Ž Š Š J F A F A F Š Š F F F 1. PE301 Manufacturing Technology DCC 4 3 0 2 3 0 15 25 20 40 2. PE303 Production planning and control DCC 4 3 0 2 3 0 15 25 20 40 3. PE305 Metrology and quality assurance DCC 4 3 0 2 3 0 15 25 20 40 4. HU301 Engineering Economics DCC 4 3 0 2 3 0 15 25 20 40 5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 1 5. PE3XX Generic Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25															
1. PE301 Manufacturing Technology DCC 4 3 0 2 3 0 15 25 20 40 2. PE303 Production planning and control DCC 4 3 0 2 3 0 15 25 20 40 3. PE303 Metrology and quality assurance DCC 4 3 0 2 3 0 15 25 20 40 3. PE305 Metrology and quality assurance DCC 4 3 0 2 3 0 15 25 20 40 4. HU301 Engineering Economics HMC 3 3 0 2 3 0 15 25 20 40 5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 2 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25	S. No.	Code	Title	Area	Cr	Г	F	Ъ	ΗT	Hd	CWS	PRS	MTE	ET	PRE
2. PE303 Production planning and control DCC 4 3 0 2 3 0 15 25 20 40 3. PE305 Metrology and quality assurance DCC 4 3 0 2 3 0 15 25 20 40 4. HU301 Engineering Economics HMC 3 3 0 0 3 0 25 0 25 50 5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 $$ 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 $$ 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 $$	1.	PE301	Manufacturing Technology	DCC	4	3	0	2	3	0	15	25	20	40	
3. PE305 Metrology and quality assurance DCC 4 3 0 2 3 0 15 25 20 40 4. HU301 Engineering Economics HMC 3 3 0 0 3 0 25 0 25 50 5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 -	2.	PE303	Production planning and control	DCC	4	3	0	2	3	0	15	25	20	40	
4. HU301 Engineering Economics HMC 3 3 0 0 3 0 25 0 25 50 5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 -	3.	PE305	Metrology and quality assurance	DCC	4	3	0	2	3	0	15	25	20	40	
5. PE3XX Department Elective course I DEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 -	4.	HU301	Engineering Economics	HMC	3	3	0	0	3	0	25	0	25	50	
6. PE3XX Generic Elective course I GEC 4 3 0/1 2/0 3 0 15/25 25/0 20/25 40/50 -	5.	PE3XX	Department Elective course I	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	
	6.	PE3XX	Generic Elective course I	GEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
Total 23			Total		23										

Production and Industrial Engineering III Year: Fifth Semester

III Year: Sixth Semester

S. No.	Code	Title	Area	Cr	L	Т	Р	ΗT	Hd	CWS	PRS	MTE	ET	PRF
1.	PE302	CNC & Robotics Manufacturing	DCC	4	3	0	2	3	0	15	25	20	40	
2.	PE304	Precision manufacturing	DCC	4	3	0	2	3	0	15	25	20	40	
3.	MG302	Fundamentals of management	HMC	3	3	0	0	3	0	25	0	25	50	
4.	PE3XX	Department Elective course 2	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	
5.	PE3XX	Department Elective course 3	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	
6.	PE3XX	Generic Elective course 2	GEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
		Total		23										

BACHELOR OF TECHNOLOGY Production and Industrial Engineering IV Year: Seventh Semester

S. No.	Code	Title	Area	Cr	L	L	Ρ	ΗT	Hd	CWS	PRS	MTF	ET	PRE
1.	PE401	BTECH PROJECT I	DCC	4	-	-	-	-	-	40	-	-	60	
2.	PE403	Internship	DCC	4	-	-	-	-	-	40	-	-	60	-
3.	PE4XX	Department Elective course 4	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
4.	PE4XX	Department Elective course 5	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
5.	PE4XX	Generic Elective course 3	GEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
6.	PE4XX	Indian Knowledge System	VAC	No Credit	-	-								-
		Total		18										

IV Year: Eighth Semester

S. No.	Code	Title	Area	Cr	Г	L	Р	ΤH	Hd	CWS	PRS	MTE	ET	PRE
1.	PE402	BTECH PROJECT II	DCC	8	-	-	-	-	-	80	-	-	120	-
2.	PE4XX	Department Elective course 6	DEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
3.	PE4XX	Generic Elective course 4	GEC	4	3	0/1	2/0	3	0	15/25	25/0	20/25	40/50	-
		Total		16										

S.No.	Subject Code	Subject	Elective No.
1.	PE-307	Advance Machine Design	′
2.	PE-309	Finite Element Method	
3.	PE-311	Rapid Prototyping Tooling & Manufacturing	
4.	PE-313	Sustainable Manufacturing	DEC -1
5.	PE-315	Design Innovation & Manufacturing	
6.	PE-317	Mechatronics	
7.	PE-319	Total Life Cycle Management	
8.	PE-321	Industrial Economics & Management	
9.	PE-306	Value Engineering	
10.	PE-308	Green Energy Technology	
11.	PE-310	Industrial Automation	DEC -2.3
12.	PE-312	Automobile Engg	220 2,0
13.	PE-314	Manufacturing of Composite Materials	
14.	PE-316	Advances in Welding	
15.	PE-318	Advances in Casting]

16.	PE 405	Measurements and Instrumentation	
17.	PE -407	Mechatronics & Control	
18.	PE-409	CNC Machine & Programming	
19.	PE-411	Computer Integrated Design and Manufacturing	
20.	PE-413	Robotics and Automation	
21.	PE-415	Financial Management	DEC 4,5
22.	PE-417	Materials Management	
23.	PE-419	Project Management	
24.	PE-421	Reliability, Maintenance & Safety Engineering	
24.	PE-423	Thermal Spray Technology	
25.	PE-406	Manufacturing & Applications of Polymer Composites	
26.	PE-408	Industrial Tribology	
27.	PE-410	Packaging Technology	
28.	PE-412	Supply Chain Management & Value Engineering	
29.	PE-414	Flexible Manufacturing System	DEC -6
30.	PE-416	Work Study & Ergonomic	
31.	PE-418	Advance Manufacturing Processes	

III Year: Fifth Semester

	ens	CWB INS	CWS FRS MIE	CWS PRS MIE EIE
	15	15 25	15 25 20	15 25 20 40

Objectives: To familiarize students with different manufacturing processes like casting, metal joining and metal deformation so that students can apply their knowledge in relevance to professional practice.

	PE-301 MANUFACTURING TECHNOLOGY	Contact Hours
Unit-1	Casting: Properties of moulding sand, Sand testing, Gating and riser system, Principle, process and applications of Die casting, Centrifugal casting, Investment casting, and Continuous casting, Melting of metal for casting, Casting defects their causes and remedies, Cleaning and Inspection of castings, Foundry mechanization and layout.	8
Unit-2	Welding: Principle, equipment, and applications of Submerged Arc Welding (SAW), Gas Tungsten Arc Welding (GTAW), Gas Metal Arc Welding (GMAW), Plasma Arc Welding (PAW).	8
Unit-3	Ultrasonic Welding, Electron Beam Welding (EBW) and Laser Beam Welding (LBW). Gas cutting and arc cutting of metals, Welding defects their causes and remedies.	8
Unit-4	Metal Forming: Mechanical behaviour of metals in elastic and plastic deformation, stress-strain relationships, Yield criteria, Concept of flow stress by true stress-strain curves.	б
Unit-5	Hot working and Cold working of metals, Analysis of important metal forming processes like Forging, Rolling, Extrusion, Wire Drawing,	6
Unit-6	Sheet metal forming processes. Introduction to High Energy rate forming processes.	6
	Total	42

Ref	Reference Book:										
1	Manufacturing Technology by P.N.Rao, Tata Mc Graw Hill Publications										
2	Manufacturing Processes and Automation by R.S.Parmar, Khanna Publications										
3	Principle of Metal Casting by Heine&Rosenthal,Tata McGraw Hills Publication										
4	Welding Processes Technology by R.S.Parmar, Khanna Publications										
5	WorkshopTechnologyVol.1, by B.S. Raghuwanshi, Dhanpat Rai Publications										

CO1	Understand the basic fundamentals and applications of various casting processes.
CO2	Understand the working principles of various welding processes and selection of appropriate processes /tools/parameters for the various fabrication work.
CO3	Understand the working of various advance welding processes and able to apply the knowledge in relevance to professional practice
CO4	Understand the Mechanical behavior of metals in elastic and plastic deformation and analysis of various metal deformation processes.
CO5	Identification and formulation of various problems in various manufacturing processes.
CO6	Apply concept of manufacturing technology in industrial application.

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	3	2	3	2	3	2	2	-
CO2	3	2	3	2	2	3	2	3	2	2	3	3	3	-	2
CO3	2	3	3	2	3	2	2	2	2	3	2	3	2	-	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	2	-	3
CO5	2	2	3	2	3	2	3	2	2	2	2	2	2	-	3
CO6	3	3	3	2	2	2	2	3	3	2	3	3	2	-	3

	PE 303: Production Planning & Control										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0	2	4	DCC		15	25	20	40	-	

Objective: To enable the students to understand the basics of production planning & control, work measurement systems, quality engineering. To understand reliability and maintenance, material handling systems and plant layout.

Syllabu	s	Contact Hours
Unit-1	Introduction- Production systems and their classifications; JIT manufacturing system, Toyota production systems- KANBAN model, and elimination of waste. Productivity-Total and partial productivity, Reasons and remedy for poor productivity.	7
Unit-2	Job analysis and Work Measurement Systems-Work System Design: Taylor's scientific management, Gilbreth's contributions; method study, micro-motion study, principles of motion economy; work measurement - stop watch time study, micro motion and memo motion, work sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process reengineering.	7
Unit-3	Production Planning and Control-Types and characteristics of production systems Objective and functions of Production, Planning & Control, Routing, Scheduling and Operations scheduling, production scheduling, job shop scheduling problems, sequencing problems, scheduling tools and techniques, Loading, Dispatching and its sheets & Gantt charts.	7
Unit-4	Quality Engineering- Quality concept and costs; statistical quality control, Concept of specification limits, statistical control limits, process capability, Process control and control charts for both attributes and variable data. Acceptance Sampling- Single and double sampling.	7
Unit-5	Reliability and Maintenance- Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; Maintenance management and its objectives, Various types of Maintenance Planning, House Keeping, 5S concepts.	7
Unit-6	Material Handling-Principles, functions, and objectives of Material Handling; Selection and classification of Material Handling Equipments; Relation of material handling with plant layout.	7
	Total	42

Ref	Reference Book:								
1	Industrial Engineering and Management; B. Kumar, Khanna Publication. 9th ed., 2011, ISBN 10-8174091963								
2	Introduction to work Study; Oxford and IBH publishing Co. Pvt. Ltd, New Delhi, Author: National Labour Office, Geneva, 3rd ed., 2008, ISBN 10:8120406028								
3	Industrial Engineering and Management: P. Kumar, Pearson Education, Delhi, ISBN: 9789332543560, 1st ed., 2015								

CO1	Understand the various tools, techniques and methodologies of production planning and control
CO2	Explain the applications of tools, techniques and methodologies of production planning and control
CO3	Solve the simple and complex problems of production planning and control
CO4	Analyze and improve the existing systems
CO5	Design the various aspects of a production system

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	3	3	1	1	1	1	1	1	3	2	2	2
CO2	2	2	2	2	2	1	1	1	1	3	1	2	3	2	2
CO3	3	3	2	3	3	3	3	2	1	1	2	2	3	2	2
CO4	3	3	3	3	3	3	3	2	2	2	3	2	3	3	2
CO5	3	3	3	3	3	3	3	3	3	2	3	3	2	3	3

	PE 305: Metrology & Quality Assurance											
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE		
3	0	2	4	DCC		15	25	20	40	-		

Objectives: To enable the students to understand the basics of metrology, line and end standards, comparators. To understand the concepts of sine bar and measurement of surface texture.

