JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

SYLLABUS III TO VIII SEMESTER

DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING

(Outcome Based)

2018 Scheme

JSS MAHAVIDYAPEETHA

JSS SCIENCE & TECHNOLOGY UNIVERSITY

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engg)

SEMESTER	CREDITS
I	19.5
II	21.5
III	26.0
IV	28.0
V	23.0
VI	25.0
VII	16.0
VIII	16.0
TOTAL	175.0

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)

SEMESTER: III

Sl. No	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in Hrs
				L	T	P	Total		CIE	SEE	TOTAL	
1	MA310	Engineering Mathematics -III	I & P	4	0	0	4	4	50	50	100	3 Hrs
2	IP310	Industrial Metrology	I & P	4	0	0	4	4	50	50	100	3 Hrs
3	IP310L	Industrial Metrology Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
4	IP320	Kinematics of Machines	I & P	4	0	0	4	4	50	50	100	3 Hrs
5	IP330	Fluid Mechanics	I & P	4	0	0	4	4	50	50	100	3 Hrs
6	IP340	Elements of Production Engineering	I & P	4	0	0	4	4	50	50	100	3 Hrs
7	IP340L	Production Engineering Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
8	IP350L	Computer aidedMachine Drawing	I & P	0	0	3	3	6	50	50	100	3 Hrs
				Total credits			26		Total marks		700	

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)

SEMESTER: IV

Sl. No	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in Hrs
				L	T	P	Total		CIE	SEE	TOTAL	
1	MA410	Engineering Mathematics -IV	I & P	4	0	0	4	4	50	50	100	3 Hrs
2	IP410	Material Science & Metallurgy	I & P	4	0	0	4	4	50	50	100	3 Hrs
3	IP410L	Material Testing Lab	I & P	0	0	1	1	2	50	-	50	-
4	IP420	Dynamics of Machines	I & P	4	0	0	4	4	50	50	100	3 Hrs
5	IP430	Metal Cutting & Machine Tools	I & P	4	0	0	4	4	50	50	100	3 Hrs
6	IP430L	Metal Cutting & Machine Tools Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
7	IP440	Thermal Engineering	I & P	4	0	0	4	4	50	50	100	3 Hrs
8	IP450	Computer Aided Design	I & P	4	0	0	4	4	50	50	100	3 Hrs
9	IP450L	Computer Aided Design Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
				Total credits			28				750	

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JSS SCIENCE & TECHNOLOGY UNIVERSITY

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)

SEMESTER: V

Sl. No	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in Hrs
				L	T	P	Total		CIE	SEE	TOTAL	
1	IP510	Management & Entrepreneurship	I & P	4	0	0	4	4	50	50	100	3 Hrs
2	IP520	Design of Machine Elements.	I & P	4	0	0	4	4	50	50	100	3 Hrs
3	IP530	Product Design & Manufacturing	I & P	4	0	0	4	4	50	50	100	3 Hrs
4	IP540	Industrial Engineering & Ergonomics	I & P	4	0	0	4	4	50	50	100	3 Hrs
5	IP55L	Industrial Engineering & Ergonomics Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
6	IP56X	Elective I	I & P	4	0	0	4	4	50	50	100	3 Hrs
7	IP57L	Computer Aided Engineering Analysis Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
				Total credits			23		Total marks		600	

ELECTIVE I

Subject code	Engineering Stream	Subject code	Manufacturing Stream	Subject code	Management Stream	Subject code	Production Stream	Subject code	Open Stream
IP561	Maintenance Engineering & Industrial Safety	IP562	Non Destructive Testing	IP563	Marketing Management	IP564	Theory of Metal Forming	HU560	Technical Communication and Professional Ethics

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JSS SCIENCE & TECHNOLOGY UNIVERSITY

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)
SEMESTER: VI

Sl. No	Subject Code	Course Title	Teaching Department	Credits				Contact Hours	Marks			Exam Duration in Hrs
				L	T	P	Total		CIE	SEE	TOTAL	
1	IP610	Operations Research	I & P	4	0	0	4	4	50	50	100	3 Hrs
2	IP62 L	Operation Research & Statistics Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
3	IP630	Applied Machine Design	I & P	4	0	0	4	4	50	50	100	3 Hrs
4	IP640	Quality Engineering	I & P	4	0	0	4	4	50	50	100	3 Hrs
5	IP650	Lean & Agile Manufacturing	I & P	4	0	0	4	4	50	50	100	3 Hrs
6	IP66X	Elective II	I & P	4	0	0	4	4	50	50	100	3 Hrs
7	IP67L	Computer Aided Manufacturing Lab	I & P	0	0	1.5	1.5	3	50	-	50	-
8	HU610G	Foreign Language (German)	Humanities	2	0	0	2	2	50	50	100	2 Hrs
				Total credits			25		Total marks		700	

ELECTIVE II									
Subject code	Engineering Stream	Subject code	Manufacturing Stream	Subject code	Management Stream	Subject code	Open Stream	Subject code	Production Stream
IP661	Mechatronics & Robotics Systems	IP662	Composite Materials	IP663	Energy Engineering & Management	IP664	Automatic Control Engineering	IP665	Non Traditional Machining.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)
SEMESTER: VII

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs
				L	T	P	Total					
1	IP710	Hydraulics & Pneumatics	I & P	3	0	0	3	3	50	50	100	3 Hrs
2	IP720	Plant Layout and Design	I & P	3	0	0	3	3	50	50	100	3 Hrs
3	IP730	Operations Management	I & P	3	0	0	3	3	50	50	100	3 Hrs
4	IP74X	Elective III	I & P	3	0	0	3	3	50	50	100	3 Hrs
5	IP75X	Elective IV	I & P	3	0	0	3	3	50	50	100	3 Hrs
6	IP76S	Seminar	I & P	1	0	0	1	1	50	-	50	
			Total credits				16	Total marks			550	

ELECTIVE III

Subject code	Engineering Stream	Subject code	Manufacturing Stream	Subject code	Management Stream	Subject code	Open Stream
IP741	Tool Engineering Design and Fixtures	IP742	World Class Manufacturing	IP743	Organizational Behavior	IP744	Mechanical Vibrations

ELECTIVE IV

Subject code	Engineering Stream	Subject code	Manufacturing Stream	Subject code	Management Stream	Subject code	Open Stream
IP751	Engineering Economics	IP752	Technology Management	IP753	Human Resource Management	IP754	Industry 4.0

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JSS SCIENCE & TECHNOLOGY UNIVERSITY

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Scheme of Teaching and Examination for B.E (I & P Engineering)

SEMESTER: VIII

Sl. No	Subject code	Course title	Teaching department	Credits				Contact hours	Marks			Exam duration in hrs
				L	T	P	Total					
1	IP810	Computer Integrated Manufacturing	I & P	3	0	0	3	3	50	50	100	3 Hrs
2	IP82X	Elective V	I & P	3	0	0	3	3	50	50	100	3 Hrs
4	IP83P	Project Work	I & P	0	0	10	10	20	70	30	100	3 Hrs
				Total credits			16		Total marks		300	

OPEN ELECTIVE V							
Subject code	Engineering Stream	Subject code	Manufacturing Stream	Subject code	Management Stream	Subject code	Open Stream
IP821	Just in Time Manufacturing	IP822	Additive Manufacturing.	IP823	Supply Chain Management.	IP824	Industrial Robotics

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Program Outcome for Undergraduate Programme

PO 1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2: Problem Analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3: Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide validconclusions.

PO 5: Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6: The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineeringpractice.

PO 7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainabledevelopment.

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities andnorms of the engineeringpractice.

PO 9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

PO 11: Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinaryenvironments.

