Program Educational Objectives and Program Outcomes
M.E. (Production Engineering) Program

Program Educational Objectives

- Impart knowledge to students in the latest technological topics on Production and Industrial Engineering and to provide them with opportunities in taking up advanced topics in the field of study.
- Create a congenial environment that promotes learning, growth and imparts ability to work with multi-disciplinary groups in professional, industry and research organizations.
- Broaden and deepen their capabilities in analytical and experimental research methods, analysis of data and drawing relevant conclusions for scholarly writing and presentation.
- Provide guidance to students for their choices in research and professional career outlook and to encourage students to take up research.

Program Outcomes

The students of Master of Engineering in Production Engineering will have the ability to

- acquire fundamental knowledge and understanding of Production and Industrial Engineering,
- acquire abilities and capabilities in the areas of advanced manufacturing methods, quality assurance and shop floor management,
- formulate relevant research problems, conduct experimental and/or analytical work and analyze results using modern mathematical and scientific methods,
- review and document the knowledge developed by scholarly predecessors and critically assess the relevant technological issues,
- design and validate technological solutions to defined problems and write clearly and effectively, for the practical utilization of their work.

PROPOSED SCHEME OF M.E. (Production Engineering) 2017 Batch Onwards

FIRST SEMESTER

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PCD105	COMPUTER AIDED MANUFACTURING	3	0	2	4.0
2	PCD 106	GEOMETRIC MODELING AND ANALYSIS	2	4	0	4.0
3	PCD 313	MACHINE TOOL DESIGN	3	1	0	3.5
4	PCL105	STATISTICAL METHODS AND ALGORITHMS	3	0	2	4.0
5	PPI312	METAL CASTING AND JOINING	3	0	2	4.0
6		ELECTIVE-I	3	1	0	3.5
TOTAL			**17**	**6**	**6**	**23.0**

SECOND SEMESTER

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PPI201	ADVANCED MANUFACTURING PROCESSES	3	1	2	4.5
2	PCD325	RAPID PROTOTYPING	3	0	2	4.0
3	PPI 204	OPERATIONS MANAGEMENT	3	1	0	3.5
4	PPI103	QUALITY ENGINEERING	3	1	0	3.5
5	PPI 313	METAL FORMING	3	1	0	3.5
6		ELECTIVE-II	3	1	0	3.5
TOTAL			**18**	**5**	**4**	**22.5**

THIRD SEMESTER

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PPI291	SEMINAR	-	-	-	4.0
2	PPI391	MINOR PROJECT	-	-	-	4.0
2	PPI491	DISSERTATION STARTS	-	-	-	-
TOTAL			**-**	**-**	**-**	**8.0**

FOURTH SEMESTER

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PPI491	DISSERTATION	-	-	-	16.0
		TOTAL	-	-	-	**16.0**

LIST OF ELECTIVES-I

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PPI 315	WORKSTUDY AND METHOD ENGINEERING	3	1	0	3.5
2	PCD204	INDUSTRIAL AUTOMATION	3	1	0	3.5
3	PCD 103	MECHATRONICS	3	1	0	3.5
4	PPI 325	ADVANCED MATERIALS TECHNOLOGY	3	1	0	3.5

LIST OF ELECTIVES-II

SR. NO.	COURSE NO.	TITLE	L	T	P	Cr
1	PCD206	COMPUTER INTEGRATED MANUFACTURING SYSTEMS	3	1	0	3.5
2	PCD 316	APPLIED OPTIMIZATION IN ENGINEERING DESIGN	3	1	0	3.5
3	PPI323	PRODUCT DESIGN AND DEVELOPMENT	3	1	0	3.5
4	PCDXXX	TRIBOLOGY	3	1	0	3.5

TOTAL NUMBER OF CREDITS: 69.5

PPI312: METAL CASTING AND JOINING

L	T	P	Cr
3	0	2	4.0

Course Objectives: To inculcate the principle, thermal and metallurgical aspects during solidification of metal and alloys. To impart knowledge about principles/methods of casting with detail design of gating/riser system needed for casting, defects in cast objects and requirements for achieving sound casting. To impart knowledge about welding behaviour of machine and process during welding, analysis of common and newer welding techniques and metallurgical and weldability aspects of different common engineering materials.

Casting Technology: Interfacial Heat Transfer, Thermodynamics & metallurgical aspects in solidification of pure metals and alloys, Homogeneous and heterogeneous nucleation,

Riser Design: Risering curves, NRL, Caine method, Feeding distance, Gating systems and their characteristics. Type of gates and design consideration, Chills pattern design consideration, Sand testing, Advanced metal casting processes, Casting defects, Their causes & redressal.

