PRODUCTION ENGINEERING SYLLABUS AND STRUCTURE

B. Tech (Production) Syllabus Structure

PRODUCTION ENGINEERING- SEM-VII

S. N	Course Code	Course Title	Scheme of Teaching Contact Hrs/week			**Examination Scheme-Marks**								Total Credit			
			L	T	P	End Sem Exam	Continuous Assessment			TW	TW/ OR	TW/ Pr	Total	TH	T	Pr	Total
							UT	Att	Ass								
1.		Operations Research	3	-	-	60	20	10	10	-	-	-	100	3	-	-	3
2.		Machine Tool Design	3	-	2	60	20	10	10		50	-	150	3		1	4
3.		Mechatronics and Automation	3	-	2	60	20	10	10		50	-	150	3		1	4
4.		Elective II	3	-	-	60	20	10	10		-	-	100	3		-	3
5.		Total Quality Management	3			60	20	10	10				100	3	0	0	3
6.		Computer Aided Manufacturing	-	-	2	-	-	-	-		50	-	50	-		1	1
7.		Inplant Training	-	-	-	-	-	-	-	-	50	-	50	-		3	3
8.		Project Stage I	-	-	2	-	-	-	-	-	50	-	50	-		4	4
		Total	15	0	8	300	100	50	50	0	250	0	750	15	0	10	25

List of Elective II

1. Powder Metallurgy
2. Materials Management
3. Manufacturing system and simulation

PRODUCTION ENGINEERING SYLLABUS AND STRUCTURE

B. Tech (Production) Syllabus Structure

PRODUCTION ENGINEERING- SEM-VIII

S. N	Course Code	Course Title	Scheme of Teaching Contact Hrs/week			**Examination Scheme-Marks**								Total Credit			
			L	T	P	End Sem Exam	Continuous Assessment			TW	TW/ OR	TW/ Pr	Total	TH	T	Pr	Total
							UT	Att	Ass								
1.		Process Planning and Tool Design	3	-	2	60	20	10	10	-	50	-	150	3		1	4
2.		Industrial Robotics	3	-	2	60	20	10	10	-	50	-	150	3		1	4
3.		Financial management and Cost Control	3	1		60	20	10	10	-		-	100	3	1		4
4.		Elective III	3	-	2	60	20	10	10	-	50	-	150	3		1	4
5.		Computer Aided Engineering	-	-	2	-	-	-	-		50	-	50	-		1	1
6.		Project Stage II	-	-	4	-	-	-	-	-	150	-	150	-		8	8
		Total	12	1	12	240	80	40	40	0	350	0	750	12	1	12	25
		Environmental Studies	3			100							100	3			3

List of Elective II

1. Human Resource Management
2. Manufacturing of Composite Material
3. Design and Analysis of Experiments
4. Finite Element Analysis
5. Computer Integrated Manufacturing
6. Knowledge Based Systems

B Tech Prod

SEM VII

OPERATIONS RESEARCH		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: --	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	--
Tutorial : --		03 Credits

Course Pre-requisites:		
The Students should have		
1.	Basic knowledge of Mathematics.	
2.	Basic knowledge of inventory control.	
3.	Basic knowledge of project management.	
Course Objectives:		
The student should understand and apply the correct operation research model Engineering Problems to satisfy the objective function.		
Course Outcomes:		
Students will be able to		
1.	Identify and develop operational research models from the verbal description of the real system and solve optimization problems using linear programming.	
2.	Use the acquired knowledge to design a transportation and assignment model.	
3.	Use the acquired knowledge to select and apply the proper inventory control system for industry.	
4.	Apply the correct sequence for sequencing problems as well as identify the queuing system and analyze it from the given data.	
5.	Use the acquired knowledge to decide the replacement policy and solve the game theory problems for different cases.	
6.	Use the network technique (PERT/CPM) to find the project costing and its duration.	
UNIT-I	**Introduction to Operation Research and Linear Programming:** Basics definition, scope, objectives, phases, models, advantages, limitations and applications of Operations Research. Linear Programming Problem – Formulation of LPP, Graphical solution of LPP. Simplex Method, Big-M method, duality in linear programming problem.	(06 Hours)
UNIT-II	**Transportation and Assignment Models:** **Transportation**: Formulation, Finding initial basic feasible solution by different methods, Optimality test: MODI method, unbalanced Transportation problem. **Assignment:** Formulation, Hungarian method for optimal solution. Solving unbalanced problem, restrictions on assignments and Traveling salesman problem.	(06 Hours)
UNIT-III	**Inventory Control:**	(06 Hours)

	Introduction to inventory, cost associated with inventory, stock out inventory models, probabilistic models, price-break models, inventory models under uncertainty and risk. Methods of selective inventory control. Introduction, application, Different problems solved by dynamic programming,	
UNIT-IV	**Sequencing and Queuing Models:** **Sequencing models:** Solution of Sequencing Problem – Processing n Jobs through 2 Machines, Processing n Jobs through 3 Machines, Processing 2 Jobs through m machines, Processing n Jobs through m Machines. **Queuing Models**: Operating characteristics, Poisson single and multi-channel queuing system (M/M/1): (∞/∞/FCFS), (M/M/1): (∞/∞/SIRO), (M/M/1): (N/∞/FCFS), (M/M/c): (N/∞/FCFS)	(06 Hours)
UNIT-V	**Replacement models and Games Theory:** **Replacement models:** Replacement of capital equipment that deteriorates with time, Time value of money. Cases in which time value of money remains same and changes with constant rates during period. Group and individual replacement. **Games Theory:** Introduction, Two -person zero sum game, Minimax and Maximin principle, Saddle point, Methods for solving game problems with mixed strategies.	(06 Hours)
UNIT-VI	**Network Modelling:** Fundamentals of CPM and PERT networks, CPM: Construction of networks, Critical paths, Forward and backward pass, Floats and their significance, crashing for optimum and/or minimum duration and the cost, PERT: Time estimates, Construction of networks, Probability of completing projects by given date.	(06 Hours)
Term work: **NA**		
Assignments: 1. Assignment on formulation of LPP and its solution. 2. Assignment on formulation of transportation problem. 3. Assignment on Assignment model. 4. Assignment on inventory control. 5. Assignment on price break models. 6. Assignment on Sequencing models. 7. Assignment on queuing models. 8. Assignment on replacement models. 9. Assignment on game theory. 10. Assignment on calculation of the total cost and duration of the project. The typical softwares are to be used for any of the 3 assignments.		

Text Books / References

- Sharma S.D., “Operations Research”, Kedarnath Ramnath and company publications.
- Gupta P.K., Hira D.S., “Operations Research”, S Chand and Co. Ltd., New Delhi.
- Taha H.A., “Operations Research - An introduction”, Prentice Hall Pvt. Ltd.
- J. K Sharma., “Operations Research Theory & Applications, 3e”, Macmillan India Ltd, 2007.
- Panneerselvam R., “Operations Research”, Prentice Hall of India Ltd., New Delhi.
- N. D. Vora, “Quantitative Techniques and Management”, Tata McGraw-Hill Education.
- Kanthi Swarup and others, “Operation Research”, S Chand and Co. Ltd.
- Basu S.K., Pal D.K., and Bagchi H., “Operations Research for Engineers”, Oxford and IBH Publishing Co. Pvt. Ltd.,

Syllabus for Unit Test

Unit Test 1	Units I , II and III
Unit Test 2	Units IV, V and VI

MACHINE TOOL DESIGN		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	
Practical: 02 Hrs / Week	TW/OR : 50 Marks	01 Credits

Course Pre-requisites:

1.	Basic knowledge of conventional and non conventional Machines.
2.	Knowledge of material science.
3.	Knowledge of Strength of Material.

Course Objectives:

The students should be able to understand the design methodology of machine tools.

Course Outcomes:

Students will be able to

1.	Understand the fundamentals of machine tool design.
2.	Select the type of gear box for applications in machine tool and design the sliding cluster gear box.
3.	Understand the design considerations for machine tool structures.
4.	Select the guideways and design the power screws.
5.	Select the spindle bearings
6.	Design cams for single spindle automate.

