7PIU1: METAL FORMING PROCESSES

B.Tech. (P&I) 7th semester

Unit	Contents	Contact hours
I	**FUNDAMENTALS OF METAL FORMING** Classification of forming processes, Mechanics of metal working, Flow stress determination, Temperature in metal working, strain rate effects, metallurgical structures, deformation zone theory, hydrostatic pressure, residual stresses, Spring back	3
	Review of state of stress – Components of stress, behavior of metal when subjected to stress, Introduction to stress tensor, principal stresses, Stress deviator, Mohr's circle of stress (two dimension and three dimensions), Mohr's circle of strain, von-mises, Tresca yield criteria.	5
II	**FORGING:** Classification, equipment, forging in plain strain, open-die forging, closed-die forging, calculation of forging loads in closed-die forging, forging defects, powder metallurgy forging, residual stresses in forging.	4
	ROLLING: Classification, Rolling mills, hot and cold rolling, rolling of bars and shapes, forces and geometrical relationships, simplified analysis of rolling load: rolling variables, Problems and defects in rolled products, theories of cold and hot rolling, torque and power.	4
III	**EXTRUSION:** Classification of extrusion processes, equipment, hot extrusion, deformation, lubrication and defects in extrusion, analysis of the extrusion process, cold extrusion and cold forming, hydrostatic extrusion, extrusion of tubing, influence of friction, extrusion force calculation, production of seamless pipe and tubing.	4
	DRAWING OF RODS, WIRES AND TUBES; Introduction, rod and wiredrawing, analysis of wiredrawing, tube-drawing processes, analysis of tube drawing, residual stresses in road, wire, and tubes, defects, Tube drawing and sinking processes, Tube bending.	4
IV	**SHEET METAL FORMING:** Classification – conventional and HERF processes – presses – types and selection of Presses, forming limit criteria, Limiting Draw ratio - processes: Deep drawing,	3
	spinning, stretch forming, plate bending, Rubber pad forming, bulging, Explosion forming, electro hydraulic forming, Magnetic pulse forming.	5
V	**RECENT ADVANCES:** Super plastic forming – Electro forming – fine blanking – Hydro forming – Peen forming – LASER Forming –	4
	Micro forming - P/M forging – Isothermal forging – high speed hot forging – near net shape forming, high velocity extrusion – CAD and CAM in forming	4
	TOTAL	40

TEXT BOOK		
1	Rao, P.N. "Manufacturing Technology", Vol 2, 3 TMH Ltd.,	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Nagpal G.R. "Metal forming processes", Khanna publishers.	
2	Serope Kalpakjian, Steven R Schmid, "Manufacturing Process for Engineering Materials" – Pearson Education	
3	Edward M. Mielink, "Metal working science Engineering, McGraw Hill, Inc,.	
4	Metal Hand book Vol.14, "Forming and Forging", Metal Park, Ohio, USA.	
5	Dieter G.E., "Mechanical Metallurgy", McGraw Hill, Co., S.I.	

Course outcome

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

CO1: Distinguish between different metal forming process

CO2: Analyse the parameters involved in Forging ,Rolling, Extrusion and wire drawing

CO3: Evaluate the force estimation for bulk and sheet metal operations

CO4: compare and judge the appropriate forming operation for specific work

CO5: Recognise the Advanced metal forming process such as , Laser forming , micro forming, super plastic forming etc

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1 PSO1	PSO2
CO1	3	2	2	1	2								
CO2	3	3	2	1	2								
CO3	2	3	2	2									
CO4	3	3	2	2									
CO5	3	3	2	2	3								
		Average		2.8	2.8	2.0	1.6	2.3					

7PIU2: OPERATIONS PLANNING AND CONTROL

B.Tech. (P&I) 7th semester

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to operations management (OM), the scope of OM; Historical evolution of OM; Trends in business; the management process. Operations Strategy, Competitiveness and Productivity	3
	Demand Forecasting: components of forecasting demand,Approaches to forecasting: forecasts based on judgment and opinion, Time series data. Associative forecasting techniques, Accuracy and control of forecasts, Selection of forecasting technique.	4
II	Product and Service design, Process selection, Process types, Product and process matrix, Process analysis.	3
	Capacity Planning: Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.	2
III	Planning levels: long range, Intermediate range and Short range planning, Aggregate planning: Objective, Strategies, and techniques of aggregate planning.	4
	Master scheduling; Bill of materials, MRP; inputs processing and outputs, and overview of MRPII , use of MRP to assist in planning capacity requirements, Introduction to ERP	4
IV	Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems.sequencing: priority	4

	rules, sequencing jobs through two work centers, scheduling services	
	Introduction to Just-in-time (JIT) and Lean Operations: JIT production, JIT scheduling, synchronous production, Lean operations system	**4**
V	Supply Chain Management (SCM): Need of SCM, Bullwhip effect, Elements of SCM, Logistics steps in creating effective supply chain, Purchasing and supplied management.	**3**
	Project Management: Nature of projects, project life cycle, Work breakdown structure, PERT and CPM, Time-Cost trade-offs: Crashing.Resource allocation, leveling	**5**
	TOTAL	**40**