Metal Joining: Classification – Welding power source, Arc and arc characteristics, Behavior of arc with variation in current and voltage, Welding electrodes, ISI specification of electrodes, Electrode selection, Newer welding process- such as plasma arc, Laser beam, Electorate, Ultrasonic welding.

Welding Metallurgy: Heat flow is welding metallurgical transformation, Implication of cooling rate, HAZ, Weldability of plain carbon steels, SS, Al and its alloys, Residual stresses and distorting, Welding defects, Testing-destructive and NDT.

Laboratory work: Joints preparation, development of welding by SMAW, GMAW, GTAW, Spot and Seam. Demonstration of SAW and flash butt welding, oxy-acetylene gas cutting.

Minor Project:
Development of aluminum alloy casting through sand casting process and investigation of metallurgical and mechanical properties of cast component. The students will develop the defined pattern casting of a given alloy/material. Further, the cut section of cast component will characterize for metallurgical and mechanical property investigation like porosity, cracks, phases, microstructure and microhardness.**Joining and characterization of aluminum alloy through MIG process.**The students will develop joining of aluminum alloy through MIG process and will optimize the process parameters. Further, Students will characterize for metallurgical and mechanical property investigation like porosity, cracks, phases, microstructure and microhardness.

Course Learning Outcomes (CLO):
The student will be able to:

1. analyze the thermal, metallurgical aspects during solidification in casting and welding and their role on quality of cast or weld objects.
2. design the gating and riser system needed for casting and requirements to achieve defect free casting.

3. analyze the welding process behavior for common and newer welding techniques
4. understand requirements to achieve sound welded joint while welding different similar and dissimilar engineering materials.

Recommended Books:

1. *Ramana Rao, T. V., Metal Casting – Principles and Practice, New Age International Pvt. Ltd. (2003).*
2. *Rao, P. N., Manufacturing Technology, McGraw Hill (2008).*
3. *Campbell, J., Castings, Butter Worth – Heinemann Publishers (2003).*
4. *Nadkari, S. V., Modern Arc Welding Technology, Oxford & India Book House Pvt. Ltd. (2005).*

Evaluation Scheme:

S. No.	Evaluation Elements	Weightage (%)
1.	MST	25
2.	EST	40
3.	Sessionals (Assignments/Projects/Quizes/Lab Evaluations)	35

PPI201 ADVANCED MANUFACTURING PROCESSES

L	T	P	Cr
3	1	2	4.5

Course Objectives: To inculcate specialized knowledge and skill in advanced manufacturing processes using the principles and methods of engineering analysis and design. To cultivate the ability to develop and implement new improved manufacturing processes resulting in creation and distribution of value in engineering applications. To impart knowledge about the significance of controlling process parameters for the optimal performance for newly developed engineering materials used in industries and research organizations.

Mechanical Processes: Development and classification,Considerations in process selection,Tool design, Mechanism of material removal in: Ultrasonic machining, Abrasive jet machining, Abrasive flow machining, Magnetic abrasive finishing, Parametric analysis: Effect of process parameters on material removal rate, surface finish, Process capabilities, Engineering applications, Development of Hybrid processes.

Thermal Metal Removal Processes: Historical backgroundand classification,Characteristics of process , Mechanism of material removal in: Electric discharge, Wire electric discharge, laser beam, Plasma arc, Electron beam advanced machining processes,Parametric analysis, advantages and limitations, applications

Electrochemical Machining and other Processes: Introduction, Mechanics, Tool design, Electrochemistry of ECM process, Kinematics and Dynamics, Effect of heat and H_2 bubble generation,Calculation of material removal rate, Parametric analysis,advantages and limitations, applications, Microwave processing,Explosive forming: Principle, Process parameters, Equipment, Mechanics and applications.

Laboratory Work:

Experimental determination of Material removal rate, Tool wear rate, Ovality of the machined surfaces for the Ultrasonic, Electric discharge,Laser beam machining processes, Determination of impact strength of shot blasted surfaces, Use of dynamometer, Surface finish measurement tests.

Micro Project/ Research assigmment:

Students will be divided in groups comprising of 4–5 students. Each group will be assigned with a separate research topic related to parametric analysis and optimization of process parameters involved in various advanced manufacturing processes. Students will be required to go through the topics from sources like reference books, journals etc. in the relevant field. Each group will be required to submit a report (and presentation) containing review of literature, summary, gaps in the existing literature, key findings etc.