UNIT-I	**Introductions to Machine Tools** General Principles of Machine Tool Design: Working and Auxiliary Motions in Machine Tools. Parameters Defining Working Motions of a Machine Tool. Techno-Economical Prerequisites for Undertaking the Design of New Machine Tool. General Requirements of Machine Tool Design. Engineering Design Process Applied to Machine Tools. Layout of Machine Tools, Modular Concept of Machine tool design.	**(06 Hrs)**
UNIT-II	**Drives:** Design considerations for drives based on continuous and intermittent requirement of power, Types and selection of motor for the drive, Regulation and range of speed based on preferred number series, geometric progression. Design of speed gear box for spindle drive and feed	**(06 Hrs)**

	gear box. Stepless drives: Design considerations of Stepless drives, electromechanical system of regulation, friction, and Kopp variators, Toroidal and Reeves Mechanisms , PIV drive, Epicyclic drive, principle of self locking, VFD and VVFD drives-Design Considerations.	
UNIT-III	**Design of Machine Tool Structures:** Functions of Machine Tool Structures and their requirements – Design criteria for machine tool structures – Materials of machines Tools structures – Static and Dynamic stiffness – Profiles of machine tool structures – Basic Design procedure of machine tool structures Analysis of forces on machine tool structure, static & dynamic stiffness. Design of beds, columns, housings, bases and tables.	**(06 Hrs)**
UNIT-IV	**Design of Guideways & Power Screws :** Functions & types of guideways, design criteria & calculation for sideways, design of hydrodynamic ,hydrostatic and aerostatic slideways , Design of Anti-Friction Guideways – Combination Guideways –Protecting devices for slideways Stick-Slip motion in slideways. Design of power screws: Distribution of load & rigidity analysis.	**(06 Hrs)**
UNIT-V	**Design of Spindles and Spindle Supports:** Functions of Spindle Unit and requirements – Materials of Spindles – Effect of machine tool compliance on machining accuracy- Design calculations of spindles– Anti friction bearing – Sliding bearings. Preloading of bearings. Bearings selection for machine tools.	**(06 Hrs)**
UNIT-VI	**Automatic Drives for Machine tools:** Principles of automation. Automatic lathes with mechanical control.Design of cams for automatic screw cutting machines.Automatic loading and feeding of workpieces. Transfer devices in automatic machine tool systems. Modular design and unit heads for machine tools. Automatic in-process gauging.	**(06 Hrs)**
Term work: Term work shall consist of record of assignments on following topics. 1. Design and working drawing of speed gear box 2. Design and working drawing of feed gear box 3. Study of stepless drives 4. Design of bed or column. 5. Design for spindle or power screw. 6. Design for guide ways and sideways. 7. Internet assignment based on any one of the topics above.		
Assignments 1. Assignment on Introductions to Machine Tools		

2. Assignment on Drives.
3. Assignment on Design of Machine Tool Structures.
4. Assignment on Design of Guideways & Power Screws
5. Assignment on Design of Spindles and Spindle Supports.
6. Assignment on Automatic Drives for Machine tools.

Text Books:

1. N. K. Mehta, "Machine Tool Design", Tata McGraw Hill, ISBN 0-07-451775-9.
2. A. Bhattacharya and S. G. Sen., "Principles of Machine Tool", New central book agency Calcutta,ISBN 81-7381-1555.
3. D. K Pal, S. K. Basu, "Design of Machine Tool", 4th Edition. Oxford IBH 2005, ISBN 81-204-0968.

Reference Books:

1. N. S. Acherkan, "Machine Tool", Vol. I, II, III and IV, MIR publications.
2. F. Koenigsberger, "Design Principles of Metal Cutting Machine Tools", The Macmillan Company New York 1964.

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

MECHATRONICS & MANUFACTURING AUTOMATION		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credits
	TW/OR: 50 Marks	

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of Mechatronics systems.
2.	Basic knowledge of sensors and system response.
3.	Basic knowledge of automation.

Course Objectives:
The student should understand the scope, objective and application of finite element analysis.

Course Outcomes:	
Students will be able to understand	
1.	Identify the suitable sensor and actuator for a Mechatronics system
2.	Develop the skill required for interfacing the electromechanical system.
3.	Illustrate basic aspects of design and development of a Mechatronics system
4.	Apply automation techniques to manufacturing set-ups.
5.	Design and develop pneumatic and hydraulic control circuits of medium complexity.
6.	Illustrate the use of PLC in control systems and Model the system and check the stability of a mechanical system.

UNIT-I	**Introduction to Mechatronics and Measurement Systems:** Introduction, concepts of Mechatronics, Principles, Objectives and applications. Elements of Mechatronics System. **Sensors:** Position and speed Measurement: Proximity sensors and Switches, Potentiometer, LVDT, Digital optical Encoder. Stress and Strain Measurement: Electrical Resistance Strain Gauge, Measuring Resistance Changes With a Wheatstone Bridge, Measuring Different States of Stress With Strain Gauges, Force Measurement With Load Cells Temperature Measurement: Liquid –in Glass Thermometer, Bimetallic Strip, Electrical Resistance Thermometer, and Thermocouple. Vibration and Acceleration Measurement: Piezoelectric Acceleration, Pressure and Flow Measurement, Semiconductor Sensors & Microelectromechanical Devices.	**(06 Hrs)**
UNIT-II	**System Response:** Introduction, Amplitude linearity, Fourier Series representation of signals, Bandwidth and Frequency response, Phase linearity, Distortion of signals , Dynamic characteristics of systems, Zero order system, First order system:- Experimental testing of a first order system. Second order system, step response of a second order system, frequency response of a system, System modeling and analogies.	**(06 Hrs)**
UNIT-III	**Signal Conditioning:**	**(06 Hrs)**

	Introduction, The operational amplifier, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing, and Pulse modulation. **Data Acquisition:** Introduction, Quantizing theory, Analog to Digital conversion, Digital to Analog conversion, Virtual Instrumentation, Data acquisition and control.	
UNIT-IV	**Basics of Automation:** Definition, Automation in Production systems, Basic elements of automated systems, Types of Automation, Need, Advantage And Disadvantages of automation, Levels of Automation. Special purpose machine, High speed machines.	**(06 Hrs)**
UNIT-V	**High Volume Manufacturing System:** Transfer lines, Material handling systems, Manufacturing cell, Group technology, Cellular manufacturing, Flexible manufacturing systems, Automated quality control and inspection systems, Automated assembly systems and line balancing, Automated flow lines and its technology.	**(06 Hrs)**
UNIT-VI	**Programmable Automation And Control Systems:** Programmable logic controller, Ladder diagram, Microprocessor, PIC 16F84 OR 8085 Microprocessor, Logic gates and control, Electrical drives, Thermal relays, PID, Industrial control devices, Computer based industrial controls.	**(06 Hrs)**

Term work:

List of Experiments: (Any Five)

- Study of Switches and relays.
- Study and experiment of different types of sensors.
- Study and experiment of ADC and DAC.
- Study and experiment of PLC
- Study and experiment of 8085 Microprocessor
- Study and experiment of PID.

Assignments:

- Different types of Sensors and Transducers.
- Assignment on system response of mechatronics systems.
- Assignment on signal conditioning and data acquisition.
- Basics of automation.
- High volume automation.
- PLC, PID, 8085 Microprocessor.
- Industrial Visit.

Oral/Practical

Term work and oral will be based on above syllabus.

Text Books / References

- Vickers manual on hydraulics.

- W. Bolten, “Mechatronics Electronics Control system in Mechanical and electrical Engineering”, Person Education (Singapore) Pvt. Ltd. ISBN 81-7808-339-6
- ”HMT Mechatronics”, HMT ISBN- 0-07-462147-5
- Ramesh Gaonkar, “Microprocessor”, Penram International Publication Pvt. Ltd. ISBN 81-900-828-7-6
- David G.Alcitore, B.H. Histon, “Introduction to mechatronics and measurement systems”, Tata McGraw Hill, ISBN-0-07-052910-8
- Peter Rohne, “Industrial hydraulic control”.
- Werner Deppert and Kurt Stol, “Mechanization by Pneumatic Control”, Vol-1, Vol-2.
- Mikell P. Groover; “Automation, Production systems, and computer integrated Manufacturing”, Prentice Hall.

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

Elective II: Powder Metallurgy

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: N A	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	

Course Pre-requisites:

The Students should have

1.	Basic knowledge of conventional manufacturing processes.
2.	Knowledge of material science.
3.	Knowledge of engineering Metallurgy.

Course Objectives:

	Student will understand the concepts of Powder Metallurgy and also able to understand Manufacturing of components by Powder metallurgy.

Course Outcomes:

Students will be able to understand

1.	To select the manufacturing of metal powders by different methods .
2.	To select proper process and understand characteristics of Metal powder .
3.	To select different methods of compacting of metal powders .
4.	To select various design of dies for compacting of metal powders.
5.	Mechanism of Sintering .
6.	To select advance processes and understand its defects and remedies in powder metallurgy.

UNIT - I	**Fundamentals of Metal Powder productions :** Introduction of Powder Metallurgy processes. Advantages and limitations of processes, production of metal powder by Machining, milling, atomization, electrodeposition, reduction from oxide, carbonyl process, production of alloy powders, New development etc..	**(06 Hours)**
UNIT - II	**Characteristics of metal powder:** Particle size, shape and size distribution, Characteristics of powder mass such as apparent density, tap density, flow rate, friction conditions. Properties of green compact and sintered compact; Powder conditioning, Mixing and blending, processes details.	**(06 Hours)**
UNIT - III	**Fundamentals of powder compaction;** Types of compaction presses, compaction tooling and role of lubricants, Single and double die compaction, isostatic pressing,	**(06 Hours)**

	hot pressing, Powder rolling, powder forging, powder extrusion and explosive forming technique, pressure less compacting .	
UNIT - IV	**Design of Press Tools in compacting:** General classification and components of press tools, types of dies simple, compound, combination dies, various press working operations. Design and calculations for above press working dies. Extrusion ratio of force equipment (with and without friction), metal flow in extrusion, defects. Role of friction and lubricants, hot dies for compacting. Tooling materials	**(06 Hours)**
UNIT - V	**Sintering** Definition, Theories of sintering: Sintering mechanism, Roll of diffusion, Recrystallization, Pore-growth and coalescence. Liquid phase sintering and related processes. Effect of compacting pressure, sintering temperature and time on sintered properties stages, effect of variables, sintering atmospheres and furnaces, infiltration process.	**(06 Hours)**
UNIT - VI	**Production Methods for typical components** : Study of sintered bearings, cutting tools, and metallic filters, Study of friction and antifriction parts and electrical contact materials, hard metals, refractory metals, magnetic materials, structural parts, dispersion strengthened materials.	**(06 Hours)**

Assignments:
1**.** Write the production of metal powder by carbonyl processes in details , Write the production of metal powder by Electrolysis method**.**
2.Write different methods for measurement of particle size ,shape and size distributions.
3. Explain in details advantages of Isostatic compacting , Slip casting ,and powder rolling .
4. Design tooling system for powder compacting for given shape of components.
5. Give the sintering temperatures and atmospheres used for different metallic components.
6. Write compete Flow chart of productions of few components by powder metallurgy, such as Tungsten carbide tools. Clutch, etc.

