

**VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**  
**SCHEME OF TEACHING AND EXAMINATION 2015-2016**

**B.E. INDUSTRIAL & PRODUCTION ENGINEERING**  
**(COMMON TO \_\_\_\_\_)**

**VII SEMESTER**

Sl. No.	Subject Code	Title	Teaching Hours/ Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15IP71	Non –Conventional Machining Processes	04		03	80	20	100	4
2	15IP72	Operations Management	04		03	80	20	100	4
3	15IP73	Mechatronics	04		03	80	20	100	4
4	15IP74X	Professional Elective	03		03	80	20	100	3
5	15IP75X	Open Elective	03		03	80	20	100	3
6	15IPL76	Software Application Lab		1I+2P	03	80	20	100	2
7	15IPL77	CNC & Robotics Lab		1I+2P	03	80	20	100	2
8	15IPP78	Project Phase-I + Seminar					100	100	2
<b>TOTAL</b>			<b>18</b>	<b>06</b>	<b>21</b>	<b>560</b>	<b>240</b>	<b>800</b>	<b>24</b>

Professional Elective		Open Elective	
15IP741	Marketing Management	15IP751	Financial Management
15IP742	Enterprise Resource Planning	15IP752	World Class Manufacturing
15IP743	Simulation Modeling and Analysis	15IP753	Product Data Management
15IP744	Automobile Engineering	15IP754	Machine Tool Design

- 1. Core Subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in a said discipline of study.
- 2. Professional Elective:** Elective relevant to chosen specialization/branch.
- 3. Project Phase-I + Seminar:** Literature Survey, problem Identification, Objectives & Methodology, Submission of synopsis and seminar.

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**B.E. INDUSTRIAL & PRODUCTION ENGINEERING**  
**(COMMON TO \_\_\_\_\_)**

**VIII SEMESTER**

Sl. No.	Subject Code	Title	Teaching Hours/ Week		Examination				Credits
			Theory	Practical/ Drawing	Duration	Theory/ Practical Marks	I.A. Marks	Total Marks	
1	15IP81	Supply chain management	04		03	80	20	100	4
2	15IP82	Facility Planning and Design	04		03	80	20	100	4
3	15IP83X		03		03	80	20	100	3
4	15IP84	<b>Internship/Professional Practice</b>	Industry oriented		03	50	50	100	2
5	15IPP85	Project Work Phase-II		6	03	100	100	200	6
6	15IPS86	Seminar		4	-	-	100	100	1
<b>TOTAL</b>			<b>11</b>	<b>10</b>	<b>15</b>	<b>390</b>	<b>310</b>	<b>700</b>	<b>20</b>

<b>Professional Elective</b>	
15IP831	Just in Time Manufacturing
15IP832	Automation in Manufacturing
15IP833	Organizational Behavior
15IP834	Advanced Joining Process & NDT

1. **Core Subject:** This is the course, which is to be compulsorily studied by a student as a core requirement to complete the requirement of a program in a said discipline of study.
2. **Professional Elective:** Elective relevant to chosen specialization/branch.
3. **Internship/Professional Practice:** To be carried between the 6<sup>th</sup> and 7<sup>th</sup> semester vacation or 7<sup>th</sup> and 8<sup>th</sup> semester vacation period

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**NON-CONVENTIONAL MACHINING PROCESSES**

Sub Code	<b>15IP71</b>	IA Marks	20
No. of Lecture Hrs/week	04	Exam Hours	03
Total Lecture Hrs	50	Exam Marks	80

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**Course objectives:**

1. The course aims in identifying the classification of unconventional machining processes.
2. To understand the principle, mechanism of metal removal of various unconventional machining processes.
3. To study the various process parameters and their effect on the component machined on various unconventional machining processes.
4. To understand the applications of different processes.

**UNIT – 1**

**INTRODUCTION:** History, Classification, Comparison between conventional and non-conventional machining process selection.

**MECHANICAL PROCESS:** Ultrasonic machining (USM) : Introduction, Equipment, tool materials & tool Size, Abrasive slurry, Cutting tool system design : Magnetostriction assembly, Tool cone (Concentrator), & Exponential concentrator of circular cross section & rectangular cross section Hollow cylindrical concentrator. Mechanics of cutting : Effect of amplitude and frequency and vibration, Effect of grain diameter , Effect of applied static load, Effect of slurry, Tool and work material, USM process Characteristics ; Material removal rate, tool wears, Accuracy, surface finish., Applications, Advantages & Disadvantages of USM **10 Hours**

**UNIT – 2.**

**ABRASIVE JET MACHINING (AJM):** Introduction, Equipment, Variables in AJM: carrier Gas Type of abrasive, Size of abrasive grain, velocity of the abrasive jet, Mean No. abrasive particles per unit volume of the carrier gas, Work material, stand off distance (SOD) nozzle design shape of cut. Process characteristics – Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, Advantages & Disadvantages of AJM.

**ELECTROCHEMICAL AND CHEMICAL METAL REMOVAL PROCESS:** Electrochemical machining (ECM): Introduction, Study of ECM machine, Elements of ECM process: Cathode tool, Anode work piece, source of DC power, Electrolyte, ECM process characteristics – Material removal rate, Accuracy, Surface finish **10 Hours**

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**UNIT-3**

**ECM TOOLING:** ECM tooling technique 7 example, Tool & insulation materials, Tool size Electrolyte flow arrangement, Handling of slug., Economics of ECM, Applications such as Electrochemical turning, Electrochemical Grinding, Electrochemical Honing, deburring, Advantages, Limitations.

**CHEMICAL MACHINING (CHM):** Introduction, Elements of process Chemical blanking process :- Preparation of work piece. Preparation of masters, masking with photo resists, etching for blanking, applications of chemical blanking, chemical milling (Contour machining) :- Process steps – masking, Etching, process characteristics of CHM :- material removal rate accuracy, surface finish, Hydrogen embrittlement, Advantages & application of CHM

**10 Hours**

**UNIT – 4**

**EDM PROCESS:** Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, Electrode manufacture, Electrode wear, EDM tool design : Choice of matching operation, electrode material selection, under sizing and length of electrode Machining time.

**EDM PROCESS CHARACTERISTICS:** Flushing – Pressure flushing synchronized with electrode movement, EDM process characteristic: Metal removal rate, Accuracy surface finish, Heat affected Zone. Machine tool selection, Application: EDM accessories / applications.

**10 Hours**

**UNIT – 5**

**PLASMA ARC MACHINING (PAM):** Introduction, equipment, generation of plasma, Mechanism of Metal removal, PAM parameters, Process characteristics.