Syllabu	Syllabus						
Unit-1	Principles of measurement: Definition of Metrology, difference between precision and accuracy. Sources of errors: Controllable and Random Errors, Effects of Environment and Temperature, Effects of support, alignment errors, application of Least Square principles, errors in measurement of a quality which is function of other variables. Length Standards: Line standards, end standards and wavelength standards, transfer from line standards to end standards. Numerical based on line standards. Slip gauges, its use and care, methods of building different heights using different sets of slip gauges. Limits, fits and tolerances: Various definitions, IS919-1963, different types of fits and methods to provide these fits. Numerical to calculate the limits, fits and tolerances as per IS 919- 1993. ISO system of limits and fits; Gauges and its types, limit gauges – plug and ring gauges. Gauge Design – Taylor's Principle, wear allowance on gauges. Different methods of giving tolerances on gauges	8					
Unit-2	Comparators: Characteristics, Uses, Limitation, Advantages and Disadvantages. Mechanical Comparators: Johanson Mikrokator and Signma Mechanical Comparator. Mechanical - optical comparator. Electrical and electronic comparators. Pneumatic comparators –Systems of Penumatic gauging: Flow type and back pressure type, different type of sensitivities and overall magnification. Solex Pneumatic gauge and differential comparators.	8					
Unit-3	Angular Measurement: Sine Bar – different types of sine bars, use of sine bars in conjuction with slip gauges, precautions and calibration of sine bars. Use of angle gauges, spirit level, errors in use of sine bars.Principle and working of Micro-optic autocollimator. Circular Division: dividing head and circular tables, circular division by precision Polygons. Caliper Principle, Calibration of polygons. Numerical based on circular division. Straightness and flatness: Definition of Straightness and Flatness error. Determination of straightness error of straight edge with the help of spirit level and auto collimator. Determination of flatness error of a surface plate with the help of spirit level or auto collimator.	8					
Unit-4	Screw Thread Measurement: Errors in threads, Measurement of elements of screw threads – major diameter, minor diameter, pitch, flank angle and effective diameter (Two and three wire methods). Effect of errors in pitch and flank angles and its mathematical derivation. Gear Measurement: Measurement of tooth thickness – Gear tooth vernier caliper, Constant chord method, base tangent method and derivation of mathematical formulae for each method. Test plugs method for checking pitch diameter and tooth spacing. Measurement of Gear Pitch, Parkinson Gear Tester.	6					
Unit-5	Machine Tool Alignment: Machine tool tests and alignment tests on lathe. Alignment tests on milling machine. Alignment tests on a radial drilling machine. Interferometry: Principle of measurement, Interferometry applied to flatness testing, surface contour tests, optical flats, testing of parallelism of a surface with the help of optical flat. Quantitative estimate of error in parallelism, Flatness Interferometer NPL-Gauge length interferometer for checking the error in slip gauges. Numericals based on Interferometry.	6					

Unit-6	Surface texture: Introduction, different types of irregularities, standard measures for assessment and measurement of surface finish.	6
	Total	42

Refe	erence Book:
1	Jain R.K., "Engineering Metrology", Khanna Publishers, ISBN 13: 9788174091536,2009.
2	Gupta I.C., "Engineering Metrology", Dhanpat Rai Publications, Delhi, ISBN: 4567144031, 2012.
3	Galyer F.W. & Shotbolt C.R., "Metrology for Engineers", ISBN: 0792372468, ELBS edition, 2001.
4	Jenkins R., "Fundamentals of Mechanical Inspection", McGraw Hill
5	Dotson C., Harlow R., Thompson R., "Fundamentals of Dimensional Metrology", Thomson Asia Pte Ltd., Singapore , ISBN: 0792372468, 2001.
6	A.S.T.M.E., "Handbook of Industrial Metrology", Prentice Hall, ISBN 10:0070015368, 1968.

CO1	Understanding about Metrology, Principles of measurement, Sources of errors, Length Standards: Line standards, end standards and wavelength Standards, along with Slip gauges, its use and care as well as Limits, fits and tolerances
CO2	To understand the principle, types and application of Comparators along with their Characteristics, Limitation and Advantages & Disadvantages.
CO3	To understand the principle, types and instruments of Angular as well as Straightness and flatness.
CO4	To enable the students to understand about the parameters of Screw Thread and Gears, their Measurements and Errors.
CO5	To understand about various Machine tool tests and Alignment tests on Lathe, Milling machines and Drilling machines. Also about principle of Interferometry and its application in Metrology.
CO6	To understand different types of irregularities, standard measures for assessment and measurement of surface finish.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	2	3	2	3	2	3	2	-	-
CO2	3	2	3	2	2	3	2	3	2	2	3	3	3	-	2
CO3	2	3	3	2	3	2	2	2	2	3	2	3	2	-	2
CO4	3	3	3	3	2	3	3	2	3	2	2	3	2	-	2
CO5	2	2	3	2	3	2	3	2	2	2	2	2	2	-	2
CO6	3	3	3	2	2	2	2	3	3	2	3	3	2	-	2

	HU 301: Engineering Economics										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0	0	3	HMC		25	-	25	50	-	

Syllabu	s	Contact Hours
Unit-1	Introduction: Nature and significance of economics, Goods and Utility, Basic Concept of Demand and Supply, Elasticity of Demand Price elasticity of Demand, Cross elasticity of Demand, Production -Production Function, Production Process and Factors of Production, Market – Introduction to Monopoly, Perfect Competition, Oligopoly and Monopolistic Competition, Cost Concepts- Opportunity Cost, Total Cost, Average Cost; Marginal Cost; Life Cycle cost, Sunk Cost; Preparation of Cost Sheet Profit Maximisation- numerical problem.	10
Unit-2	Money- Its evaluation and function, Bank- Commercial Bank and Central Bank and brief idea about function of banking system: Tax and Subsidy, Type of Tax- Direct and Indirect, Monetary and fiscal policy, Inflation and Business cycle, International trade, terms of Trade, Gain from International Trade, Free Trade vs. Protection, Dumping, Balance of Payment.	10
Unit-3	Role of Science, Engineering and Technology in Economic Development: Seven salient Feature of the Indian Economy; Inclusive Growth; relevance for the Indian Economy; Globalisation & opening up of the Indian Economy; GDP- definition and Its measurement; How knowledge of engineering and technology may be used to improve life at slum; Green Revolution and White revolution. Reasons for their success and can we replicate them. Appropriate Technology & Sustainable Development. Entrepreneurship: Macro environment for promotion of entrepreneurship: How environment has changed after advent of IT and Globalisation.	12
Unit-4	Elementary Economic Analysis: Interest formulas and their Applications; Calculations of economic equivalence, Bases for Comparison of Alternatives: Present Worth Method, Future worth method, Annual equivalent, Internal Rate of Return; Business Risk; Factors which should be taken care while deciding price of the product in the market.	10
	Total	42

Ref	erence Book:
1	G.J. Thuesen, & W.J. Fabrycky, Engineering Economy, Pearson Education, 2007, ISBN 013028128X
2	William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, Engineering Economy, PrenticeHall, (First Indian reprint). 2009, ISBN 0131486497
3	Donald G. Newman, Jerome P. Lavelle & Ted G. Eschenbach, Engineering EconomicAnalysis, Oxford University Press, USA, 2004, ISBN 0195168070
4	Seema Singh, Economics for Engineering Students, IK International Publishing House Pvt. Ltd, 2014, ISBN 8190777041

Course	e Outcomes
CO1	To understand the basic concept of demand and supply, different cost conceps and preparation of cost sheet
CO2	To understand the concept of money, , bank and taxation.
CO3	To understand Monetary and fiscal policy, tradings and dumping concepts
CO4	To knoew the Role of Science, Engineering and Technology in Economic Development in indian economy
CO5	To understand about GDP, GREEN & WHITE revolution.
CO6	To analyze the data to calculate risk, important factor by different methods of economics

CO-PO/PSO Matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2
CO6	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1

				PI	E302: CNC & Robotics Manufa	cturing				
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0	2	4	DEC/GEC		15	25	20	40	-

Objectives: To enable the students to understand the basics of welding, classification of welding and welding processes. To understand the concepts of welding metallurgy and recent trends in welding.

	PE302: CNC & Robotics Manufacturing	Contact Hours
Unit-1	Concepts and features of NC systems – Classification of NC systems - Design considerations of NC machine tools - Constructional features of CNC machine tools	6
Unit-2	Functions of MCU. Machining center - Turning center - CNC EDM, Ball screws, Bearings, Centralized lubrication systems. Manual part programming - Preparatory, Miscellaneous functions	6
Unit-3	Sinumeric, Fanuc controls – Computer aided part programming – Post processors - APT programming-CNC programming based on CAD Feedback devices.	8
Unit-4	Robotics: Introduction to robots. Types and generations of Robots, Classification of Robots. Structure and operation of Robot, Robot applications in manufacturing industries. Robot languages and programming methods. Introduction to Artificial Intelligence for Intelligent manufacturing.	8
Unit-5	Controlling the Robot systems: Introduction to drives, Mechanical, Hydraulic, Pneumatic, electric drives, feedback control	8
Unit-6	Sensing system for a robot: Introduction, types of sensors, machine vision, Artificial intelligence, Control techniques.	6
	Total	42

Ref	erence Book:
1	Koren, Y. "Computer Control of Manufacturing Systems", McGraw Hill Book co. New Delhi, 1986. ISBN-10 0070607435
2	Kundra T. K., Rao P. N., and Tiwari N. K., "CNC and Computer Aided Manufacturing", Tata McGraw Hill, New Delhi, 1991. 3.Fitzpatric, M. "Machining And CNC Technology", McGraw-Hill College, 2004, ISBN 10: 0074631039
3	Radhakrishnan P., "Computer Numerical Control Machines", New Central Book Agency, Calcutta, 1992 ISBN-10 8122433979
4	Introduction to Robotics: Mechanics and Control, John j Craig, Pearson education, ISBN- 0201543613, 2005.
5	Robotics for Engineers, Y.Koren, McGraw Hill Publications, ISBN- 0070353999, 1985.

CO1	To understand the knowledge about NC and CNC systems and its classification.
CO2	To analyze the machine elements of NC and CNC systems.
CO3	To explain computer based integration between various functions in manufacturing.
CO4	To make the students understand different types of configurations in robots.
CO5	To understand the importance of robotics manufacturing and their applications.
CO6	Application of robotics manufacturing in industries.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	2	1	1	1	1	2	2	1	3
CO2	3	3	2	2	2	2	2	1	1	1	1	3	3	2	2
CO3	3	3	3	2	2	2	1	1	1	1	1	2	2	1	3
CO4	3	3	3	3	2	2	2	1	1	1	1	2	3	1	2
CO5	3	3	3	3	3	2	2	1	1	1	1	3	3	2	3
CO6	3	3	3	3	3	2	2	2	1	1	1	2	3	2	3

	PE 304: Precision Manufacturing											
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE		
3	0	2	4	DCC		15	25	20	40	-		

Objectives: To enable the students to understand the basics of precision engineering, precision machine elements and precision manufacturing. To understand the fundamentals of energy assisted processes and surface texture.

	Syllabus	Contact Hours
Unit-1	PRECISION ENGINEERING -Introduction – Precision, Accuracy & Smoothness – Need – Development of overall machining precision Classes of achievable machining Accuracy-Precisionmachining-High precision Machining-Ultra precision Machining-application of precision machining- Materials for tools and machine elements – carbides –ceramic, CBN & diamond-Tool and work material compatibility.	8
Unit-2	PRECISION MACHINE ELEMENT- Introduction – Guide ways – Drive systems – Spindledrive – preferred numbers - Rolling 83 elements – hydrodynamic & hydrostatic bearings –Hybridfluidbearings-Aerostatic and aero dynamic bearings-Hybrid gas bearings-materials for bearings.	8
Unit-3	ERROR CONTROL- Error – Sources – Static stiffness – Variation of the cutting force – total compliance – Different machining methods – Thermal effects – heat source – heat dissipation – Stabilization –decreasing thermal effects – forced vibration on accuracy – clamping & setting errors – Control – errors due to locations – principle of constant location surfaces.	8
Unit-4	PRECISION MANUFACTURING-Micro machining processes-diamond machining - micro engraving - Micro replication techniques-forming casting-injection moulding - micro embossing	6
Unit-5	Energy assisted processes - LBM, EBM, FIB, Micro electro discharge machining photolithography-LIGA process- Silicon micro machining-Wet and dry etching-thin film deposition.	6
Unit-6	MEMS Introduction – MEMS –characteristics- principle – Design –Application: automobile, defence, health care, Industrial, aerospace etc.,	6
	Total	42

Ref	Reference Book:								
1	Venkatesh V.C. and Izman S., "Precision Engineering", Tata McGraw Hill, ISBN:9780070620902, 2007.								
2	Murthy R.L., "Precision Engineering", New Age International, ISBN: 9788122407501, 2009.								
3	Nakazawa H., "Principles of Precision Engineering", Oxford University Press, ISBN 10: 0198562667 1994.								
4	Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.								

CO1	To equip students with fundamental theories and technologies for precision machining and its classification.
CO2	To comprehend materials for precision machining tools and precision machine elements with applications in precision machining.
CO3	To Identify and design key machine elements which constitute a precision machine tool.
CO4	To study error control, tolerance allocation and analysis for precision machine design.
CO5	To study the working principle of micro machining processes, micro fabrication processes and micro replication techniques.
CO6	To overview of MEMS (Micro electro Mechanical System) with various fabrication techniques and to introduce the various opportunities in the emerging field of MEMS.

	0.1 - 10 0														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	2	2	1	2	3	1	2	3	1	2	1
CO2	1	2	2	1	2	1	3	1	2	2	3	1	2	1	1
CO3	3	1	2	1	1	3	1	2	1	3	1	2	2	1	2
CO4	1	2	3	2	1	2	3	2	2	1	1	3	3	2	1
CO5	2	1	1	2	1	2	1	2	1	3	3	1	3	3	2
CO6	1	2	3	3	2	1	2	1	1	2	3	2	3	2	3

	MG302: Fundamentals of Management												
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE			
3	0	0	3	HMC		25	-	25	50	-			

Objective: The basic objective of this paper is to acquaint the students with the basic concepts of management necessary to deal with emerging business environment besides sensitizing them about societal challenges.

Syllabu	s	Contact Hours
Unit-1	Definition of management, importance of management, management principles, managerial roles, managerial ethos, management vs administration, managerial functions, task and responsibilities, organizational structure, motivation: meaning, theories and techniques.	7
Unit-2	Concept of business environment, corporate social responsibility and corporate governance, managerial values and ethics.	7
Unit-3	Objectives and importance of financial management, basics of capital budgeting, cost of capital, emerging sources of funds for new projects, introduction to stock market.	6
Unit-4	Functions of marketing, marketing Vs sales, interface of marketing with other departments, customer life time value, new product development, unethical issues in marketing.	6
Unit-5	Introduction to knowledge management, knowledge society, knowledge economy, building knowledge assets, sources of knowledge, technology innovation process, E-governance: definition, objectives and significance; challenges in Indian context, Digital India programme.	5
	Total	32

Ref	erence Book:
1	Fundamental of Management, Stephen P. Robbins, David A. De Cenzo and Mary Coulter, Pearson Education, 2011(ISBN:9780273755869)
2	Financial Accounting, 4 ed, S.N. Maheshwari and S.K. Maheshwari, Vikas Pulication, 2005 (ISBN: 8125918523)
3	Management, James A F Stonner, Pearson Education, 2010(ISBN: 9788131707043)
4	Marketing Management, 14th ed., Philip Kotler, Kevin Lane Keller, Abraham Koshy and MithileswarJha, Pearson Education, 2013 (ISBN: 9788131767160)
5	Knowledge Management in Organizations: A Critical Introduction, Donald Hislop, Oxford University Press, 2013 ISBN: 9780199691937.

