Bansilal Ramnath Agarwal Charitable Trust's

Vishwakarma Institute of Technology

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Structure & Syllabus of

B. Tech. (Industrial Engineering)

Pattern 'D18'

Effective from Academic Year 2018-19

Prepared by: - Board of Studies in Industrial & Production Engineering

Final Year B. Tech. Industrial Engineering AY 2018-19 (D18)

Subject No.	Subject Code	Subject Name	Teaching Scheme (Hrs/Week)		Examination scheme						Credits
			Theory	Lab	CA		MSE	ESA		Total	
					HA	LAB		ESE	VIVA		
S1	IE4001	Human Factors Engineering	3	2	10	30	10	30	20	100	**4**
S2	IE4002	World Class Manufacturing	3	2	10	30	10	30	20	100	**4**
S3	IE4003	Supply Chain Management	3	2	10	30	10	30	20	100	**4**
S4	IP4074	Major Project	--	8	10	30	10	30	20	100	**4**
S5	IE4075	**Professional Development	--	--	--	--	--	--	--	--	**--**
OR											
S1	IE4071	Industry Internship	--	--	--	--	--	--	--	--	**16**
	IE4072	Research Internship	--	--	--	--	--	--	--	--	
	IE4073	Global Internship	--	--	--	--	--	--	--	--	
Total			**9**	**14**							**16**

(**) Audit Course evaluated in any semester

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			Theory	Lab	CA		MSE	ESA		Total	
					HA	LAB		ESE	VIVA		
S1	IE4071	Industry Internship	--	--	--	--	--	--	--	--	16
	IE4072	Research Internship	--	--	--	--	--	--	--	--	
	IE4073	Global Internship	--	--	--	--	--	--	--	--	
OR											
S1	IE4001	Human Factors Engineering	3	2	10	30	10	30	20	100	4
	#IE4004	Financial Management & Management Accounting									
S2	IE4002	World Class Manufacturing	3	2	10	30	10	30	20	100	4
	#IE4005	Operations Scheduling									
S3	IE4003	Supply Chain Management	3	2	10	30	10	30	20	100	4
	#IE4006	Services Management									
S4	IE4074	Major Project	--	8	10	30	10	30	20	100	4
	#IE4086	Major Project									
S5	IE4075	**Professional Development	--	--	--	--	--	--	--	--	--
Total			**9**	**14**							**16**

(#) Courses in Second semester for those students who do not opt for Semester Internship
(**) Audit Course evaluated in any semester

IE4001::HUMAN FACTORS ENGINEERING

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

SECTION-1

1. Introduction to Human Factors Engineering: Human Factors Engineering – Definition and scope, objectives, history, human-machine system, characteristics of human-machine system, need for application of Human Factors Engineering in industry and society

2. Applied Anthropometry and Work Place Design: Introduction to Anthropometry, type of dimensions, use of anthropometry data, Principles in the application of anthropometric data, work spaces, work space envelopes, design of work space, science of seating,. Principles of seat design, design of work surfaces, principles of arranging components, types of controls, factors in control design, location of controls and displays within work space

3. Information Input and Processing: Design and Displays: Information input and processing, visual displays of static and dynamic information. Auditory, textual & olfactory displays, concept of visibility Text, graphics, and symbols. Visual displays of dynamic information, Auditory, Tactual and Olfactory Response

SECTION-2

4. Human output - Physical Work and manual material handling: Muscle mechanism, BMR, MAP. Heart Rate variations, Oxygen consumption, Rest allowances, Rate of energy expenditure, Manual Material Handling Capacity determination Effect of environmental conditions and work design on Energy Expenditure. Motor Skills, Controls and Data Entry devices

5. Environmental Conditions: Illumination: Measurement of light, color systems, energy consideration, concept of visibility, effect of light on performance, Climate: Measurement of thermal conditions, wet-bulb temperature, heat exchange process, heat stress, cold stress, wind chill index, Noise: Physiological effect of noise on performance, noise exposure

6. Human Factors in System Design: Human error, accidents and safety, theories of accident causation, factors contributing to accidents, designing a safe product, Human factors application in system design, characteristics of system design process, Case studies on application of human factors in system design

Text Books:

1. M. S. Sanders and Ernest J. McCormick, “Human Factors Engineering and Design”, Seventh edition, McGraw-Hill Inc.

Reference Books:

1. Maynards H.B., Industrial Engineering Hand Book, third edition, New York and London, McGraw- Hill

2. George Kanawaty, Introduction to Work Study, Fourth revised edition, Universal Book Corporation, Bombay, International Labour Office, Geneva

List of Practical:

1. Review of research paper/case study on Ergonomic work place design
2. Review of research paper/case study on Ergonomic product design
3. Recording sound levels in various work environments
4. Recording light intensity in various work environments
5. Analysis of energy consumption in carrying out various manual tasks
6. Review of research paper/case study on Work related musculoskeletal disorders

List of Projects

1. Design a work place by applying principles of Ergonomic design
2. Design a product by applying principles of Ergonomic design
3. Anthropometric Data Collection and Analysis
4. Applied Anthropometry–Work Place Design (Seating / Standing)
5. Design/study a visualdisplay used in practice by applying Ergonomic design principles
6. Design/study a auditory display used in practice by applying Ergonomic design principles
7. Review of research paper/case study on Work related musculoskeletal disorders
8. Design a work system by applying Human Factors Engineering

Course Outcomes

Students will be able to:

1. Understand need of applying Human Factors Engineering in industry & society
2. Design workplaces and products ergonomically by applying principles of design, work physiology and anthropometry.
3. Understand information input and processing to design visual/auditory displays.
4. Evaluate and estimate human efficiency and by understanding work physiology
5. Design work environment by applying knowledge of Physiological effect of environmental conditions on human performance.
6. Apply knowledge of Human Factors in Ergonomic system design

IE4002::WORLD CLASS MANUFACTURING

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

SECTION-1

1. Lean Manufacturing: Definition & Concept. Characteristics of Lean Manufacturing. Concept of MUDA, MURA & MURI, Value Added and NVA activities

2. Value Stream Mapping: VSM Symbols, Current State and Future State, Kaizen- Types, Format. Kaizen Development,

3. Toyota Production System: Toyota's 14 Principles of Management, Problem Solving Approach, Design of JIT- Pull System, Kanban-Types, Calculations of Kanban, Concept of Standard Work – Standardization, Standard Operating Procedures

4. Set-up Time Reduction: SMED Methodology for Set-up reduction, OTED (One Touch Exchange of Dies), Quick Attachment Devices.

5. Group Technology Approaches, Characteristics of A Group/Cell Families of Parts, Group Technology – Codification & Classification Systems , Production Flow Analysis and Choice Of Family , Benefits and Applications Of Group Technology.

6. Cellular Manufacturing: Work cell concepts and applications, Work cell design, work cell staffing and equipment issues.

SECTION-2

1. Japanese Lean Principles: Heijunka (Resource Leveling), Jidoka (Autonomation), Genechi Genbitsu (Go and See)

2. Maintenance Management – Breakdown, Preventive, Predictive. Total Productive Maintenance (TPM): Concept & Origin, Outline of TPM – 8 Pillars, TPM Performance Measures – PQCDSM & OEE (Overall Equipment Effectiveness), Introduction to Autonomous Maintenance (Jishu Hozen) activities, Planned Maintenance, Small-Group activities of TPM.

3. Visual Management System- , Introduction to 5S: Steps in 5S Methodology, Concept of 1S (Seiri), 2S (Seiton), 3S (Seiso), 4S (Shiketsu), 5S, (Shitsuke). Implementation of 1S & 2S, Visual Displays, Visual Controls

4. Theory of Constraints: Introduction to TOC, Concept, Constraints – Types, Factory Physics Laws and Bottleneck Scheduling, Concept of Throughput, Inventory & Operating Expenses, Throughput Accounting, TOC Methodology, Numerical & Cases in TOC. Application of TOC in industry, Drum-Buffer-Rope Approach

5. Lean Applications in Service Sector- Logistics, Healthcare

List of Practicals:

1. Waste Identification and Classification (3M of Lean)
2. Kaizen preparation- operator or circle level
3. Value Stream Mapping- Current State and Future State

4. Standardization of processes
5. Design Work Cell as per requirements
6. Design of JIT / Kanban System for manufacturing firm
7. Cellular Manufacturing
8. Design of Single Piece Flow
9. Identification and Reduction TPM Losses
10. Assignment on TPM Performance Measures
11. Assignment on Overall Equipment Effectiveness
12. Autonomous Maintenance (Jishu Hozen)
13. Understanding and Implementation of 5S
14. Use of SIPOC Diagram
15. Identification of Bottleneck and constraint classification
16. Application of Theory of Constraints (TOC)
17. Use of constraint management tools like CRT, FRT, Evaporating Cloud etc

