FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **VI**

Course Code: **202090603**

Course Title: **Industrial Engineering**

Course Group: **Professional Core Course-XV**

Course Objectives: This course aims to acquaint students with different techniques of productivity measurement and improvement as well as quality control and improvement being used in the industries. Students will get acquainted with importance of inventory control in industry and different techniques for the same. The course also aims to introduce the concept and importance of human factors engineering in industrial systems. Students will also be introduced to contemporary methodology of Business Process Re-Engineering.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	2	4	50 / 18	50 / 17	25 / 9	25 / 9	150/53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction** Productivity: Definition, Importance, Types, Factors affecting productivity. Work-study: Concept, Application in industries.	2
2	**Method and Motion Study** Method Study: Objectives, Procedure (8-steps approach), Different Charts and Diagrams - Operations Process Chart, Flow Process Chart, Flow diagram, String Diagram, Two Handed process chart, Man-Machine Chart, Travel Chart. Motion Study: Micro and Memo Motion Study, Therbligs, Cyclegraph, Chronocyclegraph, SIMO Chart. Principles of motion economy.	7

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3	**Work Measurement** Objectives, Procedure, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS) Time Study: Terminologies – Qualified worker, Representative worker, Types of Elements, Types of Allowances, Performance rating, Normal / Basic Time, Standard Time, Calculation of basic and standard time, Different timing methods by stopwatch Work Sampling: Concept of sampling, Normal distribution curve, Calculation of sample size for work sampling study Pre-Determined Motion Time Standards (PMTS): Concept, Advantages and Limitations	**7**
4	**Quality Engineering:** Introduction: Different Definitions and Dimensions of Quality, Historical Perspective: From Evolution of Quality Control, Assurance and Management to Quality as Business Winning Strategy, Contributions of E W Deming and J M Juran in Quality Quality Control: Concept, 7 QC Tools, Quality Circle Statistical Quality Control (SQC): Concept, Types of data, Control charts for variable data (X-bar and R charts), process capability (Cp) analysis, different patterns of control charts, Control charts for attribute data (p-chart, np-chart, c-chart, u-chart), Acceptance Sampling – Concept and need of sampling inspections, Types of Sampling Plans, Operating Characteristic Curve (OC curve), AQL, RQL, Producer's and Consumer's Risks, Average Outgoing Quality Curve (AOQ curve) Quality Management System (QMS): Introduction of ISO 9001, ISO 14001, TS 16949	**10**
5	**Inventory Control:** Classification of inventories, The value and impact of inventory, Importance of inventory and its control, Inventory levels (Order quantity, Lead time, Safety stock, Reorder level), Costs associated with inventories (Ordering cost and Carrying cost), Inventory models (Static and Dynamic – Deterministic and Probabilistic), Economic Order Quantity (EOQ), Inventory model considering quantity discount, EOQ with gradual replenishment, EOQ when shortages are allowed, EOQ with different rate of demand in different cycles, Reordering systems (Two bin system, Periodic ordering system), ABC analysis of inventory control, Introduction to other methods of stock control : VED, SDE, HML, MNG/FSN analysis	**10**
6	**Introduction to Ergonomics/Human Factors Engineering:** Concept of Ergonomics/Human Factors Engineering, Man-Machine-Environment systems concept, Human Anthropometry and its applications, Concept of physiological work measurement	**6**
7	**Introduction to Business Process Re-Engineering (BPR):** Concept, Need for Re-Engineering, Methodology of BPR, Advantages and Hurdles in BPR implementation	**3**
	Total	**45**

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List of Practicals / Tutorials:

1	Exercise on Operation Process Chart (OPC)
2	Exercise on Flow Process Chart (FPC) & Flow Diagram
3	Exercise on Two-handed Process Chart (TPC) and Principles of Motion Economy
4	Practicing Performance Rating
5	Exercise on Work Measurement
6	Exercise on Statistical Quality Control: Control Charts and Process Capability Analysis
7	Exercise on Statistical Quality Control: Acceptance Sampling
8	Exercise on Inventory Control Techniques
9	Exercise on Ergonomic Evaluation of Workspace and Equipment
10	Case Study Analysis on BPR Implementation

Reference Books:

1	Introduction to Work Study, I.L.O., 3rd Revised Edn.
2	Industrial Engineering and Production Management, M. Mahajan, Dhanpat Rai & Co.
3	Industrial Engineering and Production Management, Martand Telsang, S. Chand & Co. Ltd.
4	Production and Operations Management, R. Panneerselvam, PHI Learning Pvt. Ltd.
5	Industrial Engineering and Management, by Praveenkumar, Pearson
6	Statistical Quality Control, M. Mahajan, Dhanpat Rai & Co.
7	Motion and Time Study – Design and Measurement of Work, Barnes, Raeph.M., John Wiley &sons, New York, 1990.

Supplementary learning Material:	
1	NPTEL resources
2	Coursera resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods

Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

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Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
10	20	25	20	15	10	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Student will learn and apply different industrial engineering techniques of method study and work measurement for productivity measurement and improvement.	**25**
CO-2	Student will learn and apply different quality control and improvement tools and techniques, such as, 7 QC tools and SQC techniques.	**25**
CO-3	Students will get acquainted with importance of inventory control in industry and different techniques for the same.	**25**
CO-4	Students will get acquainted with the concept and importance of human factors engineering in industrial systems and contemporary methodology of Business Process Re-Engineering (BPR).	**25**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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