PO 12: Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Programme Educational Objectives for UndergraduateProgramme:

PEO1: Graduates get employed in professions related to Industrial and Production Engineering adopting and adapting to advances intechnology and management.
PEO2: Graduates pursue advanced studies at Institutions of higher learning to engage in research and learning stimulations facilitatingthem to attain technical competence with an aptitude for life-long learning.
PEO3: Graduates become successful professionals in a challenging environment leveraging learnings for the growth of the organization bybecoming successful intrapreneurs keeping in mind the ethical responsibilities and volatile emerging societal needs.

Program Specific Outcomes (PSOs):

- Tocreatequalifiedbudding,versatileandmultifacetedEngineerstosolverealworldproblems arising in the areas of Industrial production andManagement.
- To imbibe confidence in students to start entrepreneurship on a small scale and become Successful entrepreneurs in thefuture
- To produce Engineers witha blend of both theory and practical knowledge in the field of manufacturing, management anddesign &to develop students with excellent presentation skills to take up innovative projects in industries

NOTE: Students must refer to NPTEL, SWAYAM portal, Scopus Indexed and Web of Science Indexed journals for all the courses.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

VII SEMESTER

Subject Name & Code	**HYDRAULICS & PNEUMATICSIP710**
No. of Teaching Hours – 39	**Credits : 3:0:0**

Course Objective

This course is essential in understanding the design, analysis, operation, maintenance and applications of fluid power systems.

Course Outcome:

On successful completion of the course the student will able to

1. Recall the basic concept of fluid mechanics, represent the structure of hydraulic system, able to identify different components of hydraulic system and to analyze the requirement of control components of hydraulic actuators andmotors
2. Able to design and analyse the control components in hydraulic system for various situation with a suitable hydraulic circuitdesign
3. Plan the maintenance schedule for the hydraulic system and also to understand the Pneumatics systems
4. To analyze the directional control valves and its use in the hydraulic and pneumatic systems as per ISO 1219 and ISO5599.
5. Understand and analyse multi cylinderapplications

Chap. No.	**Topics**	**Hrs**
	UNIT I	
01	**Introduction To Hydraulic Power:** Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of units. Structure of Hydraulic Control System. The Source of Hydraulic Power: Pumps Pumping theory, pump classification, gear pumps,vanepumps,pistonpumps,pumpperformance,pumpselection.Variable displacement pumps.	05 Hrs.
02	**Hydraulic Actuators and Motors:** Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.	04 Hrs
	UNIT II	
03	**Control Components in Hydraulic Systems:** Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves.	04 Hrs

04	**Hydraulic Circuit Design and Analysis:** Control of single and double – acting Hydraulic Cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter BalanceValve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control ofhydraulic cylinder, speed control of hydraulic motors, accumulators and accumulate orcircuits.	06 Hrs
	UNIT III	
05	**Maintenance of Hydraulic systems:** Hydraulic oils; Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperaturecontrol, trouble shooting.	04 Hrs
06	**Introduction to Pneumatic control:** Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. Pneumatic Actuators: Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod–less cylinders, types, working advantages. Rotary cylinder types construction and application.	04 Hrs
	UNIT IV	
07	**Directional Control valves:**Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. Simple Pneumatic Control: Direct and indirect actuation pneumaticcylinders,useofmemoryvalve.Flowcontrolvalvesandspeedcontrolof cylinders.	04 Hrs
	UNIT V	
08	**Multi-cylinder applications:** Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. Cascading method – principle. Practical application examples (up to two cylinders) using cascading method (using reversing valves). Electro-Pneumatic control: Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Control circuitry for simple single cylinder applications. Compressed air: Production of compressed air – compressors, preparation of compressed air- Driers,Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout.	08 Hrs

Text Books:

1. Fluid Power with applications: Anthony Esposito, Fifth edition pearsoneducation,Inc.
2. Pneumatics and Hydraulics: Andrew Parr. Jaico Publishing Co.

ReferenceBooks:

1. Oil Hydraulic Systems: Principles and Maintenance, S.R. Majumdar, Tata McGraw Hill publishing companyLtd.
2. Pneumatic Systems: S.R. Majumdar, Tata McGraw Hill publishingCo.,

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	PLANT LAYOUT AND DESIGN IP720
No. of Teaching Hours – 39	Credits:3:0:0

Course Objective:
To understand and analyze the importance of layout models using appropriate design and computerized techniques

Course Outcomes:
On successful completion of the course the student will able to

1. Illustrate good understanding about the planning strategies, implementation evaluation and maintaining the facility and explain various theories of plant location, objectives of plant layout and plant designImmer, Nadler Muther, Apple James and Reed'sapproaches.
2. Understand the concepts of material handling and basic devices used in material handling with suitableexamples.
3. Explain the Computerized layout planning like CRAFT, COFAD, PLANET, CORELAP, ALDEP and other aspects of plant design and its advantages andlimitations
4. Demonstrate the Space determination procedure, Construction of the layout and LocationModels.
5. Analyze the quantitative methods and models for the plant location and area allocation with the detailed construction oflayouts

Chap. No.	Topics	Hrs
	UNIT I	
01	**Plant Location:** Factors influencing plant location, Theories of plant location and location economics, location problems	04 Hrs
02	**Objectives of plant layout:** Principles of plant layout, types of plant layout, Merits and Demerits of plant layout, Function of Plant layout, types of layout problems.	04 Hrs
	UNIT II	
03	**Material Handling:** Principles of material Handling, Objectives of Material handling, Unit load concept, classification of Material handling equipment's.	04 Hrs
04	**Basic devices used in Material Handling:** Basic devices & Types of Material handling equipment, unit load concept with examples.	04 Hrs
	UNIT III	
05	**Computerized layout planning:** CRAFT, COFAD,PLANET, CORELAP , ALDEP, concepts of the above systems and use of flow chart	04 Hrs
06	**Plant Design:** Systematic layout planning, activity relationship chart, relationship diagram,spacerelationshipdiagramtoplantlayout,approaches to layout procedures.	04 Hrs

UNIT IV		
07	**Space Determination:** Space determination and area allocation, factors in space planning, receiving storage production shipping, tool room, tool crib and other auxiliary services, Factors to be considered for expansion, Flexibility aisles, columns etc.	08 Hrs
UNIT V		
08	**Area Allocation-2 :**Allocation procedure for area, plot plan, sequence demand, straight line and directional methods and simple problems, line balancing. Assembly line balancing, fabrication line balancing, simple problem in line balancing, Ranked position weight method, JR Jackson's Method	04 Hrs
09	**Detailed construction of the layout:** Methods of constructing the layout, evaluation of thelayout, efficiencies indices, presenting detailed layout to management	03 Hrs

TEXT BOOKS :

1. Plant layout and material handling- Jamesapple.
2. Plant layout and design – JamesMoore.

REFERENCES :

1. Facilities planning and Design – Tompkins.
2. Plant layout materials handling – Richard Muther
3. Facilities design – Sunderesh Hergur.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	OPERATIONS MANAGEMENT IP730
No. of Teaching Hours: 39	Credits :3:0:0

Objective: By Studying Operations Management, students will be able to appreciate the:

- Role of operations management in strategic decision making.
- Firm's competitive advantages, key concepts and issues of OM in both manufacturing and service organizations.
- Interdependence of the operations functions with the other key functional areas of a firm, apply analytical skills and problem-solving tools to the analysis of the operations problems.

Course Outcome:

Upon successful completion of the course, students should be able to

1. Understand the fundamental concepts of operations management with emphasis on System Design, Capacity Planning and Decision making methodologies used in Manufacturing and Service organizations.
2. Understand and apply the knowledge forecasting, aggregate planning and master scheduling techniques for various cases.
3. Apply the knowledge of MRP, CRP and recognize the importance of controlling production activities in Organizations
4. Understand the various scheduling techniques and apply the same for typical cases encountered in Industrial environments.
5. Understand and apply the knowledge of OM concepts applied to different situations faced in service organizations.

