and its technical considerations, Common Stresses and Their Effects, Life–Stress Relationships, Highly Accelerated Life Tests.

**Unit-IV**

**Degradation Testing and Analysis:** Introduction, Determination of The Critical Performance Characteristic, Reliability Estimation from Pseudo life, Degradation Analysis With Random-Effect Models, Degradation Analysis For Destructive Inspections, Stress-Accelerated Degradation Tests.

**Unit-V**

**Reliability Verification Testing:** Introduction, Planning Reliability Verification Tests, Sample Size Reduction by Tail Testing, Sequential Life Testing, Reliability Verification Through Degradation Testing

**Unit-VI**

**Warranty Analysis:** Introduction, Warranty Policies, Warranty Data Mining, Reliability Estimation from Warranty Claim Times, Warranty Repair Modeling, Warranty Cost Estimation, Warranty Cost Reduction

**Term Work:** It shall consist of

1. Assignments based on syllabus.
2. Case studies based on syllabus.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Textbooks:**

Relevant recent technical articles, research papers, keynote addresses, etc.

**Reference Books:**

Guangbin yang, "Life cycle reliability engineering" John Wiley & Sons, Inc Hoboken, New Jersey,2007.

Antti Saaksvuori, Ansel miImmonen, "Product Life Cycle Management" - Springer, 1st Edition (Nov.5, 2003).

## PEC-PE412–EMPLOYABILITY SKILLS

## (CREDITS THEORY-04 )

**Course code:** PEC-PE412 (L- 04, T- 00, P- 00)

**Course Objectives:**

1. Students will learn the fundamentals of mathematics, verbal & nonverbal reasoning and English to get prepared to face campus written exams.
2. This course will enable the students to solve the data interpretation in a very short span of time through the learning of speed math's and quantitative aptitude.
3. This course will enable the students to build their vocabulary, enrich the grammar, so that students will be able to read, write, speak English fluently.
4. Students will understand and become effective in oral and written communication to confidently speak during the group discussion and during the letter and essay writing respectively.
5. This course will enable the students to acquire better reasoning abilities, cognitive and problem-solving skills through the practice of verbal and nonverbal reasoning questions.

**Course Outcomes:**

At the end of course, student will be able to;

**CO1** Students will be able to learn and remember the basics of mathematics learned during schools to solve the numerical and mathematical calculations in campus written exams

**CO2** Students will understand the different verbal and nonverbal reasoning concepts to acquire reasoning skills which help them to think critically for problem solving

**CO3** Students will be able to apply the knowledge of math's to interpret data in various forms such as bar, pie, graphs to solve numerical in data interpretation

**CO4** This course will enable the students to analyze the long passages in reading comprehension and make them to answer the questions in a short time

**CO5** Students will be able to evaluate the statements in data sufficiency and will be able to solve the questions

**CO6** The knowledge obtained from this course will enable the students to clear the campus interview written tests and other competitive exams for the employment.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 2 | 2 | 2 | | | | | | | | | | | 2 | |
| CO2 | 2 | 2 | 2 | | | | | | | | | | | 2 | |
| CO3 | 3 | 2 | 1 | | | | | | | | | | | | |
| CO4 | 3 | 3 | 1 | | | | | | | | | | | | |
| CO5 | 3 | 3 | | | | | | | | | | | | | |
| CO6 | 3 | 3 | | | | | | | | | | | | | |

*Note: 1-Low, 2-Medium or 3- High*

**Evaluation Scheme:**

Evaluation will be done as per the institute Rules and Regulations (R.R)

**Course Content:**

**Unit-I**

**Quantitative aptitude:** Speed math's, Number systems, Ratio proportion and variations, Profit and loss, Partnerships, Simple Interest, Compound Interest, Boats and streams, Average mixtures and allegations, Speed, Time and work, Time and distance, Work and wages, Geometry and mensuration, LCM and HCF, Percentages, Arithmetic and geometric progressions, Pipes and cisterns, Problems on train, Sets and venn diagrams, Algebra, Problems on age, Permutation and combination, Probability, Coordinate geometry, Inequalities, Functions, Logarithm, Quadratic equations, Surds indices and dies.