**LASER BEAM MACHINING & ION BEAM MACHINING:** Introduction, metal removal mechanism, advantages and application

**10 Hours**

**TEXT BOOKS:**

1. Modern machining process - PANDEY AND SHAH - TATA Mc Graw Hill -2000.
2. Unconventional Manufacturing process – M K Singh, New age publications, ISBN 978-81-224-2244-3

**REFERENCE BOOKS:**

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1. Production Technology - HMT - TATA McGraw Hill - 2001.
2. Thermal Metal cutting processes - B G Ranganath - I K International Publishing house Pvt. Ltd,
3. Fundamentals of Machining and Machine Tools - R.K.Singal - I K International Publishing house Pvt. Ltd.

**OPERATIONS MANAGEMENT**

Subject Code: 15IM/IP72

No. of Lecture Hrs./ Week : 04

Total No. of Lecture Hrs. : 50

IA Marks : 20

Exam Hours : 03

Exam Marks : 80

**Module 1**

**OPERATIONS MANAGEMENT CONCEPTS:** Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity.

**OPERATIONS DECISION MAKING:** Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology, Decision support systems, Economic models, and Statistical models. 10 Hours

**Module 2**

**FORECASTING DEMAND:** Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods, Application and control of forecasts. 10 Hours

**Module 3**

**AGGREGATE PLANNING AND MASTER SCHEDULING:** Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods. 10 Hours

**Module 4**

**MATERIAL AND CAPACITY REQUIREMENTS PLANNING:** Overview: MRP and CRP, MRP: Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities.

**SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES:** Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control. 10 Hours

**Module 5**

**SINGLE MACHINE SCHEDULING:** Concept, measures of performance, SPT rule, Weighted SPT rule, EDD rule, minimizing the number of tardy jobs.  
**FLOW -SHOP SCHEDULING:** Introduction, Johnson's rule for 'n' jobs on 2 and 3 machines, CDS heuristic. **JOB-SHOP SCHEDULING:** Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines. 10 Hours

**TEXT BOOKS:**

1. Operations Management - Monks J.G. - McGraw-Hill International Editions - 1987.
2. Production and Operations Management - Pannerselvam. R – PHI – 2nd edition.
3. An introductory book on lean systems, TPS, Yasuhiro Monden

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**REFERENCE BOOKS:**

1. Modern Production/Operations Management - Buffa - Wiely India Ltd. - 4th edition.
2. Production and Operations Management - Chary, S.N - TataMcGraw Hill. - 3rd edition
3. Production and Operatiосn Management – Adam & Ebert, PHI, 5th edition Financial Accounting And Costing

**MECHATRONICS**

Subject Code	: 15IP 73	IA Marks	: 20
No. of Lecture Hours./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hours.	: 50	Exam Marks	: 80

**MODULE - 1**

**INTRODUCTION:** Definition of Mechatronics, Multi-disciplinary scenario, Evaluation of Mechatronics, Objectives, Advantages & Disadvantages of Mechatronics, An Overview of Mechatronics, Microprocessor Based Controllers, Principle of Working of Automatic Camera, Automatic Washing Machine & Engine Management System.

**REVIEW OF SENSORS AND TRANSDUCERS:** Definition and Classification of Transducers, Definition & Classification of Sensors, Working Principle and Application of Displacement, Position & Proximity, Velocity and Motion, Force, Fluid pressure, Liquid flow, Liquid level, Temperature, Light sensors, Selection of transducers.

**8 Hours**

**MODULE - 2**

**DIGITAL PRINCIPLES:** Introduction, Digital Number System, Range and Weight of Binary Number System, Octal and Hexadecimal Number Systems, Conversion, BCD Number Systems, Gray Code, Boolean Algebra, Logic States, Logic Functions, More Logic Gates, Universal Gates, Exclusive-OR Gate, Combinational and Sequential Logic Circuits, Flip-Flops, Minimization of Boolean Expression, Karnaugh Map, TTL and CMOS, Memory.

**MICROPROCESSOR:** Intel 8085, ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration, Intel 8085 Instructions, Op code and Operands, Instruction Word Size, Instruction Cycle, Fetch Operation, Execute Operation, Machine Cycle and State, Instruction and Data Flow, Timing Diagram, Timing Diagram for Op code Fetch Cycle, Memory Read, I/O Read, Memory Write, I/O Write, Instruction and Data Formats, Addressing Modes, Direct Addressing, Register Addressing, Register Indirect Addressing, Immediate Addressing, Implicit Addressing.

**12 Hours**

**MODULE - 3**

**MICRO CONTROLLER:** Introduction to microcontrollers, Intel 8051 Microcontroller Architecture and Pin diagram, Selection and Application of Microcontroller.

**PLC:** Programmable Logic Controllers, Basic Structure, Input/Output Processing, Programming, Mnemonics, Timers, Internal Relays and Counters, Shift Registers, Master and Jump controls, Data handling, Analogue input/output, Selection of a PLC.

**8 Hours**

**MODULE - 4**

**ACTUATORS:** Definition, Classification of Actuators, Brief survey of Electromechanical actuators, Drive requirements for cutting movements, Requirements of feed drives, Calculation of drive requirements on feed motor shaft, DC motors & Control of DC motors, AC motors, DC & AC servomotors, Stepper motors- types, Characteristics, advantages, limitations and applications.

**10 Hours**

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**MODULE - 5**

**SYSTEM MODELS:** Mathematical models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks.  
**12 Hours**

**TEXT BOOKS:**

1. **Mechatronics** - W. Bolton – Pearson Education Asia - 2<sup>nd</sup> Edition, 2001.
2. **Fundamentals of Microprocessor and Micro Computer** - B. Ram - Dhanpat Rai and Sons - 4<sup>th</sup> Revised Edition.

**REFERENCE BOOKS:**

1. **Mechatronics** Principles, Concepts and Application - Nitaigour and Premchand, Mahilik – Tata McGraw Hill - 2003.
2. **Mechatronics** by HMT - TMH.

**SOFTWARE APPLICATIONS LAB**

Subject Code	:	15IPL 76	IA Marks	:	20
No. of Lab Hours./ Week	:	03	Exam Hours	:	03
Total No. of Lab Hours.	:	42	Exam Marks	:	80

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**PART - A**

1. Development of simple MIS application programs for use in :  
(i) Library, (ii) Bank, (iii) Business shop, and (iv) Hospital
2. Regression and Correlation analysis using any of the statistical packages.

**PART -B**

3. Plotting Quality control chart using software packages.
4. Use of software package to solve Operation Research (LPP) problems.  
Plotting appropriate charts and diagrams relevant to various industrial

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applications.

**Reference Book:**

Lab manual prepared by the department/institution.

Suggested Software Packages: Oracle / MS SQL Server as the back-end,  
and VB6.0 / Developer2000 as the front-end tools, SYSTAT and OR Packages.

