BIRLA INSTITUTE OF TECHNOLOGY

MINOR in "Production and Industrial Engineering"

CHOICE BASED CREDIT SYSTEM (CBCS) CURRICULUM

(REVISED COURSE STRUCTURE - To be effective from B.Tech 2020-21)

(OFFERED ONLY TO THE STUDENTS OF OTHER DEPARTMENTS)

Students who have registered for B. Tech Minor in "Production and Industrial Engineering" should complete 20 credits and shall opt for courses listed in Course Structure for the Minor Program. The credits shall be over and above minimum requirement for degree award.

PRODUCTION AND INDUSTRIAL ENGINEERING DEPARTMENT

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
Revised and approved in Meeting of Board of Studies, dated 21/06/2021

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Students who have registered for B. Tech Minor in "Production and Industrial Engineering" should complete 20 credits and shall opt for courses listed in Course Structure for the Minor Program. The credits shall be over and above minimum requirement for degree award.

PRODUCTION AND INDUSTRIAL ENGINEERING DEPARTMENT

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
Revised and approved in Meeting of Board of Studies, dated 21/06/2021

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING
MINOR in "Production and Industrial Engineering"
(OFFERED ONLY TO THE STUDENTS OF OTHER DEPARTMENTS)

Students who have registered for Minor in Production and Industrial Engineering should complete 20 credits and shall opt for courses listed below. The credits shall be over and above minimum requirement for degree award.

Semester/ Session of Study (Recommended)	Course Level	Category of course	Course Code	Courses	Prerequisites courses with code	Mode of delivery & credits *L-Lecture; T-Tutorial; P-Practicals*			Total Credits *C-Credits*
						L *(Periods/ week)*	T *(Periods/ week)*	P *(Periods/ week)*	C
FIFTH / Monsoon	**THEORY**								
	SECOND	PC	PE223	Operation Research and Quantitative Methods	None	4	0	0	4
	SECOND	PE (any one)	PE224	Manufacturing Science and Technologies	None	4	0	0	4
					Only for other than Mechanical Engg. Department students				
	THIRD		PE343	Modern Manufacturing Processes	PE213 Manufacturing Processes	4	0	0	4
					Only for Mechanical Engg. Department students				
TOTAL									**8**
SIXTH / Spring	**THEORY**								
	THIRD	PC	PE344	Mechanical Measurement and [redacted] Quality Control	None	4	0	0	4
TOTAL									**4**
SEVENTH / Monsoon	**THEORY**								
	THIRD	PE (any one)	PE304	Production and Operations Management	None	4	0	0	4
	FOURTH		PE416	Logistics and Supply Chain Management	None	4	0	0	4
	PROJECT								
	FOURTH	PC	PE450	Applications-based Project					4
TOTAL									**8**
GRAND TOTAL									**20**

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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COURSE INFORMATION SHEET

Course code: PE 223
Course title: OPERATION RESEARCH AND QUANTITATIVE TECHNIQUES
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 L:4 T:0 P: 0
Class schedule per week: 4
Class: B. Tech
Semester / Level: V / Second
Branch: All (MINOR in "Production and Industrial Engineering")
Name of Teacher:

Course Objectives
This course enables the students to:

1	Apply the techniques of operations research in industrial engineering problems.
2	Formulate a real-world industrial problem as a mathematical programming model
3	Understand the simplex method for linear programming and perform iterations of it by hand
4	Solve specialized linear programming problems like the transportation and assignment problems
5	Operations research helps in solving problems in different environments that needs decisions, such as sequencing, queuing and games theory .

