PRODUCTION AND OPERATION MANAGEMENT **Course Code : 315368**

Programme Name/s : **Production Engineering**
Programme Code : **PG**
Semester : **Fifth**
Course Title : **PRODUCTION AND OPERATION MANAGEMENT**
Course Code : **315368**

I. RATIONALE

Industrial productivity relies heavily on the effective utilization of human and equipment resources. To ensure high productivity levels, one must be proficient in planning production schedules, managing inventory and process control. Additionally, knowledge in production planning and control along with modern production techniques is crucial. This course aims to provide a critical understanding of process and operational management concepts, enabling learners to enhance productivity and operational efficiency and gain a competitive advantage in the industry.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use principles of modern production and operation approaches for manufacturing.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Apply concepts of production systems, plant location and plant layout to enhance productivity and facility design.
- CO2 - Develop production plan to optimize manufacturing operations.
- CO3 - Implement effective production control techniques to improve operational efficiency.
- CO4 - Apply work study techniques to optimize production processes.
- CO5 - Apply project management techniques to optimize schedule.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315368	PRODUCTION AND OPERATION MANAGEMENT	POM	DSC	4	-	2	-	6	2	3	30	70	100	40	25	10	-	-	-	-	125

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Select production system for the given product with justification. TLO 1.2 Apply productivity improvement technique for the given situation. TLO 1.3 Classify the plant location factors as suitable or unsuitable based on the product requirements. TLO 1.4 Prepare plant layout for manufacturing the given product.	**Unit - I Production system and facility design** 1.1 Production systems: Definition and types of Production Systems, significance of productivity and its measurement, techniques for improving productivity. 1.2 Plant Location: Importance of plant location selection, factors influencing plant location decisions. 1.3 Plant Layout: Objectives and principles of plant layout design, features of different layouts, factors affecting plant layout.	Lecture Using Chalk-Board Video Demonstrations Presentations Site/Industry Visit Flipped Classroom
2	TLO 2.1 Explain the functions of production planning and control with reference to the given situation. TLO 2.2 Select sales forecasting techniques for the given product with justification. TLO 2.3 Predict sales demand for the given product. TLO 2.4 Prepare operation sheet for the given component/job. TLO 2.5 Prepare material requirement planning for the given product.	**Unit - II Production Planning** 2.1 Introduction: Definition, functions and importance of PPC. 2.2 Sales Forecasting: Overview and purpose of sales forecasting, basic forecasting methods: simple average, moving average, exponential smoothing. 2.3 Process Planning: Definition and concept, information required and procedure, development of Operation sheet and Process flow sheet. 2.4 Production Planning: Material Requirement Planning (MRP), Capacity planning, Bill of material, Manufacturing Resource Planning (MRP-II). 2.5 Computer aided process planning & scheduling software (like Enterprise resource planning (ERP), Advanced planning and scheduling (APS) etc;).	Lecture Using Chalk-Board Presentations Video Demonstrations

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Prepare different charts for the given type of production scheduling. TLO 3.2 Sequence 'n' number of jobs on two machines. TLO 3.3 Analyze the effect of demand on inventories. TLO 3.4 Determine economic lot size. TLO 3.5 Calculate batch size for EOQ. TLO 3.6 Apply ABC analysis for the given inventory. TLO 3.7 Write the steps to apply Just in Time (JIT) and lean manufacturing for the given situation. TLO 3.8 Develop the Gantt chart for the given situation.	**Unit - III Production Control** 3.1 Introduction of production control and progress control. 3.2 Inventory Control: Functions and classification of inventories, costs associated with inventory management, Economic Order Quantity (EOQ), lead time, safety stock, periodic review, ABC analysis. 3.3 Shop floor control: Order release, loading and scheduling, sequencing ('n' jobs, 2 machines), dispatching, routing, Gantt chart, Flow Process Sheet. 3.4 Just in Time (JIT) Production system: Philosophy, elements of JIT, seven wastes and benefits of JIT. 3.5 Lean Manufacturing: Concept, principles, advantages and limitations.	Lecture Using Chalk-Board Presentations Video Demonstrations Site/Industry Visit
4	TLO 4.1 Apply method study for manufacturing of the given job. TLO 4.2 Apply time study for manufacturing of the given job. TLO 4.3 Select relevant recording techniques for the given process with justification. TLO 4.4 Prepare different types of charts for given process using given recording techniques. TLO 4.5 Calculate standard time for given activity using work measurement.	**Unit - IV Work Study** 4.1 Method study: Definition, objectives and basic procedure, Selection of work and Charting Techniques - Flow process chart, Outline process chart, Flow diagram and travel chart, Critical examination and analysis. 4.2 Principal of Motion economy: General considerations, Tools and equipment’s, Two Handed process chart, Therbligs, cycle graph and Chronocycle graph, SIMO Chart. 4.3 Time study: Definition, procedure, factors affecting the rate of working, Time Study equipment’s, Types of elements, Rating and allowances, calculation of standard time.	Lecture Using Chalk-Board Presentations Video Demonstrations
5	TLO 5.1 Formulate the linear programming model for the given problem. TLO 5.2 Optimize the given objective of LP Model. TLO 5.3 Construct the network diagram of the given project using project management techniques. TLO 5.4 Identify critical path and calculate total duration, float and slack of the given project.	**Unit - V Linear programming and network techniques** 5.1 Introduction: Concept and importance of Operation Research (OR), linear programming (LP) model formulation. 5.2 Graphical method for solving LP problems. 5.3 Project Management Techniques: Project evaluation and review technique (PERT) and critical path method (CPM), Comparison between CPM and PERT, Calculation of time estimate in PERT and CPM.	Lecture Using Chalk-Board Video Demonstrations Presentations Flipped Classroom