TEXT BOOK		
1	Stevenson, Operations Management, Tata McGraw Hill.	2009
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Roberta S. Russell, Bernard W. Taylor, Operations Management, John Wiley & Sons	2010
2	Joseph S. Martinich, Production And Operations Management, John Wiley & Sons	2008
3	S.N. Chary, Production and Operations Management, Tata McGraw Hill	2009
4	Norman Gaither, Greg Frazier, Operations Management, Thomson Learning	2002

Course outcome

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

CO1: Explain operation management & strategies.

CO2: Calculate & analyse forecasting. inventory & supply chain.

CO3: Prepare aggregate plans and capacity plans.

CO4: Compute lot size using MRP and other lot sizing techniques.

CO5: Prepare project networks using PERT and CPM networks.

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1 PSO1	PSO2
CO1	1	1	2										1
CO2	3	2	2			2	2						1
CO3	3	2	2	3	3								1
CO4	3	2	2	2									1
CO5	3	3	2	2	3	2	2	2					1
Average	**2.6**		**2.0**	**2.0**	**2.3**	**3.0**	**2.0**	**2.0**	**2.0**	**1.0**			

7PIU3: ADVANCED MANUFACTURING METHODS

B.Tech. (P&I) 7th semester

UNIT	CONTENTS	CONTACT HOURS
I	Introduction and classification of advanced machining process, consideration in process selection, difference between traditional and non-traditional process, Hybrid process.	3
II	**Abrasive finishing processes**: AFM, MAF (for Plain and cylindrical surfaces).	4
III	**Mechanical advanced machining process**: Introduction, Mechanics of metal removal, process principle, Advantages, disadvantages and applications of AJM,USM,WJC.	5
IV	**Thermo electric advanced machining process**: Introduction, Principle, process parameters,advantages, disadvantages and applications about EDM, EDG,	4
	LBM, PAM, EBM	6
V	**Electrochemical and chemical advanced machining process**: ECM, ECG, ESD, Chemical machining,	5
	Anode shape prediction and tool design for ECM process. Tool (cathode) design for ECM Process.	3
	TOTAL	40

TEXT BOOK		
1	Modern Machining Process, Pandey and Shan, Tata McGraw Hill	1980
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Advance Machining Process, Jain V.K., Allied Publishers Ltd.	2002
2	Non Traditional Manufacturing Process, Gary F. Bevedict, Marcel Dekker Inc New York.	1987
3	Non-Conventional Machining Process, Mishra P.K., Narosa Publishing House	2006
4	Non-Conventional Machining Process, J.A. McGeough	1988
5	Rapid Prototyping: principles and applications, Chee Kai Chua, Kah Fai Leong and Chu Sing Lim,2nd Edition, World Scientific	2003
6	Rapid Prototyping: Theory and Practice, Ali Kamrani, Emad Abouel Nasr and Springer; 1st Edition,	2006

7PIU4: COMPUTER INTEGRATED MANUFACTURING

B.Tech. (P&I) 7th semester

3L+0T

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to CIM:**Overview of Production Systems, the product cycle, Automation in Production Systems, computer's role in manufacturing, sources and types of data used in manufacturing. The Beginning ofCAM: Historical Background,	2
	Introduction to manufacturing System, Classification of manufacturing system, overview of classification scheme, manufacturing progress functions.	3
II	Computer Aided Process Planning (CAPP): Traditional Process Planning,Retrieval process planningsystem, Generative Process Planning, Machinability data systems, computer generated timestandards.	8
III	Group Technology (GT): Introduction, part families, part classification and coding, codingsystem and machining cells. Introduction to Product data Management System (PDM)	4
	Computer Aided Production Management Systems (CAPM): Introduction to computer aided PPC, Introduction tocomputer aided inventory management, manufacturing resource planning (MRPII), computer processmonitoring and shop floor control, and computer process control.	5
IV	Computer Aided Quality Control (CAQ); Computer in quality control, Off-Line and On-Line Quality control, Automated inspection, contact inspection methods, Non contact inspection methods: optical and non opticalcomputer aided testing. Overview of automatic identification methods.	5
	Flexible manufacturing systems (FMS). Types of FMS, Flexibility in manufacturing, FMS components, FMS applications and benefits.	4
V	Product Design and CAD/CAM in the production system: Introductory concepts Product design and CAD, CAM,CAD/CAM and CIM	4
	Collaborative Engineering; Introduction, Faster Designthroughput, Web based design, Changing design approaches, extended enterprises, concurrentengineering, Agile and lean manufacturing.	5
	TOTAL	**40**