Chap. No.	Topics	Hrs
	UNIT I	
01	Introduction to Operations Management Concepts**:** Introduction, Historical development, Thetrend: Information and Non-manufacturing systems, Concept of productivity and its dimensions.	07 Hrs
02	System Design, Capacity Planning and Decision Making: Introduction, management as a science, characteristics of decisions, framework for decision making, decision methodology, decisionsupport systems economics models, statistical models, Manufacturing and service systems, design and systems capacity and capacity planning	
	UNIT II	
03	Demand Forecasting: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, and Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts	08 Hrs.
04	Aggregate Planning and Master Scheduling: Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.	

	UNIT III	
05	Material and Capacity Requirements Planning: Overview: MRP and CRP, Underlying concepts,System parameters, MRP logic, System refinements, Capacity management, CRP activities.Controlling Production Activities: PAC, objectives and data requirements, scheduling strategyand guidelines, scheduling methodology, priority control, capacity control.	08 Hrs.
	UNIT IV	
06	Scheduling: Concepts - , measures of performance, SPT rule, weighted SPT rule, EDD rule, minimizing the number of tardy jobs. Flow-Shop Scheduling: Introduction, Jonson 's rule for _n' jobs on 2 and 3machines, CDS heuristics.	08 Hrs.
07	Job- Shop Scheduling: Types of schedules, scheduling 2 jobs on _m' machines	
	UNIT V	
08	Service Operations Management: Nature and Characteristics, Classification of services and analyzing service operations, Service system design and delivery process, Technology & automation in services.	08 Hrs.
09	Service Capacity Management, Service Inventory and Supply Chain Management, Quantitative Models In Managing Service Operations – Application of simulation in service operations management.	

Text Books:

1. Operations Management- Monks, J.G., McGraw-Hill International Editions,
2. Production and Operations Management- Pannerselvam. R, PHI.
3. Productions & operations management - Adam &bert. PHI

Reference Books:

1. Modern Production/Operations Management- Buffa, Wiely Eastern Ltd.,
2. Production and Operations Management- Chary, S.N, Tata-McGraw Hill.,
3. Operations management - James Dilworth. PHI,
4. Operations Management – Lee J Karjewski and Larry P Ritzman, strategy and Analysis, Pearson Education.

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	TOOL ENGINEERING DESIGN & FIXTURES IP741 ELECTIVE III
No. of Teaching Hours – 39	Credits :3:0:0

Course Objectives: To establish the design of cutting tools and appropriate jigs & fixture from the industrial perspective.

Course Outcome

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

1. Understand the design of single point cutting tools and critically analyze for CNC cutting tools and drill bits, reamers with suitableexercises.
2. Understand the design of form tools and critically analyze for different types of form tools and design the milling cutters with suitableexercises.
3. Understand the design of broaches and critically analyze for different types of broaches and understand basic concepts of jigs, fixtures and the principles oflocations
4. Design and analyze the various types of jigs and their indexing methods for variousmachine tools
5. Design and analyze the various types of clamping devices and other types of clamping methods for various machinetools

Chap. No.	Topics	Hrs
	UNIT I	
01	**Cutting Tools:** Development of cutting tool materials. Design of single point tools for turning,. Problems	04 Hrs.
02	**Design of Drills :** Taper shank, Straight Shank, Design ofreamers, Strength and rigidity calculations, Exercises,	04 Hrs
	UNIT II	
03	**Design of Form Tools:** Calculations of tool profile for flat tools, circular form tools, Exercises on Form tools,	04 Hrs
04	**Design of Milling Cutters:** Types, calculation, sharpening, design details – Tools for threads – Design of threading taps for metric threads. Exercises	04 Hrs
	UNIT III	
05	**Design of Broaches:** –Exercises on Broaches for the given job, Strength and rigidity calculations	04 Hrs
06	**Jigs & Fixtures:** Tolerance analysis and procedure of designing. The economic calculations, location of the work piece, degree of freedom, references surfaces, resting components, fixture elements for surface concentric and radial locations	04 Hrs
	UNIT IV	
07	**Indexing Methods** – Basic indexing and design of Jigs and Accessories, types of drill jigs , jig bushes, and its applications for Drilling. Indexing ofjobs for Milling, Turning machines.	07 Hrs

UNIT V		
08	**Clamping of the work piece:** Principles, types and methods of clamping. Quick clamping devices, standards.	08 Hrs

TEXT BOOKS:

1. Tool Design - C Donaldson- G.H. Le CAIN V.C Goold, TMH
2. Metal cutting theory and Tool Design- Arshinav MIR Publications
3. Introduction to Jigs & Fixtures- Kempster. ELBS
4. Fundamentals of Tools Design- ASTME – Prentice Hall India Publications

REFERENCEBOOKS:

1. Metal Cutting and Tool design - Dr. B.J. Ranganath, Vikas Publishing house

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	WORLD CLASS MANUFACTURING IP742 ELECTIVE III
No. of Teaching Hours – 39	Credits :3:0:0

Course Objective:

Students understand the basics of WCM and learn the economics behind technology implementation considering adopting and developing new products.

Course Outcome:

On successful completion of the course the student will able to

1. Understand the basic principle, practices, models of WCM and how organizations gains competitiveedge.
2. Understand the concepts of Business process re-engineering from WCMperspective.
3. Appreciate the relevance of bench marking process & importance of people involvement in organizations to achieve world classstandards
4. Understand the basic philosophy of TPM, importance of modern management tools to adopt in organizations to achieve world classstatus.
5. Appreciate the relevance of Six sigma and TRIZ philosophy in achieving World Classtechnology.

Chap. No.	Topics	Hrs
	UNIT I	
01	**Principals and Practices of WCM:** Introduction to WCM,Evolution of WCM; Ohno‘s View on WCM; Principles and Practices; Quality in WCM; Deming‘s & Shingo‘sApproach to Quality Management	04 Hrs
02	**Gaining Competitive Edge Through World Class Manufacturing:** Manufacturing Excellence and Competitiveness, What is world-Class Manufacturing-Hall‘s framework of world-Class Manufacturing (WCM), Gunn‘s Model of World-Class Manufacturing, Maskell‘s Model of World-Class Manufacturing, America‘s Best Plants Model of World Class Manufacturing.	04 Hrs
	UNIT II	
03	**Definition of Reengineering:**Definition of reengineering, Michael Porter‘s five factormodel applicable to product and service organizations, Case studies on five factor model.	04 Hrs
04	**Importance of 3Cs**-customers takes charges, Characteristics of BPR, Role of informationtechnology in reengineering process, barriers to reengineering, Deming prize and Baldridge award.	04 Hrs

	UNIT III	
05	**Benchmarking:** Definition, mission and objectives, managing benchmarking process, phases of benchmarking process, Documentation, performance measures, improving business processes.	08 Hrs
06	**Employee engagement:** Motivation, Employee surveys, Empowerment, Team dynamics. Decision making methodology, Suggestion system, Performance appraisal methods	
	UNIT IV	
07	**Total Productive Maintenance:** Introduction, Foundational Pillars of TPM, The Plan, Learning the New Philosophy, Promoting the Philosophy, Loss areas of TPM and OEE, Training, Improvement Needs, Goal, Developing Plans, Case examples.	08 Hrs
08	**Management Tools:** Why Why analysis, Force Field Analysis, Nominal Group technique, Affinity diagram, Interrelation diagraph, Process Decision Program Chart, Activity networkdiagram.	
	UNIT V	
09	**Theory of Inventive Problem Solving** (TRIZ), Overview of 40 principles and 39 parameters, applications of TRIZ and case examples on minimum ten principles.	07 Hrs
10	**Six Sigma:** The Basics, The core of Six Sigma (DMAIC), design for Six Sigma, DFSS and the customer, Quality time and the Bottom line , core of DFSS-IDOV method,	