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Prepare comparative statements for plant location using appropriate software, considering key criteria and constraint. LLO 1.2 Analyze the generated statements to select the optimal plant location.	1	Prepare comparative statements for plant location using software.	2	CO1
LLO 2.1 Use software for designing a product/process layout.	2	*Prepare product/process layout using appropriate software.	2	CO1
LLO 3.1 Prepare detailed operation sheet, specifying the sequence of operations, tools used, time and equipment required for efficient production.	3	*Prepare operation sheet for the given product/job.	2	CO2
LLO 4.1 Use software to generate Material Requirements Planning (MRP) data. LLO 4.2 Analyze MRP results to address the given problem.	4	Generate MRP with appropriate software for the given problem.	2	CO2
LLO 5.1 Conduct an ABC analysis to categorize items available in the laboratory or central store. LLO 5.2 Categorize items based on their importance and usage.	5	* Perform ABC analysis of inventory items.	2	CO3
LLO 6.1 Prepare two handed process chart for the given task. (e.g. measuring dimensions or assembling components).	6	*Prepare two handed process chart.	2	CO4
LLO 7.1 Prepare a string diagram for mapping a material handling movements in the institute laboratory, workshop, or industry. LLO 7.2 Analyze material handling movement.	7	Use a string diagram to analyze material handling movements.	2	CO4
LLO 8.1 Observe and record the motions involved in machining operations in the workshop. (Turning/Milling/Drilling etc.). LLO 8.2 Analyze the findings to enhance machining process efficiency to reduce unwanted motions. LLO 8.3 Develop a flow process chart/outline process chart to detail the sequence of steps and decision points involved in the given situation.	8	Apply method study approach.	2	CO4
LLO 9.1 Measure and record the time components of a machining operation (Turning/Milling/Drilling etc.) in the workshop using a stopwatch. LLO 9.2 Analyze the recorded time data and identify opportunities for improving machining efficiency.	9	Apply work measurement techniques.	2	CO4
LLO 10.1 Prepare a CPM/PERT network diagram for a given project task (e.g. machine maintenance). LLO 10.2 Identify critical path and calculate total duration, float and slack of the given project.	10	* Prepare CPM/PERT network diagram and analyze critical path.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Design a layout for a small workshop or manufacturing unit using different layout types (Process, Product, and Cellular). Create layout diagrams and explain how each layout optimizes production efficiency for specific scenarios.
- Develop operation sheets and process flow sheets for a simple product. Detail the information required, the steps involved, and the rationale for each step. Create visual representations of the process.
- Create a simulation of Material Requirements Planning (MRP) for a small-scale production scenario. Calculate the Bill of Materials (BOM) and develop a capacity plan. Prepare a report on how MRP and MRP-II impact production planning.
- Develop a plan for implementing Just-in-Time (JIT) and Lean Manufacturing principles in a hypothetical or real company. Identify potential benefits and challenges, and propose strategies for overcoming limitations.
- Perform a time study on a specific task and use principles of motion economy to analyze the work. Create Two-Handed Process Charts, SIMO Charts, and calculate the standard time for the task. Present the findings and improvement suggestions.
- Create PERT and CPM network diagrams for a small project. Calculate the time estimates, identify the critical path, and compare the results of PERT and CPM. Prepare a report on the project scheduling and management insights.