TEXT BOOK		
1	Mikell P. Groover, , Automation, Production Systems, and Computer-Integrated Manufacturing, 3rd ed., Pearson/Prentice Hall,	2008
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	James A. Rehg and Henry W. Kraebber, Computer-Integrated Manufacturing, 3rd ed., Pearson/Prentice Hall,	2005
2	Nanua Singh, Systems Approach to Computer-Integrated Design and Manufacturing, John Willey & Sons.	1996
3	Computer Aided Manufacturing, Chang, Wysk and Wang, Pearson Education	2008
4	CAD/CAM: Principles and Applications, P.N. Rao, McGraw Hill	2003
5	Computer Control of Manufacturing Systems,Y. Koren, McGraw Hill	2009
6	Computer aided Manufacturing, Rao, Tiwari and Kundra, Tata McGraw Hill.	2002
7	Computer Numerical Control: Machining and Turning Centres, Quesada and Jeyepoovan, PearsonEducation	2007

Course outcome

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

CO1: Describe the elements of the CIMS

CO2: Explain computer aided process planning

CO3: Discuss and solve the problem in part coding system in GT and PDM

CO4: Explain computerised quality control

CO5: Construct the product design, CAD/CAM in production system and collaborative engineering

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1 PSO1 PSO2
CO1	3	2	1		3							
CO2	3	3	2		3							
CO3	3	3	3		3							
CO4	3	3	3		3							
CO5	3	3	3	1	3	1						
Average	**3.0**	**2.8**	**2.4**	**1.0**	**3.0**	**1.0**						

7PIU5.1: MODELING AND SIMULATION

B.Tech. (P&I) 7th semester
3L+0T

UNIT	CONTENTS	CONTACT HOURS
I	**Physical modeling :** Concept of system and environment, continuous and discrete system, linear and nonlinear system, stochastic activities, static and dynamic models, principles used in modeling, Basic simulation modeling,	4
	Role of simulation in model evaluation and studies, Advantages and Disadvantages of simulation. Modeling of Systems, iconic analog. Mathematical Modeling	4
II	**Computer system simulation:** Technique of simulation, Monte Carlo method, experimental nature of simulation, numerical computation techniques, continuous system models, analog and hybrid simulation, feedback systems,	4
	Buildings simulation models of waiting line system, Job shop, material handling and flexible manufacturing systems	4
III	**Probability concepts in simulation:** Stochastic variables, discrete and continuous probability functions, random numbers, generation of random numbers,	4
	Variance reduction techniques, Determination of the length of simulation runs, Output analysis.	4
IV	**System dynamics modelling:** Identification of problem situation, preparation of causal loop diagrams and flow diagrams, equation writing, level and rate relationship.	5
	Simulation of system dynamics model.	3
V	**Verification and validation:** Design of simulation experiments, validation of experimental models, testing and analysis.	4
	Simulation languages comparison and selection, study of SIMULA, DYNAMO, STELLA, POWERSIM. Simulation softwares.	4
	TOTAL	**40**

TEXT BOOK		
1	Simulation Modeling and Analysis, Law A.M., McGraw Hill.	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
1	Discrete-Event System Simulation, Banks and Carsan, Prentice Hall of India	
2	Simulation Modeling and Analysis with ARENA, Altiok and Melamed, Academic Press	
3	Simulation with ARENA, Keltan, Sadowski and Turrock, McGraw Hill	
4	Simulation Modeling and ARENA, Rossetti and Taha, John Wiley and Sons	
5	Dynamic Systems: Modeling, Analysis and simulation, Finn Hangen, Tapir Academic Press	