TEXT BOOKS:

1. Reengineering the corporation -Hammer, Michael and James Champy.
2. A Manifesto for Business revolution, Nicholas Brealey Publishing ,London.-1993
3. Finding and implementing best practices -Champ ,Robert C. Business Process Benchmarking:, Vision Books- New Delhi –2008
4. World class manufacturing -Sahay B S ,Saxena K B C, Ashish Kumar, - A Strategic Perspective: MacMillan – India Ltd, ISBN0333-93-4741.
5. Six sigma for Managers -Greg Brue, TMH 2002, ISBN-0-07-048639-5

REFERENCE BOOKS:

1. Design for Six Sigma -Grege,,TMh
2. Design for Six Sigma in Technology and Product Development -Creveling, Pearson Education.
3. Total Quality Management -Dale H. Besterfield,carol Besterfield-Minchna,glen H Besterfield and Mary Besterfield –scare, Pearson education, ISBN81-297-0260-6
4. Total Quality Management - Kesavan R - I K International Publishing house Pvt.Ltd

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	**ORGANIZATIONAL BEHAVIOUR IP743 ELECTIVE III**
Total No. of Hours – 39	**Credits :3:0:0**

Course Objective:

- Students will learn the concepts of OB based on differentmodels
- Understand the foundations of individual and group behavior which affect the organizational performance andeffectiveness.

Course Outcomes:

1. To familiarize foundations of Organizational Behaviour by understanding the individual Psychological Abilities and personality of the organizationalstakeholders.
2. To understand the perceptual theory, learning theories and skill acquisition of an individual from organizational behaviorperspective.
3. To understand the importance of different values and attitudes of an individual. To recognize the importance of organizational communication theory and organizational conflictprocess.
4. To be able to comprehend the basic motivational theories and leadership styles pertaining to individual level and to organizationalsettings.
5. To be able to understand group dynamics in organizational settings, also to understand job satisfaction and stress management with reference to organizationalsettings.

Chap No	**Topics**	**Hrs**
	UNIT I	
01	**Introduction:** Definition of Organisation Behaviour and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems). The Individual: Foundation of individual behaviour, Personality theory and Individual ability	08 Hrs.
	UNIT II	
02	**Learning:** Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social making, learning theory, Dreyfus Skill acquisition principles, continuous and intermittent reinforcement. **Perception:** Definition, Factors influencing perception, attribution theory, selective perception,projection, stereotyping, Halo effect	08 Hrs
	UNIT III	
03	**Values and Attitudes:** Definition – values, Attitudes: Types of values, job satisfaction, job involvement, professional Ethics, Organizational commitment, cognitive dissonance, Values and attitudes- terminal values and instrumental values, formation of attitudes, sources of attitudes and measurement of attitudes. Organizational communication types, mediums and barriers to communication, Conflict Management: Definition of conflict, functionalanddysfunctional conflict, stages of conflict process.	08 Hrs

	UNIT IV	
04	**Motivation:**Maslow's Hierarchy of Needs, Mc. Gregor's theory X and Y, Herzberg's motivation Hygiene theory, David Mc Cleland three needs theory, Victor Vroom's expectancy theory of motivation. **Leadership:** Definition, Behavioural theories – Blake and Mounton managerial grid, **Contingency theories** – Hersey - Blanchard's situational theory, Leadership styles – characteristics, Transactional, transformation leaders	08 Hrs
	UNIT V	
05	**The Group: Definition and classification of groups,** Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making. Workplace stress management and job satisfaction-its relationship to productivity,absenteeism and employee turnover.	07 Hrs

TEXT BOOKS:

1. Organizational Behaviour - Stephen P Robbins –Pearson EducationPublications
2. Organizational Behaviour – Schermerhorn - Wiley India PvtLtd.
3. Management of Organizational Behavious - Paul Henry and Kenneth H. Blanchard - Prentice Hall ofIndia.
4. Organizational Behaviour – Fred Luthans - McGraw Hill International Edition

REFERENCE BOOKS:

1. Organisational Behaviour – Hellriegel, Srocum and woodman, Thompson Learning - Prentice Hall India-.
2. Organizational Behaviour – VSP Rao and others – KonarkPublishers

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Subject Name & Code	**Mechanical VibrationIP744 Elective III**
Total Contact Hours: 39	**Credits (L:T:P): 3:0:0**

Course Outcome:

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

CO1: Understand and explain free vibration, forced vibration, single degree, two degrees and multi degrees of freedom systems, vibration measuring instruments, and continuous systems.

CO2: Apply knowledge to determine the frequency response of free and forced vibrations systems.

CO3: Analyse and derive the vibration characteristics of free and forced vibration systems, single and two degrees of freedom systems in terms of natural frequency, mode shapes and coupling phenomena.

CO4: Demonstrate the characteristics of continuous vibrating systems and multi degrees of freedom systems.

Chap. No.	Topics	Hrs
	UNIT I	
01	Introduction: Types of vibrations, S.H.M, Principle of super position applied to simple Harmonic Motions, Beats. Fourier theorem and simple problems. Single degree of freedom systems and simple problems.	04 Hrs.
02	Un damped Free Vibrations: Introduction, un damped free vibrations –natural frequency of free vibrations, stiffness of spring elements, and effect of mass of spring.	04 Hrs
	UNIT II	
03	Damped Free Vibrations: Single degree freedom systems, different types of damping, concept of critical damping and its importance, study of response of viscous damped systems for cases of under damping , critical and over damping, Logarithmic decrement.	06 Hrs
	UNIT III	
04	Forced Vibration: Single degree freedom systems, steady state solution with viscous damping due to harmonic force, solution by complex algebra, concept of response, Reciprocating and rotating unbalance, vibration isolation- Transmissibility ratio. Energy dissipated by damping, sharpness of resonance, base excitation.	04 Hrs
05	Vibration Measuring Instruments: Accelerometer and vibrometers, Whirling of shafts with and without air damping. Discussion of speeds above and below critical speeds.	06 Hrs
	UNIT IV	
06	Systems with Two Degree of Freedom: Introduction, principle modes and normal modes of vibrations, Co-ordinate coupling, generalized and principle co-ordinates, free vibrations in terms of initial conditions. Geared systems. Forced Oscillations – Harmonic excitation. Applications: a) Vehicle suspension (b) Dynamic vibration absorber(c) Dynamics of Reciprocating Engines.	07 Hrs

	UNIT V	
07	Continuous Systems : Introduction, vibration of string, longitudinal vibration of rods, torsional vibrations of rods Euler's equation for beams, simple problems M.D of systems. Introduction, influence co-efficient, Maxwell Reciprocal theorem.	04 Hrs
08	Numerical Methods for Multi Degree Freedom Systems: Dunkerly's equation. Orthogonality of principle modes,.Hozler'smethod, geared and branched systems, Rayleigh's method, Stodola method.	04 Hrs

TEXT BOOKS :

1. Fundamental Mechanical Vibration – S .GrahamKelly, Tata McGraw Hill,2000.
2. Mechanical Vibrations – Singireru .Mcgrawhil, Pearson Eduacation Inc. 4thEdition, 2003.

REFERENCEBOOKS:

1. Mechanical Vibrations- Kelly Schum's outline series . McGrawHill.
2. Vibrations- TSE, Morse &Hindle prentice HallIndia
3. MechanicalVibrations –AustinsH.Church,JohnWileyandsons,Theory&PracticeofMechanical Vibrations:J.S. Rao & k. Guptha , New Age Intl.,Publication.
4. Theory of Vibration with applications – William T. Thomson and maric Dillon Dahleh, pearson EducationInc.
5. Vibrations- BalakumarBalachandran and Edward B. Magrab, ThomsonAsia,
6. Fundamentals of Mechanical Vibrations- S .GrahamKelly, Tata McGraw Hill, InternationalEdition

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	ENGINEERING ECONOMICS IP751 ELECTIVE IV
No. of Teaching Hours – 39	Credits :3:0:0

Objective: To impress upon the students relating to the taxation, cash flow analysis, Methods of Depreciation and its effects.