Text Books/Reference Books:	
1	Gopal S. Upadhayay. Powder Metallurgy " Science ,Technology and Materials" -University press
2	P. N. Rao, Manufacturing Technology, Tata McGraw Hill
3	Powder Metallurgy ASM Metal hand book Vol: 7
4	A K Shinna Powder Metallurgy ; Dhanpatrai Publications

5	Gopal S. Upadhayay. Cemented Tungsten carbide Production, properties and testing- University press

Syllabus for Unit Test:	
Unit Test -1	Unit I to III
Unit Test -2	Unit IV to VI

Elective II: Materials Management		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: --	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	--
Tutorial : --		03 Credit

Course Pre-requisites:		
The Students should have		
1.	Basic knowledge of management	
2.	Basic knowledge of purchasing	
3.	Basic understanding for stores operations	
Course Objectives:		
The students should be able to apply different materials management techniques for the maximization of the profit and minimization of the production cost.		
Course Outcomes:		
Students will be able to		
1.	Understand various types of values and value analysis techniques.	
2.	Use the proper inventory control system for the industry	
3.	Take correct decision for make or buy for a situation.	
4.	Understand the various techniques of logistic management	
5.	Understand the various warehousing techniques	
6.	Understand and apply import export substitutions in given situation	
UNIT-I	Introduction to Materials Management **Functions of Materials Management** – Sourcing/Procurement, Inventory, Stores, Vendor Development, value analysis and value engineering. Classification and Costs of Inventories: Types, Objective of holding inventories, Different types of Inventories, Costs Associated with Inventory - Carrying cost, Procurement cost. EOQ - Concept, Assumptions of EOQ Model, Practical Constraints – Numerical Analysis, Quantity Discounts. EMQ Model - Carrying cost, Set up cost. EOQ Special Considerations – Spares, Bought-outs, etc. **Organization of Materials Management Function**	(06 Hours)
UNIT-II	**Replenishment Systems and Inventory Management** A. **Replenishment Systems:** Introduction, Concept of lead time and its effects on Inventory, Components of Lead Time - Internal and External. Variability in demand and lead time. Safety Stock Evaluation and ways to minimize lead time, Different types of replenishment systems like Fixed order quantity system, Fixed order interval system, Combination of fixed order interval and quantity system, Two Bin System. Forecasting - Methods of forecasting - Moving Average Method, Regression Analysis, Exponential Smoothing Method	(06 Hours)

	B. Probabilistic Replenishment System. Selective Inventory Control - VED analysis, HML analysis, SDE analysis, SOS analysis, FSN analysis, GOLF analysis.	
UNIT-III	**Procurement Management** A. Procurement Management: Responsibilities of Purchase Department. Procurement Procedure, Documents in Procurement, Types of Buying, Methods of Buying, Legal Aspects of Buying, Vendor Selection, Vendor Development, Vendor Rating. B. Documentation – Bin Cards, Stores Ledger, Goods Receipt Note, Material Requisition, Purchase Order – Format, Terms & Conditions. Documentation in Imports	(06 Hours)
UNIT-IV	**Logistics Management** A. Definition, Logistics Function: Transportation – Significance, Modes of Transportation, Warehousing – Objectives, Warehousing Functions, Types of Warehouses, Inventory Management, Order Processing – Role of IT, Material Handling Transportation: Modes of Transportation – Rail, Road, Pipelines, Water Air – Advantages & Disadvantages, Concept of TL, LTL, FTL. Selections of Appropriate Modes of Transportation B. Modes of Transportation – Rail, Road, Pipelines, Water Air – Advantages & Disadvantages	(06 Hours)
UNIT-V	**Stores Management and Warehouse Management** A. **Warehouse Management**: Concept of SKUs, Warehousing Principles & Best Practices in Receiving, Shipping, Order Picking, Storage & Put away, Warehouse Activity Profiling, Warehouse Layout Planning. Stores Management: Functions of Stores, Stores Procedure – Documentation. Need of physical stock taking, method of stock taking like annual, continuous, reorder point stock taking, Inventory records. Surplus and Obsolescent stocks: Introduction, Genesis of surplus materials. Disposal of surplus and obsolete materials B. Stores Documentation – Bin Cards, Stores Ledger. WMS Systems in Practice	(06 Hours)
UNIT-VI	**Import Export and supply chain management:** Factors affecting National and International markets, Import procedure and documents, current EXIM policies, import substitution, E-procurement. **Supply chain management:** Basic concepts of SCM, design considerations, role of safety inventory, planning and managing inventories, order processing, economic considerations.	(06 Hours)
Term work: **NA**		
Assignments: 1. Assignment on materials management 2. Assignment on replenishment systems 3. Assignment on inventory control 4. Assignment on procurement and documentation 5. Assignment on logistic management		

6. Assignment on material handling
7. Assignment on stores management
8. Assignment on warehouse management
9. Assignment on import exports
10. Assignment on supply chain management

Students are required to present case studies on any two topics.

Text Books / References

1. K S Mennon, “Purchasing management and inventory control”, Wheeler Publication, ISBN 81-85814-10-4.
2. P Gopal Krishnan, “Purchasing and materials management”, Tata McGraw-Hill Education.
3. L. D. Miles, “Techniques of Value Analysis and Engineering”, Tata McGraw-Hill.
4. L.C. Jhamb, “Inventory management”, Everest Publishing House.
5. Tony Arnold, “Materials Management”, Pearson Publication.
6. L. Lee, D. Dobler, “Purchasing and Material Management”, McGraw-Hill.

Syllabus for Unit Test

Unit Test 1	Units I , II and III
Unit Test 2	Units IV, V and VI

Elective II: MANUFACTURING SYSTEM AND SIMULATION		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of Manufacturing System.
2.	Basic knowledge of advance manufacturing system .
3.	Basic knowledge of Simulation.

Course Objectives:
The student should understand the scope, objective and application of modeling, simulation and analysis of advanced manufacturing systems.

Course Outcomes:	
Students will be able to understand	
1.	The basics of manufacturing system.
2.	Discuss the information system about manufacturing machine tools.
3.	The modeling and analysis of manufacturing system.
4.	Describe the continuous path of simulation process.
5.	The simulation and programming languages.
6.	Develop the simulation process in industry.

UNIT-I	**Manufacturing Systems:** Definition of systems, basic concepts and problems concerning systems. Systems design: Decision making procedures, Structural, Transformational and procedural aspects of manufacturing, Modes of production. Process systems for manufacturing, logistic systems, material flow & technological information flow. Management and information systems for manufacturing: Managerial information flow in manufacturing systems.	**(06 Hrs)**
UNIT-II	**Information Systems:** Fundamentals of information technology, information systems, information networking, and parts oriented production information systems, and computerized production scheduling, online production control systems. Computer based production management systems. Automation systems for manufacturing: Industrial automation, kinds of automation, principles of CIM, effectiveness of CIM, factory automation, automatic machine tools for mass production, NC machine tools, and computer controlled manufacturing systems, FMS, automated assembly, automatic material handling, automatic inspection and testing, computer integrated automation systems unmanned factory.	**(06 Hrs)**
UNIT-III	**System Models:** Concepts, continuous and discrete systems, systems modeling, type of models, subsystems, corporate model, and system study. System	**(06 Hrs)**

	simulation, Techniques, comparison of simulation and analytical methods, types of simulation, distributed log model, cobweb models.	
UNIT-IV	**Continuous System Simulation:** Numerical solution of differential equation, analog computers, hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves. Discrete systems simulation: Events generation of arrival patterns, simulation programming tasks, analysis of simulation output. Queuing theory: Arrival pattern distribution, service times, queuing disciplines, and measure of queues.	**(06 Hrs)**
UNIT-V	**GPSS and SIMSCRIPT:** General description of GPSS and SIMSCRIPT, programming in GPSS Simulation Programming Techniques: Data structures, implementation of activities, event and queues, event scanning, simulation algorithms in GPSS and SIMSCRIPT.	**(06 Hrs)**
UNIT-VI	**Application of Simulation:** Flow shop system, Job shop system, M/M/1 Queues with infinite and finite capacities, Simple fixed inventory system, Output data analysis, steady state analysis, Building of simulation validation.	**(06 Hrs)**

Assignments:

- Basic concepts of manufacturing system.
- Advanced manufacturing system.
- Modeling and simulation of any manufacturing system.
- Assignment on continuous simulation process used in manufacturing system.
- GPSS and SIMSCRIPT programming techniques.
- Application of simulation in automated industry.
- Industrial visit

Text Books / References

- David Bedworth & James Bailey, Integrated production control system management, analysis & design, 2nd ed., John Wiley & Sons Ltd.
- Katsundo Hitomi, Manufacturing System Engineering.
- Y Narahari and N Vishwanadhan, Performance Modeling and Automated Manufacturing System, Prentice hall India 1994.
- Stanley B Gershwin, Manufacturing Systems, Engineering PHI latest Edition.
- Ronald Zskin & Charles Standridge, Modeling and Analysis of Manufacturing Systems, John Wiley & Sons Ltd.
- Geofery Gordan, Systems Simulation, Prentice Hall, 1980.
- Deo. N., System Simulation with Digital Computers, Prentice Hall, 1980.