7PIU5.2: SUPPLY CHAIN MANAGEMENT

B.Tech. (P&I) 7th semester

3L+0T

Contents	Contact Hours
Introduction to Supply Chain Management: Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing -pricing	7
Designing the supply chain Network: Designing the distribution network – role of distribution – factors influencing distribution – design options – e-business and its impact – distribution networks in practice design in the supply chain – role of network – factors affecting the network design decisions	4
Designing and planning for transportation network: Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs – Tailored transportation.	4
Sourcing & pricing Sourcing – In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment, selection – design collaboration – procurement process – sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contract.	4
Dimensions of Logistics: Introduction, Nature and Concepts, Evolution; Supply Chain Management, Logistical Mission and Objectives; Components and Functions of Logistics Management; Integrated Logistics Management; Key Distribution-Related issues and Challenges and Strategic Logistics Management; Total Cost Analysis and Trade-off	3
Inventory Management: Introduction, Concept, types, Functions; Elements of Inventory Costs; Inventory Management under certainty, Managing Finished Products Inventory under Uncertainty, Strategic Inventory Management Tools and Techniques; Distribution Requirement Planning.	3
Supply Chain Integration: Introduction – push, pull and push–pull systems – push – based supply chains – pull – based supply chain – push-pull supply chain - identifying the appropriate supply chain strategy – implementing a push-pull strategy – demand – driven – strategies – the impact of the internet on supply chain	3
Strategies: distribution strategies – direct shipment – cross docking – trans shipment – centralized versus decentralized control – central versus local facilities.	
Decision-support systems for supply chain management: Introduction – the challenges of modeling – structure of decision support systems – input data – analytical tools – presentation tools – supply chain decision – support systems.	
	40

TEXT BOOK		
1	Donald J Bowersoy & David J Closs, Logistical Management- - TataMcGrawHill	
2	R P Mohanty & S G Deshmukh, Supply Chain Management- Theories & Practice	
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Pub. Year**
1	Sunil Chopra, Supply Chain Management-–Pub: Peter Meindi	
2	Badi N V , Supply chain Management- - Pub : Vrindra Publications (P) Ltd. , Delhi	
3	Sunil Sharma , Supply Chain Management- Concept, Practice & Implementation –- Pub: Oxford Univ. Press	
4	Sople- Logistics Management-Pub.- Pearson edition-2013	
5	Desai K D – Six Sigma, Pub. Himalaya Publishing house	
6	Ray & Ruben- Stores Management, Pub. Himalaya Publishing House	

CO1: **Describe** the basic concepts of operations management and production systems
CO2: **Analyse** and **solve** the problems of production planning, scheduling & control.
CO3: **Understand** the concepts of MRP, JIT and SCM.
CO4: **Solve** the problems using project management & reliability.

Course Outcomes	P01	P02	P03	P04	P05	P06	P07	P08	P09	P10	P11	P12
C01	1	1	2	-	-	-	-	-	-	-	-	-
C02	1	3	3	3	-	-	-	-	-	-	-	-
C03	1	3	3	3	2	-	-	-	-	-	-	-
C04	1	1	2	3	1	-	-	-	-	-	-	-

7PIU5.3: RAPID PROTOTYPING

B.Tech. (P&I) 7th semester
3L+0T

Contents	Contact Hours
Overview of Rapid Product Development (RPD). Product Development Cycle;	**3**
Definition of RPD; Components of RPD. Rapid Prototyping (RP);Principle of RP; Technologies and their classifications;	**4**
Selection of RP process; Issues in RP; Emerging trends.	**4**
Rapid Tooling (RT);Introduction to RT, Indirect RT process-Silicon rubber molding, Epoxy tooling, Spray metal tooling and Investment Casting, Direct RT processes-Laminated Tooling, Powder Metallurgy based technologies, Welding based technologies, Direct pattern making (Quick Cast, Full Mold Casting),	**4**
Emerging Trends in RT, Reverse Engineering: Geometric data acquistion,3D reconstruction, Applications and Case Studies, Engineering applications, Medical applications.	**3**
Processing Polyhedral Data: Polyhedral BRep modeling, STL format, Defects and repair of STL files,	**3**
Overview of the algorithms required for RP&T and Reverse Engineering-slicing, support generation, feature recognisation etc.	**3**
TOTAL	**40**

TEXT BOOK		
1	C.K. Chua , K.F. Leong , C.S. Lim, Rapid Prototyping: Principles And Applications, World Scientific Publishing Co Pte Ltd; 3rd Revised	2008
REFERENCE BOOKS		
SN	**Name of Authors /Books /Publisher**	**Year of Pub.**
2	Ali K. Kamrani , Emad Abouel Nasr,Rapid Prototyping: Theory And Practice (Manufacturing Systems Engineering Series) ,Springer-Verlag New York Inc	2006
3	Stucker, David W. Rosenand Ian Gibson, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, And Direct Digital Manufacturing, Springer New York.	2014
4	Neil Hopkinson , Richard Hague , Philip Dickens, Rapid Manufacturing: An Industrial Revolution For The Digital Age 1st Edition,Wiley New York;	2005
5	Chee Kai Chua, Kah Fai Leong, 3d Printing And Additive Manufacturing: Principles And Applications , Fourth Edition Of Rapid Prototyping, World Scientific Publishing Company;	, 2014

7PIU11: METAL FORMING AND TOOL DESIGN LAB.