- Provides clear understanding of the fundamentals of engineeringeconomics.
- Learn the concepts of decision making, problem solving, and comparison of the alternatives and elements ofcost.

Course Outcome:
On successful completion of the course the student will able to

1. CO1: Define and explain the basic concepts of Engineering Economics, importance of decision making, supply and demand concepts, types of interest, interest factors, characteristics of taxation, replacement principles, and methods of depreciation and components of cost accounting.
2. CO2: Apply the knowledge to calculate interest rate, present and future worth comparisons, equivalent annual worth comparisons of business projects, rate of depreciation, EMI's, rate of return in starting new ventures.
3. CO3: Analyze cash flow diagram, different methods of comparison, like present worth, equivalent worth comparisons, perform replacement analysis, break even analysis, minimum cost analysis
4. CO4: Demonstrate the principles of an ideal taxation system in managing projects in multi-disciplinary environment.

Chap. No.	Topics	Hrs
	UNIT I	
01	**Introduction:** Engineering Decision-Makers, Engineering and Economics, Demand & Supply. Agents of production, labour& its characteristics	02 Hrs.
02	**Interest and Interest factors**: Interestrate, Simpleinterest, Compoundinterest, interest formulae, Cash – flow diagrams, Exercises and Discussion.	06 Hrs
	UNIT II	
03	**Present Worth Comparisons:** Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay-back comparison, Exercises, Discussions and problems.	04 Hrs
04	**Taxation:** Direct & Indirect cost, Characteristics of a good taxation system	04 Hrs

	UNIT III	
05	**Equivalent Annual Worth Comparisons:** Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparisons, Consideration of asset life, Comparison of assets with equal and unequal lives, Use of shrinking fundmethod, Annuity contract for guaranteed income, Exercises, Problems	08 Hrs
06	**Replacement Analysis:** Basic reason for replacement, installation & removal costs, common errors in replacement studies	
	UNIT IV	
07	**Depreciation and Tax:** Nature of Depreciation, Causes of Depreciation, Basic methods of depreciation - Straight line, declining balance, sum of the years digit method and sinking fund method. Problems	08 Hrs
	UNIT V	
08	**Cost & Cost Accounting:** First cost, fixed cost, variable cost, incremental cost, sunk costand marginal cost. Break even analysis and minimum cost analysis. Direct Material Costs, Direct Labourindirect manufacturing expenses, allocation of factory overheads.	07 Hrs

TEXT BOOKS:

1. RIGGS J.L., Engineering economy, McGrawHill
2. THUESEN H.G., Engineering economy,PHI

REFERENCE BOOKS:

1. TARACHAND, Engineeringeconomy
2. OP KHANNA, Industrial Engineering and Management, DhanpatRai&Sons.
3. I M PANDAY , Financial Management , Vikas PublishingHouse
4. PAUL DEOARMO, Engineering economy, Macmillan Pub,Co

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Subject Name & Code	TECHNOLOGY MANAGEMENT IP752 ELECTIVE IV
No. of Teaching Hours – 39	Credits :3:0:0

CourseOutcome:

Upon successful completion of the course, students should be able to

1. Understand the fundamental concepts of Technology management with emphasis onTechnology Acquisition, Technology Strategy and Competitiveness and Adaption
2. Apply the knowledge & techniques for various cases.
3. Synthesis the knowledge and techniques to solve real life problems

Chap No.	Topics	Hrs
	UNIT I	
01	**Introduction to Technology Management:** Concept and Meaning of Technology and Technology Management- Technology; Technology management, Evolution and Growth of Technology, Role and Significance of Technology Management, Impact of Technology on Society and Business- Technology and competition; Key issues in managing technological innovation, Forms of Technology- Process technology; Product technology	08 Hrs
02	**Technology Acquisition:** Technology Acquisition, Alternatives for Acquiring New Technologies, Reasons Compelling a Company for Obtaining a New Technology, Management of Acquired Technology, Measures of Scale and Mechanisms for Acquiring Technologies- Economy of scale or Scale economy; Levels of scale; The measurement of scale; Factors affecting the choice of scale	
	UNIT II	
03	**Technology Strategy and Competitiveness:** Technology Strategy-Technology strategy and management; Elements of an accessible technology strategy, Innovation Management, Competitive Advantage- Components of competitive advantage; Creating competitive advantage using value chain, Technology Management Evaluation or Assessment	08 Hrs.
04	**Technology Adoption, Diffusion, and Absorption:** Technology Adoption, Technology Diffusion- of technology diffusion; Perspectives of innovation diffusion process; Activities necessary for diffusion process, Technology Absorption- Role of technology absorption; Benefits of technology absorption; Constraints in technology absorption, Technology Package and Technological Dependence, Indian Experience in Technology Absorption Efforts, Issues Involved in the Management of Technology Absorption and Government Initiatives	
	UNIT III	
05	**Aspects and Issues in Technology Management:** Technological Change-Characteristics of technological change; Classification of technological change; Impact of technological change, Technology Life Cycle, Technology Transformation, Technology	08 Hrs.

	Policies and Policy Instruments, Technological Development Options and Strategies, Technology and Socio-Economic Planning, Diffusion and Growth of Technologies- Information technology revolution; Macro effects of technological change	
06	**Technology Transfer:** Transfer of Technology, Models of Technology Transfer- Traditional technology transfer models; Qualitative technology transfer models, Technology Transfer Modes, Dimensions of Technology Transfer, Features of Technology Package, Routes of Technology Transfer	
	UNIT IV	
07 08	**Managing Technology Based Innovation:** Innovation and Technology- Innovation – Technology relationship; Technological innovation and management, Process of Technology - Based Innovation, Measures of Innovative Performance, Characteristics of Innovative Work Environment, Key Areas of Management Focus for Productive Innovation, Measures for Building High-Performing Innovative Technology- Based Organization's.	08 Hrs.
	Knowledge Based Technologies and Knowledge Management: Knowledge Based Technology and Techniques - Knowledge based technology process; Tools and techniques, Role of Artificial Intelligence Techniques, Knowledge Management Techniques for Technology Management	
	UNIT V	
09	**Human Aspects in Technology Management:** Integration of People and Technology, Factors Considered in Technology Management- Organizational factors; Psychological factors, Organizational Structure and Technology	07 Hrs.
10	**Social Issues in Technology Management:** Social Issues, Technological Change and Industrial Relations- Implementation of rationalization and automation in India; Impact of technological change, Technology Assessment and Environmental Impact Analysis- Environmental impact analysis process- Guidelines on the scope of EIA; Issues in preparation of EIA report; Elements of the environmental problem	

Text Books:

1. Management of New Technologies For Global Competitiveness — Christian N Madu - Jaico Publishing,
2. Technology management by IGNOU

Reference Books:

1. Strategic Technology Management - Betz. F. - McGraw-Hill.
2. Management of Technology - Tarek Khalli -, McGraw-Hill.
3. Strategic Management of Technological Innovation - Schilling - McGraw-Hill, 2nd ed.
4. Managing Technology and Innovation for Competitive Advantage - V K Narayanan - Pearson Education Asia
5. Strategic Management of Technology & Innovation - Burgelman, R.A., M.A. Madique, and S.C. Wheelwright -. Irwin.
6. Handbook Of Technology Management - Gaynor - Mcgraw Hill
7. Managing New Technology Development - Souder, W.C. and C.M. Crawford – McGraw-Hill.
8. Managing Technological Innovation - Twiss, B. -. Pitman.
9. Bringing New technology To Market - Kathleen R Allen - Prentice Hall India

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Subject Name & Code	HUMAN RESOURCE MANAGEMENT IP753 ELECTIVE IV
No. of Teaching Hours – 39	Credits :3:0:0

Objective: The topic covers the need for planning, recruitment, training, appraisal and motivational aspects to be addressed to in order to effectively manage the organization. To know industrial laws to start and manage a company/industry

Course Outcome

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

1. Know the nature, Scope and objectives of HRM and the environmental factors that have effect on HRM and do effective HR planning, Job design and Jobanalysis
2. Describe the importance of both recruitment and selection process to select potential candidates for variousjobs
3. Motivate group to achieve concern goal & objectives by acquiring the knowledge of motivation theories and study the performance appraisalmethods
4. Understand the basic concepts of HR auditing and accounts and demonstrate with numerical examples.
5. Understandvariousindustriallawsandclearlyapplytheselawswithsuitableindustrialcaseexamples.