List of Project areas:

1. Value Stream Mapping, Kaizen, Setup Time Reduction (SMED Philosophy)
2. Autonomation (Jidoka) and Andon implementation
3. Kanban, JIT feasibility and implementation
4. Group Technology and Cellular Manufacturing
5. TPM- KK, JH and PM Pillars, Overall Equipment Effectiveness,
6. Developing Maintenance Schedule
7. Standardization - Formation of SOP, Work Instructions
8. Theory pf Constraints Applications

Text Books:

1. B.S. Sahay, Saxena, World Class Manufacturing -A strategic perspective, Laxmi Publications Pvt. Ltd, 1st Edition, 2018
2. Richard Schonberger , World Class Manufacturing – The Next Decade: Building Power, Strength, and Value, Free Press, 1996
3. Jeffrey Liker, The Toyota Way, McGraw Hill Publications, Indian Edition, 2017

Reference Books:

1. Mishra R.C., Pathak K, Maintenance Engineering and Management, PHP Publications, 2nd Edition , 2016
2. James Womack & Daniel Jones ,Learning to See, 1998
3. John Bicheno , Cause and Effect Lean – The essentials of Lean Manufacturing, 1994
4. Nakajima Seiichi ,Introduction to TPM: Total Productive Maintenance, 1995
5. Terry Wireman ,Total Productive Maintenance, Industrial Press,2004
6. Kelley, M.J. Harris, Management Of Industrial Maintenance, Newness Butterworths Press, 2002

Course Outcomes:

The student will be able to –

1. Identify, eliminate and reduce the non-value added activities (wastes) in manufacturing organization
2. Apply the tools and techniques of lean manufacturing to improve productivity in manufacturing and service organizations
3. Understand the principles and benefits of Toyota Production System philosophy
4. Apply the concept, tools and techniques in TPM philosophy
5. Analyze, map and improve business processes for achieving improvements
6. Apply the tools and techniques of constraint management to improve productivity in manufacturing and service organizations

IE4003::SUPPLY CHAIN MANAGEMENT

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

SECTION-1

1. Basics of Supply Chain Management: Concept, Objective. Decision Phases in Supply Chain. Process View of Supply Chain – Cycle View, Push/pull view, Supply Chain Performance – Achieving Strategic Fit. Types of Supply Chain – Responsive, Efficient, Achieving Strategic Fit. Supply Chain Drivers – Facilities, Inventory, Transportation, Information

2. Network Design in Supply Chain - Factors Influencing Distribution Network Design – Response time, Product variety, Product availability, Customer experience, Order visibility, Return ability.

3. Transportation Modeling & Optimization: Transportation Model: Vogel's Approximation Method, UV Method, Stepping Stone Method, Transshipment problems, Shortest Path Problem, Minimal Spanning Tree, Maximal Flow Problem, Traveling Salesman Problem, Vehicle Routing Problem.

4. Managing Supply and Demand: Managing Capacity – time flexibility of workforce, seasonal workforce, subcontracting, use of dual facilities, and design product flexibility into production processes. Managing Inventory – use common components across multiple products; build inventory of high demand of predictable demand products Managing Demand: Variable pricing, Forward buying. Collaborative Planning Forecasting & Replenishment

SECTION-2

1. Inventory Management in Supply Chain - Managing Economies of Scale: Cycle Inventory- Role in SC - Lot sizing for single product, multiple products or customers, Aggregating multiple products in single order Managing Uncertainty: Safety Inventory – Role in SC – Determine appropriate level of safety inventory. Pipeline/ In-transit Inventory, Seasonal Inventory, Transportation & Inventory Cost Trade-off: Choice of Transportation Mode, Inventory Aggregation. Transportation cost and customer-responsiveness trade-off;

2. Pricing & Revenue Management in Supply Chain: Role, Revenue Management for Multiple Customer Segments, Seasonal Demand, Bulk & Spot Customers,

3. Outsourcing & Co-ordination in Supply Chain: Procurement Process, Sourcing, 3PL, 4PL, Vendor Managed Inventory. Co-ordination in Supply Chain: Lack of SC Coordination & Bullwhip Effect, Obstacles to SC Coordination, Manager Levers to Achieve Coordination

4. IT and Technology in Supply Chain: Role of IT in Supply Chain IT Framework. E-business & Supply Chain, EPR Solutions, Future of Supply Chain, Cases on E-business and supply chains, Recent Technologies in SCM – Blockchain, Artificial Intelligence