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

TOTAL QUALITY MANAGEMENT		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits *
	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	

Course Pre-requisites:	
The Students should have	
1.	Basics of Quality Control
2.	Basics of Measurements and measuring Instruments
3.	Knowledge of Statistics.

Course Objectives:

To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management and to understand the statistical approach for quality control.

Course Outcomes:	
1.	Implement the principles of total quality management.
2.	Apply six sigma concepts and increase the quality of product.
3.	Make use of Advanced Techniques
4.	They will be able to implement TQM Tools.
5.	Execute Quality standards in companies
6.	Make use of Advanced Techniques of Total Quality Management like Design of experiments, Failure mode effect analysis, Taguchi method Taguchi's quality engineering

UNIT-I	**Quality & Total Quality Management:** Quality, New philosophy of quality, Product quality, & its prospects. Overview of TQM: Concept & definition, Fundamentals, Principles of TQM, Elements of TQM, Approaches of TQM, Models of TQM, Zero defect concept, Benefits of TQM.	**(06 Hrs)**
UNIT-II	**Quality Assurance:** Basic concepts, Quality assurance input – process – output.Significance of feedback for Quality assurance, Process capability analysis, Concept of Six Sigma. Internal customer approach, Customer – Satisfaction, data collection &complaint, Redressal mechanism.	**(06 Hrs)**
UNIT-III	**TQM PRINCIPLES:**	**(06 Hrs)**

	Customer satisfaction - Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement - Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement - Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership - Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures - Basic Concepts, Strategy, Performance Measure, Just – in- Time.	
UNIT-IV	**TQM TOOLS** Benchmarking - Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) - House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) - Concept, Improvement Needs, FMEA - Stages of FMEA.	**(06 Hrs)**
UNIT-V	**Quality Systems :** Policy & objectives, Quality standards, Concept of quality system standards, Relevance & origin of ISO 9000–2000 standard & certification, Benefits. Elements of ISO 9001, 9002, 9003 series–Clauses, contents, interpretations & implementation. TS - 16949, QS-9000, ISO 14000, OHSAS	**(06 Hrs)**
UNIT-VI	**Advanced Techniques of Total Quality Management:** Design of experiments, Failure mode effect analysis, Taguchi method Taguchi's quality engineering –Loss function, orthogonal arrays, Signal to noise ratio, parameter design & tolerance design.Total Quality in service sector. S. S. Technique, Kaizen.	**(06 Hrs)**
Term work:	Detail Study and Presentations on Above topics to be submitted.	
Assignments		
1. Assignment on TQM 2. Assignment on Six sigma concept. 3. Assignment on TQM principles. 4. Assignment on TQM tools. 5. Assignment on Quality Systems 6. Assignment on Advanced Techniques of Total Quality Management		

Text Books/ References

1. Sundar Raju, “Total Quality Management”, Tata McGraw Hills.
2. M. Zairi, “Total Quality Management for Engineers”, Aditya Books.
3. ISO 9000 Quality System”, Dalela & Saurabh, Standard Publishers.
4. R.C. Gupta, “Statistical Quality Control”.
5. Grant E. L. & R. Leavenworth, “Statistical Quality Control”, Tata McGraw Hills
6. Tapan Bagchi, “Taguchi Methods Management”, Pearson Education.
7. Feigenban, “Total Quality Control”, Tata McGraw Hills.
8. Total Quality Management Handbook, J. K. Hradeskym, Tata McGraw Hills.

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

Computer Aided Manufacturing		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory:	End Semester Examination: Nil	
Practical: -- 02 Hrs/Week	Internal evaluation: NIL Assignments : Nil Unit Test : NIL	01 Credit
Tutorial : --	TW/OR – 50 Marks	

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of mechanical drawing
2.	Knowledge of various symbols of dimensioning and tolerancing
3.	Basic knowledge of process planning and programming

Course Objectives:
To provide proper interfacing between theoretical aspects and the practical aspects of computer aided manufacturing.

Course Outcomes:	
Students will be able to	
1.	Students will describe basic concepts of CAM application and understand CAM wheel
2.	Students will prepare CNC programs for manufacturing of different geometries on milling and lathe machines.
3.	Students will classify different components using different techniques of group technology
4.	Students will select layouts of FMS for industrial applications
5.	Students will classify different components using different techniques of group technology
6.	Students will prepare Process planning for different components
	Term Work
	1. Cim Model For Any Industry: Term work assignment based on background theory of CIM System, actual visit to any industry to see and study the different aspects of CIM system
	2. Simulation on CNC lathe and CNC mill enabling the learning of following points, **1. Simulation on CNC lathe -**Description of codes, Description of codes, Directives, programs covering basics operations **2. Simulation on CNC Mill-** Description of M codes, Description of codes, Directives, programs covering basics operations, Liner Interpolation, Circular Interpolation
	3. Manual part programming on CNC lathe, milling And drilling enabling learning of a) NC technology, CNC components, Part programming techniques, Manual part programming technique, Interpretation of codes, Usage of codes, Formulation of part program, Compete sketch with Dimensions b) Execution of complete part program on CNC machine.

	4. Study and demonstration on robots: a. Term work assignment based on Introduction to Cybernetics, Robot Anatomy, Joints and Links, Common Robot configurations, Drive System, End Effectors, Types of sensors, Robot Economics, Robot applications in manufacturing b. Robot programming – actual execution of the programme on the robot	
	5. Computer aided process planning: a. Term work assignment based on Traditional Process plan, Introduction to Computer Aided Process Plan (CAPP), Types of CAPP, Algorithm for process planning software. b. One recent paper or Case Study of CAPP.	
	6. Exercise on group technology, part coding enabling learning of Introduction to GT, Concept of Part Family, Methods of grouping part into part family, Parts classification and Coding, Opitz classification and coding system, Two Examples on FORM code.	
	7. Computer aided quality control: a. Term work assignment based on Quality control, Concept of 100% inspection, Automated Inspection principles and methods, On Line inspection system, Off Line Inspection System. b. Actual measurement of any standard component on Coordinate Measuring Machine (CMM).	
	8. Introduction to CAM software: a. Term work assignment based on Fundamentals of CAM, applications. b. Use of CAM software for specific application.	
	9. Study of computer controlled business functions: Term work assignment based on Purchase order receiving, Sales and marketing, Job costing, Bill of Material, Financial control, Inventory management b. One recent paper or Case Study of computer controlled business functions.	
	10. Generation of any one simple model using Any CAM software: 1) simulate the process 2) tool path generation	
Assignments: NA		

Text Books / References 1. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education 2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education 3. Robotics Technology and Flexible Automation, by S R Deb, S Deb, McGraw Hill Education Private Limited. 4. Flexible Manufacturing Cells and System -William. W. Luggen Hall, England Cliffs, Newjersy 5. P. Radhakrishnan, " Computer Numerical Control ", New Central Book Agency, 1992. 6. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India. 7. System Approach to Computer Integrated Manufacturing. Nanua Singh, Wiley and sons Inc, 1996. 8. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993 9. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010 10. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007	
Syllabus for Unit Test NA	

INPLANT TRAINING		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: -		
Practical: -	Term Work and Oral Examination: 50Marks	03 Credits

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of theoretical subjects of Production Engineering
2.	Basic knowledge of Industrial Management
3.	Basic knowledge of Manufacturing Processes
Course Objectives:	
To help to correlate the lessons learnt in theory and actual practices followed in the industries, expose to an industrial environment, make aware of the psychology of the workers, their habits, attitudes and to prepare them to approach the problems.	
Course Outcomes:	
Students will be able to	
1.	Get an opportunity to apply their knowledge in problem solving and eventually develop that skill.
2.	Demonstrate understanding of various constraints of time and cost within which goods are produced and services rendered in a specified quantum.
3.	Get familiarized with various technological trends, approaches and applications along with managerial exposure.
4.	Develop a positive attitude, which will bring in a visible change in their approach while dealing with technical and interpersonal issues.
5.	Describe the scope, functions and job responsibilities in various departments of an organization.
6.	Appreciate and realize the size and scale of operations in Industry.
	Training: The student shall undergo training programme prepared by the industry in following manufacturing and functional areas: 1. Industrial Engineering: Method Study, Work Measurement, Ergonomics and Productivity Improvement Technique. 2. Production Planning & Control, Quality Assurance. 3. Material Management: Inventory Control, Vendor Development, Vendor Rating, Raw Material and Finished Goods stores. 4. Plant Engineering: Plant Layout, Plant Maintenance, Housekeeping, Material Handling & safety. 5. Costing and Cost Control. 6. Management Information System (M.I.S.). 7. Incentive Schemes, Labour Laws. Factory Acts. 8. Import Export Procedures. 9. Incentive schemes, labour laws, factory laws.

	10. Machine / Process Diagnosis. 11. Quality Assurance, Quality Improvement. 12. Improvement in tool layout, tool selection machine selection. 13. Maintenance of machines, housekeeping, safety precautions. 14. Computer based information study for stores, purchase wastage of material.

Term Work

Term work will consist of a comprehensive report based on his observation, training received and assignments completed during 45 Days of training. The report shall also include good drawing figure, process sheets, machine and product specifications.