Course Outcomes
After the completion of this course, students will be able to:

CO1	Understand how to translate a real-world problem, given in words, into a mathematical formulation.
CO2	Formulate and solve engineering and managerial situations as LPP.
CO3	Formulate and solve engineering and managerial situations as transportation and assignment problems
CO4	Apply Sequencing, Game theory and Queuing theory for performance evaluation of engineering and management system.
CO5	Conduct descriptive data analysis including various measures of central tendency and dispersion. Also Plan and design proper statistical survey mechanism

SYLLABUS

Module 1 Introduction & Linear Programming: **[12]**
Importance of Operation Research, Methodology, Characteristics, Scope, Application and Limitation of Operations Research
Requirement of LP, Basic Assumptions, Mathematical formulation of LP, Graphical solution; numerical problems based on these methods. Analytical Methods Simplex method, Big-M method

Module 2 Transportation and Assignment Model [8]

Basic feasible solution by different methods (North-west corner method, least cost method, Vogel's approximation method), finding optimal solutions (MODI method), unbalanced transportation problems; numerical problems based on these methods (preferably industrial engineering-based problems)

Balanced and unbalanced assignments, travelling salesman Problem; numerical problems based on these methods (preferably industrial engineering-based problems)

Module 3 Sequencing and Queuing Model [10]

Processing of n jobs through two machines, processing n jobs through three machines; Processing of 2 jobs through m machines –graphical method, numerical problems based on these methods

Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Queuing system and their characteristics of M/M/1/FIFO/ Queuing system

Module 4: Games Theory [8]

Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and sub games methods.

Module 5: Basics of Quantitative Analysis [12]

Classification and Scope of Quantitative Techniques, Nature and Classification of data, Primary and Secondary data, univariate, bivariate, and multivariate data, time-series and cross-sectional data, Measures of central tendency and dispersion, Quartile deviation, Inter-quartile range, Percentiles.

Planning and design of surveys, Business Data Sources: Primary and Secondary Data, Methods of collecting Primary data, Drafting a questionnaire, Collection of secondary data, Census method and Sampling, sampling theory, Sampling Methods, Managing Total Survey Error

Text books:

1. Operations Research, (Revised Edition), D.S. Hira, P.K. Gupta, S. Chand & Company Ltd, 2014 **[T1]**
2. Quantitative Techniques Vol I and Vol II, L. C. Jhamb, Everest Publishing House **[T2]**
3. Operations Research, - Kanti Swarup, P. K. Gupta and Man Mohan, Sultan Chand & Sons **[T3]**
4. Ken Black, Business Statistics for Contemporary Decision Making, 5th Edition, Wiley Publications (India Edition) **(T4)**
5. Levin and Rubin, Statistics for Management, Prentice Hall of India, New Delhi. **(T5)**
6. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill, New Delhi. **(T6)**

Reference books:

1. Operations Research an Introduction –Hamady A. Taha, Prentice Hall. **[R1]**
2. Introduction to Operations Research, 9e, Frederick S. Hillier, Gerald J. Lieberman, Bodhibrata Nag and Preetam Basu, McGraw Hill **[R2]**

Gaps in the syllabus (to meet Industry/Profession requirements):
Revised Simplex, Integer programming, other queuing models, Decision theory, Goal programming, Dynamic programming, Non-linear programming and Simulation. These topics are to be covered in a advanced course.

POs met through Gaps in the Syllabus:
POs 1-3, 12

Topics beyond syllabus/Advanced topics/Design:
Advanced Operation Research

POs met through Topics beyond syllabus/Advanced topics/Design:
POs 1, 3, 5, 7, 12

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	√
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√			
Quiz1	√	√			
Quiz 2			√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –
1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
Revised and approved in Meeting of Board of Studies, dated 21/06/2021

Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	1		1		1			1	3	3	3	3
CO2	3	3	3	1		1	1	1	2		2	2	3	2	3
CO3	3	3	2			1	1		2		1	3	3	2	3
CO4	3	2	1			1	1	1	2		2	2	3	3	3
CO5	3	2	1			1			2		2	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between Course Outcomes (Cos) and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6
CO2	CD1, CD2, CD3, CD6
CO3	CD1, CD2, CD3, CD6
CO4	CD1, CD2, CD3, CD6
CO5	CD1, CD2, CD3, CD6