Course Outcomes

CO1	To understand the basics of management, its principles and its importance
CO2	To understand basic environment ,CSR,ethics and corporate governence
CO3	To know about financial management, stock market and capital budgeting
CO4	To understand knowledge management and technology.
CO5	To know about marketing, its ethics and its its interface with other departments.
CO6	To understand e governance and digital india programmes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2
CO6	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1

	PE-307: Advance Machine Design										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	_	

Objective: To understand the fundamentals of systematic engineering design process including, problem definition, information collection, concept generation & selection, and design configuration to design of mechanical systems and elements.

		-
Syllabus		Contact
-		Hours
Unit-1	Design of Friction clutches, uniform wear, and uniform pressure assumptions, centrifugal clutches. Brakes: Design of internal expansion elements, assumptions, design of external contraction elements, Band brakes.	8
Unit-2	Bearings and Lubrication: Types of Lubrication, viscosity, journal bearing with perfect lubrication, hydrostatic and hydrodynamic lubrication theory, journal bearing design. Selection and applications of rolling element bearings with axial and radial loads, bearing materials, bearing seals, mounting of bearings.	6
Unit-3	Mechanical drives: selection of transmission, Belt and Chain drives: Flat belts, V Belts, Roller chains.	6
Unit-4	Design of Gears: Helical, Bevel, and Worm gears, design stresses, stress concentration, overload factors, velocity factors, bending strength of gear tooth, Buckingham equation for dynamic loads, and wear characteristics, AGMA design equations, Design of an automobile gear box.	8
Unit-5	Hoisting elements: Theory of curved beams, Crane hooks, Snatch block assembly elements.	8
Unit-6	Design of Engine parts: Connecting rod, crank shaft, piston	6
	Total	42

Ref	erence Books:
1	Shigley, J. E., Mischke, C. R. and Budynas, R. G., Mechanical Engineering Design, McGraw Hill, ISBN 10: 0071232702, 7th Edition, International, 2004
2	Juvinall, R. C., and Marshek, K. M., John, Fundamental of Machine Component Design, Wiley and Sons, ISBN 10: 0471244481, 2000.
3	Hamrock, B. J., Jacobson, B. Schmidt, S. R., Fundamentals of Machine Elements, McGraw Hill, ISBN 10:0072465328, 1999
4	Norton, R. L., Machine Design: An Integrated Approach, Pearson Education, ISBN 10:8131705331, Indian Reprint-2001.
5	Aggarwal D.K and Sharma P.C, Machine Design, ISBN:8185749094, S.K Kataria & Sons, 1997.
6.	

CO1 To understand friction clutches, uniform wear, and uniform pressure. CO2 To analyze fundamentals of bearings and Lubrication. CO3 To Explain the mechanical drives.	
CO2 To analyze fundamentals of bearings and Lubrication. CO3 To Explain the mechanical drives.	
CO2 To analyze fundamentals of bearings and Lubrication. CO3 To Explain the mechanical drives.	
CO2 To analyze fundamentals of bearings and Lubrication. CO3 To Explain the mechanical drives.	
CO2 To analyze fundamentals of bearings and Eubrication. CO3 To Explain the mechanical drives.	
CO3 To Explain the mechanical drives.	
CO3 To Explain the mechanical drives.	
CO3 To Explain the mechanical drives.	
I I I I I I I I I I I I I I I I I I I	
CO4 To discuss the Theory of curved beams and Crane books	
10 discuss the Theory of curved ocality and crane hooks	
CO5 To diamon different stores in the design of Engine parts	
COS 10 discuss different stages in the design of Engine parts.	
CO6 To apply knowledge of machine design in various case studies	
To upply his wedge of machine design in various case stations.	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-309: Finite Element Method									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To familiarize the students with basics of FEM, formulation of stiffness, load matrix and solution of bar, truss, beam, frames two-dimensional plane problems axisymmetric solids, numerical integration, three dimensional solids, dynamic problem, heat transfer and fluid problems. To impart in-depth knowledge of software MATLAB, ABAQUS & ANSIS to solve real life application

Syllabus		Contact Hours
Unit-1	Fundamental concepts of the Finite Element Method. One Dimensional Problem (Bar of uniform and variable cross sections), The Galerkin Approach, The potential –Energy Approach, shape Functions, Derivation of stiffness matrix and load vector for the element and for the entire domain. Evaluation of displacement, stresses and reaction forces.	8
Unit-2	Matrix and Stress calculations	6
Unit-3	Beam Elements-Analysis of Beams and Frames: Beam elements, Reduced integration, Elements based on Bernoulli and Timoshenko theory of beams Two –Dimensional problem using Constant strain triangles (CST), Two dimensional isoparametric elements and numerical integration, element stiffness matrix, Force vector.	8
Unit-4	Heat Transfer <i>and</i> Fluid Flow: Steady state heat transfer, heat conduction governing equation, boundary conditions, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, Basic differential equation for fluid flow in pipes and around solid bodies.	8
Unit-5	Dynamic analysis: Element mass matrices, Evaluation of Eigenvalues and Eigenvectors.	6
Unit-6	Electromagnetic simulation using FEM. Application of finite element method to electrical systems. Use of Softwares such as MAT LAB/ABAQUS/ANSYS/ NASTRAN/IDEAS. Basic feature of these softwares.	6
	Total	42

Ref	erence Books:
1	Finite Element Procedures, K.J. Bathe, Prentice Hall of India.
2	Finite Elements in Engineering by Chandrupatla and Belegundu.
3	Finite element Method by J.N.Reddy.
4	Finite element Method, O.C. Zienkiewicz& R.A. Taylor
5	Finite element Analysis, C.S. Krishnamurthy
6.	Finite element Method, Kenneth H. Hubener
7	Finite Element Method, Desai & Abel

CO1	Apply and understand the basic concepts of Finite element analysis procedure.
CO2	Apply the knowledge of mathematics and engineering in solving the problems related to structural and
	heat transfer
CO3	Application of finite element method to electrical systems.
CO4	Use of Galerkin Approach, The potential – Energy Approach, shape Functions
CO5	Able to learn Two dimensional isoparametric elements and numerical integration
CO6	Use the commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life
	structural problems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-311: Rapid Prototyping Tooling & Manufacturing									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	_

Objective: To study topics fundamental to rapid prototyping and automated fabrication, including the generation of suitable CAD models, current rapid prototyping fabrication technologies

Syllabus		Contact Hours
Unit-1	Introduction: Historical developments, Fundamentals of RP Systems and its Classification, Rapid prototyping process chains, 3D modelling and mesh generation, Data conversion and transmission.	8
Unit-2	RP Systems: Liquid polymer based rapid prototyping systems, Teijin Seikis' solid form and other similar commercial RP systems, Solid input materials based rapid prototyping systems, laminated object manufacturing (LOM) and fused deposition modelling systems etc.,	8
Unit-3	. Power based rapid prototyping systems, selective Laser sintering, Soligen Diren's shell production casting (DSPC), Fraunhofer's multiphase jet solidification (MJS) and MIT's 3D printing (3DP)	8
Unit-4	RP Database: Rapid prototyping data formats, STL format, STL file problems, STL file repair, Network based operations, Digital inspection, Data warehousing and learning from process data	6
Unit-5	RP App Applications: Development of dies for moulding, RP applications in developing prototypes of products,	6
Unit-6	Application in medical fields, Development of bone replacements and tissues, etc., RP materials and their biolological acceptability.	6
	Total	42

Ref	erence Books:
1	Hamblen James O, Rapid Prototyping of Digital Systems: A Tutorial Approach, KLUWER Academic Publisher, ISBN : 0-89512-203-0, 2001.
2	Chua Chee Kai, Rapid Prototyping: Principles And Applications, World Scientific Publishing Company, ISBN 10:9812778985,2005.
3	Cofer R.C., Rapid System Prototyping With Fpgas: Accelerating The Design Process, ISBN:9780750678667,2005
4	Hamblen James O, Rapid Prototyping of Digital Systems, Springer International Publication, ISBN: 978-0-306-47051-6,2002.

	-
CO1	To define and recognize the importance of CAD and CAM, engineering product specification and
	interpreting geometric specifications
	merprening geometrie specifications.
CO2	To analyze and improve knowledge on the integration of CAD and CAM.
CO3	To exhibit competency in rapid prototyping using software packages.
000	To endow competency in tuple processing source pretages.
CO4	To describe the implementation of RP Systems in manufacturing processes.
005	
CO5	To apply RP database to manufacture industrial components.
000	
CO6	To implement and understand the application of RP system in various aspects of Manufacturing.
L	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-313: Sustainable Manufacturing									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	_

Objective: Students will learn to anticipate the implications of decisions and to evaluate options in a global context that minimizes the impact of manufacturing activities on people, the environment, and resources, while understanding the underlying economics of producing goods

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Syllabus		Contact
v		Hours
Unit-1	Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Sustainable Product Development – Various Phases.	8
Unit-2	Tools and Techniques – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly.	8
Unit-3	EIA Methods –CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters.	8
Unit-4	Design for recycling – Eco friendly product design methods – Methods to infuse sustainability in early product design phases.	6
Unit 5	Sustainability Assessment – Concept Models and Various Approaches	
Unit-5	Sustainuonity rissossinont – Concept models and Various ripproaches,	6
Unit-6	Product Sustainability and Risk/Benefit assessment–Corporate Social Responsibility	
		6
	Total	42

Ref	erence Books:
1	Atkinson G., Dietz S., Neumayer E., —Handbook of Sustainable Manufacturing. Edward Elgar Publishing Limited, ISBN: 9781848444720, 2007.
2	Rodick D., Industrial Development for the 21st Century: Sustainable Development Perspectives, UN New York, ISBN: 9211045649, 2007.
3	Lawn P., Sustainable Development Indicators in Ecological Economics, Edward Elgar Publishing Limited, ISBN 10:1-84542-099-3,2006.
4	Asefa S., The Economics of Sustainable Development, W.E. Upjohn Institute for Employment Research, ISBN 10:0-88099-321-9, 2005.

CO1	Understand the global energy scenario, the need for sustainability, and the role of sustainable energy technologies.
CO2	Analyze the principles and applications of renewable energy systems, including solar, wind, and biomass.
CO3	Evaluate advanced energy storage solutions for enhancing Sustainable manufacturing.
CO4	Design hybrid energy systems and assess their technical, economic, and environmental viability for Sustainable manufacturing.
CO5	Explore emerging trends in smart grids, AI-based energy management, and energy policy frameworks for Sustainable manufacturing.
CO6	Applications of Sustainable Energy Technologies for Sustainable manufacturing

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-315: Design Innovation & Manufacturing									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	_

Objective: To familiarize the students with the process of design and analysis of engineering systems and to enhance critical thinking and prepare him for facing design challenges. To comprehend the design of a variety of tools used in practical applications.

Syllabus		Contact Hours
Unit-1	Identification of engineering solution parameters for mechanical components like materials, manufacturing and configuration variables.	8
Unit-2	Modern techniques for design of the components and improvement of existing designs.	6
Unit-3	Open ended design problems for generating innovative designs/ solutions.	6
Unit-4	Mechanical Engineering 123 engineering problem solving, design with other life-cycle considerations in mind such as manufacturing, maintenance and environmental considerations.	8
Unit-5	Product IPR and Patents Introduction to IPR: Overview & Importance; IPR in India and IPR abroad; Patents; their definition; granting; infringement; searching & filing; Utility Models an introduction; Copyrights; their definition; granting; infringement; searching & filing, distinction between related and copy rights; Trademarks, role in commerce, importance, protection, registration; domain names.	8
Unit-6	Industrial Designs; Design Patents; scope; protection; filing infringement; difference between Designs & Patents' Geographical indications legal issues, enforcement; Case studies in IPR.	6
	Total	42

Ref	Reference Books:						
1	J L Yowell and D W Carlson, Eds., Introductory Engineering Design: A Projects Based Approach, Third Edition						
	2011,						
2	A H Burr and J B Cheatham, Mechanical Analysis and Design, 2nd Ed., Prentice Hall 1997, ISBN:						
	9780023172656						
3	J R Dixon, Design Engineering: Inventiveness, Analysis and Decision Making, TMH, New Delhi 1980, ISBN:						
	978-0824701611						
4	Rao P.N, Manufacturing Technology; Metal cutting and Machine tools' Published by Tata McGraw Hill						
	Publishing company Limited; [ISBN 13: 9780-07-0087699] [ISBN 10: 0-07-0087695]						

CO1	To define and understand suitable materials for various design the components/machine elements
CO2	To understand and estimate allowable loads in machine elements using failure theories
CO3	To analyze steady and variable stresses induced in machine elements for different applications
CO4	To describe product IPR and patent for specific applications
CO5	To understand the difference between Designs & Patents
CO6	To design Mechanical components for specific applications

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-317: Mechatronics									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: Have a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.