Chap. No.	Topics	Hrs
	UNIT I	
01	**Introduction:** Overview, Objectives, competitive advantage, skills required. H.R. Policies, conceptual framework, methodologies	04 Hrs.
02	**Human Resource Planning:** Integrated strategic planning and human resources planningHRP at different levels, Process of HRP, Control and review mechanism.	04 Hrs
	UNIT II	
03	**Recruitment:** Need, Sources and techniques of recruitment assessment of recruitment programs Selection, Placement and Induction: Meaning, Significance factors affecting decisions, procedure, concept of testing, Interviews, Placement and induction process Training the work force: Importance, scope, training verses development, trainingprocess, techniques - Career Management - Planning and Development.	08 Hrs
	UNIT III	
04	**Leading:** Motivation – Human factors in managing, Motivation and Motivators, The hierarchy of needs theory, Theory X and Theory Y, The Motivation-Hygiene theory, Immaturity-Maturity theory, A systems and contingency approach to Motivation, Situational, or Contingency, approach to leadership	04 Hrs
05	**Performance Appraisal:** Meaning, need, purpose, content, legalities of performance appraisal. Methods of performance appraisal – traditional, graphic rating scales, ranking, pairedcomparison,forceddistribution,checklist,criticalincidence,essayorfreeform, Groupconfidentialreports.BehaviourallyAnchoredRatingScales(BARS)andrelated	04 Hrs

	Modern Scales	
	UNIT IV	
06	**HR audit, HR accounting,** absenteeism, labour turnover, separations, promotion, transfer, research in HRM, HR records, importance of HRIS, management of knowledge workers - HRM in future, International HRM.	04 Hrs
07	**Compensations Management:** Concept and Theories of wage machinery, Benchmarking– Performance linked compensation system – statutory requirement in compensation Management.	04 Hrs
	UNIT V	
09	**Industrial Safety and Welfare:** 1. The Factories Act 1948: Health, safety and welfare - hours of work - holidays and leave with pay - employment of women and children inspection and regulation. 2. The Employees Provident Fund Act1952. 3. The Industrial Disputes Act1947. 4. The Industrial Employment (Standing Orders) Act1946 5. The Payment of Wages Act1936 6. The Minimum Wages Act1948 7. The Payment of Bonus Act1965 8. The Equal Remuneration Act1976.	07 Hrs

TEXT BOOKS :

1. P.SubbaRao,-HumanResourceManagementandIndustrialRelationsII,Text,CasesandGames,New Delhi:HimalayaPublishingHouse
2. Human resource and personnel management byK.Aswathappa.
3. C.B. Memoria, -PersonnelManagementIIHimalayaPublishing

REFERENCE BOOKS:

1. Dessler, Gary, Human Resources Management, New Delhi: Prentice Hall of IndiaPvt.Ltd.
2. Saiyadain, Mirza S., Human Resource Management, New Delhi:TMH,.
3. San Beardwell and Len Holden, Human Resource Management, New Delhi:Macmillan,
4. Nair,N.G. and Latha Nair, Personnel Management and Industrial Relations, New Delhi: S.Chand& Co.
5. Peter C.Cairo,-Counselling in Industry–PersonnelPsychologyII
6. Wayne F Cascio, -Management Human ResourcesIITATAMcGraw HillNew Delhi.
7. H.JohnBernardino, and Joyce E.A Russel, -Human Resource ManagementII, McGraw HnternationalEditions.

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Subject Name & Code	INDUSTRY 4.0 IP754 ELECTIVE IV
No. of Teaching Hours – 39	Credits : 3:0:0

Course Outcome:

Upon successful completion of the course, students should be able to

1. Understand the fundamental concepts of Industry 4.0
2. Apply the knowledge & techniques of Industry 4.0 with emphasis on IoT.
3. Synthesis the knowledge and techniques to solve real life problems.

Chap. No.	Topics	Hrs
	UNIT I	
01	Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II, : Industry 4.0: Globalization, The Fourth Revolution, LEAN Production Systems	08 Hrs
	UNIT II	
02	Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation	08 Hrs
	UNIT III	
03	IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II. Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I	07 Hrs
	UNIT IV	
04	Industrial IoT- Layers: IIoT Communication , IIoT Networking-Part I, Part II, Part III. Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science Part I, Part II	09 Hrs

UNIT V		
05	Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT, Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains	07 Hrs

Text Books:

1. NPTEL Resource Book
   https://drive.google.com/file/d/17CPu--DdQHwUGzcbjDdNZbEcvHQ56-Cf/view

Reference Books:

1. Industry 4.0 by Navya Yugachi Olakh, 2019 edition
2. Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist, January 2019

Web Resources:

1. https://nptel.ac.in/courses/106/105/106105195/

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VIII SEMESTER

Subject Name & Code	**COMPUTER INTEGRATED MANUFACTURING IP810 ELECTIVE IV**
No. of Teaching Hours – 39	**Credits :3:0:0**

Course Objective:

To make student learn the techniques of automation, planning, material handling, computer networks and inspection methods used in manufacturing systems

Course Outcome

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

4. Describe automation in production systems, manufacturing systems and production concepts
5. Understand the objectives of automated flow lines and its balancing with themethods.
6. Understand the concept of CAPP ,MRP and should critically evaluate itsconcepts.
7. Study and analyse the phases of shop floor control in an industrial environment and also know the concepts of Computer networks inmanufacturing
8. Study and collect through cases the future trends in manufacturing and also critically analyze the role of humans in future automatedfactory.

Chap. No.	**Topics**	**Hrs**
	UNIT I	
01	**Automation:** Definition, Types, Reasons for Automating, Arguments for and against Automation.	04 Hrs
02	**Production Concepts and Mathematical Models:** Automation Strategies.Problems	04 Hrs
	UNIT II	
03	**Automated flow Lines:** Objectives of the use of flow line automation. TransferMechanisms – Linear & Rotary	04 Hrs
04	**Methods of Line Balancing:** Largest Candidate rule, Kilbridge and Wester's method with illustrations	04 Hrs
	UNIT III	
05	**Computer Aided Process planning :**RetrievalType andGenerativeType andits applications	04 Hrs
06	**Material Requirement Planning:**Fundamental's concept of MRP- Inputs to MRP,applications	04 Hrs
	UNIT IV	
07	**Shop Floor Control:**The 3 Phases of shop floor control, Factory Data collection systems,applications	04 Hrs

08	**Computer Networks for Manufacturing:** Hierarchy of Computers in Manufacturing. Benefits of the Hierarchical Systems	04 Hrs
	UNIT V	
09	**Future Trends in Manufacturing :** Future Automated Factory, Case studies	04 Hrs
10	**Human Workers in the future automated Factory:** Social Impact, otherimportant considerations	03 Hrs

Text Books:

- Automation production Systems & CIM-M.P.Groover.
- CAD/CAM –M.P.Groover

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Subject Name & Code	JUST IN TIME MANUFACTURING IP821 ELECTIVE V
No. of Teaching Hours – 39	Credits :3:0:0

Course Objective:
To learn the basic concept of Just in Time Manufacturing and methods to be adopted for implementing JIT practices.