5. Special Cases in Supply Chain : **Sustainable** -Green SCM, Reverse Logistics, Global Supply Chain Management – Case studies, Cold & Liquid Supply Chain,

List of Practicals:

1. Detailed Study of Supply Chain of any one company in an Industry of your choice
2. Study of Industry or Sector Based on Economics Times Intelligence Group
3. Single Facility Location Models-
4. Multiple Facility Location Models-
5. Allocation Models – Transportation, Transshipment model
6. Application of Travelling Salesman Problem
7. Application of Vehicle Routing Problem
8. Design/ Develop Inventory policy
9. Selective Inventory Control – ABC, FSN, VED etc.
10. Computerized Simulation Games – Bullwhip Effect
11. Supply Chain Optimization and Integration
12. Application of Recent Technologies in SCM

List of Project areas:

1. Distribution Network Design
2. Inventory Management
3. Supply Chain Optimization
4. Logistics Modelling
5. Application of Recent Technologies in SCM
6. Outsourcing
7. Sustainable Supply Chains – Green, Reverse

Text Books:

1. Sunil Chopra & Peter Meindl; Supply Chain Management - Strategy, Planning & Operation, Pearson Education

Reference Books:

1. Bowersox , Logistical Management - The Integrated Supply Chain Process
2. Christopher, Logistics & Supply Chain Management, Pearson Education
3. Raghuram ; Logistics & Supply Chain Management
4. Ronald Ballou; Business Logistics / Supply Chain Management; Pearson Education.

Course Outcomes:

The student will be able to –

1. Identify the key elements and processes in a supply chain and their interaction
2. Understand and analyze the designing, planning and operational decisions of SCM.
3. Identify the techniques used in management of critical components of supply chain
4. Analyze, design and optimize supply chain networks for manufacturing organizations
5. Design and optimize inventories across the supply chain
6. Explain the likely future development of logistics and supply chain management

IP4074::MAJOR PROJECT

Credits: 04	**Teaching Scheme: -** Lab 8 Hr/Week

The project work could be of the following nature:

1. Manufacturing /Fabrication of a prototype machine' including selection, concept, design, material, manufacturing the components, assembly of components, testing and performance evaluation.
2. Improvement of existing machine / equipment / process.
3. Design and fabrication of Jigs and Fixtures, dies, tools, special purpose equipment, inspection gauges, measuring instruments for machine tools.
4. Computer aided design, analysis *of* components such as stress analysis.
5. Problems related to Productivity improvements.
6. Problems related to value engineering.
7. Problems relating to material handling system.
8. Energy Audit of organization, Industrial evaluation of machine devices.
9. Design of a test rig for performance evaluation of machine devices.
10. Product design and development.
11. Analysis, evaluation and experimental verification of any engineering problem encountered.
12. Quality systems and management. Total Quality Management.
13. Quality improvements, In-process Inspection, Online gauging.
14. Low cost automation, Computer Aided Automation in Manufacturing.
15. Time and Motion study, Job evaluation.
16. Ergonomics and safety aspects under industrial environment
17. Management Information System.
18. Market Analysis in conjunction with Production Planning and Control.

OR

Fabrication of models, machines, prototypes based on new ideas, robots and machine based on hitech systems and automation, experimental set-up, fabrication of testing equipment, renovation of machines, etc. Computer based design / analysis or modeling / simulation of product(s), mechanism(s) or system (s) and its validation or comparison with available benchmarks / results. Modelling/simulation of product(s), mechanism(s) or system(s) and its validation or comparison with available bench marks / results. Design/development and Fabrication of models, machines, and prototypes based on new ideas, robotic and automation systems, Experimental set ups, test rigs/ equipments.

The project work shall be taken up individually or in a group consisting of not more than 4 students.

A report containing maximum 30 pages shall be submitted based on the background, need and scope of the project, project specifications, activities involved in the project and activity plan, study of literature and basic theory, and work completed (if any).