		<i>a</i> .
Syllabus		Contac
		l Hours
Unit-1	Introduction: Basic Definitions and key elements of Mechatronics, Mechatronic Design Approach: Functions of Mechatronic Systems, Ways of Integration, Information Processing Systems (BasicArchitecture and hardware and Software trade-offs, Concurrent Design Procedure for Mechatronic Systems	8
Unit-2	System Interfacing, Instrumentation, and Control Systems: Input and output Signals of a Mechatronic System, Signal Conditioning and microprocessor control, Microprocessor-Based Controllers and Microelectronics, Programmable Logic Controllers	6
Unit-3	Introduction to Micro- and Nanotechnology, Micro-actuators, Micro-sensors, Nanomachines. Modeling Electromechanical Systems: Models for Electromechanical Systems, Rigid Body Models, Basic Equations of Dynamics of Rigid Bodies, Simple Dynamic Models, Elastic System Modeling, Dynamic Principles for Electric and Magnetic Circuits, Earnshaw's Theorem and Electromechanical Stability	6
Unit-4	The Physical Basis of Analogies in Physical System Models: The Force-Current Analogy: Across and Through Variables, Maxwell's Force-Voltage Analogy:Effort and Flow Variables, A Thermodynamic Basis for Analogies;	8
Unit-5	Introduction to Sensors and Actuators: Characteristics of Sensor and Actuator Time and Frequency Measurement, The Role of Controls an modelling in Mechatronics: Integrated Modeling, Design, and Control Implementation, Special Requirements of Mechatronics that Differentiate from Classic Systems and Control Design, Modeling as Part of the Design Process, Modeling of Systems and Signals	8
Unit-6	Design Optimization of Mechatronic Systems: Optimization Methods, Principles of Optimization : ParametricOptimization, General Aspects of the OptimizationProcess, Types of Optimization Methods, Selection of aSuitable Optimization Method, Optimum Design of Induction Motor (IM), IM Design Introduction : Classical IM Design, Use of a Neuron Network for the Identification of the Parameters of a Mechanical dynamic system, Mechatronics and Computer Modelingand Simulation, Mechatronics and the Real-Time useof Computers, Communications andComputer Networks,Control withEmbedded Computersand ProgrammableLogic Controllers,	6
	Total	42

Ref	erence Books:
1	Alciatore David G., Introduction to Mechatronics and Measurement systems (special Indian edition), Tata- McGraw Hill India Ltd, ISBN 10:0-07-064814-X,
2	Mahalik N.P., Mechatronics: Principles, Concepts and applications, Tata-McGraw Hill India Ltd, ISBN978-81-265-1048-1,2003.
3	Onwubolu C.G, Mechatronics: Principles and applications, Elsevier India Pvt Ltd, ISBN: 9788131205235, 2006.
4	Hindustan Machine Tools Ltd., Mechatronics & Machine Tools, McGraw-Hill Ltd, ISBN 10: 0071346341, 1998.
5	Bolton W., Mechatronics: Electronic Control systems in Mechanical and Electrical Engineering. 3/e, Pearson Education, ISBN: 8177582844, 2007.
6.	Necsulescu Dan, "Mechatronics", Pearson Education Asia, ISBN: 9788177585407, 2002(Indian reprint).

CO1	Students will be able to know the basics, details and components of Mechatronic Systems.
CO2	Students will be able to know the principle of Sensors & Transducers and
	Pneumatic/Hydraulic/Mechanical/Electrical Actuation Systems.
CO3	Students will be able to understand the System Modelling, Analysis and Simulation of dynamic systems
	using Mechanical/Electrical/Thermal system building blocks.
CO4	Students will be able to know the various Feedback systems: PID controllers and phase lag and phase lead
	compensation.
CO5	Students will be able to understand the DA/AD converters, microprocessors, interfacing with computers,
CO6	Students will be able to know the Digital logic: Analysis and synthesis of mechatronic systems with
	application to robotics, CNC systems and others Advanced Applications in Mechatronics.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE319: Total Life cycle Management										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0/1	2/0	4	DEC/GEC		15/25	25	20/25	40/50	-	

Objective: To enable the students to understand the Concurrent Engineering, Quality function deployment and Rapid prototyping. To understand concept of stages of design of products, product lifecycle and components of PLM.

Syllabu	S	Contact Hours
Unit-1	Introduction: Extensive definition of Concurrent Engineering (CE), CE design methodologies, Review of CE techniques like DFM (Design for manufacture), DFA (Design for assembly),	8
Unit-2	Quality function deployment (QFD), RP (Rapid prototyping), TD (Total design), for integrating these technologies, Organizing for CE, CE tool box, Collaborative product development	8
Unit-3	Use of Information Technology: IT support, Solid modeling, Product data management, Collaborative product Commerce, Artificial Intelligence, expert systems, Software hardware component design.	6
Unit-4	Design Stage: Lifecycle design of products, Opportunities for manufacturing enterprises, Modality of concurrent engineering design, automated analysis, Idealization control, CE in optimal structural design, Real time constraints	6
Unit-5	Need for PLM: Importance of PLM, Implementing PLM, Responsibility for PLM, Benefits to different managers, Components of PLM, Emergence of PLM, Lifecycle problems to resolve, Opportunities to Seize	6
Unit-6	Components of PLM: Components of PLM, Product lifecycle activities, Product organizational structure, Human resources in product lifecycle, Methods, techniques, Practices, Methodologies, Processes, System components in lifecycle, slicing and dicing the systems, Interfaces, Information, Standards	8
	Total	42

Ref	erence Book:
1	Integrated Product Development M.M. Anderson and L Hein IFS Publications
2	Design for Concurrent Engineering J. Cleetus CE Research Centre, Morgantown
3	Concurrent Engineering Fundamentals: Integrated Product Development Prasad Prentice hall India
4	Concurrent Engineering in Product Design and Development I Moustapha New Age International
5	Product Lifecycle Management John Stark Springer-Verlag, UK
6	Product Lifecycle Management Michael Grieves McGraw Hill
7	Concurrent Engineering: Automation tools and Technology Andrew Kusiak Wiley Eastern

CO1	Explain basic concepts of product life cycle management.
CO2	Demonstrate product development approaches.
CO3	Explain elements of product modelling.
CO4	Discuss in detail the concept of product data management.
CO5	Discuss about integration of PLM with other applications.
CO6	Applications of Total Lifecycle Management

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2
CO6	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1

Course code: Course Title	Cour	se Struc	ture	Pre-Requisite		
PE-321: Industrial	L	Т	Р	NII		
Economics & Management	3	0	2			

Course Objective: To familiarize the students with the basic concepts of industrial economics, policies, cost estimation. To impart knowledge about fiscal policies, inflations and study for improvement unemployment.

S. No.	PE321: Industrial Economics & Management		Contact Hours				
Unit 1	Introduction to Industrial Economics, Scope of Economics, Microeconomi its importance and limitations, Macroeconomics and its Importan microeconomics Policies, Difference between Micro economics	cs and ce of and	8				
	Macroeconomics Law of Demand and determinants of Demand, Exception of of Demand, Elasticity of Demand, Variation in Price Elasticity of Demand Elasticity, Income Elasticity and Cross-price Elasticity, Law of Suppl determinant of Supply, Indifference Curve	of Law , Price ly and					
Unit 2	Theory of Production and Concept of Production Function, Law of Variable	;					
	Proportion and, Law of Returns, Introduction to Cost Estimation, Various types of Costs, Opportunity Cost, Short-run and long-run costs, Elements of Cost: Direct						
I	and Indirect Cost, Break-Even Analysis and its terminology,						
Characteristics, Monopoly and its Characteristics, Monopolistic Competition and its characteristics, Oligopoly and its Characteristics, Type of Money, Fiscal Policy Monetary Policy and its working							
Unit 4	4 Introduction to National Income and its Measurement, National Income,						
	Domestic Product, and Expenditure, Gross National Income, National Income at						
Current and Constant Price, Stock and flow concept, Gross Domestic Product, Gross National Product and Net National Product Personal and Disposable							
Incomes, Inflation and Its Measurement, CPI and RPI. Cost of Inflation. Type of							
	Inflation, Causes and remedies of Inflation.						
Unit 5	. Poverty, Unemployment, and Inflation, Introduction to Scarcity and Eco	onomic					
	Problems, Poverty: Absolute, Relative and Asset poverty, Causes of Poverty Deverty Reduction, Unemployment and its Measurement, Types of	/,					
	Unemployment, Corporate		8				
	Social Responsibility (CSR) and Business Ethics, Introduction to CSR,						
	Importance of CSR, Types of CSR, Nature and Objectives of Ethics, 3C's o	f					
	Business Ethics, Need and Objectives of Business Ethics		10				
	1 otal		42				
REFE	RENCES						
S. No	5. No. Name of Books/Authors/Publishers Publi Rep						
1	Engineering Economy and Management by Pravin Kumar, John Wiley	2	2019				
2	Fundamentals of Engineering Economics by Chan S Park, Pearson India		2017				
3	Engineering Economy by Sullivan, Wicks, and Koelling Pearson India						

*: Latest edition of the title of author may please be listed.

S. No.	Course Outcomes (CO)
CO1	To understand types of money, fiscal policy, monetary policy.
CO2	To identify the characteristics of various methods used for the generation of financial management decisions
CO3	To analyze information on investment planning and cost controls, and conduct cost/benefit analysis.
CO4	Quantify and include elements of uncertainty and risk into an economic analysis
CO5	Use modern computer-based tools such a spreadsheet in performing engineering economic analysis
CO6	To apply concept of money and fiscal policy on national economy.

	CO-PO Articulation Matrix									
COs		POs								
	PO1	PO2	PO3	PO4	PO5	PO6				
CO1	3	2	2	3	3	3				
CO2	2	2	2	3	2	1				
CO3	3	1	2	2	3	1				
CO4	2	1	2	2	2	2				
CO5	2	3	2	2	2	1				
CO6	3	3	2	2	2	3				

PE306: Value Engineering

L	Т	Р	Credit	Area	CWS	PRS	MTE	ETE	
3	0/1	2/0	4	DEC/GEC	15/25	25	20/25	40/50	

Objective: To enable the students to understand the Value Engineering, Life Cycle Cost (LCC), Case studies. To understand concept of function analysis system techniques- FAST diagram, Case studies.

Syllabu	S	Contact Hours
Unit-1	An Overview of Value Engineering-Concepts and approaches of value analysis and engineering - importance of value, Function - identity, clarify – analysis	6
Unit-2	Evaluation of VE-Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value	8
Unit-3	Results accelerators, Basic steps in using the systems	6
Unit-4	Understanding the decision environment, Effect of value analysis on other work in the business- Life Cycle Cost (LCC), Case studies	8
Unit-5	VE Level of Effort-VE Team, coordinator, designer, different services, definitions, construction management contracts, value engineering case studies,	8
Unit-6	Effective organization for value work, function analysis system techniques- FAST diagram, Case studies	6
	Total	42

Reference Book:						
1	Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990					
2	Miles, L.D., "Techniques of Value Engineering and Analysis", McGraw Hill Book Co., 2nd End., 1972					
3	Khanna, O.P., "Industrial Engineering and Management", Dhanpat Rai and Sons, 1999.					

CO1	Understand the basic concepts, techniques and applications of value engineering
CO2	Describe job plan of value engineering
CO3	Illustrate different value engineering techniques and versatility of value engineering.
CO4	Illustrate the efforts of value engineering team during the process of value engineering
CO5	Appraise the value engineering operation in maintenance and repair activities.
CO6	Create the value engineering team and discuss the value engineering case studies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2
CO6	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1

PE-308: Green Energy Technology										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ЕТЕ	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: The purpose of this course is to provide a survey of the most important renewable energy resources, and the technologies for harnessing these within the framework of a broad range of simple to state-of the-art advanced energy systems

Syllobuc		Contact
Synabus		Hours
Unit-1	World Energy: International Outlook for Both Traditional and Renewable Energy Sources; Energy, Economic Growth and the Environment, Implications of the Kyoto Protocol; and Structural Change in the Electricity Supply Industry. The Comparative Economics of Sustainable Energy Systems. A Detailed Analysis of Projected US Energy Requirements Through 2020, and Their Related Environmental Implications, Recent US Energy Information Administration Estimates.	8
Unit-2	Energy and Environmental Implications: This Unit Will Consider: -the Sources of the Critical Pollutants As Defined by the EPA Together With Control Strategies and Forms of Regulation; the Concept of the Environment As A Closed System (I.E. Spaceship Earth) and the Optimal Level of Pollution; the Concept of Environmental Externalities and the Use of Market Instruments to Ensure That the Polluter Pays. Climate Change and the Kyoto Protocol: Science, Economics, and Politics Will Be Considered in Overlap With Section 1. The Impact of Each of the Renewable Technology Areas on Environmental Appropriate Unit of the Course.	6
Unit-3	Energy and Sustainable Development Energy Systems Have a Critical Role to Play in Driving Sustainable Development. Sustainability Drivers: Energy Poverty in the Developing World and the Environmental Harms of Present Energy Systems. Highly Energy efficient 'Energy Services' Model for Designing Sustainable Energy Systems and Use Renewable Energy Sources.	6
Unit-4	Energy and the Built Environment Energy Use in Buildings, Domestic and Commercial; Sustainable Architecture; Thermal Comfort; Passive Design; Energy Performance Modeling; Building Systems; Hvac and Lighting in Buildings. The Use of Computer Simulations to Show Effects of Various Design Techniques on Energy Usage – Glazing of Windows, Thermal Storage, Insulation, and Ventilation.	8
Unit-5	Emerging Energy Technologies There Are A Number of Highly Promising But, As Yet, Commercially Unproven Energy Technologies Which May Play A Very Important Role in Our Future Energy Systems Over the Longer Term. We Focus, in Particular, on Some Emerging Carbon Capture and Storage (CCS) and Hydrogen Technologies.	8
Unit-6	Energy Storage: Energy Storage Systems Electrochemical, Chemical and Thermal. The Principles of Electrochemical Energy Systems and Fundamentals of Electro chemistry, Secondary Batteries and Fuel Cells Are Considered. The Latest Advanced Batteries for Stationary and Mobile Applications, Including the Vanadium Redox Flow Battery, Sodium Sulphur, Zinc-Bromine, Sodium Metal Chloride and Nickel Hydride Are Discussed. Laboratory Work Includes Battery Design, Testing and Performance Colculations.	6
	Total	42
Refe	erence Books:	
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1	Hirao Osamu and Pefley R.K., Present and Future Automotive Fuels, John Wiley and Sons, ISBN: 0471802596 1988.	
2	Owen Keith and Eoley Trevor, Automotive Fuels Handbook, SAE- Publication, ISBN: 1-56091-598-7, 1990.	
3	Bechtold R.L., Automotive Fuels Guide Book, SAE-Publications, ISBN: 978-0-7680-0052-8, 1997.	
4	Boyle Godfrey, Renewable Energy, Oxford University Press, ISBN:9780199261789, 2004.	
5	Hirao Osamu & Richard & Petly, Present & Future automotive, John Wiley & Sons, 1988, ISBN 10: 047180259	

CO1	To understand the principles of Traditional and Renewable Energy Sources and green energy Sources.
CO2	To learn the concept of Energy and Environmental Implications like Climate Change and the Kyoto Protocol.
CO3	To design the Model for Designing Sustainable Energy Systems and Use Renewable Energy Sources.
CO4	To enable the students to understand the concept of Built Environment Energy Use in Buildings, Domestic and Commercial; Sustainable Architecture; Thermal Comfort; Passive Design.
CO5	To learn The Use of Computer Simulations to Show Effects of Various Design Techniques on Energy.
CO6	Demonstrate self -learning capability to design & establish renewable energy systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-310: Industrial Automation									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: An automation engineering course trains students to troubleshoot, repair and maintain automated industrial equipment, such as computer numerical control (CNC) equipment and robots.