Note: A minimum of 12 exercisers are to be conducted

**CNC AND ROBOTICS LAB**

Subject Code	: 15IPL 77	IA Marks	: 20
No. of Lab Hours./ Week	: 03	Exam Hours	: 03
Total No. of Lab Hours.	: 42	Exam Marks	: 80

**PART - A**

1. Study of functions assigned to Alphabets and Symbols. G and M codes, grouping of codes, Assigned and Unassigned, Model and Non Model codes.
2. Writing the program for Contour Milling - 4 exercises
3. Writing the program using Canned Cycles, Subroutine Programs for Drilling, Reaming and Thread Cutting - 4 exercises
4. Introductory concept of loop in loop program - 2 exercises.

**Note:**

1. The programs should be written with reference to one user manual provided by manufacture of control unit.
2. Atleast 10 programs must be simulated.

**PART - B**

- 1 Writing CNC program for Lathe - 2 exercises.



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2 Exercises on Robots (only demonstration)

- a. Study of a General Configuration of a Robot.
- b. Study of Programming methods
- c. Study of Overview of Robot languages.

Atleast 4 programs to be discussed with specific applications

## **PROFESSIONAL ELECTIVE**

### **MARKETING MANAGEMENT**

Subject Code	: 15IIM/IP 741	IA Marks	: 20
No. of Lecture Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 40	Exam Marks	: 80

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#### **MODULE - 1**

**INTRODUCTION:** Historical development of marketing management, Definition of Marketing, Core marketing concepts, Marketing Management philosophies, Micro and Macro Environment, importance of marketing in the India Socio – economics system.

**CONSUMER MARKETS AND BUYING BEHAVIOR:** Characteristics affecting consumer behaviour, Types of buying decisions, Buying decision process, Classification of consumer products, Market segmentation.

**8 Hours**

#### **MODULE - 2**

**MARKETING INFORMATION SYSTEMS AND RESEARCH:** Components of marketing information system–benefits & uses marketing research system, marketing research procedure, measurement of market demand.

**MARKETING OF INDUSTRIAL GOODS:** Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behaviour, characteristics of industrial market demand. Determinants of industrial market demand Buying power of Industrial users, buying motives of Industrials users, the industrial buying process, buying patterns of industrial users

**8 Hours**

#### **MODULE- 3**

**PRODUCT PLANNING AND DEVELOPMENT:** The concept of a product, features of a product, classification of products, product policies – product planning and development, product line, product mix – factors influencing change in product mix, product mix strategies, meaning of New – product; major stages in new – product development, product life cycle.

**BRANDING, LABELLING AND PACKAGING:** Branding, Reasons for branding, functions of branding, features and types of brands, kinds of brand name.

**LABELLING:** Types, functions, advantages and disadvantages

**PACKAGING:** Meaning, growth of packaging, function of packaging, kinds of packaging.

**8 Hours**

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**MODULE - 4**

**PRICING:** Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for price determination, kinds of pricing, pricing strategies and decisions.

**DISTRIBUTION:** Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.

**8 Hours**

**MODULE-5**

**PERSONAL SELLING:** Objectives of personal selling, establishing the Sales force objectives, sales – force strategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major steps in effective selling.

**8 Hours**

**TEXT BOOKS:**

1. **Principles of Marketing** - Philip Kotler - Prentice Hall - 11<sup>th</sup> Edn.
2. **Marketing Management** - Philip Kotler , Prentice Hall - 12<sup>th</sup> Edn.

**REFERENCE BOOKS:**

1. **Fundamentals of Marketing** - Wiliam J Stanton - McGraw Hill – 1994.
2. **Marketing Management Text & Cases** - Rajagopal - Vikas Publishing House - ISBN 81-259-0773-4.
3. **Marketing Management** - Michael R Czinkota - Vikas Publishing House - 2<sup>nd</sup> Edition ISBN 981-240-366-3.

**ENTERPRISE RESOURCE PLANNING**

Subject Code	: 15 IM /IP742	IA Marks	: 20
No. of Lecture Hrs./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hrs.	: 40	Exam Marks	: 80

**MODULE - 1**

**INTRODUCTION TO ERP:** Introduction, Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, The advantages of ERP, Why do Man ERP Implementations Fail? Why are ERP packages being used now?

**ENTERPRISE – AN OVERVIEW:** Introduction, Integrated Management Information, Business modelling, Integrated Data Model.

**7 Hours**

**MODULE - 2**

**ERP AND RELATED TECHNOLOGIES:** Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management.

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**ERP- MANUFACTURING PERSPECTIVE:** Introduction, ERP. CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP. Manufacturing Resource Planning, Distribution Requirements Planning.

**13 Hours**

**MODULE - 3**

**KANBAN:** JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.

**ERP MODULES:** Introduction, Finance, Plant Maintenance, Quality Management, Materials Management.

**10 Hours**

**MODULE - 4**

**BENEFITS OF ERP:** Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision – making capability.

**ERP PACKAGES:** Overview of ERP Software Introduction, SAP AG, Baan Company, Oracle Corporation, PeopleSoft, JD Edwards World Solutions Company, System Software Associates, Inc. QAD

**12 Hours**

**MODULE – 5**

**ERP Implementation Life Cycle:** Pre-Evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, end user Training, Post Implementation

**VENDOR, CONSULTANTS AND USERS:** Introduction, In-house implementation – Pros and Cons, Vendors, Consultants, End-users.

**ERP- Case studies**

**8 Hours**

**TEXT BOOKS:**

1. **Enterprise Resource Planning** - Alexis Leon - Tata Mc Graw Hill Publishing Company Ltd -1999.
2. **Enterprise Resource Planning Concept and Practice** -Vinod Kumar Garg and Venkitakrishnan - Prentice Hall, India - 2<sup>nd</sup> Edition.

**REFERENCE TEXT BOOK:**

1. **Manufacturing Planning & Controls** -Thomas Volloman, et,al.

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**SIMULATION MODELING AND ANALYSIS**

Sub Code	<b>15IP743</b>	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

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**Course objectives:**

1. Define basic concepts of simulation modelling and replicating the practical situations in organizations.
2. Generate and test random number variates using different techniques and apply them to develop simulation models.
3. Analyse and interpret output data produced by a model, and test validity of the model.

**UNIT – 1**

**Introduction to Simulation:** Simulation, advantages & disadvantages, Areas of application, System environment, Components of a system, Model of a system, Types of models, steps in a simulation study.

**Simulation Examples:** Simulation of Queuing systems, simulation of Inventory System **08 Hours**

**UNIT – 2.**

**General Principles:** Concepts in discrete events simulation, event scheduling/Time advance algorithm, simulation using event scheduling.