**Unit-II**

**Verbal reasoning Mental ability:** Analogy, Classification, Series completion, Coding-decoding, Blood relations, Puzzle test, Sequential output racing, Direction sense test, Logical venn diagrams, Alphabet test, Number ranking & time sequence test, Mathematical operations, Logical sequence of words, Arithmetical reasoning, Inserting the missing character, Data sufficiency, Decision making, Assertion and reason, Situation reaction test, Verification of truth of statement, Data interpretation – table charts, graphs, pie charts, bar graphs, line graphs, caselets, combined data sets. Logical reasoning: Logic, Statements – arguments, Statements – assumptions, Statements – courses of action, Statements – conclusions, Deriving conclusions from passages, Theme detection, Question-Statements, Miscellaneous statements.

**Unit-III**

**Nonverbal reasoning Series:** Analogy, Classification, Analytical reasoning, Mirror images, Water images, Embedded figures, Completion of incomplete pattern, Figure matrix, Paper folding, Paper cutting, Rule detection, Group of identical figures, Cubes and dice, Dot detection, Construction of squares and triangles, Figure formation & analysis.

**Unit-IV**

**Verbal ability and reading comprehension:** Fill in the blanks, Verbal reasoning, Sentence completion, Grammar, Syllogisms, Jumbled paragraphs, Parts of speech, Phrases modifiers, Para completion and inference, Subject-verb agreement, Foreign language words in English, Reading comprehension, Analogies, Sentence correction, Preposition, Errors in tenses, Verbal logic, Para jumbles, Para jumbles, Different usage of the same word, Idioms and phrases, Synonyms, Antonyms, One word substitution, Types of clauses, Articles usages, Letter writing, Essay writing.

**Unit-V**

**Group discussion (G.D):** Definition of group discussion Difference between debate and group discussion, Main areas of evaluation of G.D – Subject knowledge, oral communication skills, listening skills, clarity of thought and expression, apt language, proper nonverbal clues, team behavior, leadership skills and team management. Advantages of G.D, Roles in a structured G.D, Expectation of the panel, Phases In G.D, Dos and Don'ts in G.D.

**Term Work:**

For subject knowledge, students must equip themselves by reading daily newspapers, good magazines, national and international journals,

Watch news bulletins and informative programs on the television and internet.

A report should be submitted to faculty based on above assignments.

**Practical Examination:**

The practical examination consists of an oral/practical based on syllabus and Term Work.

**Reference Books:**


1. Mathematics books set from 6th to 10th by National Council of Education Research and Training (NCERT), School Waale Publishers, Edition:2019
2. Quantitative Aptitude for Competitive Examinations by R.S. Aggarwal, S. Chand Publishing New Delhi, ISBN: 9789352534029, 9789352534029, Edition: Revised & Enlarged Edition, 2020
3. A Modern Approach to Verbal & Non-Verbal Reasoning by R.S. Aggarwal, S Chand Publishing New Delhi, ISBN: 9789352832163, Edition: 2020.
4. Word Power Made Easy by Norman Lewis, Penguin Publishers, ISBN: 9780143424680, Edition: 2015
5. High School English Grammar and Composition by P. C. Wren and H. Martin Revised by Dr. N.D.V Prasada Rao, S. Chand & Company Pvt. Ltd publishers, New Delhi, ISBN: 9789352530083, 935253008X, Edition:2015.

## SII-PE421– INPLANT TRAINING

## (CREDITS: 02)

**Course code: PCC-PE421** **Contact Hours: Unsupervised learning**

**Course Objectives:**

1. To make students aware about different types of industries.
2. To make students understand the organization structure of the industry.
3. To study different processes and different machines.
4. To study the state of art technology used by reputed industries.
5. To make students understand the communication between management and employers and between managers and workers.
6. To study different welfare facilities provided by the company to their employees.
7. To get hands on experience on different machines.