Syllabus		Contac t Hours
Unit-1	Basic Principles- Introduction to Automation. Productivity v/s automation materials handling systems. Evaluation of automatic production. Designing for automation.	8
Unit-2	Hydraulic System- Hydraulic Principles. Hydraulic pumps: Characteristics, Pump Selection, Pumping Circuits. Hydraulic Actuators:Linear, Rotary, Selection, Characteristics. Hydraulic Valves: Pressure, Flow, Direction Controls, Applications. Servo and Proportional Valves, Hydraulic Fluids: Symbols.	6
Unit-3	Pneumatic Systems- Pneumatic fundamentals. Production of compressed air. Types of cylinders. Control valves: direction, pressure and flow-air hydraulic equipments. Actuators. General approach to control system design. Symbols and drawing. Schematic layout. Cascade, Karnaugh, Veitch mapping method, air hydraulic control.	6
Unit-4	Pneumatic and hydraulic circuits- Hydraulic circuits: Reciprocating, Quick return, Sequencing synchronizing. Accumulator circuits. Safety circuits. Pneumatic circuits: Classic, Cascade, Step-counter, Karnaugh Veitch mapping, Combination Methods.	8
Unit-5	Electrical control of fluid power: components and circuits. Micro electronic control of fluid power: PLC-Microprocessors uses and selection criteria for components. Logic Circuits: Position, Pressure Sensing, Switching, Electro Pneumatic, Electro Hydraulic, Robotic Circuits. Case studies: conveyor feed system, power pack, Bunker automatic circuits, etc.	8
Unit-6	Automation in machine tools- Mechanized feeding. Automatic assembly. Automatic machine tool control. Transfer lines. Factory automation	6
	Total	42

Ref	Reference Books:						
1	Srinivasan R., "Hydraulic and Pneumatic Controls", Vijay Nicole imprints Pvt. Ltd., Chennai. ISBN- 9788182091382.						
2	Ilango S and Soundararajan V., "Introduction to Hydraulic and Pneumatic" Prentice Hall of India, Delhi ISBN 978-81234468.						
3	Majumdar S.R., "Pneumatic Systems : Principles and Maintenance", Tata McGraw Hill, Delhi, ISBN 10: 0074602314.						
4	Esposito Anthony, "Fluid Power with Applications", Prentice Hall, ISBN: 0135136903, 2008.						

Course Outcomes							
CO1	Implement concepts of automation in machine tools and plant						
CO2	Understand the fundamentals of control in automation as they apply to Manufacturing						
CO3	Design of Pneumatic Circuit for manufacturing application						
CO4	Design of Hydraulic Circuit for manufacturing application						
CO5	Ability to apply PLC timers and counters for the control of industrial processes						
CO6	Application of automation in industries						

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-312: Automobile Engineering									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To provide general classification of vehicles, and Principle of power transmission systems.

Syllabus		Contact
Synasas		Hours
Unit-1	Engine and Fuel System-Introduction: General classification of vehicles- major parts-Petrol and Diesel Engines - their working.	8
Unit-2	Cooling, lubrication and electrical system-Types of cooling -Transmission Systems Need for clutch - Type of clutches – Mechanical details	6
Unit-3	Brakes, Wheels And Suspension System-Principle of braking, Mechanical brake system, Hydraulic and pneumatic brakes - drum and disc brakes - power assisted brakes. Wheels - tyres wheel tyre specification - tyre wear and maintenance	6
Unit-4	Suspension system: Purpose and characteristics- rigid axle suspension system, and torsion bar	8
Unit-5	Steering-Principle of Steering, Ackerman principle of correct steering, center point steering, steering geometry	8
Unit-6	Maintenance, Servicing and tuning up on engine, Fault finding and remedy.	6
	Total	42

Ref	Reference Books:							
1	Narang, G.B.S., "Automobile Engineering", Khanna Publishers, ISBN 10:8174092823, 1991							
2	Heitner Joseph., "Automotive Mechanics", 2nd Edition, East West press, ISBN 10:812390891, 2004.							
3	Singh Kirpal, "Automobile Engineering", Vol I and Vol II, Standard Publishers, Delhi, ISBN: 8180141195,							
	1998.							

Course Outcomes

CO1	Introduction of Engine and Fuel System, Classification of Vehicles, knowledge of major parts of petrol and diesel engines with their Constructional and working principles.
CO2	Cooling, Lubrication and electrical systems, Transmission systems, need for clutch types of clutches with their mechanical details.
CO3	Brakes, wheels and suspension system, Principle of friction braking, Mechanical brake system, Hydraulic and pneumatic brakes, drum and disc brakes, power assisted brakes, Tyres wheel alignment, tyre specification, tyre wear and maintenance.
CO4	Suspension system, purpose and characteristics, rigid axle suspension system, and torsion bar.
CO5	Steering, principle of steering, Ackerman principle of correct steering, center point steering, power steering, and steering geometry.
CO6	Maintenance, servicing and tuning up on engine, fault finding and their remedies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-314: Manufacturing of Composite Materials									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: The objective of this course is to develop ability to identify the properties of fibre and matrix materials used in commercial composites and some common manufacturing techniques, also to predict the elastic properties of both long and short fibre composites based on the constituent properties.

Syllabus		Contact
		Hours
Unit-1	Introduction to Composite Materials: Definition, Classification, Types of matrix materials and	8
	reinforcements, Characteristics & selection, Fiber composites, laminated composites, Particulate	
	composites, Prepegs, and sandwich construction.	
	Metal Matrix Composites: Re-inforcement materials, Types, Characteristics and selection,	
	Base metals, Selection, Applications.	
	Macro Mechanics of a Lamina: Hooke's law for different types of materials, Number of elastic	8
Unit-2	constants, Derivation of nine independent constants for orthotropic material, Two - dimensional	
	relationship of compliance and suffness matrix. Hooke's law for two-dimensional angle famina,	
	lamina of arbitrary orientation Numerical problems	
	Micro Mechanical Analysis of a Lamina: Introduction Evaluation of the four elastic moduli	8
	Rule of mixture. Numerical problems	0
Unit-3	Biaxial Strength Theories: Maximum stress theory Maximum strain theory Tsa-Hill theory	
	Tsai, Wu tensor theory, Numerical problems.	
	Macro Mechanical Analysis of Laminate: Introduction, code, Kirchoff hypothesis, CL T, A,	6
Unit-4	B, and D matrices (Detailed derivation) Engineering constants, Special cases of laminates,	
	Numerical problems.	
Unit-5	Manufacturing: Lay up and curing - open and closed mould processing, Hand lay, Up	
	techniques, Bag moulding and filament winding. Pultrusion, Pultorming, Thermotorming,	6
	injection moulding, Cutting, Machining and Joining, tooling, Quality assurance, introduction,	
Unit 6	Application Developments: Aircrafts missiles Space hardware automobile Electrical and	
Umt-0	Electronics. Marine, Recreational and sports equipment-future potential of composites.	6
	Total	12
	10(a)	42

Ref	eference Books:								
1	Composite Materials handbook, Mein Schwartz Mc Graw Hill Book Company, 1984.								
2	Mechanics of composite materials, Autar K. Kaw CRC Press New York.								
3	Mechanics of Composite Materials, Rober M. Joness Mc-Graw Hill Kogakusha Ltd.								
4	Stress analysis of fiber Reinforced Composite Materials, Michael W, Hyer Mc-Graw Hill International.								
5	Composite Material Science and Engineering, Krishan K. Chawla Springer.								
6	Fibre Reinforced Composites, P.C. Mallik Marcel Decker.								

CO1	The student will develop a knowledge of the manufacturing of composite materials.
CO2	The student will develop a working knowledge of the various testing and performance protocols for composite materials.
CO3	The student will develop an understanding of the economics of composite materials.
CO4	Summarize the manufacture of metal matrix, ceramic matrix and composites.
CO5	Describe the manufacture of polymer matrix composites.
CO6	Describe the properties of various reinforcements of composite materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-316: Advances in Welding									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To Provide a far deeper study and applications into the individual characteristics of various wieldable industrial materials, A welding engineer will decide what material are used in a project and what process to weld those materials. Students gain an understanding of the properties of various materials. They acquire a solid base of engineering knowledge in order to develop advanced welding techniques and operate special equipments

Syllabus		Contac
·		t
		Hours
Unit-1	Weldability of high specialty alloys and materials	8
Unit-2	Weld joint design	6
Unit-3	Welding Automation, Weld quality and Inspection,	6
Unit-4	Heat flow in welds, Metallurgy of welds,	8
Unit-5	Weldability tests, Residual stress and distortion in welds	8
Unit-6	Advance welding processes	6
	Total	42

Ref	erence Books:
1	AWS Welding Handbook, 'Fundamentals of Welding Vol. I [ISBN -087171-281-4],1987
2	AWS Welding Handbook, 'Welding Process' Vol. II [ISBN -087171-354-3], 1991
3	AWS Welding Handbook, 'Materials and applications' Vol. III [ISBN -087171-470-1], 1996
4	AWS Welding Handbook, 'Metals and their weldability' Vol. IV [ISBN -087171-218-0], 1982
5	AWS Welding Handbook, 'Engineering, Costs, Quality & safety;' Vol. V [ISBN -087171-239-3], 1984
6.	ASM handbook, 'Welding, Brazing and Soldering,' Vol VI, [ISBN-0-87170-377-7(v.i)] 1993

Course Outcomes

CO1	To understand welding processes with their specific applications.
CO2	To analyze different welding zones.
CO3	To Explain the defects, their causes and remedies.
CO4	To discuss the working principle, advantages, limitations, applications of various joining processes including advance processes and apply knowledge to select appropriate joining process based on the type of industrial application.
CO5	To discuss the weldability criteria of Steels, Cast Iron and Aluminium and explain different welding position and joint configurations.
CO6	To apply knowledge of welding in various case studies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-318: Advances in Casting									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: Study of advanced casting processes, gating system design, die / pattern design and mechanization of foundry

Syllabus		Contact Hours
Unit-1	Characteristics and selection of molding sand: Bonding Theory, Foundry equipment, and mechanization.	8
Unit-2	Ferrous and Nonferrous materials and their properties. Metal Matrix Composites and their properties and suitability as casting materials.	6
Unit-3	Mechanism of solidification of ferrous and nonferrous materials. Casting design considerations, gating system design, riser design, casting defects: their causes and effects	6
Unit-4	Specific considerations to Grey CI, steel and nonferrous foundry practices	8
Unit-5	Inspection and Quality control of castings.	8
Unit-6	Recent developments, Foundry Mechanization Pollution control in Foundries	6
	Total	42

Reference Books: 1 Campbell John, Castings, Butterworth-Heinemann, ISBN: 0080488447, 2003. 2 Heine R.W, Loper C.R. and Rosenthal P.C., Principles of metal casting, Tata McGraw-Hill, ISBN:0-471-25394-4, 2008. 3 Campbell J.S., Principles of Manufacturing Materials and Processes, McGraw-Hill Education, ISBN 10-:0070992525 1984. 4 Taylor H.F, Flemings M.C. and Wulff J., Foundry Technology, ISBN: 0-13227271-7, 1959. 5 Khanna O. P., Foundry Technology, Dhanpat Rai Publications, ISBN 13:9788189928346, 2011. 6. Srinivasan Malur, Science and Technology of castings, In Tech, ISBN: 978-953- 51-0774-3, 2012.