Random Numbers: Properties, Generations methods, Tests for Random Number-Frequency test, Runs test, Gap Test, Poker Test  
**08 Hours**

**UNIT-3**

**Random Variate Generation:** Inverse Transform Technique-Exponential, Uniform, Weibull, Triangular distributions, direct transformation for Normal and log normal Distributions, convolution methods-Erlang distribution, Acceptance – Rejection Techniques – Poisson distribution  
**08 Hours**

**UNIT – 4**

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**Analysis of Simulation Data:** Input Modelling: Data collection, Identification and distribution with data, parameter estimation, Goodness of fit tests, Selection of input models without data, Multivariate and time series analysis

**Verification and Validation of Model** – Model Building, Verification, Calibration and Validation of Models

**Output Analysis:** Stochastic Nature of output data, Measures of Performance and their estimation

**08 Hours**

**UNIT – 5**

**Optimization via Simulation:** Meaning, Difficulty, Robust Heuristics, Random Search Applications: Simulation of Manufacturing and Material Handling Systems, Simulation of Computer Systems

**Simulation Softwares:** Selection of Simulation Software, Simulation packages, Experiment and Statistical Analysis tool, Trend in Simulation Software.

**08 Hours**

**TEXT BOOKS:**

1. Discrete Event system Simulation – Jerry Banks, John S Carson, II, Berry L Nelson, David M Nicol - Pearson Education, Asia - III Edition, ISBN - 81-7808 – 505 - 4.

**REFERENCE BOOKS:**

1. Systems Simulation with Digital Computer –NarsinghDeo-PHI Publication (EEE), ISBN – 0-87692-028-8.
2. Simulation Modelling & Analysis – Averill M Law, W David Kelton - McGraw Hill International Editions – Industrial Engineering series, ISBN – 0-07-100803-9.
3. System Simulation - Geoffrey Gordon - Prentice Hall publication, 2nd Edition, 1978, ISBN:81-203-0140-4.

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**AUTOMOBILE ENGINEERING**

<b>Subject Code</b>	<b>15IP744</b>	<b>No. of Credits</b>	<b>: 3 - 0 - 0</b>
<b>No. of Lecture Hours / Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 3</b>
<b>Total No. of Lecture Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 80</b>

**COURSE OBJECTIVES**

1. To identify and name the various parts of an automobile.
2. To recognize the effects and types of Superchargers and Turbochargers.
3. To identify the various components of an Ignition System and know their functions
4. To describe the Transmission system and know the use .
5. To explain the modes of power transmission and indicate the types of braking

**UNIT-1**

**Engine Components and Cooling & Lubrication systems:** cylinder - arrangements and their relatives merits, cylinder Liners, Piston rings, connecting rod, crankshaft, valves, cooling requirements, Methods of cooling- lubrication system and Different lubrication methods.

**08 Hrs**

**UNIT – 2.**

**Super Chargers And Turbochargers:** Naturally aspirated engines, Forced Induction, Supercharging of SI Engines and CI Engines, Effects of supercharging on performance of the engines, supercharging limits. Methods of supercharging, Types of superchargers, Turbocharger construction and operation.

**10 Hrs**

**UNIT – 3**

**Ignition Systems:** Introduction, Requirements of an ignition system, Battery Ignition systems components of Battery Ignition systems, magneto Ignition system- rotating armature type, rotating magnet type, Electronic Ignition system

**08 Hrs**

**UNIT – 4**

**Transmission Systems:** General arrangement of clutch, Principle of friction clutches, Torque transmitted, Constructional details, and Single plate, multi-plate and centrifugal clutches.

**Gear Box -** Principle of gear box, Sliding mesh gear box, constant mesh gear box, synchromesh gear box and Epicyclical gear box, over drives, fluid coupling and torque converters, principle of automatic transmission

**12 Hrs**

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**UNIT – 5**

**Drive To Wheels:** Propeller shaft, universal joints, differential, rear axle drives, Hotchkiss and torque tube drives, steering geometry, power steering,

**Brakes:** Types of brakes, Disk brakes, drum brakes, Hydraulic brakes and Air brakes, Antilock -Braking systems, purpose and operation of antilock-braking system

**10 Hrs**

**COURSE OUTCOMES:**

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

1. Explain functions of piston and piston rings, valves, cooling system and lubrication system.
2. Differentiate between supercharger and turbocharger and their respective constructions.
3. Understand the working principles of various ignition methods used and their operations.
4. Develop the knowledge on different energy transmission systems and their applications.
5. Develop the knowledge on steering types and different braking methods.

**TEXT BOOKS**

1. **Automotive Mechanics**, S. Srinivasan, Tata McGraw Hill 2003.
2. **Automobile engineering**, Kirpal Singh. Vol I and II 2002.

**REFERENCE BOOKS**

1. **A course in I.C. Engines**, M.L. Mathur and R.P. Sharma 2001
2. **Internal Combustion Engines**, Ganeshan, Tata McGraw Hill, 2ndEdition, 2003.

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**OPEN ELECTIVE**

**FINANCIAL MANAGEMENT**

Sub Code	15IM/IP751	IA Marks	20
No. of Lecture Hrs/week	03	Exam Hours	03
Total Lecture Hrs	40	Exam Marks	80

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**Course objectives:**

1. To provide the concepts and foundations of managing finance in business enterprises.
2. To equip students with tools and techniques for managing finance.
3. To orient students regarding financial management practices in Indian companies and Global enterprises.

**UNIT – 1**

**Introduction:** Evolution of Financial Management, Goals, Forms of Business.  
**Risk and Required Return:** Risk and return relationship, Business risk, financial risk, and risk in portfolio context, expected rate of return, Capital asset pricing model.

**Capital Budgeting:** Risk analysis in Capital Budgeting, Cost of Capital – Debt, Preference Equity forms of capital  
**08 Hours**

**UNIT – 2.**

**Capital Structure and Firm Value:** Assumption, Definition and approaches, Modigliani and Miller Mode, Capital Structure decisions – EBIT, EPS analysis, ROI, REI analysis and Cash Flow comparative Analysis.

**Working Capital Management:** Factors influencing working capital requirement, determination of operating cycle and working capital.  
**08 Hours**

**UNIT-3**

**Long Term Financing:** Raising of finance form primary and secondary markets, Valuation of securities, features of convertibility securities and warrants, SEBI guide lines on capital issues, stock market in India, Venture capital, Initial Public Offering.



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**Merger Acquisition and Restructuring:** Reasons, Mechanics, Cost and benefits of a merger, Evolution, terms and purchase of a division, Takeovers, Acquisitions, Portfolio and financial restructuring  
**08 Hours**

**UNIT – 4**

**Securities and Portfolio Analysis:** Derivatives, Futures Trading,

**Financial Statement Analysis:** Ratio analysis, time series analysis, Du pont analysis, funds flow analysis  
**08 Hours**

**UNIT – 5**

**International Financial Management:** World Monitoring system, Foreign Exchange Markets, International Parity Relationships, International Capital budgeting, Financing Foreign Operations, Raising Foreign Currency Finance, Financing Exports, Documents in International Trade.