Assignment

- Analyze a real-world company and identify the production system used (Job Shop, Batch, Mass, Continuous). Discuss how the system impacts productivity and suggest improvements.
- Select a manufacturing company and evaluate the factors influencing its plant location decision. Classify these factors as suitable or unsuitable based on the company’s product requirements.
- Using historical sales data, apply different forecasting methods (Simple Average, Moving Average, Exponential Smoothing) to predict future sales. Compare the accuracy of each method.
- Develop an operation sheet and process flow sheet for a given product or job.
- Calculate the Economic Order Quantity (EOQ) and safety stock for a given set of inventory data. Prepare a report including EOQ calculations, cost analysis, and inventory management strategies.
- Conduct a motion economy study for a simple task. Prepare two-handed process charts, SIMO charts, and time study reports to identify and reduce unnecessary motions.
- Develop a PERT and CPM network diagram for any project. Calculate the time estimates and determine the critical path.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Any open-source CAD software	2,3,10
2	Department Laboratory	2,3,5,6,7,10,8,9
3	Institute Workshop	2,3,5,6,7,10,8,9
4	Computer Aided Process planning and Scheduling software. e.g., Enterprise Resource Planning (ERP), Advanced Planning and Scheduling (APS) Software	3,4,5
5	Standard samples like steel balls, bearings, turning operation jobs, gear samples for sample measurement.	5,6,7,8,9
6	Stop Watch :- Timing capacity: 23 hrs., 59 mins and 59.99 sec, Accuracy : ±3 seconds/day.	6,7,8,9
7	Display Wall chart showing Therbligs symbols.	6,7,8,9
8	Digital Video Camera for Micro Motion Analysis with following specification (i) ISO 100-12800 (ii) Focal length f = 3.5-5.6 (iii) 24.2 MP (iv) lenses 18-55 mm.	6,7,8,9

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Production system and facility design	CO1	6	2	4	4	10
2	II	Production Planning	CO2	8	2	6	6	14
3	III	Production Control	CO3	8	2	6	6	14
4	IV	Work Study	CO4	10	4	4	10	18
5	V	Linear programming and network techniques	CO5	8	4	4	6	14
Grand Total				**40**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering 60% weightage to process 40% weightage to product A continuous assessment-based term work..

Summative Assessment (Assessment of Learning)

- End semester examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	2	2	-	-			
CO2	3	2	2	1	-	1	-			
CO3	3	2	2	2	-	1	-			
CO4	3	2	2	2	2	1	-			
CO5	3	2	2	1	-	2	-			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. O. P. Khanna	Industrial Engineering and Management	Dhanpat Rai Publications Pvt. Ltd., New Delhi, 2018, ISBN-13: 978-8189928353.
2	Martand Telsang	Industrial Engineering and Production Management	S. Chand, 2006, 3rd Edition, ISBN-13: 978-8121917735.
3	L. C. Jhamb	Production planning and control	Everest Publishing House, 12th Edition, 2010, ISBN-13: 978-8186314722.
4	Samuel Eilon	Elements of Production planning and control	Colliern Macmillan Ltd., 2015, ISBN: 978-0023318009.
5	K. K. Ahuja	Production Management	CBS publishers and Distributers, New Delhi, 2016, ISBN-13: 978-8123901855.
6	L. C. Jhamb	Work Study and Ergonomics	Everest Publishing House, ISBN: 9788176601566, 9788176601566.
7	George Kanawaty	Introduction to Work Study	International Labour Office, 4th revised edition, 1992, ISBN-13: 978-9221071082.
8	P. K. Gupta and D. S. Hira	Operation Research	S. Chand and Company Pvt. Ltd., New Delhi, 2015, ISBN: 9788121902816.
9	Mikell P. Groover	Automation, Production systems, and Computer Integrated Manufacturing	Pearson Prentice Hall, fourth Edition, ISBN: 978-9332572492.

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description

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Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=OshyCwH3TJM	Plant location, Factors affecting Plant Location
2	https://www.youtube.com/watch?v=4vq0FKWYud8&t=63s	Plant Layout, Objectives of Plant Layout, Types of Plant Layout
3	https://www.youtube.com/watch?v=OLXq4nEWr9k	Plant Layout, Objectives of Plant Layout, Types of Plant Layout
4	https://www.youtube.com/watch?v=bjz4pKsXyMs	Production Planning and control
5	https://www.youtube.com/watch?v=9qBZyzjoqAo	Production Planning and control
6	https://www.youtube.com/watch?v=y24meNZbUoU	Process Planning
7	https://www.youtube.com/watch?v=ALIwbEvVl0M	Sales Forecasting methods
8	https://www.youtube.com/watch?v=ZpUD9kkPTiI	Inventory control
9	https://www.youtube.com/watch?v=SHXR6B90IfA	MRP
10	https://www.youtube.com/watch?v=6RFiU8j_PIA	MRP-II
11	https://www.youtube.com/watch?v=D2OJB1EgBSI	Cell Layout, Just-in-time manufacturing
12	https://www.youtube.com/watch?v=zWQovrjB7Uc&list=PLLy_2iUCG87BbIF6sF5sy_ZZLFoUcnncb	Work System Design
13	https://www.youtube.com/watch?v=66aKgySf9vo&list=PLLy_2iUCG87Bq8RGMTdeFZiB-87V4i9p1	Linear programming
14	https://www.youtube.com/watch?v=-TDh-5n90vk	PERT/CPM

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students