Guidelines:

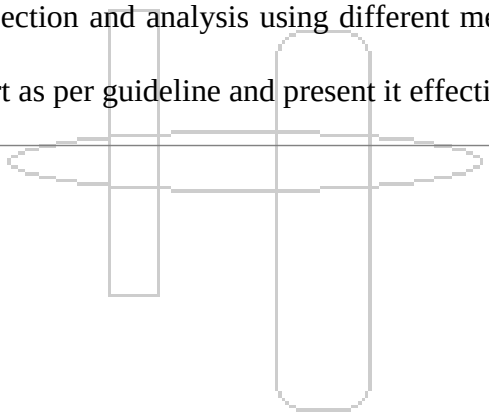
- Report shall be typed or printed.
- Figures and tables shall be on separate pages and attached at respective positions.
- Project title and approval sheets shall be attached at the beginning of the report followed by index and synopsis of the project.
- References shall be mentioned at the end followed by appendices (if any).
- When a group of students is doing a project, names of all the students shall be included on every certified report copy.

Each group of students shall submit two copies of reports to the institute and one copy shall be prepared for each individual student.

Course Outcomes :

Students will be able to:

1. Survey literature for problem identification
2. Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach
3. Correlate the theoretical and experimental/simulations results and draw the proper inferences.
4. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation.
5. To practice data collection and analysis using different measurement equipment's and software packages.
6. Prepare project report as per guideline and present it effectively



IE4004::FINANCIAL MANAGEMENT AND MANAGEMENT ACCOUNTING

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

SECTION-1

1. Financial Statement Analysis- Nature and Scope of Finance Function; Financial goal profit vs. wealth, Maximization; Scope and Functions of Financial Management, Financial Planning and Forecasting. Budgets & Budgetary Control: Types of Budget, Preparation of Budgets: Operational &Financial Budgets, Financing and Dividend decisions. Operating & Financial Leverage, Types of accounts, Profit and Loss Account and Balance Sheet, Cash Flow Statement

2. Capital Budgeting and ratio Analysis -Ratio Analysis Classification, Ratio Analysis and its limitations. Types of Ratios, Activity Turnover, Profitability, Liquidity, etc., B: Common Size Statement, Index Statement, Capital Budgeting - Nature of Investment decisions; Investment evaluation criteria - Non- DCF& DCF Techniques, PBP, Discounted PBP, PI, ARR, Annual Worth,

3. Working Capital Management - Meaning, significance and types of working capital; calculating operating cycle period and estimation of working capital requirements; sources of working capital, NPV and IRR comparison; Capital rationing. Various committee reports on bank finance; Dimensions of working capital management

SECTION-2

4. Introduction to concept of Cost and Overheads- Cost, Cost Centre, Cost Unit, Elements of Cost: Material Cost. Different methods of pricing of issue of materials Labour Cost: Direct& Indirect cost, Different methods, Direct Expenses: Constituents and Significance, Prime Cost, Classification: Production, Office & Administration, Selling & Distribution. Treatment of Overheads: Collection of Overheads - Primary and Secondary Distribution of Overheads: Absorption of Overheads: Machine hour, Labour hour rate, Under and Over Absorption of Overheads, Preparation of Cost Sheet

5. Costing Methods - Job Costing, Unit Costing, Contract Costing, Process Costing, Activity Based Costing Simple numerical on various methods of costing to enable ascertains cost of product. Standard costing: Concept, Standard Cost, Standard costing. Calculation of Variance Numerical on calculation of variances, Variance – Variance Analysis, Material variance, Labour Variance, Overhead Variance

6. Marginal Costing and Break Even Analysis - Fixed& Variable (Marginal) Cost, Marginal Cost. Applications of Marginal Costing in Decision-making: Product Mix, Profit Planning, Make or Buy Decisions. Limiting Factor, Cost Volume Profit Analysis, Concept of Break-Even, P/V Ratio and Margin of Safety

Text Books:

1. Prasanna Chandra, Financial Management– Theory and Practice, Edition 8, 2011, Tata McGraw Hill Education,
2. B. K. Bhar, Cost Accounting– Methods and Problems, Edition No., Academic Publishers, 1980
3. M. Y. Khan and P K Jain, Financial Management: Text, Problems and Cases, Edition 52011, Tata McGraw Hill Education,
4. Amitabha Mukherjee, and Mohammed Hani, Modern Accountancy, Edition 2, 2002, Tata McGraw Hill Education

Reference Books:

1. Paresh P. Shah, Financial Management, Reprint No. 2 2011, Biztantra, New Delhi,
2. S. N. Maheshwari, Introduction to Accountancy, Edition No. 11, 2013, Vikas Publishing House P Ltd.
3. M. Y. Khan, P. K. Jain, Management Accounting –Text, Problems, Cases, Edition No. Tata McGraw Hill Publishers, 2013

List of Practical:

1. Case study on sources of capital and working capital
2. Studying and understanding Financial Statements
3. Studying and understanding various financial ratios used in practice
4. Case study on Analysis of published results of an organisation
5. Prepare a cost sheet to estimate cost of any product or process
6. Case study on use Marginal Costing to determine Break Even Point and profitability

List of Project areas:

1. Budgeting including sources of capital and working capital
2. Preparation of Journal entries, Ledgers, Profit and Loss Account and Balance Sheet
3. Ratio Analysis based on real life data from project on Profit and loss and Balance sheet
4. Compare Analysis of published results of organisations to enable investment decision
5. Apply Product Costing to estimate cost of any process used in practice
6. Apply Service Costing to estimate cost of any process used in practice
7. Apply Process Costing to estimate cost of any process used in practice
8. Apply Marginal Costing to determine Break Even Point and profitability

Course Outcomes:

The student will be able to –

1. Understand and analyze functions of financial management and budgeting, interpret financial statements through accounting ratios
2. Understand the concepts of Capital Budgeting and Working Capital management for effective financial management
3. Understand the mechanics of financial accounting for preparation of financial statements to ascertain the performance and financial position of a business

4. Classify and apply different types of costs and overheads to ascertain costs of a product or a process
5. Apply different types of costing methods and techniques according to the suitability for various production processes and services.
6. Develop an ability of decision making about optimum product mix, profit planning, make or buy, limiting factors based on marginal costing concept

IE4005::OPERATIONS SCHEDULING

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

SECTION-1

1. **Single Machine Scheduling:** Basic theorems performance measures – mean flow time, mean tardiness etc. Hodgson's algorithm, method to minimize tardiness, Branch and Bound method, Commonly used heuristics like Cost over Time rule (COVERT), LPUL Rule, SWPT Rule, Largest Weight (WT) Rule and LPUL rule. Backward forward (BF) heuristic method, single machine scheduling problems with early and late penalties

2. Other Objectives in a single machine scheduling: Problems with early and late due dates, Minimize number of jobs delayed, problems of different types like maximizing the number of jobs completed when the available time is less, when the sequence dependent jobs, minimizing Variation of flow time, sequence dependent set up times, multiple criteria scheduling, Jobs arriving at different times.

3. Parallel Processing & Batch Sequencing: Parallel machine models, Make span minimization of independent and dependent jobs – Mc Naughton's algorithms, Weighted mean flow time minimization, Parallel Processing- Job with equal weights, Job with due dates, Batch scheduling for a limited capacity, fixed-period process problem, baking problem-ovens in sequence. **DSRO**-Network Base scheduling of jobs on m machines, LCR method used for line balancing, mixed model assembly.

SECTION-2

1. **Flow shop models:** Introduction of Flow shop model**,** objectives of flowshop model, Use of Gantt chart –Minimize machine idle time method, Nawaz heuristic, Compbell Dudek method, Palmer's method.

2. Job Shop Models Minimize makes pan- SPT rule, Network approach to Job shop scheduling, Modified shifting bottleneck heuristic (MODSB), Two stage job shop scheduling heuristic, Job shop scheduling CEXSPT rule, Graphical representation – Feasible, semi-active and active schedules – Single pass approach –Non-delay schedule generation. Heuristic schedule generation – Priority dispatching rules – Dynamic job shop simulation.

3. Other Models: Scheduling of intermittent production – Giffler Thomson algorithm – Branch and Bound Scheduling of continuous production – RPW, Inverse RPW methods – Tree search, Largest candidate methods, COMSOAL – KANBAN/FMS system scheduling

List of Practicals:

1 Assignment on Single machine scheduling Problems- minimizing tardiness, Tardy jobs etc
2. Assignment on Single machine scheduling Problems- jobs arriving at different times
3. Assignment based on Minimize machine idle time method, CDS Method
4. Assignment on 2 stage job shop scheduling heuristic, Job shop scheduling CEXSPT rule

5. Assignment on Scheduling of intermittent production – Giffler Thomson algorithm
6. Assignment on on Single Machine scheduling or Parallel Processing & Batch Sequencing

Project work on

1) Flow shop scheduling Models
2) Job Shop scheduling Models

Text Books:

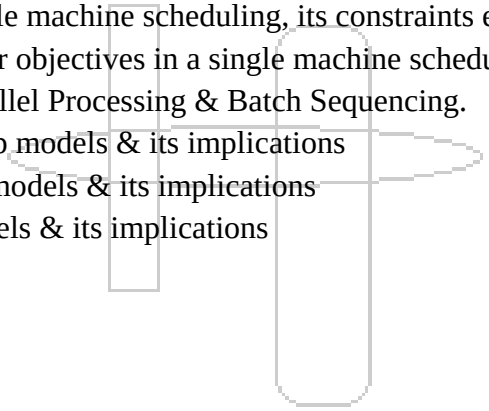
1. Dileep R Sule; Industrial Scheduling; 1st edition, International Thomson Publishing Company, London
2. Kenneth R.Baker; Introduction to sequencing and scheduling; 1st edition, John Wiley and Sons, 2000

Reference Books:

1. Michael Pinedo, Scheduling: theory, Algorithms and Systems, 1st edition, Prentice Hall of India, 1996
2. King, J.R, "Production planning and control", 1st edition, Pergamum International Library, 1975.

Course Outcomes:

1. Understanding of single machine scheduling, its constraints etc.
2. Understanding of other objectives in a single machine scheduling.
3. Understanding of Parallel Processing & Batch Sequencing.
4. Analysis of Flow shop models & its implications
5. Analysis of Job shop models & its implications
6. Analysis of other models & its implications



FF No. : 654

IE4006::SERVICES MANAGEMENT

Credits: 04 **Teaching Scheme: Theory 3 Hrs / Week & Lab/Project 2 Hrs/Week**

Section-1

1. Economic Evolution, Stages of Economic Development- Agrarian, Manufacturing, Service and Experience, Gig Economy. Measures of Economy – GDP, GNP, GNH, Net Income etc. Service definitions, Understanding services and the service economy,

2. Dependency of Manufacturing on Services, Nature of service sector, Sources of service sector growth, Service classifications- Service Process Matrix, Service Value Model, Service package and its evaluation,

3. Service Operations-Distinctive characteristics- Customer Participation, Simultaneity, Perishability, Intangibility, Heterogeneity.

4. Service Strategy, Classifying services for strategic insight, Understanding the competitive environment of services, Competitive service strategies, Role of information as resource in services,

5. New service development, Role of Technology in services, The service encounter triad, Service facilities and process flows, Approaches to service system design, **Servicescape**, Service Blueprint,

6. Aspects of facility design, Facility layout, Process analysis, Environmental Psychology and orientation, Service facility location, Facility location techniques, Site considerations, Managing service projects

Section-2

1. Service Quality-Managing service operations and Service Quality, Forecasting demand for services, Subjective, causal and time-series models, Defining service quality, Dimensions of service quality, Gaps model, Measuring service quality, **SERVQUAL**, Designing service quality.

2. Service Recovery, Managing capacity and demand, Strategies for managing demand, Strategies for managing capacity, Scheduling strategies,

3. Yield management, Managing waiting lines, Psychology of waiting, Essential features queuing system, Capacity planning and analytical queuing models, Capacity Planning criteria, Service benchmarks.

4. Maintenance As A Service (MaaS)- Services include E-mails, Storage Space, Enterprise databases, Enterprise Resource Management (ERP), Customer Relationship Management (CRM), Asset Management (AM) , Equipment health monitoring and maintenance recommendations as a service

5. Simulation-as-a-Service (SaaS)- What-if scenarios in the scope of FMEA operations

6. Training-as-a-Service (TaaS) – Cloud-based training services: Virtual Reality (VR) and/or Augmented Reality (AR), MOOCs

7. Information as a Service (IaaS): Information Repository Approach, Core building blocks of IaaS- Virtual Data Access & Federation, Virtual Data Placement & Management , Virtual Runtime Management

8. Relevance of industrial engineering to services, Productivity improvement techniques related to man, material, money, method etc. and its applications for service competitiveness, Managing Human Resources, Internet of Services, IT Security, Green Services

List of Practicals:

1. Identify and Evaluate Service Package of given business
2. Classify Services and Develop Service Strategy
3. Develop Blueprint of Service Business of your choice
4. Evaluate Service Quality by using SERVQUAL
5. Identify scope and apply IE Techniques to improve Service productivity
6. Formation of SOP, Work Instructions
7. Standardization of processes
8. Developing Maintenance Schedule based on MaaS
9. Assignments based on TaaS, SaaS, IaaS etc.
10. Simulation Modeling based on Queing Theory application in Service Organizations

List of Project areas:

1. Service Facility Design
2. Experience Economy based Businesses
3. Productivity Improvement for Service Operations
4. Industrial Engineering in Services Management
5. Banking, Healthcare, Tourism Sector,
6. Green Services
7. Internet of Services in IoT