**Financial Management in Sick Units:** Definition of sickness, Causes of sickness, Symptoms of sickness, Prediction of sickness, Revival of a sick unit  
**08 Hours**

**TEXT BOOKS:**

1. Financial Management Theory and practice – Prasanna Chandra – TMH – ISBN– 007-044501-X, 5th edn.
2. Financial accounting – B.S. Raman – United publication – VoI II

**REFERENCE BOOKS:**

1. Financial Management Text & Problems – Khan & Jain – TMH – ISBN 0—07-460208-X.
2. Financial management – IM Pandey – Vikas Pub. House – ISBN 0- 7069-5435-1.

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<b>WORLD CLASS MANUFACTURING SEMESTER-VII</b>	
<b>Course Code : 15IM/IP752</b>	<b>IA Marks : 20</b>
<b>Contact Hours/Week : 03</b>	<b>Exam. Hours : 03</b>
<b>Total Hours: 40</b>	<b>Exam. Marks : 80</b>
<b>CREDITS-03</b>	

<b>MODULE S</b>	<b>NO OF HRS</b>
<b>MODULE -1</b>	
<p><b>INTRODUCTION TO WORLD CLASS MANUFACTURING</b>            Manufacturing Excellence and Competitiveness, What is world-Class Manufacturing?-Halls framework of world-Class Manufacturing (WCM), Gunn s Model of World-Class Manufacturing, Maskells Model of World-Class Manufacturing.</p> <p><b>WORLD CLASS MANUFACTURING</b>            The philosophy of world-class Manufacturing-The First Principles of World-Class Manufacturing, The practices of World-Class Manufacturing-The customers Interface ,The Supplier Interface, World-Class Practices in the factory.</p>	09
<b>MODULE -2</b>	
<p><b>PRINCIPLES AND PRACTICIES OF WCM</b>            Data collection plan, research-internal public domain sources, outside experts etc , original research, site visits, and code of conduct, Analyzing the gap: Top displaying data, deciding and combining best work practices, Balance Score Card Technique, Value Stream Mapping, validation, recommendations etc</p>	07
<b>MODULE -3</b>	
<p><b>BENCHMARKING</b>            Definition, mission and objectives, managing benchmarking process, training and code of conduct, future scope and benchmarking process , What to benchmark: concept of step zero, priorities, business processes linking to goals etc, investigation, documentation, performance measures, improving business processes , Whom to benchmarks: Developing candidate list, systematic search, refining the initial list</p>	07
<b>MODULE -4</b>	

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<p><b>DEFINITION OF REENGINEERING</b>  Importance of 3Cs-customers takes charges, competition intensifies, and change becomes constant , Definition of Business Process Reengineering fundamentals rethinking, radical redesign, and dramatic improvement  Rethinking business process, new world of and enabling role of information technology</p> <p><b>QUALITY MANAGEMENT SYSTEMS</b>  ISO 9000-2000, IS 14000, Frame Work for Business Excellence - Malcolm Baldrige Award, Deming’s Award</p>	09
<b>MODULE -5</b>	
<p><b>SIX SIGMA</b>  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 , DFSS Metrics, DFSS Infrastructure People and resources, Implementing DFSS</p> <p><b>ACTIVITY BASED MANAGEMENT (ABM)</b>  Introduction, Traditional Cost Systems, Activity Based activity Based Costing, Activity Based Management, ABM Implementation, Case Study.</p>	08
<p><b>Course Outcomes:</b> On completion of this course, students are able to:</p> <ol style="list-style-type: none"> <li>1. Understanding the need for learning the world class manufacturing setup.</li> <li>2. Learn the principles and practices of world class manufacturing.</li> <li>3. Determine the quality practices as applied to world class product.</li> <li>4. Standard practices of quality of conformance systems.</li> </ol>	
<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. <b>World Class Manufacturing- A Strategic Perspective</b> – Sahay B S, Saxena K B C, Ashish Kumar – MacMillan India Ltd – ISBN 0333-93-4741. (unit 1 &amp; 2)</li> <li>2. <b>Finding and Implementing Best Practices- Business Process Benchmarking</b> - Champ, Robert C. – Vision Books, New Delhi – 2008.(unit 3 &amp; 4)</li> <li>3. <b>Reengineering the corporation – A Manifesto for Business revolution</b> – Hammer, Michael and James Champy – Nicholas Brealey Publishing , London.- 1993(unit 5 &amp;</li> </ol>	

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4. **Six sigma for Managers**- Greg Brue – TMH – ISBN- 0-07-048639- 5 -2002.(unit 7)

**Reference Books:**

1. **Design for Six Sigma** –Grege – TMH – ISBN 0-07-058120. – 2003.
2. **Design for Six Sigma Technology and Product Development** – Creveling - Pearson Education – 2008.
3. **Total Quality Management** -Dale H. Besterfield, carol Besterfield- Minchna, glen H Besterfield and Mary Besterfield scare – Pearson education – 3rd edition – ISBN 81-297-0260-6 (Part of Unit 6 )
4. **Total Quality Management** – Kesavan R – I K International Publishing house Pvt. Ltd – 2008

**Question paper pattern:**

1. The question paper will have **ten** full questions carrying equal marks. Each full question consisting of **16** marks
2. There will be **two** full questions from each module.
3. Each full question will have questions covering all the topics under a module.
4. The students will have to answer **five** full questions, selecting **one** full question from each module.

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**DATA WAREHOUSING AND MINING**

Subject Code : 15IP753  
No. of Lecture Hrs./ Week : 03  
Total No. of Lecture Hrs. : 40

IA Marks 20  
Exam Hours : 03  
Exam Marks : 80

**MODULE 1**

**OVERVIEW AND CONCEPTS:** Need for Data Warehousing, Basic Elements of Data Warehousing, Trends in Data Warehousing.

**PLANNING AND REQUIREMENTS:** Project planning and management, collecting the requirements.

**8 hours**

**MODULE 2**

**ARCHITECTURE AND INFRASTRUCTURE:** Architectural components, Infrastructure and metadata.

**DATA DESIGN AND DATA REPRESENTATION:** Principles of dimensional modeling. Dimensional modelling advanced topics, data extraction, transformation and loading, data quality. **8 Hours**

**MODULE 3**

**INFORMATION ACCESS AND DELIVERY:** Matching information to classes of users, OLAP in data warehouse, Data warehousing and web.

**IMPLEMENTATION AND MAINTENANCE**

Physical design process, data warehouse deployment, growth and maintenance. **8 Hours**

**MODULE 4**

**INTRODUCTION:** Basics of data mining, related concepts, Data mining techniques.

**DATA MINING ALGORITHMS:** Classification, Clustering.

**DATA MINING ALGORITHMS:** Association rules.

**8 Hours**

**MODULE 5**

**KNOWLEDGE DISCOVERY:** KDD process.

**WEB MINING**

Web content mining, Web structure mining and Web usage mining.