B.Tech. (P&I) 7th Semester

SN	NAME OF EXPERIMENT
Perform any ten experiments from the list given below	
1	Study of the effect of clearance and shear angle on the blanking and piercing operations
2	To determine the effect of percentage of reduction and the semi-cone angle of the die on the drawing load.
3	To find the effect of percentage of reduction and the die geometry on extruding force.
4	Experimental determination of wire drawing force for wire drawing operation.
5	Study of the drop forging operation (flowability, forging load etc by plasticine model.
6	To determine roll load in the sheet rolling process.
7	Students will be given at least one practical problem regarding the design and fabrication of Jigs & Fixture or Press tool.
8	Working drawings of the following:- Drilling Jigs (Box type, Leaf type, Indexing type, Trunion type etc.), Milling Fixtures, Grinding fixtures, Assembly and welding fixtures (for automobile components and frames etc.), Drawing Dies, Bending Dies, Compound Dies, Combination Dies & Progressive Dies.
9	Determination of true stress true strain relationship.
10	To mount die assembly on power press and produce the desired blanks.
11	To mount forming die assembly and to form a cup of M S Sheet.
12	Study of sheet gauges and sheet metal working machines and preparing a funnel using shear, circle cutting machine, ending rollers and spot wring machine.
13	Determine the drawing force component during wire drawing operation using wire drawing dynamometer.

7PIU12: CIMS Lab(CAM, IE & SIMULATION Practicals)

B.Tech. (P&I) 7th Semester

SN	NAME OF EXPERIMENT
1	To prepare part programming for plain turning operation.
2	To prepare part program for turning operations using turning cycle.
3	To prepare part program for threading operation.
4	Toprepare part program for gear cutting using mill cycle.
5	To prepare part program for multiple drilling in X and Z axis using drilling cycle.
	Case Study on the following:
1	Work Methods Design
2	Process Control Charts
3	Materials Management
4	Capacity Planning
	Simulation experiments
1	Generate Pseudo Random No. using different Techniques
2	Develop an Analytical Model for a given physical system
3	Develop a Monte-Carlo Simulation Model for a given physical system
4	Find a area of an irregular 2-D shape using Monte-Carlo Simulation
5	Find the effectiveness of simulation on a physical Stochastic System
6	Develop an algorithm for a selected Simulated Study and write the program in a high level language.
7	Modeling of manufacturing system using simulation software such as ARENA

7PIU13: PROJECT STAGE –I

Course outcome

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

CO1: Identify a real life problem or industrial problem.

CO2: Collect and analyse possible solutions, examine technical and economic feasibility of the solution.

CO3: Design promising solution considering environment and sustainability.

CO4: Prepare DPR(Detailed Project Report) and present.

CO5: Grasp the norms for performing in team.

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1
	PSO1	PSO2										
CO1	2	3			1	1	2	1	3	1	2	3
CO2	2	3	3	1	1	1	2	1	3		2	3
CO3	2	3	3	3	2	2	3	1	3		3	3
CO4	2	2	1	1	1			1	2	3	2	3
CO5								1	3	2	1	2
Average	**2.0**	**2.8**	**2.3**	**1.7**	**1.3**	**1.3**	**2.3**	**1.0**	**2.8**	**2.0**	**2.0**	**2.8**

7PIU14: PRACTICAL TRAINING AND INDUSTRIAL VISIT

Course outcome

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

CO1: Explore the recent technological development through visiting the industries

CO2: Discover the various theoretical aspects in real time industrial scenario

CO3: Simulate and practice the concept in real situations

CO4: Collect data and prepare reports on the experiments/field visit

CO5:

CO-PO Mapping

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1
	PSO1	PSO2										
CO1	1	1				1	2		2	3		2
CO2	2	2	1		2	2	1		2	2	2	3
CO3	2	3	2	2	3	1	1	1	2	2	2	2
CO4	2	2	1	3	3	1			2	3	2	2
Average	**1.8**	**2.0**	**1.3**	**2.5**	**2.7**	**1.3**	**1.3**	**1.0**	**2.0**	**2.5**	**2.0**	**2.3**