CO1	To understand the different casting methods, its applications, product defects, inspection and factory mechanization and layout
CO2	To explain the different equipment and applications and defects.
CO3	To describe the different casting methods.
CO4	To discuss the mechanical behavior, stress, strain, plastic deformation in casting products.
CO5	To apply the fundamental of casting for solving variety of practical problems.
CO6	To implement fundamentals of casting in case studies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	CODE: PE 405 Title: Measurements and Instrumentation									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0	2	4	DCC		15	25	20	40	-

Objectives: To familiarize and analyze the instrument's performance, understand different types of measuring instruments, and apply their knowledge to measure physical quantities

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Syllabus		Contac t Hours
Unit-1	Basic concepts, Generalised Measurement System: definition of terms, calibration, standards and errors, static and Dynamic performance characteristics; analysis of experimental data	8
Unit-2	instrumentation for measurement of Position and displacement, force, Strain, pressure, temperature, proximity and range. Concept of feedback;	6
Unit-3	open and close loop systems: Loop control systems, transducers and devices for applications, digital readouts, data Acquisition and processing.	7
Unit-4	introduction, measuring instruments, measuring range, sensitivity, repeatability, precision and accuracy. Standards: definitions of line standard, end standard and wavelength standard, sub divisions of Standards. Slip gauges. Measurement of angles: introduction, bevel venire protractor, sine bar, angel gauges, spirit level, Autocollimator, angle dekkor, rotary tables, precision polygon, calibration of polygons. Measurement of internal and external tapers	7
Unit-5	Measurement of threads: introduction, screw thread terminology, pitch error, angle error, measurement of major and minor diameter, measurement of effective diameter by one wire, two wire and three wire Method. Best size wire. Measurement of surface finish: introduction, surface texture, surface roughness terminologies, methods of measuring surface finish, stylus probe instruments, taylor hobson talysurf, sample length or cut off Length, analysis of surface traces.	8
Unit-6	Gear measurements: introduction, terminology of gear tooth, errors in manufacturing gears, rolling Test, measurement of tooth thickness, Parkinson gear tester. Inspection of straightness, flatness, and alignment. Interferometry and use of optical flats. Measurement of coordinates using coordinate measuring machine	6
	Total	42

Ref	erence Books:
1	T.G.Beckwith,"Mechanical measurements", N. L. Buck and R. D. Marangoni, 3rd Ed, Narosa Publishing house.1993, ISBN 10: 0201004542 ISBN 13: 9780201004540
2	R. K. Jain,"Metrology",Khanna pub. 2002, ISBN-13978-81-7409-153/ISBN-1081- 7409-153
3	C. Dotson,"Fundamentals of dimensional metrology", R. Harlow and R. Thomson. Pub. 2003, ISBN-13: 978-1418020620/ISBN-10: 1418020621
4	B. C. Nakra and K. K. Chaudhari,"Insrumentation, measurement and analysis",Tata McGraw-Hill, 19855, ISBN 0070482969, 9780070482968
5	Turner and Hill,"Instrumentation for Engineers and Scientists", Oxford university Press, ISBN-10: 0198565178ISBN-13: 978-0198565178

CO1	To Study the basic concept of measurement and its performance characteristics.
CO2	To explain about open loop and close loop systems.
CO3	To describe the measurement calibration and it's all terms.
CO4	To analyze the performance characteristics of each instrument
CO5	To explain the concept of measurement for various practical problems.
CO6	To apply the knowledge of measurement for various case studies.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

					PE407: Mechatronics and Con	trol				
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC/GEC		15/25	25	20/25	40/50	-

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Objectives: To enable the students to understand the mechatronic systems and components, and simulation of dynamic systems. To understand Fundamentals of Stepper and servo motors and Digital logic.

Syllabu	Syllabus					
Unit-1	Introduction to mechatronic systems and components; Sensors and transducers; Actuators- electrical, electromechanical, electromagnetic, hydraulic, pneumatic, smart material actuators, micro actuators, nano actuators. Active actuators- piezoelectric, shape memory alloys (SMA), electro active polymers (EAP), magneto restrictive, magneto rheological fluid (MR).	8				
Unit-2	Stepper and servo motors, Encoders and resolvers	6				
Unit-3	Modeling, analysis and simulation of dynamic systems; use of MATLAB; Bode, Nyquist and root-locus plot	6				
Unit-4	Feedback systems: Open and closed loop control systems; Stability and sensitivity; PID, phase lag and phase lead compensation	6				
Unit-5	Sampled data systems and Digital controllers; DA/AD converters, microprocessors, interfacing with computers	8				
Unit-6	Digital logic: Analysis and synthesis of mechatronic systems with application to robotics, CNC systems and others	8				
	Total	42				

Ref	erence Book:
1	Introduction to Mechatronics and Measurement systems, (special Indian edition), Alciatore, David Tata-
	McGraw Hill India Ltd.
2	Mechatronics: Principles, Concepts and applications, Mahalik.N, Tata-McGraw Hill India Ltd.
3	Mechatronics: Principles and applications, Onwubolu, Elsevier India Pvt Ltd.
4	Mechatronics by Hindustan Machine Tools Ltd., McGraw- Hill Ltd.
5	Mechatronics: Electronic Control systems in Mechanical and Electrical Engineering. 3/e, Pearson Education.
6	Dan Necsulescu, "Mechatronics", Pearson Education Asia,2002(Indian reprint)
7	Mechatronics – W. Bolton, Pearson Education

CO1	Students will be able to know the basics, details and components of Mechatronic Systems.
CO2	Students will be able to know the principle of Sensors & Transducers and
	Pneumatic/Hydraulic/Mechanical/Electrical Actuation Systems.
CO3	Students will be able to understand the System Modelling, Analysis and Simulation of dynamic systems
	using Mechanical/Electrical/Thermal system building blocks.
CO4	Students will be able to know the various Feedback systems: PID controllers and phase lag and phase
	lead compensation.
CO5	Students will be able to understand the DA/AD converters, microprocessors, interfacing with computers,
CO6	Students will be able to know the Digital logic: Analysis and synthesis of mechatronic systems with
	application to robotics, CNC systems and others Advanced Applications in Mechatronics.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	2	1	1	1	1	2	2	1	3
CO2	3	3	2	2	2	2	2	1	1	1	1	3	3	2	2
CO3	3	3	3	2	2	2	1	1	1	1	1	2	2	1	3
CO4	3	3	3	3	2	2	2	1	1	1	1	2	3	1	2
CO5	3	3	3	3	3	2	2	1	1	1	1	3	3	2	3
CO6	3	3	3	3	3	2	2	2	1	1	1	2	3	2	3

	PE-409: CNC Machine & Programming									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To understand CNC classification, its need, construction details and part programming, adaptive control, inspection and rapid prototyping.

Syllabus		Contact Hours
Unit-1	Concepts and features of NC systems – Classification of NC systems - Design considerations of NC machine tools - Constructional features of CNC machine tools	8
Unit-2	Functions of MCU. Machining center - Turning center - CNC EDM, Ball screws, Bearings, Centralized lubrication systems. Manual part programming – Preparatory, Miscellaneous functions	8
Unit-3	Sinumeric, Fanuc controls – Computer aided part programming – Post processors - APT programming-CNC programming based on CAD Feedback devices.	6
Unit-4	Tooling for CNC machine – Interpolators. Point-to-point and contouring systems	6
Unit-5	Adaptive control – ACO and ACC systems. Maintenance of CNC Machines- Economics of manufacturing using CNC machines	6
Unit-6	Reverse engineering, Reasons for reverse engineering, importance of reverse engineering, Process of reverse engineering, Applications of reverse engineering. Integration of reverse engineering with CAM, Flexible Manufacturing System, Elements of FMS, tool management systems, FMS control, Typical layouts of FMS, Benefits of FMS in the industries. Production planning and operation of FMS, Computer Aided Design, Concept and Description, Origin of CAD, Representations & Simulations, Various models of CAD, Analytical programs, Different models of CAD, Advantages of CAD & its limitations, etc.	8
	Total	42

Ref	erence Books:
1	Koren, Y. "Computer Control of Manufacturing Systems", McGraw Hill Book co. New Delhi, 1986. ISBN-10 0070607435
2	Kundra T. K., Rao P. N., and Tiwari N. K., "CNC and Computer Aided Manufacturing", Tata McGraw Hill, New Delhi, 1991. 3.Fitzpatric, M. "Machining And CNC Technology", McGraw-Hill College, 2004, ISBN 10: 0074631039
3	Radhakrishnan P., "Computer Numerical Control Machines", New Central Book Agency, Calcutta, 1992 ISBN-10 8122433979
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CO1	To understand the knowledge about NC and CNC systems and its classification.
CO2	To analyze the machine elements of NC and CNC systems.
CO3	To explain computer based integration between various functions in manufacturing.
CO4	To describe the application of NC and CNC systems in variety of problems.
CO5	To apply computer aided part programming on manufacturing of products
CO6	Applications of NC and CNC in industries

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-411: Computer Integrated Design and Manufacturing									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: Understand the possible applications of the CAD/ CAM systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering.

Syllabus		Contact Hours
Unit-1	NC/CNC/DNC terminology, Operations of NC/CNC machine tools. Control cycles in CNC machine tools and how do these reduce operator activities, Central Processing Unit (CPU), Input Devices, Storage Devices, System Configuration, Feasible report to introduce CAM technology for the first time in the industry, advantages &limitations of using CNC technology.	8
Unit-2	Parameters for adaptation of CAM technology, Advantages and disadvantages of CAM, Part programming, Manual & CAP, APT& its statements/programming with suitable examples to machine the components on CNC lathe, CNC milling machine, CNC jig boring machine, etc, Parallel programming& its advantages, Post processor commands, Compilation control commands, Repetitive programming etc.	6
Unit-3	Canned cycles, linear/circular, parabolic interpolation, online/offline programming, unidirectional, bidirectional approach, point to point and continuous control, Buffer storage, adaptive control, Nesting, opti part,opti route, precision sheet metal processing, CNC turret punch press, CNC press brake &its programming to machine the sheet metal components, Auto indexing, safety aspects in CNC machine tools length/ cutter compensation, Computer optimized manufacturing etc.	6
Unit-4	Reverse engineering, Reasons for reverse engineering, importance of reverse engineering, Process of reverse engineering, Applications of reverse engineering. Integration of reverse engineering with CAM, Flexible Manufacturing System, Elements of FMS, tool management systems, FMS control, Typical layouts of FMS, Benefits of FMS in the industries. Production planning and operation of FMS, Computer Aided Design, Concept and Description, Origin of CAD, Representations & Simulations, Various models of CAD, Analytical programs, Different models of CAD, Advantages of CAD & its limitations, etc.	8
Unit-5	CAPP, Types of CAPP, Group technology, Merit/ Demerits, Database management in the development of CAPP, CAD-CAM integration, Essential elements of CAPP, Future trends in CAPP, Importance of CAPP in CAM/CIM, etc. Introduction to Robots, its types, Laws of robotics, Symbolic modelling of robots, Robotic sensors, Configurations of robot, Applications of Robots in engineering industries.	8
Unit-6	Basic concepts of CIM, Evolution of CIM, Unmanned manufacturing, Elements of CIM, CIM implementation, CIM hardware and CIM software. Product development through CIM, Sequential engineering, Concurrent engineering, Comparison of sequential and concurrent engineering, implementation of concurrent engineering, concurrent engineering and information technology, Characteristics of concurrent engineering. Soft computing in CIM: Artificial neural networks/Artificial intelligence, Fuzzy, Fuzzy AHP	6
	Total	42

Ref	erence Books:
1	Craig J John, Introduction to Robotics: Mechanics and Control, , Pearson education, [ISBN-10 0201543613], 2003.
2	Y.Koren, Robotics for Engineers, McGraw Hill Publications, [ISBN-10 0070353999],1985.

CO1	Explain the knowledge about role of computer and automation in manufacturing.
CO2	Describe the automation, types of automation and automation strategies.
CO3	Explain computer based integration between various functions - manufacturing, sales, design, and materials.
CO4	Describe the application of computer in CAPP, Production Management and ERP.
CO5	Explain the concept of group technology, FMS, concurrent engineering, Simulation in CIM systems
CO6	Applications of CIM in industries

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-413: Robotics and Automation									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To be familiar with the automation and brief history of robot and applications. To give the student familiarities with the kinematics of robots. To give knowledge about robot end effectors and their design. To learn about Robot Programming methods & Languages of robot.

Syllabus		Contact Hours
Unit-1	Introduction to Robotics, Classification of Robots, Characteristics of Robots, performance, advantages and disadvantages of a Robot, industrial applications of a Robot	8
Unit-2	Fundamentals of a Robot: Various system, structure and definition, terms relating to industrial Robots, basic terms related to Robot performance and Characteristics, Control volume of a Robot.	6
Unit-3	Robot languages and programming	6
Unit-4	Controlling the Robot systems: Introduction to drives, Mechanical, Hydraulic, Pneumatic, electric drives, feedback control	8
Unit-5	Sensing system for a robot: Introduction, types of sensors, machine vision, Artificial intelligence, Control techniques.	8
Unit-6	Robot safety: Introduction, potential safety hazards, safety planning check lists, safety guidelines, latest development in safety measurement	6
	Total	42

Ref	erence Books:
1	Craig J John, Introduction to Robotics: Mechanics and Control, , Pearson education, [ISBN-10 0201543613], 2003.
2	Y.Koren, Robotics for Engineers, , McGraw Hill Publications, [ISBN-10 0070353999],1985.

Course	e Outcomes
CO1	To make the students understand basics of robots and automation
CO2	To understand the basics of various methods, machines with respect to robotics and automation
CO3	To make the students understand different types of sensors
CO4	To make the students understand different types of configurations
CO5	To understand the importance of robotics and automation and their applications.
CO6	To make the students understand basics of robots and automation

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

					PE-415: Financial	Manage	ment			
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To familiarize the students with the procurement, allocation and control of financial resources. In corporate finance we will learn capital budgeting, valuation, capital structure, and payout policy. In asset pricing we will be studying the risk and return tradeoff, the Capital Asset Pricing Model, market efficiency, and derivative securities.