**8 Hours**

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**TEXT BOOKS:**

1. **Data Warehousing Fundamentals** - Paulraj Ponnian, John Wiley.-1st edition
2. **Data Mining Introductory and advanced Topics** - M.H. Dunham - Pearson education – 2002.
3. **Data mining concepts and techniques** - Han, Kamber - 2nd edition

**REFERENCES BOOKS:**

1. **The Data Warehouse Lifecycle Toolkit** - Ralph Kimball, John Wiley - 2nd edition.
2. **Mastering Data Mining** - M Barry and G. Linoff - John Wiley - 1<sup>st</sup> edition.
3. **Building the Data warehouses** - W. H. Inmon, Wiley Dreamtech - 1st edition.
4. **The Data Warehouse Toolkit** - R. Kimball - John Wiley - 2<sup>nd</sup> edition.
5. **Decision Support and Data warehouse systems** - E.G. Mallach - TMH.- 2000.

**MACHINE TOOL DESIGN**

Subject Code	: 15IP754	IA Marks	: 20
No. of Lecture Hours./ Week	: 03	Exam Hours	: 03
Total No. of Lecture Hours.	: 40	Exam Marks	: 80

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**MODULE - 1**

**Principles of Machine Tool Design:** General requirements of machine tool design - design process machine tool layout general requirements of machine tool design – design process machine tool layout.

**Machine Tool Drives and Mechanisms:** Working and auxiliary motion, Drives – Electric drives, Hydraulic transmission, Kinematic structure, Regulation of speed and feeds, stepped regulation, standardization of speed and feed, Stepless regulation of speeds and feeds.

**8 Hours**

**MODULE - 2**

**Cutting Force Analysis and Power Requirement:** Turning, Milling, Drilling, Shaping and Broaching operation with simple problems, and General requirements of machine tools – Centre lathe, Milling machine.

**Design of Machine Tool Structures:** Functions – Requirements – Design criteria Material used – static and dynamic stiffness – Profile and basic design procedure for machine tool structures. Design of beds, columns, housing, bases, tables, cross-rails, arms saddle, carriages.

**8 Hours**

**MODULE- 3**

**Design of Guide Ways and Power Screws:** Function and types of guide ways – Design and lubrication of slide ways – aerostatic slide ways – antifriction guide ways, combination guide ways – protecting devices, design of power screws

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**Design of Spindle and Spindle Bearings:** Functions – Requirements and materials for spindle compliance and machining accuracy, Design of spindles, antifriction bearing, Hydrodynamic and Hydrostatic bearing **8 Hours**

**MODULE- 4**

**Dynamics of Machine Tools:** Concept of dynamic cutting process, Physical causes of chatter and vibrations, Types of Chatter, chatter vibration in Lathe, Drilling machine, Grinding machine and Milling machine, **8 Hours**

**MODULE - 5**

**Control Systems in Machine Tools:** Functions, requirements and classification, Control system for speed and feeds centralized control, pre selective control, Control system for forming and auxiliary motions

**8 Hours**

**TEXT BOOKS:**

1. **Machine Tool Design** - N. K. Mehta – Tata McGraw Hill - 2001.
2. **Principles of Machine tools** - Sen and Bhattacharya – Oxford IBM Publishing - 2000.

**REFERENCE BOOKS:**

1. **Machine Tool Design Volume** - N. Acharkan – MIR Publications - II and III - 2000.
2. **Design of Machine Tools** - S. K. Basu and D. K. Pal – 2000.

**SUPPLY CHAIN MANAGEMENT**

Subject Code	: 15IM/IP81	IA Marks	: 20
No. of Lecture Hrs./ Week	: 04	Exam Hours	: 03
Total No. of Lecture Hrs.	: 50	Exam Marks	: 80

**MODULE - 1**

**BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS:** Supply chain stages and decision phase, 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.

**DESIGNING THE SUPPLY CHAIN NETWORK:** Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

**11 Hours**

**MODULE - 2**

**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 trees. Analytical problems.

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**PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN:** Review of inventory concepts., Concepts of Safety Inventory, Concept of Aggregation of Inventory, Concept of product availability.

**11 Hours**

**MODULE - 3**

**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 of Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

**11 Hours**

**MODULE- 4**

**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.

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.

**10 Hours**

**MODULE-5**

**EMERGING CONCEPTS:** Reverse Logistics, Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

**7 Hours**

**SUGGESTED TEXT BOOK:**

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

**REFERENCE BOOKS:**

1. **Supply Chain Redesign – Transforming Supply Chains into Integrated Value Systems** - Robert B Handfield, Ernest L Nichols, Jr. - Pearson Education Inc - ISBN: 81-297-0113-8. - 2002.
2. **Modelling the Supply Chain** -Jeremy F Shapiro, Duxbury - Thomson Learning – ISBN 0-534-37363. -2002.
3. **Designing & Managing the Supply Chain** -David Simchi Levi, Philip Kaminsky & Edith Simchi Levi - Mc Graw Hill.
4. **Supply Chain and Logistics Management** – Upendra Kachuru



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**SCHEME OF TEACHING AND EXAMINATION 2015-2016**

<b>Subject Code</b>	<b>15IM/IP82</b>	<b>No. of Credits</b>	<b>: 3 - 0 - 0</b>
<b>No. of Lecture Hours / Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 3</b>
<b>Total No. of Lecture Hours</b>	<b>: 48</b>	<b>Exam Marks</b>	<b>: 80</b>

**COURSE OBJECTIVES**

6. To know the importance of location, layouts and material handling
7. To know and distinguish between different approaches to layout and draw activity relationship chart
8. To compute space requirement and demonstrate skills in area allocation and construct the layout.
9. To examine the quantitative approaches to facility planning and identify the different models.
10. To know the different computerized techniques and model appropriate design.

**COURSE CONTENT**

**UNIT-1**

**Plant Location:** Factors influencing plant location, theories of plant location, plant layout – objectives of plant layout, principles of plant layout, types of plant layout, their merits and demerits, facilities design function: objectives. Simple exercises on layouts.

**Introduction to Material Handling:** Objectives and principles of material handling, unit load concept, Basic handling equipment types, Common material handling equipments

**08 Hours**

**UNIT – 2.**

**Plant Design:** Layout procedure, study of some approaches (Immer, Nadler, Muther, Apple James and Reed’s approach), systematic layout planning, the activity relationship chart, Constructing the activity relationship chart, Activity relationship diagram.

**12 Hours**

**UNIT – 3**

**Space Determination and Area Allocation:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions, establishing total space requirement, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan.

**Construction of the Layout:** Methods of constructing the layout, evaluation of layout, efficiency indices, presenting layout to management..