Course Learning Outcomes (CLO):

The students will be able to:

1. Model the material removal in various modern manufacturing processes
2. Analyze the processes and evaluate the role of each process parameter during machining of various advanced materials.
3. Solve the various problems for the given profiles to be imparted on the work specimens.
4. Select the best process out of the available various advanced manufacturing

processes for the given job assignment.

5. understand requirements to achieve maximum material removal rate and best quality of machined surface while machining various industrial engineering materials.

Recommended Books:

1. *Pandey, P.C. and Shan H.S., Modern Machining Processes, Tata McGraw Hill (2004).*
2. *Mishra, P.K., Non Conventional Machining, Narosa Publications (2006).*
3. *Hofy, H.E., Advanced Manufacturing Process, B and H Publication (1998).*
4. *Jain, V.K., Advanced Machining processes, Allied Publishers Private Limited (2004).*
5. *Ghosh, A. and Mullik, A., Manufacturing Science, East –West private Limited (2010).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1	MST	25
2	EST	40
3	Sessionals (Projects/Tutorials/Quizzes/Lab Evaluations)	35

PPI 204: OPERATIONS MANAGEMENT

L	T	P	Cr
3	1	0	3.5

Course Objectives: The objective of this course is to develop understanding of the strategic role of operations management in creating and enhancing a firm's competitive advantages. This will help to apply key concepts and issues of OM in both manufacturing and service organizations. Further, apply analytical skills and problem-solving tools to the analysis of the operations problems like forecast demand, material requirement planning, inventory etc.

Production Systems: Production/ Operations Management: meaning and scope; significance of operations management in increasing productivity of firms; design of different production systems (project, job shop, batch.

Forecasting Analysis: Need, benefits and applications, cost and accuracy of forecasting, factors affecting demand, types of forecast based on methodology, types of forecast based on time horizon (causal methods, time series and qualitative methods); error analysis in quantitative forecasting.

Aggregate Planning: Need of aggregate production planning, inputs for aggregate plan, Reactive aggregate planning strategies, Aggressive aggregate planning strategies, pure and mixed aggregate planning strategies, level and chase strategies, Graphical method to choose aggregate plan.

Master Production Scheduling and MRP: Functions, planning horizon and planning periods for master production schedule, types of master production schedule; Independent Demand versus dependent demand, Functions of material requirements planning and manufacturing resource planning (MRP I and MRP II), inputs for MRP system, performance characteristics of MRP system (planning lead time, lot sizing rules, safety stocks), materials requirement planning explosion

Inventory Management and Control: Objectives and functions of materials management, inventory: need and types, inventory record systems, inventory costs and order quantities, economic order quantity, economic run length.

Minor Project:
Demand forecasting and error analysis of given product manufactured by identified manufacturer**.**

Course Learning Outcomes (CLO):
The student will be able to:

1. Understand the fundamental theory of operations and production management.
2. Solve various kinds of problems or issue faced by service and manufacturing industries like economic consideration, optimum utilization of resources, productivitysolve various kinds of problems or issue faced by service and manufacturing industries
3. solve various kinds of problems or issue faced by service and manufacturing industries for production planning, inventory management and control.
4. Get the solutions for materials requirement planning

Recommended Books:

1. *Monks, J. G., Operations Management: Theory and Problems, McGraw Hill, New York (1987).*
2. *Krajewski, L. J., Ritzman, L. P. and Malhotra, M. K., Operations Management, Prentice Hall, New Delhi (2009).*
3. *Ebert, J and Adams, D.J., Production/Operations Management, Prentice Hall of India, New Delhi (2007).*
4. *Chase, R. B., Aquilano, N. J. and Jacob, F. R., Production and Operations Management: manufacturing and services, Tata McGraw Hill, New Delhi (1999).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (Assignments/Projects/Quizes/Seminar presentation)	25

PPI 103 : QUALITY ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives: To impart knowledge about the significance of quality and the various tools/ concepts of building quality into products. To learn the techniques used for quality control and quality improvement. To impart knowledge about plans for acceptance sampling and quality systems.

Introduction: Quality - meaning and significance, Essential components of quality, Phases or elements for building quality, Evolution of the concepts of quality, Spiral of progress of quality, Changing scope of quality activities, Ishikawa's seven quality tools, Quality Circles, Quality system economics, Hidden quality costs, Economic models of quality costs.