Course Outcome:
On successful completion of the course the student will able to

1. Recognize the underlying philosophy of the Toyota ProductionSystem.
2. Know the concepts and implementation of Kanban, Jidoka and Value Stream systems.
3. Analyze the different concepts of Kanban and Pokayoke. to keep material control and avoid mistake proofing in the operation.
4. Discover how to look at one's own shop floor in terms of lead-time reduction, waste elimination and materialflow.
5. Implementing the continuous improvement concept and Taylor's principles and Develop and understanding of how to manage people in a JIT environment in order to sustain improvements in productionmethod.

Chap No	Topics	Hrs
	UNIT I	
01	**JIT-An Introduction:** Spread of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, creating continuous manufacture, enabling JIT to occur, basic element of JIT, benefits of JIT.	03 Hrs.
02	**Toyota Production System:** Key features and basic framework, Production smoothing, production planning, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production, Shortening lead time andreducing the setup time in Toyota production system	05 Hrs
	UNIT II	
03	**Kanban system** – Basics of Kanban system, Kanban rules, adapting to fluctuations in demand through Kanban, Types of Kanbans cards- Withdrawal, Production ordering, subcontract, emergency Kanbans, concept of whirligig, Andon, determining the number OfKanbans, detailed Kanban systems with examples.	04 Hrs
04	**Value Stream Mapping** – The concept, the symbols, current state value streammapping and future state value stream mapping, Value Network Mapping, a case study to implement VSM, pokayoke mistake proofing.	04 Hrs
	UNIT III	
05	**Design, Development and Management of JIT Manufacturing Systems:** Plantconfigurations and flow analysis, comparison of JIT's -demand pullsystem with	08 Hrs

	conventional-push type planning and control systems, quality management system, product design, human resource management, flexible workforce system, creation and maintenance of teams for the implementation of JIT in an industry. Assessing performance in JIT manufacturing systems, product costing information systems in JIT manufacturing, Case studies	
	UNIT IV	
06	**Supply Management For JIT:** JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys on JIT purchasing, buyer-seller relationship in JIT purchasing, quality certification of suppliers in JIT purchasing, some problems in implementation of JIT purchasing, reduction freight costs in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing, frequency of shipments, inventory policy, supplier reaction capability, quality, communication sole sourcing, delivery performance and supplier flexibility, conclusion.	08 Hrs
	UNIT V	
08	**Framework for Implementation of JIT:** Implementation risks - Due to inappropriate understanding, technical, operational and people problems, in Kanban system, Value stream Mapping. Activities to be performed during the implementation, steps in implementation, a case study to implement JIT.	07 Hrs

TEXTBOOKS:

1. M.G. Korgaonker: -Just In Time Manufacturing, Macmillan India Ltd.
2. Richard J. Schonberger:-Japanese Manufacturing Techniques The Free Press–Macmillan Pub. Co, Inc. New York

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Subject Name & Code	Additive Manufacturing IP822 ELECTIVE V
No. of Teaching Hours – 39	Credits :3:0:0

Objective: To introduce students:

1. Basics of additive manufacturing/rapid prototyping and Its applications in various fields, reverse engineering techniques
2. To understand and appreciate the difference between subtractive manufacturing and additive manufacturing
3. To learn the concept of joining of materials to make objects from 3D model data, usually layer upon layer, as opposed to subtractive manufacturing methodology.
4. To understand the cutting edge technology of Rapid Prototyping its potential to extensively transform the nature of manufacturing processes.
5. About mechanical properties and geometric issues relating to specific rapid prototypingapplications.

Course Outcomes:

1. Understand the importance of prototyping concepts with emphasis on Rapid manufacturing processes. Understand role of additive manufacturing in productdevelopment.
2. Recognize the techniques of Liquid, Solid and Multi Jet based Additive Manufacturing Systems and its applications in variousdomains.
3. Understand the various techniques involved in Powder based AM and Rapid toolingtechniques
4. Recognize the role of Reverse engineering in Additive Manufacturing and understand the importance of various data digital representationformats
5. Understand and appreciate the uses of Additive manufacturing in range of domains from engineering and otherfields.

Chap. No.	Topics	Hrs
	UNIT I	
01 02	**INTRODUCTION:** Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), and classification of Rapid Manufacturing Processes: Additive, Subtractive, Formative, Generic RP process. **OVERVIEW OF ADDITIVE MANUFACTURING**– History – Need-Classification -Additive Manufacturing Technology in product development-Materials for Additive ManufacturingTechnology – Tooling – Applications	08 Hrs.
	UNIT II	
03 04	**LIQUID BASED ADDITIVE MANUFACTURING SYSTEMS** Classification – Liquid based system – Stereolithography Apparatus (SLA)- Principle, process, advantages and applications – Solid based system –Fused Deposition Modeling – Principle, process, advantages and applications, Laminated Object Manufacturing **SOLID-BASED AM SYSTEMS:**Laminated Object Manufacturing (LOM): Models and	08 Hrs

	specifications, Process, working principle, Applications, Advantages and Disadvantages,Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. **MULTI-JET MODELLING (MJM):** Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.	
	UNIT III	
05	**POWDER BASED ADDITIVE MANUFACTURING and 3D Printing SYSTEMS:** Selective Laser Sintering – Principles of SLS process – Process, advantages and applications, Three Dimensional Printing – Principle, process, advantages and applications- Laser Engineered Net Shaping (LENS), Electron Beam Melting.	08 Hrs
06	**RAPID TOOLING: INTRODUCTION TO RAPID TOOLING (RT), CONVENTIONAL TOOLING VS RT, NEED FOR RT. RAPID TOOLING CLASSIFICATION:** Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process.Direct Rapid Tooling: Direct AIM,LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using3DP	
	UNIT IV	
07	**AM & REVERSE ENGINEERING:** Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology, concept of Reverse Engineering, nature and characteristics.	08 Hrs
08	**AM DATA FORMATS: REENGINEERING FOR DIGITAL REPRESENTATION**, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub division Techniques. AM Software's: Need for AM software, Features of various AM software's like Magics, Mimics, SolidView, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, Surgi Guide, 3-matic, Simplant, Mesh Lab.	
	UNIT V	
09	**AM APPLICATIONS: APPLICATION** – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts andArchitecture.	07 Hrs
10	**RP MEDICAL AND BIOENGINEERING APPLICATIONS:** Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules. Web Based Rapid Prototyping Systems.	

TEXT BOOKS:

1. Chua C.K., Leong K.F.,andLimC.S., -Rapid prototyping: Principlesand applicationsll, ThirdEdition, World ScientificPublishers,.
2. GebhardtA.,-Rapid prototypingll, Hanser Gardener Publications.

REFERENCES:

1. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, Springer, Brent Stucker, David W. Rosen, and IanGibson,
2. Liou L.W. and Liou F.W.,-Rapid Proto typing and Engineering applications:A tool box for prototype developmentll, CRC Press
3. KamraniA.K. and Nasr E.A., -Rapid Prototyping:Theory and practiceII, Springer, 2006.

JSS MAHAVIDYAPEETHA
JSS SCIENCE & TECHNOLOGY UNIVERSITY
DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	SUPPLY CHAIN MANAGEMENT IP823 ELECTIVE V
No. of Teaching Hours – 39	Credits :3:0:0

Course Objective:

To conceptualize, design and implement supply chains aligned with product, market and customer characteristics. Managing the flow of products , information , and revenue across supply chains differentiates the ability of supply networks to fulfill customer needs.