Some instructions for Inplant Training Report:

Language	The report should be written in **English**
Printing	• Report must be printed single sided. • Printing must be of high quality. Text and figures must be clear and legible
Number of Copies	Final Report (3 copies)
Page Margin	Left, Right, Top, Bottom margins: 2.5 cm
Title / Paragraph Margin	• Chapter number and title should be centered. • Subsection number should align with the left margin • Subsection title should be indented 1.5 cm from the left margin. • The first paragraph in a subsection should align with left margin. • The subsequence paragraphs should be indented 1.27 cm from the left margin. • General alignment for texts in paragraph should be “justified”.
Numbering the Chapters and Subsections	All chapters and their subsections must be numbered and titled. Example: Chapter 2 Title of Chapter 2.1 Title of the subsection (second level) 2.1.1 Title of the sub-subsection (third level) 2.1.1.1 Title of the sub-sub-subsection (fourth level)
Typesetting	• Font Type : Times New Roman • Font Size : 12 pt • Chapter Title : Uppercase, Bold, Centered • Chapter Sub-section : Title Case, Bold, Align left
Page Numbering	Page numbering should start from chapter-1 in number format (1,2,3,4 etc)
Report Submission	The report to be submitted within fifteen days from completion of the training.

Examination

Oral Examination shall be conducted after training by appointing one internal examiner and one external examiner from industry .45 Days Industrial Inplant Training successful completion certificate is essential for granting the term of student.

PROJECT STAGE-I		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Practical: 02 Hours / Week	TW/OR : 50 Marks	04 Credits

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of conventional and non-conventional Machines.
2.	Knowledge of material science.
3.	Knowledge of Strength of Material.

Course Objectives:

To prepare the students to carry out a comprehensive study of any design or process or phenomenon, to encourage the process of independent / creative thinking and working in groups and to expose them to industrial atmosphere of accountability.

Course Outcomes:	
Students will be able to	
1.	Work in Team
2.	Allocate work among students according to expertise in specific field
3.	Break the Project into Tasks.
4.	Develop Leadership quality
5.	Carry out Purchasing activity
6.	Carry out fabrication and assembly of components.

Term Work

While selecting the projects preference should be given to industrial projects, social impact projects, productivity improvement and renewable energy resources or development of manufacturing technique.The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The work started in Semester VII will be continued in the Semester VIII. There will be an end semester University Exam on work done in semester VII.Different tools should be used for Project Management like PERT technique or use of software for analysis of data etc. Three reviews will be conducted throughout the semester and the reference of these reviews will be considered during final assessment. An interim report of the work completed in Semester VII in the form of report and yellow card shall be submitted for the term work along with the synopsis. The report will be assessed by the Project Guide and External faculty member appointed by the Head of the Department / concerned responsible official of the sponsoring industry (Co-guide). The synopsis shall be endorsed by the Head of Department.

The work to be completed in Semester VII shall include,

a) Literature Review
b) Problem Identification/Definition
c) Design and Methodology / CAD simulation of component or Mechanism
d) Activity planning for the time frame and division of responsibility to each student.

The oral examination shall be based on the work planned and completed in Semester VII.

CERTIFICATE

This is to certify that Mr. /Ms ……..

(Seat No.)…… has carried out a Project entitled ,…… (Project Stage –I) for partial fulfillment of the requirement of the B.Tech. Production Engineering Course during the academic Year ……

Date:

Place:

(Guide) (Project Co-Ordinator)

(Examiner) (Head of Department)

B Tech Prod

SEM VIII

Subject: Process Planning and Tool Design		
EACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
	Attendance : 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	
Practical: 02 Hours / Week	TW/OR : 50 Marks	01 Credit

Course Pre-requisites:	
The Students should have	
1.	Knowledge of Machines and Processes
2.	Knowledge of Tooling's used in Machine shops
3.	Knowledge of using Machining data.
Course Objectives:	
	The students should be able to do Prepare process sheets.
Course Outcomes:	
Students will be able to	
1.	Perform part print analysis for Establishing general characteristics of work piece, Auxiliary methods for visualizing part print, Functional surfaces, nature of Work piece, finishing and identifying operations, relating the part to assembly.
2.	Perform dimensional and tolerance analysis
3.	Identify operations for classification based on importance.
4.	Carry out Selection of Equipment and toolings from manufacturers catalog
5.	Select and plan the process and carryout process planning with holistic approach.

UNIT - I	**Product and Process Engineering** General Manufacturing processes, Product Engineering, Process Engineering, communications, relation with other departments, classification of processes, manufacturing operations. Part Print analysis-Establishing general characteristics of work piece,Auxiliary methods for visualizing part print, Functional surfaces, nature of work piece, finishing and identifying operations, relating the part to assembly.	**(06 Hours)**
UNIT – II	**Dimensional and tolerance analysis** Types of dimensions, concept of straightness, squareness, roundness, and concentricity symmetry, surface quality and surface integrity, surface finish affecting product properties and product cost, base lines, direction of specific dimensions. Tolerance analysis-causes of work piece variations, to express limits and tolerance, tolerance stack, purpose of tolerance chart,	(06 Hours)

	balancing the Tolerance Chart, Rules for adding and subtracting tolerances , layout of tolerance chart.	
UNIT - III	**Work piece Control & Classifying operations** Work piece control theories, Causes of Work piece variation, shape of part affecting processing, Mechanical, Geometric and Dimensional Control Variables influencing Work piece control, Classifying operations: Basic process operations, principal process operations, major operations, qualifying and requalifying operations, auxiliary process operations.	(06 Hours)
UNIT - IV	**Selection of Equipment and tooling's** Process capability of Equipments, prime accuracies and producible accuracies of Equipments, Factors influencing make or buy decisions, relation between Process selection and Machine selection, sources for selection , General purpose, special purpose machines, factors in machine selection in terms of cost and design factors, cost analysis, operating cost, comparative cost analysis. Classification of tooling: Factors affecting selection of Tooling, sources of tooling, tool holders, work piece holders, jigs fixtures, moulds, pattern, core boxes, dies, templates, gauges.	(06 Hours)
UNIT - V	**Selecting and planning the process** Function, Economy and appearance, fundamental rules for manufacturing process, Engineering approach, basic design of product, influence of process engineering on product design, specifications, materials and its cost analysis, eliminating operations, combined operations, availability of equipment, effect of operations speed on performance of economy, Computer aided process planning	(06 Hours)
UNIT - VI	**Process sheet design** Determining manufacturing sequence, Factors affecting operation sequence, major process sequence, combining operations, Operation routing, routing uses routing description, process picture, process picture sheet, processing dimensions and views	(06 Hours)

Term Work/Practical's (All the assignments include time estimation of processes)**:**
1. Part print analysis of one industrial component drawing
2..Process design of one component on GPM/CNC for batch production.
3. Process design of one component for mass production
4. Time estimation for one component on GPM / CNC for batch production
Assignments:
1. Assignment on Product and Process Engineering. 2. Assignment on Dimensional and tolerance analysis

3. Assignment on work piece control and classifying operations. 4. Assignment on Selection of equipment and toolings. 5. Assignment on selecting and planning the process 6. Assignment on process sheet	
Text Books/Reference Books:	
1	D.F.Eary, G.E.Johnson, “Process Engineering for Manufacturing”, Prentice-Hall
2	P.W.Wang, J.Kelly, “ Computer Aided Process Planning”.
3	Nanua singh, “System Approach to Computer Integrated Design and Manufacturing”
4	H.W.Wage, “Manufacturing Engineering”, McGraw hill
5	“Manufacturing catalogues for cutting tools and inspection equipments” P.Radhakrishnan, S.Subrmaniyum, V.Raju, “CAD\CAM\CIM”, New Age Interanational Pvt. Ltd.
6	K.Hitomi , “Manufacturing Systems Engg”, John Willey
7	Groover Mikell. P. “Fundamentals of Modern Manufacturing”, Materials, Processes and Systems”, 2nd edition, Willey 2002.

Syllabus for Unit Test:	
Unit Test -1	Unit I to III
Unit Test -2	Unit IV to VI

INDUSTRIAL ROBOTICS		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credits
	TW/OR: 50 Marks	

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of Industrial robotics
2.	Basic knowledge of Sensors and Grippers and Vision system.
3.	Basic knowledge of Programming.
Course Objectives:	
The student should understand the scope, objective and application of industrial robotics.	
Course Outcomes:	
Students will be able to understand	
1.	The basic concepts of mechatronics and robots.
2.	Develop skills in understanding various sensors, robot peripherals and their use & deployment in manufacturing system.
3.	Acquire skills in understanding robot language and programming.
4.	The concept of kinematics and dynamics equations.
5.	Acquire skill in robot task planning for problem solving.
6.	Develop skills in identifying areas in manufacturing where robotics can be deployed for enhancing productivity.