Taguchi's Quality Loss Function: System approach for quality management, Juran's quality trilogy, Quality planning activities, Sporadic and chronic quality problems, Causes of variation, General quality control methodology.

Statistical Quality Control: Control charts for variables: X bar-R, X bar-S, median, X-MR charts, Control charts for attributes: p, np, c charts, Product reliability, Process capability analysis.

Acceptance Sampling: Plans and tables for attributes and variables, Sampling methods, Type of plans, Operating characteristic curves, Quality improvement methodology, Just-in-time philosophy.

ISO 9000 Philosophy: Documentation, Implementation and certification process.

Course Learning Outcomes (CLO):

The student will be able to:

1. Apply the tools and techniques of quality to resolve industrial engineering issues.
2. Estimate the obvious and hidden quality costs for a given production system.
3. Apply a system based approach for quality management
4. Prepare and analyze various charts/ methods for quality control and improvement.
5. Use plans for sampling and concepts of quality system management.
6.

Recommended Books:

1. *Juran, J.M. and Gryna, F.M, Quality Planning & Analysis, McGraw Hill (2001).*
2. *Grant, E.L., Statistical Quality Control, McGraw Hill (2008).*
3. *Feignbaum, A.V., Total Quality Control, McGraw Hill (1991).*
4. *Juran, J.M., Juran's Quality Control Handbook, McGraw Hill (1988).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Research Assignments//Tutorials/Quizes)	25

PPI: 313 METAL FORMING

L	T	P	Cr
3	1	0	3.5

Course Objectives: To impart knowledge about principles and criteria of yielding during forming of metals, analysis of different bulk metal forming processes following different analysis approach. To understand the process mechanics with role of different controlling process parameters.

Elementary Theory of Plasticity: Stress / strain / strain-rate characteristics, Von-Mises and Tresca Yield Criteria, Levy Mises and Prandtl – Reuss stress-strain relationship, Experimental investigation, Plastic potential theory and plastic work, Kinematically admissible velocity field, Upper bound solution, Slab method, Slip line field theory.

Drawing: Analysis of 2D frictionless drawing, Analysis of wire and sheet drawing process by Slab method, Upper bound and Slip line field theory.

Rolling: Analysis of cold rolling by Slab method, Rolling pressure, torque and power requirements.

Forging: Determination of forces in disc forging considering sticking and slipping, Forging defects.

Extrusion: Analysis of direct cold extrusion process through conical dies by Slab method, Upper bound and Slip line field.

Research Assignment:
Assignment containing the full analysis with appropriate boundary conditions (and coding to solve equations, if needed) for bulk or sheet metal forming processes to obtain the variations of force, torque, power etc. with process parameters. Students may refer recent journal publications to borrow the idea for the problem and analysis approach. Student should submit individual report with derivations of equations and results of parametric analysis.

Course Learning Outcomes (CLO):
The students will be able to:

1. Decide yielding of a material according to different yield theory for a given state of stress,
2. Develop the kinematically admissible velocity field for different forming processes.
3. Analyze the different bulk metal forming process mechanics using different analysis approach and calculate the force, power requirements etc.
4. Evaluate the effect of process parameters on the process mechanics during bulk metal forming.

Recommended Books:

1. *Rowe, G.W., Principles of Industrial Metal Working Process, CBS Publishers (2004).*
2. *Avitzur, B., Metal Forming Analysis, McGraw Hill (1998).*
3. *ASTME, High Velocity Forming of Metals, Prentice Hall (1995).*
4. *Ghosh, A. and Malik, S., Manufacturing Science, Affiliated East-West Press (2001).*
5. *Johnson, W. and Mellore, P.B., Plasticity for Mechanical Engineers, Van Nostrand*

(1995).
6. *Narayan, S.R., Metal Forming Technology, Ahuja Book Publishers (2001).*
7 *Haffmann, O., Introduction to the Theory of Plasticity-Metal Forming Applications, McGraw Hill (1995).*

Evaluation Scheme:

S. No.	Evaluation	Weightage (%)
1	MST	30
2	EST	45
3	Sessional (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

PPI 315:WORK STUDY AND METHOD ENGINEERING

L	T	P	Cr
3	1	0	3.5

Course Objectives: To inculcate specialized knowledge and skill in production process optimization using the principles and methods of engineering analysis and design. To cultivate the ability to build and implement new improved methods resulting in creation and distribution of value in operations. To cultivate work space design capability. To develop the skill in systems integration by fostering the ability to work with inter-disciplinary groups in professional, industry and research organizations.