**12Hrs**

**UNIT – 4**

**Quantitative approaches to facilities planning:** Deterministic models, single and multi facility models, Conventional layout model: Block stacking, location allocation models,

**Layout Models:** Warehouse layout models, waiting line models, Storage models.

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**08 Hours**

**UNIT – 5**

**Computerized Layout Planning:** Computerized relative allocation of facility techniques (CRAFT), Plant layout Evaluation Techniques (PLANET), Computerized Relationship Layout Planning (CORELAP), Comparison of computerized layout techniques.

**08 Hours**

**COURSE OUTCOMES:**

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

1. Identify the planning strategies for implementation, evaluation and maintaining the facility.
2. Arrive at suitable layout for given situations having understand different approaches.
3. Demonstrate the Space determination and area allocation procedure, construction of the layout.
4. Analyze the quantitative methods and models to determine for the plant location. Explain the warehouse and waiting line models.
5. Demonstrates the ideas on various types of layout and evaluation techniques using computers.

**TEXT BOOKS**

1. **Plant layout and material handling**- James M. Apple, 3<sup>rd</sup> edition John, Wiley and sons, 1991.
2. **Facility layout and location** – Françoise, R.L. and White, J.A, Mc Graw Hill 2<sup>nd</sup> edition, 1994.

**REFERENCE BOOKS**

1. **Practical layout** – Muther Richard -Mc Graw Hill-1956.
2. **Plant layout design** – James.M Moore, Mac Millon co.1962.
3. **Facilities design** – Sunderesh Heragu, PWS publishing company-ISBN-0-534-95183, August 2008
4. **Facilities planning** –Tompkins white –wiley India Pvt ltd 3<sup>rd</sup> edition.
5. **Facility Layout and Location**, Richard L Francies. 2<sup>nd</sup> Edition PHI learning Pvt. Ltd

**PROFESSIONAL ELECTIVE**

**JUST IN TIME MANUFACTURING**

Subject Code : 15IM/IP831  
No. of Lecture Hrs./ Week : 03  
Total No. of Lecture Hrs. : 40

IA Marks : 20  
Exam Hours : 03  
Exam Marks : 80

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**MODULE 1**

**JIT-AN INTRODUCTION:** Speed of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, enabling JIT to occur, basic element of JIT, benefits of JIT.

**MODERN PRODUCTION SYSTEM:** Key feature of Toyota's production system, basic framework of Toyota production system. **KANBAN SYSTEM** – other types of kanban's, kanban rules, determining the number of kanban's in Toyota production system. **8 Hours**

**MODULE 2**

**PRODUCTION SMOOTHING IN TOYOTA PRODUCTION SYSTEM:** production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production. EDP system for support of the Toyota Production system.

**GLOBAL IMPLEMENTATION OF JIT:** JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, conclusion. **8 Hours**

**MODULE 3**

**JIT IMPLEMENTATION SURVEYS:** JIT implementation in US manufacturing firms-analysis of survey results, just in time manufacturing industries, just in time production in West Germany, just in time production in Hong Kong electronics industry, conclusion.

**DESIGN, DEVELOPMENT AND MANAGEMENT OF JIT MANUFACTURING SYSTEMS:** plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota.

**8 Hours**

**MODULE 4**

**SUPPLY MANAGEMENT FOR JIT:** JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys of 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. **8 Hours**

**MODULE 5**

**FRAMEWORK FOR IMPLEMENTATION OF JIT:** Implementation risk, risks Due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion. **8 Hours**

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**TEXT BOOKS:**

1. **Just In Time Manufacturing** - M.G. Korgaonker – Macmillan India Ltd.- 1992
2. **Japanese Manufacturing Techniques** - Richard J. Schonberger - The Free Press – Macmillan Pub. Co., Inc. New York - 1988.

**AUTOMATION IN MANUFACTURING**

Course	Code	Credits	L-T-P	Assessment		Exam Duration
Automation In Manufacturing	15IM/IP832	3	3-0-0	SEE	CIA	3 Hrs
				80	20	

**Course Learning Objectives**

<b>CLO-1</b>	To understand the concepts of automation in manufacturing systems
<b>CLO-2</b>	To impart the knowledge of a line balancing and assembly systems
<b>CLO-3</b>	To explore the idea of robotics and understand the computerized manufacturing planning
<b>CLO-4</b>	To gain the knowledge of automated inspection and shop floor control
<b>CLO-5</b>	To understand the concepts of additive manufacturing and latest trends in manufacturing

**Module -1**

**Introduction:** Production system facilities, Manufacturing support systems, Automation in production systems, Automation principles & strategies

**Manufacturing Operations:** Manufacturing operations, Product/production relationship, Production concepts and Mathematical models & costs of manufacturing operations. Problems on mathematical models

**8 Hrs**

**Module -2**

**Line Balancing:** Methods of line balancing, Numerical problems on largest candidate rule, Kilbridge's and Wester's method, and ranked positional weights method, computerized line balancing methods.

**Automated Assembly System:** Design for automated assembly, types of automated assembly system, Parts feeding devices, Analysis of single and multi station assembly machines.

**8 Hrs**

**Module -3**

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**Computerized Manufacture Planning and AGVS:** Computer aided process planning (CAPP), Retrieval and Generative systems, and benefits of CAPP. Material requirement planning, Inputs to MRP system, working of MRP, Outputs and benefits. Automated Guided Vehicles System: Applications, Guidance and routing,

**Industrial Robotics:** Definition, Robot anatomy, Joints and links, Robot configurations, Robot control systems, Accuracy and repeatability, End effectors, Sensors in robotics. Industrial robot applications: Material handling, Processing, assembly and inspection. **9 Hrs**

**Module -4**

**Inspection Technologies:** Automated inspection, coordinate measuring machines construction, Operation & programming, Software, application & benefits, Flexible inspection system, Inspection probes on machine tools, Machine vision, Optical inspection techniques & Non-contact Non-optical inspection technologies.

**Shop Floor Control and Automatic Identification Techniques:** Shop floor control, Factory data collection system, Automatic identification methods, Bar code technology, Automatic data collection systems. An Introduction to QR Code Technology **9 Hrs**

**Module -5**

**Additive Manufacturing Systems:** Basic principles of additive manufacturing, Slicing CAD models for AM, Advantages and limitations of AM technologies, Recent trends in manufacturing, Hybrid manufacturing.

**Future of Automated Factory:** Trends in manufacturing, the future automated factory, Human workers in future automated factory, Social impact. **8 Hrs**

**Text Books:**

1. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 3rd Edition, 2009, PHI Learning.
2. Automation, Production Systems and Computer-Integrated Manufacturing, by Mikell P Groover, 1999, Prentice-Hall of India.
3. CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, TataMcGraw-Hill.
4. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker
5. "Understanding Additive Manufacturing", Andreas Gebhardt, Hanser Publishers, 2011

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**Reference Books:**

1. Systems Approach to Computer-Integrated Design and Manufacturing by Dr. Nanua Singh, Wiley, 1996.
2. CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U.Raju, New Age International Publication Revised Third Edition 2007.