UNIT-I	**Basic concept in Robotics:** Automation and robotics, robot anatomy, basic structure of robots, resolution, accuracy and repeatability. Classification and structure of robotics system Point to point and continuous path system control loops of robotics system, manipulators, wrist motions and grippers.	**(06 Hrs)**
UNIT-II	**Drives** Control Loops, Basic Control System Concepts & Models, Control System Analysis, Robot Activation & Feedback Components, Position& Velocity Sensors, Actuators and Power Transmission system. **Robot & its Peripherals** **End Effecters:** Type mechanical and other grippers, Tool as end effecter. **Sensors:** Sensors in Robotics, Tactile Sensors, Proximity & Range Sensors, Sensor Based Systems, Vision systems and Equipment.	**(06 Hrs)**
UNIT-III	**Machine vision** Introduction, Low level & High level Vision, Sensing & Digitizing, Image Processing & analysis, Segmentation, Edge detection, Object Description & recognition, interpretation and Applications. **Programming for Robots**	**(06 Hrs)**

	Method, Robot Programme as a path in space, Motion interpolation, motion & task level Languages, Robot languages, Programming in suitable languages and characteristics of robot.	
UNIT-IV	**Robot Kinematics and Dynamics** Forward, reverse & Homogeneous Transformations, Manipulator Path control and Robot Dynamics. The direct kinematics problem, the inversion kinematics solution, Lagrangian –Euler formation, generalized D'Almbert equations of motion. Denavit Hartenberg convention and its application.	**(06 Hrs)**
UNIT-V	**Root Intelligence & Task Planning** Introduction, State space search, Problem reduction, use of predictive logic, Means. Ends Analysis, Problem solving, Robot learning and Robot task planning. **Implementation Principles and Issues** An Approach for implementing robotics, Safety, Training, Maintenance and Quality. And Social issues and The future of Robotics.	**(06 Hrs)**
UNIT-VI	**Robot application in manufacturing** Material transfer, machine loading & un loading, processing operation, Assembly & inspectors, robotic Cell design & control, Social issues & Economics of Robotics. Interfacing robot with PC, handshaking, hardware handshaking, RS232C serial interface.	**(06 Hrs)**

Term work:

List of Experiments: (Any Five)

- Study of elements of industrial robots.
- Study of model a work space for robot application.
- Design a robot gripper.
- Study of vision systems in industrial robots.
- Design a pick and place robot.
- Programming of pick and place robot.
- Make individual model of robot.

Assignments:

- Assignment on basic concepts of robots.
- Drives and control systems for robot application.
- Different types of sensors and grippers used in robots.
- Advances in robot programming
- Robot applications in manufacturing systems.
- Industrial visit

Oral/Practical

Term work and oral will be based on above syllabus

Text Books / References

- S. R. Deb. “Robotics”, Tata McGrawHill Publishing Co. Ltd., ISBN 0-07-460090-7.

- Yoren Koren, " Robotics for Engineers", McGraw Hill Book Co., ISBN 0-07-035341-7.
- M. P. Grover, M. Weiss, R. N. Nagel, N. G. Odrey, "Industrial Robotics Technology",ISBN 0-07-100442-4.
- K. S. Fu, C. G. S. Lee, R. C. Gonzaler, "Robotics Control, Sensing, Vision and Intelligence", Tata McGraw Hill, ISBN 0-07-100421-4.
- H. Asada John, "Robot Analysis and Control".
- M. W. Thring, "Robots and Telechirs", Ellis Horwood Limited, ISBN 0-85312-274-1.
- Hall A. S., "Kinematics and Linkage Dynamics", Jr. Prentice Hall.
- J. Hirchhorn,, "Kinematics and Dynamics of Machinery", McGraw Hill Book Co.
- Kafler, "Robotics Engineering", Prentice Hall India Pvt. Ltd., ISBN 81-203-0842-5.
- Jankiraman, "Image Processing and Analysis"

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

FINANCIAL MANAGEMENT & COST CONTROL		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: -- Tutorial - 01 Hrs/Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credit

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of Mathematics.
2.	Basic knowledge of Production Planning And Control
3.	Basic knowledge of Manufacturing Process And Inventory Control

Course Objectives:
The student should understand the scope, objective and application of financial management & costing control

Course Outcomes:	
Students will be able to understand	
1.	Function, scope, goals and tools used for financial management & costing control
2.	Control of Capital Expenditure.
3.	Concept and design of Working Capital.
4.	Methods of costing and Depreciation cost.
5.	Budgetary control and variance Analysis.
6.	Concept, development & use of standard costing.

UNIT-I	**Financial Management** Financial function, Scope, goals and tools. Sources of finance, corporate planning and financial management. Financial Statements: Balance sheet, profit and loss account. Ratio Analysis: Classification, Ratio Analysis and its limitations. Operating and Financial Leverage.	**(06 Hrs)**
UNIT-II	**Capital Budgeting** Control of Capital Expenditure, Evaluation Process-Payback approach, Accounting of Rate of Return, Present Value Method Vs Internal Rate of Return. Replacement cost and discounted cash flow.	**(06 Hrs)**
UNIT-III	**Working Capital Management** Concept and design of Working Capital, types of working capital, sources of working capital, time value of money, cost and capital, cost of capital. Funds Flow Analysis: Concepts, Objectives, and Techniques of Funds Flow Statement, cash flow statement.	**(06 Hrs)**
UNIT-IV	**Costing And Cost Accounting** Methods of costing and elements of cost. Type of cost, Material Cost: Different methods of pricing of issue of materials. Material losses - Wastage and its consideration. Labour Cost: Different methods wages and incentive plans. Principles of good remunerating system, labour turnover and its methods.	**(06 Hrs)**

	Job And Process Costing: Job costing, Factory job costing, Contract cost a) Unit costing:, output and operating cost b) Process costing; Normal and abnormal losses, abnormal gains, waste, scrap, by-products	
UNIT-V	**Standard Costing And Marginal Costing:** **Standard Costing: Material**, Labour, Overhead, Sales. Profit, Product-mix and Yield Variance. Capital cost control repetitive operating cost, standard costs, cost reporting and corrective action. Advantages and disadvantages. **Marginal Costing:** Concept ,Profit Volume relationship, Breakeven chart, contribution, breakeven point, Margin of Safety, Advantages and disadvantages	**(06 Hrs)**
UNIT-VI	**Depreciation And Overheads:** **Depreciation:** Concept, importance and different methods of depreciation. Estimation of material, machining and labour cost machining. **Overheads**: Classification, collection of overheads, Primary and Secondary apportionment of overheads, absorption of overheads. Machine hour and labour hour rate. Under and over absorption of overheads. Estimation of overheads	**(06 Hrs)**

Assignments:(Any six)

- Assignment on Financial Management
- Assignment on Capital Budgeting.
- Assignment on Working Capital Management..
- Assignment on Costing Cost Accounting
- Assignment on Standard Costing And Marginal Costing
- Assignment on Depreciation And Overheads
- Case Study

Text Books

1. N. K. Prasad, “Principles and Practice of Cost Accounting”, Syndicate Pvt. Ltd., Calcutta
2. M. Pandy, “Financial Management”, New Delhi Vikas Publication House Pvt. Ltd., ISBN 81-259-0638-X
3. M. Y. Khan, P. K. Jain, “Financial Management”, Tata McGraw Hill Publishing Ltd.
4. B. K. Bhar, “Cost Accounting Methods and Problems”, Academic Publishers, Calcutta
5. P.C.Tulsian “Cost Accounting” Sultan Chand & Co.,
6. P.C.Tulsian “Financial Management” Sultan Chand & Co.,

Reference Books:

1. Henry M. Steiner, “Engineering Economics Principles”, McGraw Hill Publication.
2. C.B. Gupta, “Fundamentals of Business”, Sultan Chand & Co.,
3. P. A. Samualson, “Economics”, McGraw Hill International.
4. K. K. Dewett, “Modem Economic Theory”, Sultan Chand & Co., ISBN 81-219-0331-1
5. Colin Drury, “Management and Cost Accounting”, English Language Book Society, Chapman & Hall London.

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

Elective III - Human Resource Management		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hrs/Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credit
Tutorial: --	TW/OR: 50 Marks	

Course Pre-requisites:		
The Students should have		
1.	Basic knowledge of business management	
2.	Knowledge of employee welfare	
3.	Basic knowledge of factory acts and labour laws	
Course Objectives:		
The student should be able to understand and apply the principles of human resource management.		
Course Outcomes:		
Students will be able to		
1.	Understand the concept of human resource management	
2.	Use proper HR forecasting techniques for successful planning	
3.	Understand the concept of training and development	
4.	Understand the concept of performance appraisal and compensation	
5.	Use the various methods of job evaluation, analysis and design	
6.	Understand the grievance procedure and employee welfare	
UNIT-I	**Introduction to Human Resource Management:** Introduction, Concept of Human Resource Management, Scope of Human Resource Management, History of Human Resource Management, Function of Human Resource Management, Role of HR Executives Changing Role of Human Resource in India, Globalization, Its Impact on HR.	(06 Hours)
UNIT-II	**Human Resource Planning**: Process of Human Resource Planning, Need for Human Resource Planning, HR Forecasting Techniques, Successful Human Resource Planning **Recruitment and Selection**: Concept of Recruitment, Factors Affecting Recruitment, Sources of Recruitment, Recruitment Policy, Selection, Selection Process, Application Forms, Selection Test, Interviews, Evaluation, Placement, Induction	(06 Hours)
UNIT-III	**Training and Management Development**: Meaning of Training, Area of Training, Methods of Training, Concept of Management Development, Management Development Methods, Differences Between Training and Development, Evaluation of Training and Management Development	(06 Hours)