Text Books:

1. Fitzsimmons James and Fitzsimmons Mona Service Management 5th edition McGraw Hill 2006

Reference Books:

1. Haksever, Render, Russel and Murdick Service Management and Operations, 2nd edition, Pearson Education , 2003
2. Zeithaml, Bitner and Gremler Services Marketing, 6th Edition , McGraw Hill 2013

Course Outcomes:

The student will be able to –

1. Explain the distinctive nature of services and characteristics of service economy
2. Analyze service encounters and service strategy
3. Plan facilities for service delivery
4. Evaluate various dimensions of service quality
5. Match requirements of service capacity and demand
6. Apply various Industrial Engineering Techniques for service competitiveness

IE4086::MAJOR PROJECT

Credits: 04	**Teaching Scheme: -** Lab 8 Hr/Week

The project work could be of the following nature:

1. Manufacturing /Fabrication of a prototype machine' including selection, concept, design, material, manufacturing the components, assembly of components, testing and performance evaluation.
2. Improvement of existing machine / equipment / process.
3. Design and fabrication of Jigs and Fixtures, dies, tools, special purpose equipment, inspection gauges, measuring instruments for machine tools.
4. Computer aided design, analysis *of* components such as stress analysis.
5. Problems related to Productivity improvements.
6. Problems related to value engineering.
7. Problems relating to material handling system.
8. Energy Audit of organization, Industrial evaluation of machine devices.
9. Design of a test rig for performance evaluation of machine devices.
10. Product design and development.
11. Analysis, evaluation and experimental verification of any engineering problem encountered.
12. Quality systems and management. Total Quality Management.
13. Quality improvements, In-process Inspection, Online gauging.
14. Low cost automation, Computer Aided Automation in Manufacturing.
15. Time and Motion study, Job evaluation.
16. Ergonomics and safety aspects under industrial environment
17. Management Information System.
18. Market Analysis in conjunction with Production Planning and Control.

OR

Fabrication of models, machines, prototypes based on new ideas, robots and machine based on hitech systems and automation, experimental set-up, fabrication of testing equipment, renovation of machines, etc. Computer based design / analysis or modeling / simulation of product(s), mechanism(s) or system (s) and its validation or comparison with available benchmarks/results. Modelling/simulation of product(s), mechanism(s) or system(s) and its validation or comparison with available bench marks / results. Design/development and Fabrication of models, machines, and prototypes based on new ideas, robotic and automation systems, Experimental set ups, test rigs/ equipments.

The project work shall be taken up individually or in a group consisting of not more than 4 students.

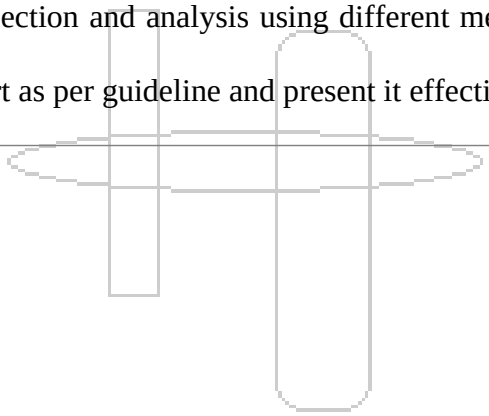
A report containing maximum 30 pages shall be submitted based on the background, need and scope of the project, project specifications, activities involved in the project and activity plan, study of literature and basic theory, and work completed (if any).

Guidelines:

- Report shall be typed or printed.
- Figures and tables shall be on separate pages and attached at respective positions.
- Project title and approval sheets shall be attached at the beginning of the report followed by index and synopsis of the project.
- References shall be mentioned at the end followed by appendices (if any).
- When a group of students is doing a project, names of all the students shall be included on every certified report copy.

Each group of students shall submit two copies of reports to the institute and one copy shall be prepared for each individual student.

Course Outcomes :

Students will be able to:

1. Survey literature for problem identification
2. Cultivate the habit of working in a team, communicate effectively and attempt a problem solution in a right approach
3. Correlate the theoretical and experimental/simulations results and draw the proper inferences.
4. Apply engineering knowledge in carrying out project starting from design, drafting, process planning, project management, costing, manufacturing, QC and inspection, down to assembly, testing and evaluation.
5. To practice data collection and analysis using different measurement equipment's and software packages.
6. Prepare project report as per guideline and present it effectively