**Course Outcomes:**

At the end of course, students will able to;

**CO 1** Understand knowledge and skill /requirements of industrial world for practical applications.

**CO 2** Learn to work in team to acquire knowledge/skills.

**Articulation Matrix**

| ➡ PO/PSO ⬇ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | | 2 | 2 | |
| CO2 | | | 2 | | | | | | | | | | 2 | 3 | |

*Note: 1-Low, 2-Medium or 3- High*

**Course Content:**

Every student will be undergoing in-plant training for maximum 4 weeks in the industry immediately after SY/TY examination 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 Internship.

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

If a student fails to complete his/her in-plant training for any reason they should undergo the online courses of at least 4 weeks duration from platforms like NPTEL, Edx etc) and submit the certificate of completion of course to the department for appearing in-plant training examination.,

**Evaluation Scheme:**

Students should submit a report on training along with the diary of activities to the head of the department at the time of his/her admission to final year. The report should be prepared as per the guidelines given by the department. The Internship report shall be evaluated based on a seminar by the student or viva conducted at the Department.

| Component | End term Evaluation |
|---|---|
| **Practical** | 100% |

**Term Work:**

It shall consist of abstract submission of final comb bound report at the time of presentation.

**Practical Examination:**

It shall consist of oral examination/demonstration of in-plant training in the presence of guide/supervisor and external examiner.

**PRJ-PE422– PROJECT**

**(CREDITS: 12)**

**Course code: PROJ-PE422** (**06 Hrs/week for a batch of 09 students**)

**Course Objectives:**

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 approximately 4 students will be allotted the project topic.

The objectives of the project work are listed below:

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

**Course Outcomes:**

At the end of course, students will able to;

**CO 1** Design, analyze and manufacture the machines/testing rigs/experimental setups.
**CO 2** Customize/develop software in the relevant area.
**CO 3** Solve the problems of industry through acquired knowledge during the course work.
**CO 4** Exhibit presentation and documentation skills.
**CO 5** Improves Communication.
**CO 6** Interfaced with Technological Excellence

**Articulation Matrix**

| ➡PO/PSO ⬇ CO | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | | | | | | 3 | 3 | |
| CO2 | | | 3 | 3 | | | | | | | | | 3 | 3 | |
| CO3 | | | 3 | 3 | | | | | | | | | 3 | 3 | |
| CO4 | 3 | | | | | | | | 3 | 3 | 3 | 3 | 3 | 3 | |
| CO5 | | | | | | | | 3 | | 3 | | | 3 | 3 | |
| CO6 | | | | | | | | | | | | 3 | 3 | 3 | |

*Note: 1-Low, 2-Medium or 3- High*

**Course Content:**

The project work may consist of an extensive work, study, or analysis of field/industrial problems with appropriate solutions or remedies. It includes like:

1. Fabrication of model, machine, prototype based on innovative ideas.
2. Modeling and/or simulation of a system and improvements in the system.
3. Design of experiments, experimental setups, fabrication of test equipment, experimentation an
4. Statistical analysis, comparison with the existing data.
5. Renovation of machines, testing equipment and extensive analysis of some problems solved with the help of suitable software.
6. Design, modeling, analysis and so on as deemed fit.

**Evaluation Scheme:**

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

1. The students doing project in industry have to maintain a project diary, in which continuous (at least weekly) improvement of work should be noted and should be duly signed by supervisor. (Industry person).
2. The students who are doing in-house project (non-industrial) should also maintain project diary and must report improvements in work to the guide/supervisor in institute 04 hours weekly at least.
3. Projects must be performed in groups (Max 4 students in a group) and individual. roll/participation/ work will be evaluated through project diary and presentations.

| Component | Continuous Evaluation | End term Evaluation |
|---|---|---|
| **Practical** | 50% | 50% |

4. Project Report writing should be done only as per given guidelines.

**Term Work:**

It shall consist of progress report submission before Mid Term and End Term presentations

Hard bound copy of project report should be submitted to the department.

**Practical Examination:**

It shall consist of oral examination/demonstration of project in presence of guide/supervisor and external examiner.