	Employee Career Planning and Growth: Concept of Employee Growth, Managing Career Planning, Elements of a Career Planning Programme, Succession Planning.	
UNIT-IV	**Performance Appraisal**: Concept and Need for Performance, Reviews, Overview of Performance Appraisal, Types of Appraisal Methods, 360 degree appraisal, Benefits **Compensation Management**: Wage and Salary Administration, Managing Wages, Concept of Rewards and Incentives, Managing Benefits in Organisations Labour Laws: introduction to labour laws and factory act.	(06 Hours)
UNIT-V	**Job Evaluation:** Concept of Job Evaluation, Objectives, Techniques, Advantages and Limitations, Introduction to Competency **Job Analysis and Design:** Concept of Job Analysis and Design, Process of Job Analysis, Methods of Job Analysis, Job Analysis Information, Concept of Job Design, **Human Resource Information System:** Introduction, Concept, Components, Types, Application, Implementation, Benefits, Impact,	(06 Hours)
UNIT-VI	**Employee Welfare and Working Conditions:** Concept of Employee Welfare, Welfare Measures, Types, Employee Welfare Responsibility, the Business Benefits of Employee Welfare Activities **Grievance and Grievance Procedure:** Concept of Grievance, Causes of Grievances, Forms and Effects of Grievance, the Grievance Handling Procedure, Need for Grievance Redressal Procedure **Emerging Trends in HRM**: Competency Mapping, Business Process Outsourcing, Right Sizing of Workforce, Flexi time, Talent Management, Employee Engagement	(06 Hours)
Term work: 1. Introduction to Human resource management 2. Exercise covering human resource planning, recruitment and selection. 3. Exercise on training and development 4. Assignment on employee career planning and growth 5. Exercise on career planning and compensation. 6. Exercise on job evaluation, analysis and design. 7. Assignment on employee welfare and working conditions. 8. Exercise on grievance procedure and emerging trends in HRM.		
Assignments: 1. Assignment on cost effective recruitment 2. Assignment on use of portals for recruitment. 3. Assignment on training need analysis. 4. Assignment on compensation benchmarking. 5. Assignment on mandatory requirements of factories act. 6. Assignment on design of appraisal system. 7. Assignment on employee satisfaction survey.		

Text Books / References

1. Aswathappa, “Human Resource and Personnel Management”, Tata McGraw hIll.
2. C.B. Mammoria, “Personnel Management”,
3. Dessler, “Human Resource Management”, Prentice Hall India.
4. DeCenzo & Robbins, “Personnel/Human Resource Management: “Prentice Hall India.
5. D. K. Bhattacharya, “Human Resource Management”, Excel Books; 2nd edition
6. V. S. P. Rao, “Human Resource Management”, Excel Books.
7. Gomez, “Managing Human Resource”, Prentice Hall India.
8. Dr P Jyothi and Dr D.N Venkatesh, “Human Resource Management”, Oxford Publications.

Syllabus for Unit Test

Unit Test 1	Units I , II and III
Unit Test 2	Units IV, V and VI

Elective III: Manufacturing of Composite Materials		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hours / Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credits

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of conventional manufacturing processes.
2.	Knowledge of material science.
3.	Knowledge of engineering Metallurgy.
Course Objectives:	
	Student will understand the concepts of Composite and also able to understand the Manufacturing of Composite Materials .
Course Outcomes:	
Students will be able to understand	
1.	Different types of composite and its classification .
2.	To select proper process and understand characteristics of fibers .
3.	To select different methods of reinforcement of materials .
4.	To select various design of dies for manufacturing .
5.	Mechanism of curing.
6.	To select advance processes and understand its defects and remedies in Manufacturing of Composite Materials

UNIT - I	**Introduction**: Definition of composite material, Classification based on matrix and topology, Constituents of composites, Interfaces and Interphases, Distribution of constituents, Nano-composites,	**(06 Hours)**
UNIT - II	**Performance of Structural Composites**: Combination effects Fabrication and processing of metal matrix (MM), polymer Matrix (PM) and ceramic matrix (CM) composites and their characterization; Fabrication of nano-composites; Secondary processing and joining of various composite materials for structural applications and their fracture behaviour and safety.	**(06 Hours)**
UNIT - III	**Strengthening mechanisms**, Stress distribution in fibre and the matrix (shear stress and axial tensile stress in the fibre along its length), critical length of fibre for full strengthening, Analysis of uniaxial tensile stress-strain curve of unidirectional continuous and short fibre composites, Estimation of the required minimum amount of fibre and critical amount of fibre to gain a composite strength, Analysis of strength of a composite during loading at an angle to the fibres,	**(06 Hours)**

UNIT - IV	**Characterisation Composites** :Control of particle/fibre and porosity content, particle/fibre distribution, Interfacial Reaction of matrix-reinforcing component, Coating of reinforcing component, Strength analysis Performance of Composite in Non-structural Applications :Composites in Electrical, Superconducting and Magnetic Applications, Nano-composite devices	**(06 Hours)**
UNIT - V	**Fabrication Composites** :Fabrication of Metal Matrix Composites: Commonly used Matrices, Basic Requirements in Selection of constituents, solidification processing of composites - XD process ,Spray processes - Osprey Process, Rapid solidification processing, Dispersion Processes - Stir-casting & Compocasting, Screw extrusion, Liquid- metal impregnation technique - Squeeze casting, Pressure infiltration, Lanxide process), Pinciple of molten alloy infiltration, rheological behaviour of melt -particle slurry, Synthesis of In situ Composites;	**(06 Hours)**
UNIT - VI	**Fabrication of Polymer Matrix Composites** - Commonly used Matrices Basic Requirements in selection of Constituents, Moulding method, Low pressure closed molding, pultrusion, Filament winding, Fabrication of ceramic matrix composites - Various techniques of vapour deposition, Liquid phase method and Hot pressing etc. Fracture & Safety of Composite : Fracture behavior of composites, Mechanics and Weakest link statistics,Griffith theory of brittle fracture and modification for structural materials, Basic fracture mechanics of composite	**(06 Hours)**

Term work:

List of Experiments: (Any six)

- Manufacturing of Fibres on Electrospin Machine
- Study of different binders
- Manufacturing of composite by Hand Lay up processes .
- Manufacturing of composite by VARTUM
- Study of MMC .
- Study of CMC.
- Study of different Matrix Materials and reinforced materials
- Testing of composite component

Assignments:

1. Explain the different types of composite ,Interfaces and Interphases.
2. Discuss the Fabrication of nano-composites in details
3. Explain the Stress distribution in fiber and the matrix.
4. How the carbon and glass fiber are manufactured.
5. What is Liquid- metal impregnation technique?
6. Explain the basic requirements in selection of Constituents in composite .

Text Books/Reference Books:	
1	Composite materials, K.K. Chawala, 2nd ed., (1987) Springer-Verlag, New York. 2
2	Nanocomposite Science and Technology, P.M. Ajayan, L.S. Schadler, P. V. Braun, (2003), Wiley-VCH Verlag GmbH Co. KGaA, Weinheim.
3	Ceramic matrix composites, K.K. Chawala, 1sted., (1993) Chapman & Hall, London
4	Advances in composite materials, G. Piatti, (1978) Applied Science Publishers Ltd., London.

Syllabus for Unit Test:	
Unit Test -1	Unit I to III
Unit Test -2	Unit IV to VI

Elective III: KNOWLEDGE BASED SYSTEMS		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credit
	TW/OR : 50 Marks	

Course Pre-requisites:

The Students should have

1.	Basic Knowledge of Information Technology
2.	Introductory computer course.
3.	Information systems course.

Course Objectives:

The basic purpose of the course is to discuss the application of artificial intelligence techniques and more specifically knowledge based systems, in information processing and information systems design. Discuss methodological and project management approaches to developing knowledge based systems.

Course Outcomes:

Students will be able to

1.	Understand the knowledge-based systems representation.
2.	Understand automatic reasoning.
3.	Understand inductive and deductive learning.
4.	Implement a small knowledge- based system.
5.	Understand Methodologies for building knowledge based systems
6.	Understand Organizational and Managerial Issues

UNIT-I	**(06 Hrs)**
Artificial Intelligence and Information Systems: Fourth & fifth generation languages, Nonprocedural Paradigms, Data and Knowledge.AI, knowledge based systems, Expert Systems. Basic architecture of knowledge based systems	
UNIT-II	**(06 Hrs)**
Knowledge representation and the knowledge base: First-Order Logic, Production Rules, Horn Clauses, Frames, Semantic Networks, Objects. Metaknowledge, Conceptual modelling.	

UNIT-III	**(06 Hrs)**
Interfaces: User interface: explanation facilities, unknown values. Systems interface: language and database hooks. Developer interface: knowledge acquisition, testing & debugging	
UNIT-IV	**(06 Hrs)**
Methodologies for building knowledge based systems: Development lifecycle, structured development and prototyping. Knowledge acquisition techniques, protocol analysis, repertory grid. Integration with databases, data processing and information systems methodologies	
UNIT-V	**(06 Hrs)**
Expert system building tools: AI-Languages, Knowledge representation languages, E.S.-shells, products and environments .Knowledge base management systems	
UNIT-VI	**(06 Hrs)**
Organizational and Managerial Issues: Knowledge as a strategic asset in the organization, knowledge problems and management. Applications, pitfalls and successes.	
Term work: **List of Experiments: (Any Five)** 1. Study of Artificial Intelligence 2. Study of Basic architecture of knowledge based systems 3. Conceptual modelling. 4. Study of Developer interface. 5. Data processing and information systems methodologies. 6. Knowledge base management systems. 7. Study of knowledge problems and management.	
Assignments: (Any Six) 1. Study of Expert Systems. 2. Knowledge based systems. 3. Study of Production Rules. 4. Study of Semantic Networks. 5. Study of Systems interface. 6. Study of protocol analysis.	