Introduction to Productivity: Definition of productivity, Productivity and production, Importance and role of productivity, Factors affecting productivity, Industrial productivity

.

Productivity Evaluation, Measurement Approaches: Need for productivity measurement, Productivity measurement approaches, Total and partial productivity, Productivity measurement models and their comparisons, Work study and productivity.

Productivity Improvement, Implementation Factorsand Techniques: Internal and External, Productivity analysis – productivity appraisal, Approaches to productivity analysis, **Strategy** and structure of productivity improvement, Organizational approaches to productivity improvement, Productivity improvement and implementation techniques.

Introduction to Work Study: Definition, Scope, Inter-relation between method study and work measurement, Human aspects, Role in improving plant productivity and safety.

Method Study: Objectives and step-wise procedure for method analysis, Recording & evaluation techniques, Micro-motion and macro motion study, Therbligs and Simo-charts, Principle of motion economy, Normal work areas and design of work places, Principles of work design, Multiple activity chart, Flow process chart, String diagram, Travel charts.

Work Measurement: Work measurement objectives, Techniques & criteria for selection of technique, Stop watch time study, Systems of performance ratings, Calculation of standard time, Introduction to allowances, Production study, Work sampling, MTN & Work Factor system, Standard data usage, Engineered time standard, Predetermined motion time system (PMTS), Job evaluation & merit rating.

Laboratory Work (if any):

Minor Project (if any):
Method Study and Time study of an assembly and a dis-assembly operation.

Course Learning Outcomes (CLO):
The student will be able to:

1. Address issues related to productivity assessment and improvement.
2. Analyse the operations and using systematic approach to improving shop floor operations.

3. Use tools for analysis and design of operations.
4. Determine time standards and conditions of work.
5. Redesign layout of a shop floor.
6. Pre-empt assessment and design of methods of operations.

Recommended Books:

1. *Barnes, R. M., Motion and Time Study: Design and Measurement of work, Wiley, (1980).*
2. *Kanawaty, G., Introduction to Work Study, ILO, Geneva (1992).*
3. *Niebel , Methods Standards Work Design, McGraw-Hill Education, (2000),.*
4. *Meyers, F. E., Stewart, J. R., Motion and Time Study for Lean Manufacturing, Prentice Hall, (2002),*
5. *Freivalds, A., Niebel, B.,Niebel's Methods, Standards, and Work Design, McGraw-Hill Higher Education,* (*2013).*
6. *Mundel, M. E., Motion and Time Study: Principles and Practice, New York: Prentice-Hall, (1950).*
7. *Groover, M. P., Work Systems: The Methods, Measurement and Management of Work, Pearson Prentice Hall, (2007).*
8. *Christopher. W. F., Productivity measurement handbook: how to measure productivity performance for plant operations, administration and services, profit centers and total company, Productivity, Inc., (1985).*
9. *Sumanth, D. J., Productivity engineering and management: productivity measurement, evaluation, planning, and improvement in manufacturing and service organizations, International student edition, McGraw-Hill, (1984).*
10. *Maynard, H. B., Zandin, K., Maynard's Industrial Engineering Handbook, McGraw-Hill Education, (2001).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Assignments/Projects/Tutorials/Quizes/Lab Evaluations)	25

PPI 325 : ADVANCED MATERIALS TECHNOLOGY

L	T	P	Cr
3	1	0	3.5

Course Objectives: To understand the various strengthening mechanisms and also failure mechanisms for alloy systems to achieve enhanced mechanical performance. To gain knowledge with regards to kinetics of phase transformations and their effect on mechanical properties of alloys. To gain knowledge about the characteristics, processing and applications of polymers and composite materials.

Strengthening Mechanisms for Alloys: Strengthening by grain refinement, effect of grain size on various mechanical properties, solid solution strengthening, strain hardening, precipitation hardening mechanisms for alloys, especially steels and aluminium.

Failure Mechanisms: Ductile and brittle fracture, principles of fracture mechanics, impact fracture testing, design for fatigue, stages of fatigue failure, factors affecting fatigue life, generalized creep behaviour.

Phase Transformations in Steels: Kinetics of Phase Transformations, mechanisms of phase transformations, isothermal transformation diagrams, continuous cooling transformation diagrams, influence of alloying elements on these diagrams, heat treatment and surface hardening of steels (plain carbon as well as special purpose steels). Effect of phase transformations on mechanical properties of steels. Hardenability determination in steels. Modeling and simulation tools for analysing phase transformations.