Course Outcomes

On successful completion of the course the students will be able to

1. Develop the ability to explain basic supply chain strategies and practices and to define the role, factors and framework for supply chain designdecisions.
2. Explain the models for facility location and capacity allocation and selection decision using analytical way.
3. Demonstrate the Optimum level of product availability through managing and planning of inventories, concept to improve supply chainprofitability
4. Explain the role, assessment and selection of the supplier and transportation and pricing concept in supply chain
5. Define the importance and coordination between the stages of supply chain, Bull whip effect.

Chap. No.	Topics	Hrs
	UNIT I	
01	Building a Strategic Frame Work to analyse Supply Chains**:** Supply chain stages and decision phases process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit. Case discussions.	04 Hrs.
02	Designing the Supply Chain Network**:** Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.	04 Hrs.
	UNIT II	
03	Facility Location and Network Design**:** Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision using decision trees. Analytical problems.	08 Hrs
	UNIT III	
04	Planning and Managing Inventories in a Supply Chain: Review of inventory concepts. Trade promotions, Managing multi-echelon cycle inventory, safety inventory determination. Impact of supply uncertainty aggregation and replenishment policies on Safety inventory. Optimum level of product availability;i mportance factors.Managerial	08 Hrs

	levers to improve supply chain profitability.	
	UNIT IV	
06	Sourcing, Transportation and Pricing Products**:** Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration**:** Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role Revenue Management in the supply chain, Revenue management for: Multiple customer segments,perishableassets, seasonal demand, bulk and spot contracts.	08 Hrs
	UNIT V	
07	Coordination and technology in the Supply Chain**:** Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve co-ordination, Building strategic partnerships.	04 Hrs
08	Coordination and technology in the Supply Chain**:** The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of E-business in a supply chain, The E-business framework, E-business in practice. Case discussion. Lean supply chains, Implementation of Six Sigma in Supply Chains.	03 Hrs

TEXT BOOK:

1. Supply Chain Management – 2001, Strategy, Planning & Operation. Sunil Chopra & Peter Meindl; Pearson Education Asia, ISBN:81-7808-272-1.

REFERENCE BOOKS:

1. Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems, Robert B Handfield, Ernest L Nichols, Jr. 2002, Pearson Education Inc, ISBN:81-297-0113-8
2. Modelling the Supply Chain- Jeremy F Shapiro, Duxbury 2002, Thomson Learning, ISBN 0-534-37363

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DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

Subject Name & Code	INTELLECTUAL PROPERTY RIGHTS IP824 ELECTIVE V
No. of Teaching Hours – 39	Credits :3:0:0

Course Objective:

Students understand the basics of IPR and learn the economics behind its implementation considering adopting and developing new products and obtaining patents and rights.

Course Outcome:

On successful completion of the course the student will able to

1. To understand the fundamentals of Intellectual property rights, its types, laws behind the different types of IPR in Indian and Internationalcontexts.

2. To be in a position to understand the enforcement, remedial measures of IPR in the event of infringement and general procedure for applying for variousIPR.

3. To understand the application of various intellectual property rights to different knowledge domain like - Information technology, Software and computer programming, Literary works, Music, Entertainment industry from Indian and Internationalperspective.

4. To understand the different intricacies involved in objective, characteristics, and defences in IPRs like trademarks, copy rights, GIs and procedure involved in obtaining the IPRs in differentsituations.

5. To be in a position to learn the basic principles of Design Acts, application procedures and fundamentals of Quasi IPRs and its protection and infringement.

Chap No.	Topics	Hrs
	UNIT I	
01	**Basic Principles and Acquisition of Intellectual Property Rights:** Philosophical Aspects of Intellectual Property Laws, Basic Principles of Patent Law, Patent Application procedure, Drafting of a Patent Specification, Understanding Copyright Law, Basic Principlesof TradeMark,BasicPrinciplesofDesignRights,InternationalBackgroundofIntellectualProperty	08 Hrs.
	UNIT II	
02	**Ownership and Enforcement of Intellectual Property Rights**:Patents-Objectives, Rights, Assignments, Defences in case of Infringement, Enforcement of Intellectual Property Rights - Civil Remedies, Criminal Remedies, Border Security measures, Specifications – Provisional and Complete specification for IPRs, Practical Aspects of Licensing - Benefits,Determinative factors, important clauses, licensing clauses.	08 Hrs

	UNIT III	
03	**Information Technology Related Intellectual Property Rights:** Computer Software and Intellectual Property-Objective, Copyright Protection, Reproducing, Defences, Patent Protection, Database and Data Protection-Objective, Need for Protection, Domain Name Protection-Objectives, domain name and Intellectual Property, Registration of domain names, disputes under Intellectual Property Rights, Jurisdictional Issues, and InternationalPerspective.	08 Hrs
	UNIT IV	
05	**Trademarks-**Objectives, Rights, Protection of goodwill, Infringement, Passing off, Defences, Designs- Objectives, Rights, Assignments, Infringements, Defences of Design InfringementGeographical Indications –nature, characteristics.	04 Hrs
06	**Copyright:** Objectives, Rights, Transfer of Copyright, work of employment Infringement, Defences for infringement	04 Hrs
	UNIT V	
07	**Designs:** The design act 2000, registration of design, procedure for registration, piracy, case study. Quasi Intellectual property Rights-Trade Secret, Confidential information, Knowhow.	07 Hrs

TEXT BOOKS:

1. Intellectual Property Law Handbook: Dr. B.L. Wadehhra, Universal Law publishing Co. Ltd.,2002
2. Intellectual property Law: P. Jaganathan. UshaJaganathanLawseries.
3. Intellectual property rights: PrabuddhaGanguli TMH publishing

co.ltd.,2001**REFERENCEBOOKS:**

1. Intellectual property law (Bare acts with short comments),Universal Law publishing Co.Ltd.,
2. Patents: Fundamentals for scientists and Engineers, Thomas T Gordon and Arthur S Cook fair, CRC press,
3. Patents: Fundamentals for scientists and Engineers, Thomas T Gordon and Arthur S Cook fair, CRC press,

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Subject Name & Code	PROJECT WORK IP83P
No. of Teaching Hours – 20	Credits : 0:0:10

Course Objective:

- To carry out real time projects in emerging areas of Design, Production, Thermal and ManagementStreams
- To convert ideas into realizable solution in the identified areas of I&PEdomain
- To find or propose solutions for existing problems identified in the Manufacturing/Service or in social scenarios.

	Description	
01	Students should identify the thrust areas of I&PE domain and must carry out a groupproject. The student batches should be formed during 7th semester Thorough literature review should be conducted to narrow down the project topic during 7th to 8th Semesterbreak. Projects can carried out either in the Industries/organizations with proper permission from the respective guide(s) andHOD. A total of 3 presentations in 3 different phases have to be done during the course of the semester and the progress reports has to be submitted to thedepartment.	20 Hrs

Phase – I report should include:

- Problem definition and Problemstatement.
- Objective and Scope of the proposed Projectwork.
- Methodology of proposed Projectwork.
- Literature review andreferences.

Phase-II report should include:

- Work completed tilldate.
- Work inprogress.
- Future work to be carriedout.

Phase-III report should include:

- Detailed report of the projectwork
- Based on the area of work, students shouldsubmit:

Material specimen (if any), Design Prototype (if any), Layout design drawings (if any), related graphs, charts etc and other outcome on the day of evaluation.

Note: Students should refer to Peer reviewed journals for citing source and for literature review.

References: Project Report Guidelines Prepared by I&PE Department.

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