Syllabug		Contact
Synabus		Hours
Unit-1	Fundamentals of Financial Management- Introduction, Objectives, goals and functions of financial Management. Time value of Money, Risks and Returns, Valuation of Securities.	8
Unit-2	Financial Instruments and Markets-Forms of Business Organizations, capital structure, Construction analysis and interpretation of standard financial statements, Dividend policy and share valuation	6
Unit-3	Capital Budgeting-Concept of Operating cycles and working of Capital Management; Capital Budgeting: Cost of capital investment decisions and Risk analysis in Capital Budgeting.	6
Unit-4	Financial Planning-Planning of profit and leverages (operating and financial) Risk and Return: Nature of risk, Inter-relationship in risk and return, effect of Tax on return.	8
Unit-5	Cost Accounting-Definition and scope of cost accountancy and costing methods, elements of cost overhead classification distribution and absorption, process costing- Uniform, Marginal and standard costing methods, Case studies	8
Unit-6	Inflation and Financial Management-Inflation and Asset revaluation, firm value, financial market returns, financial analysis, capital budgeting.	6
	Total	42

Refe	erence Books:
1	Khan and Jain, Financial Management, Tata McGraw Hill, [ISBN-10 007106785X, 13: 9780070656147], 2012
2	Pandey M.I, Financial management, Vikas Publishing House ,Tenth edition,[ISBN-10:8125937145],2010

Course	e Outcomes
CO1	To define and evaluate the influence of historical forces on the current practice of management
CO2	To identify and evaluate social responsibility and ethical issues involved in business situations and
	logically articulate own position on such issues.
CO3	To develop the process of management's four functions: planning, organizing, leading, and controlling.
CO4	To evaluate leadership styles to anticipate the consequences of each leadership style.
CO5	To describe the areas to control and selecting the Appropriate controlling methods/Techniques
CO6	To apply the circumstances that lead to management evolution and how it will affect future managers

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-417 Materials Management									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: The key objective of this course is to acquaint the students with Decision making for effective and efficient purchase, storage and flow of materials in manufacturing and service organizations; Cost-reduction techniques in prepurchase

Syllabu	S	Contact Hours
Unit-1	Scope of materials management, integrated materials management, Reasons of materials management, relation with other functional areas of organization, Organizing for materials management, integrated materials management, conventional and modern approaches to organizing materials management	6
Unit-2	Classification, codification, Specification, standardization, simplification and variety reduction of materials, scope of materials management	6
Unit-3	Inventory problems, inventory policies, classification of inventory models, Static inventory models	6
Unit-4	Multi-item Budget Constraint model, Optimal Policy Curve Selective inventory management: ABC, VED, FSN analysis,	6
Unit-5	Inventory models: EOQ-ROP Model, Finite Replenishment Rate Model, Lot Size Model with Planned Backlogging, Sensitivity analysis of Lot Size System, Quantity discount model	10
Unit-6	Vendor development, Make-Buy decision, Store management, Future trends	8
	Total	42

Ref	erence Books:
1	Datta A.K, Integrated materials management, -PHI Learning, [ISBN 10 8120312511], 2009
2	Dobbler, Burt D.N, Purchasing and Supply ManagementMcGraw-Hill Education (ISE Editions); 6th edition
	edition, ISBN-10: 0071141383, (1 January 1996)
3	P Gopalakrishnan ,Materials Management — PHI LEARNING PVT. LTD , [ISBN 10 8120300270],2009
4	Purchasing And Materials Management – LeendersFearon – Universal Book Stall

Course Outcomes

COI	Able to learn the scope of materials and spare parts management in an organization.
CO2	Apply the key characteristics of the purchasing system.

CO3	Apply the policies of Inventory Management and Develop overall materials requirement plan.
CO4	Explain the ERP System for Materials management.
CO5	Understand the importance of warehouse and supplier development in materials management.
CO6	Apply the subject knowledge for e-commerce.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

PE-419: Project Management										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-
Objective: With a specific focus on developing practical project management skills, the Project Management										

Professional Development Program prepares students to apply proven methodologies to projects within their individual field

Syllabus		Contact Hours
Unit-1	Introduction-Definitions, classifications, and scope of project management; project life cycle and uncertainty.	8
Unit-2	Project planning-Scope, problem statement, project goals, objectives, success criteria, assumptions, risks, obstacles, approval process, projects and strategic planning.	6
Unit-3	Project implementation-Project resource requirement, types of resources: men, materials, finance, resource distribution.	6
Unit-4	Project monitoring-Evaluation, control, project network technique, planning for monitoring and evaluation, project audits, project management information system, Nature of project inventory, supply and transportation of materials, use of Material Requirement Planning. Project scheduling, PERT & CPM, project communication.	8
Unit-5	Project team management-Recruitment, organizing, human resources: team operating rules, project organization, various forms of project organizations, project organization charting, project contracts, principles, compilation of contracts, practical aspects, legal aspects, global tender, negotiations, insurance.	8
Unit-6	Project completion-Closing the project, types of project termination, strategic implications, project in trouble, termination strategies, evaluation of termination possibilities, termination procedures, post project reviews	6
	Total	42

Ref	erence Books:
1	Beenet P Lientz, Kathyn P rea, Project Management for 21st Centrury, - Academic Press, [ISBN 10 012449983X], 2001.
2	Project Management –Dennis Lock, Gower Publishing Ltd; 9th Revised edition edition; [ISBN 10 0566087693], 2007
3	David I Cleland, Project management, Mcgraw Hill International Edition, [ISBN 10 0442221142], 1988.
4	Gopalakrishnan, Project Management, Mcmillan India Ltd, [ISBN 10 0333926218],1993
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COI	
	Ability to understand the basics of project management
	Ability to understand the basics of project management
CO2	
	Identification and formulation of various problems in project management
CO3	
	Selection of appropriate process/tool/techniques in project management
CO4	
	Application of knowledge in relevance to professional practice
CO5	
	Lifelong learning in technological world
CO6	
2.20	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-421: Reliability, Maintenance & Safety Engineering									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-

Objective: To develop the ability in formulating suitable maintenance strategies to achieve reliable a manufacturing system. To equip with essential system diagnosis techniques so that students can identify and take appropriate actions on error symptoms and causes of failures.

<i>a</i>		0 4 4
Syllabus		Contact
		Hours
Unit-1	Introduction and Reliability Mathematics: Relevance of reliability, availability and	8
	maintainability, definition of reliability, factors influencing system effectiveness, laws of	
	probability, probability distributions; exponential Weibull normal, log normal, data collection	
	recovery of data, Statistical analysis of failure data.	
	Eurodemontals of Paliability, Various reliability related functions, probability density function	6
	rundanting distribution function reliability function and hazard rate reliability models:	U
Unit-2	rate Waibull normal and lognormal model	
	rate, weibun, normai and iognormal model.	
Unit-3	System Reliability Assessment: Types of systems- series, parallel, series-parallel, parallel-series,	6
	stand by and complex; method of reliability evaluation; cut set and tie set methods, event trees	
	and fault trees methods, Markov method, Reliability of repairable systems.	
	Reliability Improvements - Methods of reliability improvements, low level and high level	8
Unit-4	redundancy, active, stand by and K-out-of-N redundancy, effect of maintenance.	
Unit-5	Availability and Maintainability Assessments Point, mission and steady state availability.	
	Availability assessment, Maintainability and its assessment. Maintenance policies	8
		-
	Design for Reliability - Reliability allocation, Design for reliability and maintainability,	6
Unit-6	optimization of reliability and maintainability and their trade-off, Practical applications of	
	RAM Engineering to systems,	
	products and processes., Monte Carlo simulation	
	Total	42

Ref	Reference Books:							
1	EbelingChariesE.,"An introduction to Reliability and Maintainability Engineering", Tata McGraw-Hill							
	Publishing Co. Ltd., New Delhi, [ISBN 10 0070421382], 2000.							
2	Srinath,L.S." Reliability Engineering", Affiliated East –West Press Ltd., New Delhi, [ISBN 10 8176710482], 2011							
3	Dhillon,B.S.,"EngineeringMaintainbility",Prentice Hall of India, New Delhi,2000.							
4	Blanchard, Benjamin, S., "Logistics Engineering and Management", Pearson, [ISBN 10 1292027134], 2013.							

Course	e Outcomes
CO1	Understand the reliability, availability and maintainability
CO2	Appreciate the concepts of System Reliability Assessment in operations.
CO3	Comprehend key decision areas of Methods of reliability improvements for effective decision making in management.
CO4	Understand optimum allocation and efficient utilization of manpower, materials, equipment and technology at strategic and tactical levels in the organization
CO5	Develop and implement Availability and Maintainability Assessments Point.
CO6	Practical applications of RAM Engineering to systems.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-423: Thermal Spray Technology										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-	

Objective: To understand the physical principles of thermal spraying. To know the features and benefits of the different thermal spray processes Plasma, Arc etc.

		<u>a</u> ,
Syllabus		Contac
		t
		Hours
Unit-1	Significance of Surface engineered materials in modern engineering application, surface dependent engineering properties (mechanical, chemical, thermal, electrical, electronic, optical).	8
Unit-2	Role of surface coating and surface modification technologies in obtaining required surface characteristics of a product.	6
Unit-3	Various surface modification techniques (mechanically modified, thermally modified). Scope of their application	6
Unit-4	Different surface coating technologies: chemical vapour deposition, physical vapour deposition, electro – deposition, electro – less deposition, thermal spray process, coating deposition by wetting. Various process parameters controlling the yield of the coating and various surface properties of the coating.	8
Unit-5	Criteria for selection of a surface coating technology. Product oriented surface coating technology. Different coating systems and function of various elements of coating system.	8
	Substrate technology and its significance in obtaining high performance coating. Physical and mechanical characterization of the coating. Various methods for evaluating the performance of the coating.	6
	Total	42

Ref	Reference Books:								
1	Future development of thermal spray coating by N.Espallargas, ISBN:9780857097699								
2	The science and engineering of thermal spray coating, by Lech. Pawlowski, ISBN:9780471490494, Wiley-2008								
3	Thermal spray coating, Kurt H. Sien, Chapman and Hall, 1996.								
4	Handbook Thermal spray technology, by J. R. Davis, ISBN-9780871707956								

CO1	
CO2	
CO3	
CO4	
CO5	
CO6	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

L	Т	Р	Credit	Area	CWS	PRS	MTE	ETE	
	0/1	2/0	4	DEC	15/25	25/0	20/25	40/50	

Objective: This course covers the science and technology underlying polymer composites manufacturing processes from the perspectives of process selection, materials efficiency, and sustainability

~		<i>a</i> ,
Syllabus		Contac
		t
		Hours
Unit-1	Polymer matrix –classification- thermoplastics and thermosetting plastics, types of matrix	8
	material, remote material-Types-MMC-PMC-CMC Advantages and Disadvantages	
	Manufacturing of PMC material-Lay-up, Autoclave Molding filament Winding, Pultrusion, etc.	8
Unit-2	Machining of polymeric composite material, Forming methods for Polymers and polymeric	
0	composite material component design consideration.	
	Joining of PMC-Friction Welding of PMC, Thermal Welding of PMC, Electromagnetic Welding	8
	of PMC-Process-Processing Parameters Materials-Advantages & Disadvantages and	U
Unit-3	Applications. Mechanical	
	fastening of PMC, Chemical bonding of PMC, Joint design, equipment and application methods,	
	Advantages and disadvantages,	
	Applications adhesive bonding Application of Polymers and PMC material Automotive	6
Unit-4	Industry- Marine Industry- Materials Handling- Chemical Industry- Electrical & Electronics	
	Industry- Aerospace Industry	
	Biomedical field.	
	Recent advancements in polymeric materials- Blends and composites conducting polymer - nano	
TT •4 F	fibers- Polymeric nano composites Biodegradable Polymeric Nano fibers for Biomedical	6
Unit-5	Applications- nano	
	tube based Conducting Polymer Composite- polymeric Nano materials in piezoelectric sensors	
U	Biodegradable Polymers to improve new Antifouling coating ,Polymer in health care,	
Unit-6	Environmental issues concerning polymers and polymer in energy application	6
		-
	Total	42

Ref	erence Books:
1	Schwartz, M. "Composite Materials Handbook", 2nd Edition, McGraw Hill, ISBN-10: 0070558191, 1992
2	"ASM Hand book on Composites", Volume 21, 2001.
3	Andrew William, "Handbook of Plastics Joining- A Practical Guide" Plastics Design Library, NewYork, ISBN- 10: 1884207170, 1997
4	Hollaway Leonard, "Handbook of Polymer Composites for Engineers", Woodhead Publishing series, CRC Press, ISBN-10: 1855731290, 1994.