7. Study of AI-Languages.
8. Different Knowledge acquisition techniques.
9. Study of Knowledge representation languages.
10. Study of products and environments.
11. Knowledge as a strategic asset in the organization

ÿ **Text Books / References**

- VANTHIENEN J., Knowledge Based Systems (Wouters Bookstore)
- HARMON, P., HALL, C., ***Intelligent Software Systems Development*** , Jojn Wiley & Sons, Inc., 1993, 472 pp.
- LUGER, G., STUBBLEFIELD, W., ***Artificial Intelligence*** , Second edition, Benjamin/Cummings, 1993.
- TURBAN, E., LIEBOWITZ, J. (Eds), ***Managing Expert Systems*** , Idea Group Publishing, 1992.
- PATTERSON, D., ***Introduction to Artificial Intelligence and Expert Sytems***, Prentice-Hall, 1990.
- Peter Jackson**, Introduction to Expert Systems**, Addison-Wesley (3rd Ed), 1998

Syllabus for Unit Test

Unit Test 1	**Units I , II and III**
Unit Test 2	**Units IV, V ,VI**

Elective III: **Design And Analysis of Experiments.**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs/Week	End Semester Examination: 60 Marks	03 Credits
Practical: 02 Hours / Week	Attendance: 10 Marks Assignments : 10 Marks Unit Test : 20 Marks	01 Credit
	TW &OR :50Marks	

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of Introduction to Statistics or a similar basic statistics course
2.	Basic knowledge of Graphical Representation.
3.	Basic knowledge of some Software's such as statease and Minitab.

Course Objectives:
This course provides an introduction to designing experiments and analyzing their results.

Course Outcomes :
Students will be able to understand

1.	Design of Experiments
2.	Selection of Levels and Parameters.
3.	Factorial Design. The 2^k Factorial Design
4.	Analysis of Variance (ANOVA)
5.	Model building using the method of least squares.
6.	Performing hypothesis tests,

UNIT-I	**Introduction to design of experiments:** Strategy of Experiment, Basic Principles, Guide Lines for designing Experiment, Brief History of Stastical Design. Using Stastical Techniques in Experimentation. A typical application of Experimental Design.	**(06 Hrs)**
UNIT-II	**Simple Comparative Experiments**.: Introduction, Basic Stastical Concepts, Sampling and Sampling distributions, difference in means, hypothesis testing, choice of sample size, confidence intervals, comparing single mean to Specified value, difference in means, paired comparison designs.	**(06 Hrs)**
UNIT-III	**Design of Experiments:** Introduction to Factorial Designs. The 2^k Factorial Design, The 2^2 Factorial Design, The 2^3 Factorial Design, General 2^k design, Single replicate of the 2^k design, Taguchi Method and addition of center points to the 2^k design.	**(06 Hrs)**
UNIT-IV	**Analysis of Variance :(ANOVA)**	**(06 Hrs)**

	Analysis of the fixed effects Model, decomposition of the Total Sum of Squares, Stastical Analysis, Estimation of the Model Parameters, Unbalanced Data.	
UNIT-V	**Regression Analysis:** Regression Model, Comparison among Means, Regression Approach to the Analysis of Variance Least Squares, Estimation of the Model Parameters, General Regression Significant Test,	**(06 Hrs)**
UNIT-VI	**Result Analysis:** Fitting Regression Models, Linear Regression Models, Estimation of the Model Parameters in Linear Regression Models, Hypothesis Testing in Multiple Regression, Test for Significance of Regression, Test on Individual Regression Coefficient and group of Coefficients, Confidence intervals on the individual Regression Coefficient, Confidence intervals on the Mean Response, Prediction the new response observation F-Test, Matching the Calculated value with standard value, Use of Software's,Statease, Systat, Minitab ,Predict analysis	**(06 Hrs)**

Term work: Students have to write the assignments as well as perform the experiment and prepare the journal for the same.

Assignments: (Any Six)

- Assignment on Introduction to design of experiments
- Assignment on Simple Comparative Experiments
- Assignment on Design of Experiments.
- Assignment on Analysis of Variance (ANOVA)
- Assignment on Regression Analysis
- Assignment on Result Analysis.
- Case Study (Perform the experiments by selecting at least 2 levels and 3 parameters.)

Oral/Practical

Term work and oral will be based on above syllabus

Text Books

1) George E. P. Box, William G. Hunter, J. Stuart Hunter, Statistics for Experimenters: An Introduction to Design, Data Analysis, and Model Building, Second Edition, John Wiley & Sons, New York, 2005

2) Douglas C. Montgomery, Design and Analysis of Experiments, Sixth Edition, John Wiley & Sons, New York, 2004.

Syllabus for Unit Test

Unit Test 1	**Units I , II , III**
Unit Test 2	**Units IV, V ,VI**

Computer Aided Engineering		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: --	End Semester Examination: --	
Practical: -- 02 Hrs/Week	Internal evaluation: -- Assignments : -- Unit Test : --	01 Credit
Tutorial : --	TW/OR – 50 marks	01 Credit

Course Pre-requisites:	
The Students should have	
1.	Basic knowledge of computer aided design and analysis
2.	Basic knowledge of manufacturing
3.	Basic knowledge of numerical methods
Course Objectives:	
The students should understand the scope, objectives and applications of Computer Aided Engineering.	
Course Outcomes:	
Students will be able to	
1.	Solve ordinary and partial differential equations using Galerkin method.
2.	Analyse the 2D problems by using software.
3.	Solve the problems related to heat transfer by using software.
4.	Design and analyse the connecting rod.
5.	Design and analyse the burnished components.
6.	Analyse the screw jack.
	Term work:
1.	Structural analysis of a corner bracket.
2.	Structural analysis of Truss structure.
3.	Modal analysis of Simple Pendulum.
4.	Steady state heat transfer through a plate with hole.
5.	Analysis of a connecting rod.
6.	Analysis of Leaf spring
7.	Analysis of burnished components
8.	Analysis of piston
9.	Analysis of camshaft
10.	Analysis of Screw jack.

Assignments: NA

Text Books / References

1. S. S. Rao, " Finite Element methods in Enginering", Pergomon press Oxford, 2nd edition 1989
2. Sagarlind L J, Applied Finite Element Analysis, John Willey, 1984
3. Chandrupatla & Belegundu, Introduction to Finite Element Engineering, Prentice Hall, 1999.
4. David Hutton, “Fundamentals of Finite Element Analysis”, Mcgraw-Hill
5. Saeed Moaveni, “Finite Element Analysis Theory And Application With ANSYS”, Prentice Hall.
6. Sham Tickoo,” Ansys Workbench 14.0 for Engineers and Designers (MISL-DT), Dreamtech Press.

Syllabus for Unit Test NA	

PROJECT STAGE-II		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Practical: 04 Hours / Week	TW/OR :150 Marks	08 Credits

Course Pre-requisites:

The Students should have

1.	Basic knowledge of Machines.
2.	Knowledge of material science.
3.	Knowledge of Strength of Material.

Course Objectives:

To prepare the students to carry out a comprehensive study of any design or process or phenomenon, to encourage the process of independent / creative thinking and working in groups and to expose them to industrial atmosphere of accountability.

Course Outcomes:

Students will be able to

1.	Work in Team
2.	Allocate work among students according to expertise in specific field
3.	Break the Project into Tasks.
4.	Develop Leadership quality
5.	Carry out Purchasing activity

6.	Carry out fabrication and assembly of components.

Term Work

The students will complete their project work started in B.Tech. (Production Engineering) – Semester VII and will submit the report in a prescribed format as given below at the end of Semester VIII. The report will be assessed by the Project Guide and External faculty member appointed by the Head of the Department / concerned responsible official of the sponsoring industry (Co-guide). A publication of work in national conference or journal is compulsory. The report shall be submitted, typed on A4 size sheets and hard bound.(One copy for the department and one copy for each student). The contents of the report shall include the following in a broad sense.

Detailing may be done according to the problem undertaken.

a) Problem identification and statement

b) Review of relevant literature / present practices regarding the problem

c) Methodology followed to carry out the work

d) Inputs for the project design

e) Processing / conversion of these inputs

f) Outputs testing / validation

g) Results, conclusion, future scope, references, acknowledgement

h) **Review of initial plan and deviations in it.**

1) Term work will be assessed by the project guide along with Co-guide from sponsoring industry **or** one more faculty member appointed by the Head of Department for in-house projects; based on the work done and the report submitted.

2) The students will be examined orally by the examiner appointed by the university and the project guide as the internal examiner.

Marks will be awarded on the basis of the work done and performance in the oral examination.

Format of the project report should be as follows:

1. Paper: The Project report should be typed/printed on white paper of A-4 size.

2. Typing: The typing shall be with one and half spacing and on one side of the paper.

3. Binding: The Industrial Implant Report should be submitted with front and back cover in black Hard bound, with golden embossing.

4. Margins: Left - 1.25", Right - 1". Top and Bottom 1"

5. Sequence of Pages:

1. Title page

2. Certificate form Institute

3. Completion Certificate form Industry, if sponsored.

4. Acknowledgement

5. Abstract

6. Index

7. Nomenclature and Symbols

8. Actual Content

9. Conclusion

10. References.

6. Front cover: The front cover shall have the following details in block capitals

i. Title at the top.

ii. Name of the candidate in the centre, and

iii. Name of the Institute, Name of Industry, if sponsored and the year of submission on separate

lines, at the bottom.

CERTIFICATE

This is to certify that Mr. /Ms ……..

(Seat No.)…… has carried out a Project entitled ,……for partial fulfillment of the requirement of the B.Tech. Production Engineering Course during the academic Year ……

Date:

Place:

(Guide) (Project Co-Ordinator)

(Examiner) (Head of Department)