Characteristics, Applications, and Processing of Polymers: Mechanical behaviour of polymers, mechanisms of deformation and for strengthening of polymers, glass transition phenomena in polymers, stress–strain behaviour, fracture of polymers, degradation of polymers.

Characteristics, Applications, and Processing of Composites: Classification of composites, factors affecting properties of composites, polymer-matrix composites, metal-matrix composites, processing methods for composites.

Advanced High Strength Steels for Automotive Applications: Dual Phase (DP) steels, Transformation Induced Plasticity steels (TRIP), Complex Phase (CP) steels, Super Martensitic Stainless Steels (SMSS), Super alloys.

Research Assignments:
Students will be divided in groups comprising of 4–5 students. Each group will be assigned with a separate research topic in the field of materials technology. Students will be required to go through the topics from sources like reference books, journals etc. in the relevant field. Each group will be required to submit a report (and presentation) containing review of literature, summary, major findings and gaps in the existing literature. The topics may include strengthening mechanisms for a given alloy composition, cases of famous engineering disasters reflecting the failure mechanisms involved, kinetics and also mechanisms of phase transformations in steels etc.

Course Learning Outcomes (CLO):

The student will be able to:

1. Select a suitable strengthening mechanism for a given alloy composition and application.
2. Analyze the type of failure and reasons thereof for an alloy system under different loading conditions.
3. Select a suitable heat treatment/ case hardening for a given alloy application.
4. Identify the key characteristics, processing and applications of composites and AHSS.

Recommended Books:

1. *Joachim, R. Harders, S and Baker, M., Mechanical behaviour of engineering materials: metals, ceramics, polymers, and composites, Springer (2007),*
2. *Parton, V.Z., Fracture mechanics: from theory to practice, CRC Press (1992).*
3. *Higgins, R. A., Engineering Metallurgy-Applied Physical Metallurgy, Elsevier (2004).*
4. *Colling, D and Thomas, V., Industrial materials: polymers, ceramics, and composites, Printice-Hall (1995).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessional (may include Research Assignments/ Tutorials/Quizes)	25

PPI 323 : PRODUCT DESIGN AND DEVELOPMENT

L	T	P	Cr
3	1	0	3.5

Course Objectives: To introduce the objectives of product design and the requirements of a good product design. To expose the students to different design principles like designing for function, production, installation and handling, maintenance, packaging etc. To expose them to the latest CAD/CAM/CAE software for different design and development functions.

The Process of Product Design: Design by evolution, Limitations of evolutionary method in modern design situation, Structure of design process, Morphology of design, Specifications and Standards of performance, Environmental factors, Creativity techniques in design problem.

Strategies for Search of Design Concepts: Physical realizability, Economic and financial feasibility, Designing for function, Designing for production, Tolerance analysis, Use, Maintenance, Designing for handling and installing, Economics of design, Human factors in design, Optimization of design, Reverse engineering of ergonomic shape designs,Visual design

Use of CAD / CAM /CAE: Software for concurrent engineering design. Case studies in design of products for manufacture, Aesthetics, Surface styling and shaping tools in modern CAD software, Exercises in design, Reverse engineering and surface design and review software.

Research Assignments:
Students will be divided in groups comprising of 4–5 students. Each group will be assigned with a separate research topic/ case study in the field of product design and development. Students will be required to go through the topics from sources like reference books, journals etc. in the relevant field. Each group will be required to submit a report (and presentation) containing review of literature, summary, major findings and gaps in the existing literature. The topics may include design morphologies for product design, models for physical realizability of design concept, case studies of products comparing products developed through tradition design approach vs those developed through the modern systemic approach.

Course Learning Outcomes (CLO):
The student will be able to:

1. Apply the principles of product design to modify existing engineering systems or to develop new artifacts.
2. Design a system taking into consideration the concepts of ease of production, maintenance, handling, installation etc.
3. Translate the concepts of economics in design, optimization of design and human factors approach to product design.

Recommended Books:

1. *Gupta, V. and Murthy, P.N., Introduction to Engineering Design Method, McGraw Hill (1980).*
2. *Chitale, A. K. and Gupta, R. C., Product Design and Manufacturing, Prentice Hall of India (2004).*

Evaluation Scheme:

S.No.	Evaluation Elements	Weightage (%)
1.	MST	30
2.	EST	45
3.	Sessionals (May include Research Assignments/Tutorials/Quizes/Lab Evaluations)	25