CO1	The student will develop a knowledge of the manufacturing of composite materials.
CO2	The student will develop a working knowledge of the various testing and performance protocols for composite materials.
CO3	The student will develop an understanding of the economics of composite materials.
CO4	Summarize the manufacture of metal matrix, ceramic matrix and composites.
CO5	Describe the manufacture of polymer matrix composites.
CO6	Describe the properties of various reinforcements of composite materials.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-408: Industrial Tribology										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-	

Objective: To explain the different wear processes in contacts between surfaces and processes of lubrication in all regimes

tact rs
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Refe	erence Books:
1	Stachowiak Gwidon, Batchelor A.W., "Engineering Tribology", Butterworth Heinemann Ltd, ISBN -10:
	0750673044 ,2000 Edition
2	Stachowiak Gwidon, Batchelor A.W., "Experimental Methods in Tribology", Elsevier Science Ltd, ISBN-10:
	0444515895, 2004
3	Williams John, "Engineering Tribology", Cambridge University Press, ISBN-10: 0521609887, 2005

CO1	The student can identify different areas of Industrial Tribology.
CO2	Be able to know the surface, properties of surface and related instruments
CO3	Understand the friction, friction theory and behaviour of metals and non-metals
CO4	Understand wear processes, wear theory, behaviour of metals and non-metals and different instruments
CO5	Be able to understand the lubricants, lubrication and instruments for measuring lubricant's properties.
CO6	Can find the applications of all the areas in day to day life

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-410: Packaging Technology									
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	_

Objective: Understand the working principles of key packaging materials and processes needed to provide a workable packaging solution to meet logistics and regulatory requirements. Become competent in identifying the technological, economic, and societal factors that underline the selection of appropriate packaging materials, processes, and storage methods for specific products.

Syllabus		Contact Hours
Unit-1	Introduction- Packaging as an integral process in production and marketing, Packages, Packaging characteristics, Physical properties. Mechanism of spoilage, degradation, corrosion & their prevention. Compatibility-permissible plasticizers and their migration to food products. Package design.	8
Unit-2	Packaging Materials: Papers and speciality papers, cellulosic films and laminates. Plastic-PE, PP PS, PVC, PVDC, Nylon, Polyester and their combinations. Expanded PE, PS and bubble films. Glass containers, ampoules and vials. Composite containers, drums and paper tubes. Aluminum foils, laminates and coating. Single layer and multilayer polymer packaging.	8
Unit-3	Ancillary materials: Adhesives, Adhesive tapes. Cushioning materials and properties, reinforcements. Stitching methods. Seals and enclosures. Lining compounds and lacquers. Labels and instant labeling. Ink jet printing and bar coding. Graphic design. Printing techniques-Printing inks and print evaluations.	8
Unit-4	Testing, Standards and Quality control: Mechanical testing, resistance to light, insect and mould. Barrier testing for air, oxygen etc., shelf life, worthiness of filled packages. Seal tests.	6
Unit-5	Standards - basic concepts for rigid and non rigid and non rigid and ancillary materials standards for export packages, ISO 9000 and implications. Eco packaging and regulations.	6
Unit-6	Process machinery and equipment Machinery and equipment for manufacture of bottles, carry-bags and laminates.	6
	Total	42

Ref	erence Books:
1	Lu Daniel(Editor), Wong C.P.(Editor), "Materials for Advanced Packaging", Springer; ISBN: 144194611X, 2009
	edition
2	Yam Kit L (Editor), Encyclopedia of Packaging Technology, Wiley; ISBN-10: 0470087048, 3 edition 2009
3	Susan E. M. Selke, John D. Culter, Ruben J. Hernandez, "Plastics Packaging", Hanser Gardner Pubns; ISBN- 10: 3446214046, 2 edition 2005
4	
5	
6.	
Course Outcomes

CO1	The student can identify key areas of packaging and study an integral process in production and marketing.
CO2	Be able to know the , cellulosic films and laminates.
CO3	Understand the Adhesives, Adhesive tapes. Cushioning materials and properties, reinforcements.
CO4	Understand mechanical testing, resistance to light, insect and mould.
CO5	Be able to understand basic concepts for rigid and non rigid and ancillary materials.
CO6	Can find the applications of process machinery and equipment.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-412: Supply Chain Management & Value Engineering											
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE		
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-		

Objective: To understand the key considerations at the various stages involved in the supply of product in order to maintain the smooth flow from source to the point of consumption so that overall organizational performance may improve.

Syllabus		Contact Hours
Unit-1	Introduction : Perspective of Supply Chain Management, Managing uncertainty, Key issue in supply chain management.	8
Unit-2	Inventory Management and Risk Pooling: Inventory management, Classification of inventory, Centralized versus Decentralized Warehousing and Risk pooling, Value of Information, Quantification of Bullwhip effect, Causes and remedies of Bullwhip effect.	6
Unit-3	Resource planning: Aggregate Production Planning- Chase and leveling strategies, MRP, MRP-II, Agile manufacturing Systems	6
Unit-4	Procurement and Outsourcing strategies: Introduction, outsourcing benefits and risks, Make/Buy decision, e-procurement, Vendor selection and quota allocation.	8
Unit-5	Strategic Alliances : Introduction, Third party logistics, Demand driven strategies, Distribution strategies- direct shipment, cross docking, transshipment, Supplier relationships management, Customer relationship management.	8
Unit-6	International Issues in Supply Chain Management : Concepts in Globalization, Globalization forces, Risks and Advantages of International supply chains, Issues in International supply chain management, Regional differences in logistics.	6
	Total	42

Ref	erence Books:
1	Simchi-Levi, Kaminsky, Philip K. and 'Designing and Managing the Supply Chain: Concepts, Strategic and Case Studies', McGraw-Hill/Irwin, (ISBN, 10: 0072357568, 13: 978-0072357561),
2	Chopra Sunil, Meindl Peter, "Supply Chain Management" Pearson, ISBN-10: 8131789209 ,5 edition, 2012
3	Shah Janat, "Supply Chain Management: Text and Cases", Pearson Education; ISBN-10: 8131715175 ,First edition 2009

Course Outcomes

CO1	Students will be able to understand the different types of uncertainties and issues in supply chain
	management.
CO2	Students will be able to know the importance of inventory management with concepts of risk pooling and
	Bullwhip effect in a supply chain
CO3	Students will have knowledge of resource planning to meet the fluctuating demand of the products and
	services in the market.
CO4	Students will have knowledge of sourcing, outsourcing and procurement of the materials.
CO5	Students will have knowledge of supplier relationship management and integration with other supply chain
	partners.
CO6	Students will be able to know about globalization of supply chain activities and their requirement.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-414: Flexible Manufacturing System											
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE		
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-		

Objective: To understand the concept of group technology and various models of manufacturing systems.

Syllabus		Contact Hours
Unit-1	Planning, Scheduling and Control of Flexible Manufacturing Systems-Introduction to FMS- development of manufacturing systems – benefits – major elements – types of flexibility – FMS application and flexibility – single product, single batch, n–batch scheduling problem – knowledge based scheduling system.	8
Unit-2	Computer Control and Software for Flexible manufacturing systems- Introduction – composition of FMS- hierarchy of computer control – computer control of work center and assembly lines – FMS supervisory computer control – types of software specification and selection – trends	8
Unit-3	FMS Simulation and Data Base - Application of simulation-model of software - limitation - manufacturing data systems- data flow-FMS database systems-planning for FMS database.FMS-simulation	8
Unit-4	Economic justification of FMS- application of possibility distributions in FMS systems justification, Applications of FMS and Factory of the future -FMS application in machining, sheet metal fabrication, prismatic component production–aerospace application	6
Unit-5	FMS development towards factories of the future – artificial intelligence and expert systems in FMS – design philosophy and characteristics for future	6
Unit-6	Group Technology and Justification of FMS -Introduction – matrix formulation mathematical programming formulation –graph formulation– knowledge based system for group technology	6
	Total	42

Ref	erence Books:
1	Jha, N.K. "Handbook of flexible manufacturing systems", Academic Press Inc.,1991.
2	Raouf, A. and Ben-Daya, M., Editors, "Flexible manufacturing systems: recent development", Elsevier Science, ISBN-10: 0444897984, 1995.
3	Groover M.P., "Automation, production systems and computer integrated manufacturing", Prentice Hall of India Pvt., New Delhi, ISBN-10: 9332549818, 1996.
4	RadhakrishnanP. and Subramanyan S., "CAD/CAM/CIM", Wiley Eastern Ltd., New Age International Ltd., ISBN-10: 8122422365, 1994.

Course	e Outcomes
CO1	Explain the knowledge about role of computer and automation in manufacturing.
CO2	Describe the flexibility, types of flexibility and flexible manufacturing systems.
CO3	Explain computer based integration between various functions.
CO4	Describe the application of computer numerical control machine4s in manufacturing.
CO5	Explain the concept of group technology, FMS, concurrent engineering, Simulation in CIM systems
CO6	Applications of FMS in industries

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-416: Work Study & Ergonomic											
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE		
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-		

Objective: To provide basic understanding to the students about the concept and significance of work study and ergonomics. To impart thorough knowledge to the students about various techniques of work-study for improving the productivity of an organisation.

Syllobus		Contact
Synabus		Hours
Unit-1	Productivity: Definition, reasons for low productivity, methods to improve productivity, Work- study and productivity	8
Unit-2	Human factor in work-study: Relationship of work-study man with management, supervisor & workers, qualities of a work-study man.	6
Unit-3	Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Like outline process charts, flow process charts, multiple activity charts, two handed process chart, string diagram, travel chart, cycle graph, Chrono-cycle graph, therbligs, micro motion study and film analysis, Simo chart, principles of motion economy. Development and installation of new method.	6
Unit-4	Work-Measurement: Definition, various techniques of work measurement work-sampling, stopwatch time study & its procedure, Job selection, Equipment and forms used for time study, rating, methods of rating, allowances and their types, standard time, numerical problems, predetermined - time standards and standard data techniques. Incentive: Meaning, objectives of an incentive plan, various types of incentive plans	8
Unit-5	Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements. NIOSH lifting equation, Lifting Index, Maximum acceptable Weights and Forces, Distal upper extremities risk factors, Strain Index, RULA, REBA.	8
Unit-6	Applied anthropometry - types, use, principles in application, design of work surfaces and seat design. Visual displays for static information, visual displays of dynamic information, auditory, tactual and olfactory displays and controls. Assessment of occupational exposure to noise, heat stress and dust .Effect of vibration/ noise, temperature, illumination and dust on human health and performance	6
	Total	42

Ref	erence Books:
1	Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, ISBN-10: 8126522178, 2009.
2	Marvin E, Mundel & David L, "Motion & Time Study: Improving Productivity", Pearson Education, ISBN-10: 0136030440, 2000.
3	Benjamin E Niebel and FreivaldsAndris, "Methods Standards & Work Design", McGraw Hill, ISBN-10 1259064840, 1997.
4	International Labour organization, "Work-study", Oxford and IBH publishing company Pvt. Ltd., N.Delhi, ISBN-10 8120406028, 2001

Course Outcomes

CO1	To define and describe the scope of work study, trends in business and management process and forecast the demand for products and services for a given organization.
CO2	To solve l problems related human factor in work-study.
CO3	To analyze method-study, step-by-step procedure, questioning techniques.
CO4	To develop an understanding ergonomics, history of development, man-machine system and its components.
CO5	To implement an in-depth understanding workload and energy consumption, biomechanics.
CO6	To apply principles of work study in design of work surfaces and seat design.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2

	PE-418 Advance Manufacturing Processes										
L	Т	Р	Credit	Area		CWS	PRS	MTE	ETE	PRE	
3	0/1	2/0	4	DEC		15/25	25/0	20/25	40/50	-	

Objective: To understand basic principles of various processes and their applications. State various parameters influencing the Manufacturing process

Syllabus		Contact Hours
Unit-1	Introduction, need of advanced machining processes, hybrid processes, microelectro mechanical system, (MEMS), nano electromechanical systems(NEMS),Ultrasonic micro machining - mechanics of cutting, parametric analysis, process capabilities, applications.	8
Unit-2	Abrasive jet machining: Introduction, set ups, gas propulsion system, abrasive feeder, machining chamber, AJM nozzle, abrasive parametric analysis, process capabilities, applications, abrasive micro machining, Water jet machining: Introduction, process characteristics, process performance, applications, Abrasive Water jet machining: Abrasive finishing process: Working principle, parametric analysis, process variables, process performance and applications,	6
Unit-3	Abrasive flow machining- Working principle, parametric analysis, process variables, process performance and applications, Magneto rheological abrasive flow finishing- Working principle, parametric analysis, process variables, process performance and applications, Magnetic float polishing, Magnetic abrasive finishing- Working principle, parametric analysis, process variables, process variabl	6
Unit-4	Electro discharge machining (EDM): Introduction, Working principle, parametric analysis, process variables, process characteristics, applications, hybrid processes such as electro discharge grinding, diamond grinding, wire EDM, Electro discharge micro grinding,	8
Unit-5	Laser beam machining- production of laser, working principle, types of laser, process characteristics and applications. Electron beam machining: Working principle, process parameter, process characteristics, and applications. Ion beam machining: Working principle, process parameter, process characteristics, and applications.	8
Unit-6	Plasma arc machining: Working principle, Plasma arc cutting system, applications.	6
	Total	42

Ref	erence Books:
1	Advanced machining process, Dr.V.K.Jain
2	Non traditional methods of manufacturing, shah &Pandey

Course Outcomes

CO1	The course aims to equip students with overview and the need of advanced manufacturing processes.
CO2	To comprehend working principle of advanced manufacturing processes based on energy used such as mechanical, thermal, and Kinetic energy.
CO3	To study parametric analysis of advanced manufacturing processes such as EDM, ECM, USM, AJM, AJWM.

CO4	To study the process variables on the performance of advanced manufacturing process such as metal removal and surface finish.
CO5	To study the capabilities and limitations of the advanced manufacturing processes and the guidelines for their selection of different materials.
CO6	To learn the working principle of hybrid advanced manufacturing techniques to enhance the manufacturability.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	0	0	0	0	0	0	2	2	1	1
CO2	3	3	2	3	1	0	0	0	0	0	0	1	2	1	1
CO3	3	3	3	3	1	0	0	0	0	0	0	2	3	3	2
CO4	3	3	3	3	1	0	0	0	0	0	0	1	3	3	2
CO5	2	2	2	2	2	0	0	0	0	0	0	1	2	2	2