**Course Outcome**

**After studying this course, students will be able to:**

<b>CO-1</b>	Explain the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model.
<b>CO-2</b>	Analyze and solve problems on line balancing
<b>CO-3</b>	Explain CAPP and MRP system and analyze the AGVS
<b>CO-4</b>	Understand the inspection technologies and shop floor control
<b>CO-5</b>	Explain the modern trends in additive manufacturing and automated factory

**ORGANIZATIONAL BEHAVIOR**

<b>Subject Code</b>	<b>: 15IP833</b>	<b>No. of Credits</b>	<b>: 3 - 0 - 0</b>
<b>No. of Lecture Hours / Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 3</b>
<b>Total No. of Lecture Hours</b>	<b>: 40</b>	<b>Exam Marks</b>	<b>: 80</b>

**COURSE OBJECTIVES**

1. To know and recognize the importance of human behavior at work in organizations.
2. To relate human behavior with learning and demonstrate how the two go together.
3. To recognize the importance of motivation in learning and other performance attributes.
4. To know and locate the importance of group interactions and group behavior in organizations.
5. To manage and resolve conflicts through effective communication.

**COURSE CONTENT**

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**Introduction:** Definition of Organization Behavior and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems).

**The Individual:** Foundations of individual behavior, individual differences. Ability. Attitude, Aptitude, interests. Values – Types of Values, Changing Values.

**8 Hours**

**UNIT – 2**

**Learning:** Definition, theories of learning, individual decision making, classical conditioning, operant conditioning, social learning theory, continuous and intermittent reinforcement.

**Perception:** Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect.

**8 Hours**

**UNIT – 3**

**Motivation:** Maslow's Hierarchy of Needs theory, Mc-Gregor's theory X and Y, Herzberg's motivation Hygiene theory, David Mc-Clelland's three needs theory, Victor Vroom's expectancy theory of motivation.

**08 Hours**

**UNIT – 4**

**Groups Behavior:** Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making.

**8 Hours**

**UNIT – 5**

**Conflict & Stress Management:** Definition of conflict, functional and dysfunctional conflict, stages of conflict process. Sources of stress, fatigue and its impact on productivity. Job satisfaction, job rotation, enrichment, job enlargement and reengineering work process.

**Communication:** Principles of Communication: Useful definitions, communication principles, communication system, role of communication in management, barriers in communication, how to overcome the barriers, rule of effective communication.

**8 Hours**

**COURSE OUTCOMES:**

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

1. Appreciate human behavior at work.
2. Demonstrate how learning depends on behavioral aspects.
3. Value motivation and work and demonstrate their motivational skills.
4. To identify themselves as a part of a group and perform well.
5. To manage organizational conflict and be able to produce results.

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**TEXT BOOKS**

1. **Organizational Behaviour**, Stephen P Robbins, 9th Edition, Pearson Education Publications, ISBN-81-7808-561-5 2002.
2. **Organizational Behaviour**, Fred Luthans, 9th Edition, Mc Graw Hill International Edition, ISBN-0-07-04-002.

**REFERENCE BOOKS**

1. **Organizational Behaviour**, Aswathappa - Himalaya Publishers, 2001.
2. **Organizational Behaviour**, (Human behaviour at work) 9th Edition, John Newstrom/ Keith Davis, 2002.
3. **Organizational Behaviour**, Hellriegel, Srocum and Woodman, Thompson Learning, 9th Edition, Prentice Hall India, 2001.
4. **Organizational Behaviour**, VSP Rao and others, Konark Publishers, 2002.

**ADVANCES IN JOINING PROCESS and NDT**

<b>Subject Code</b>	<b>15IP834</b>	<b>No. of Credits</b>	<b>: 3 - 0 - 0</b>
<b>No. of Lecture Hours / Week</b>	<b>: 03</b>	<b>Exam Hours</b>	<b>: 3</b>
<b>Total No. of Lecture Hours</b>	<b>: 40</b>	<b>Exam Marks</b>	<b>: 80</b>

**COURSE OBJECTIVES**

11. To know the different types of welding and describe welding and cladding of dissimilar metals
12. To distinguish the weldability of metals
13. To identify the welding design principles and compute welding design parameters
14. To illustrate the symbols used in welding practice and identify the adhesive bonding applications
15. To Identify and use the welding inspection techniques and standards

**COURSE CONTENT**

**UNIT-1**

**Types of Welding:** Forge welding, Electro Slag Welding, Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding.

**Welding and Cladding of Dissimilar Materials:** Overlaying and surfacing, different methods and applications, thermal –Spray coating or metalizing.

**8 Hours**

**UNIT – 2.**

**Weldability of Metals:** like stainless steel, Cast iron, Copper, and Aluminium.

Advanced soldering and brazing processes-different types. Welding of plastics- different methods.



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**08 Hours**

**UNIT – 3**

**Welding design:** Basic principles of sound welding design, welding joint design, welding positions, Allowable strength of welds under steady loads, allowable fatigue strength of welds, Design of welds subjected to combined stresses, Numerical examples

**8Hrs**

**UNIT – 4**

**Welding Symbols:** Need for representing the welds, Basic weld symbols, location of weld, supplementary symbols, dimensions of weld, examples.

**Adhesive Bonding:** Adhesive materials and properties, non-structural and special adhesives, surface preparation and joint design considerations.

**08 Hours**

**UNIT – 5**

**Inspection of Welds:** ASTM standards for testing weldments, Destructive techniques like Tensile, Bend, Nick break, Impact and Hardness. Non Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye penetrant

**08 Hours**

**COURSE OUTCOMES:**

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

1. Explain the importance of grain size control, methods to avoid distortion and residual stresses; also know the techniques of surfacing and cladding of surfaces.
2. Interpret and understand the advantages and limitations of different advanced welding process knowing fully the characteristic features, this identify research topics in the area of welding and related processes.
3. Explain the weld ability of engineering materials including plastics and the advanced soldering and brazing processes.
4. Design welds subjected to for various loading conditions.
5. Explain the symbols used to represent the welds: also be able to explain the methods of adhesive bonding of materials.

Inspect the welds in accordance with ASTM standards employing both destructive and non-destructive methods.

**TEXT BOOKS**

1. Welding Technology by O.P. Khanna, Dhanpat Rai Publication 2008.
2. Welding and welding Technology by Richard Little Tata Mc Graw hill 2005

**REFERENCE BOOKS**

1. Welding Engineering Handbook by A.W.S. Ninth Edition.
2. Advanced Welding processes – G.Nikolaev and N.Olshansky, MIR Publications 1977.
3. ASM handbook on welding, brazing and soldering, Vol 6, 2005.

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