COURSE INFORMATION SHEET

Course code: PE 224
Course title: MANUFACTURING SCIENCE AND TECHNOLOGIES
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 L:4 T: P:
Class schedule per week: 4
Class: B. Tech
Semester / Level: V / Second
Branch: All [except Mech.Engg.] (MINOR in "Production and Industrial Engineering")
Name of Teacher:

Course Objectives:
This course enables the students to:

1	Learn about the gating system design, riser design and product design for casting
2	Understand the mechanisms of different bulk forming and sheet metal forming techniques
3	Understand the mechanics of orthogonal and oblique cutting including process mechanics of different machining processes
4	Understand the principles of fusion welding, solid state welding and solid-liquid state welding
5	Learn about the mechanism of material removal, process parameters and applications of different modern machining processes

Course Outcomes:
After the completion of this course, students will able to:

CO1	Design a suitable sand-casting process for given component. Also select appropriate casting for a given component
CO2	Derive the mathematical relationship between the cutting forces and understand the mechanics of metal cutting.
CO3	Select appropriate machine tool for a particular machining process
CO4	Select appropriate welding process for a given joint
CO5	Select appropriate forming process for a given product

SYLLABUS

Module 1: Casting Processes **[10]**

Introduction to foundry process and its importance; Sand casting: patterns, pattern allowances, moulding sand, gating system design and riser design. Other casting processes: centrifugal casting, hot chamber and cold chamber die casting, investment casting; Casting defects and their remedies.

Module 2: Theory of Metal Cutting **[10]**

Geometry of single point cutting tool; Introduction to orthogonal cutting; Tool forces in orthogonal cutting; Types of chips; Tool failure and tool life, Machinability, Cutting tool materials.

Module 3: Machine Tools **[10]**

Construction, operations and specifications of lathe and shaper; Construction, operations and specifications of milling & drilling machine; Introduction to grinding and types of grinding processes.

Module 4: Welding Processes **[10]**

Principle, working and application of oxy-acetylene gas welding; Electric arc welding: Power source, electrode coating, MMAW/SMAW, SAW, GTAW and GMAW, Resistance welding; Soldering and Brazing.

Module 5: Metal Deformation Processes **[10]**

Metal forming processes: Introduction to recovery, recrystallization, and grain growth; Hot working and cold working.
Rolling: Classification of rolling processes, types of rolling mills, products of rolling.
Forging: Open and closed die forging.
Extrusion: Classification of extrusion processes, hot and cold extrusion processes
Sheet metal forming operations: Blanking and piercing, deep drawing, bending.

Text books:

1. Serope Kalpakjian and Steven Schmidt, Manufacturing Processes for Engineering Materials, Pearson Education, 6th Edition
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Material. Processes, and systems, 2nd Edition, Wiley India, 2007
3. P.N. Rao, Manufacturing Technology – Metal Cutting and Machine Tools, McGraw Hill.
4. P.N. Rao, Manufacturing Technology, Foundry, Forming and Welding, McGraw Hill
5. Hajra Choudhury, Elements of Workshop Technology--Vol.-II, Media Promoters and Publishers

Reference books:

1. T. Childs, K. Maekawa, T. Obikawa, Y. Yamane, Metal Machining: Theory and Applications, Arnold.**[R1]**
2. P.K. Mishra, Nonconventional Machining, Narosa Publishing House Pvt. Ltd.**[R2]**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Process modelling of casting, forming, machining and joining. Advanced studies on non-conventional machining and additive manufacturing.

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POs met through Topics beyond syllabus/Advanced topics/Design:
POs 1-5, 12

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√			
Quiz 1	√	√			
Quiz 2			√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –
1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	3	1					1		3	3	3	3
CO2	3	3	3	2	1					1		3	3	3	3
CO3	3	3	3	3	1							3	3	2	3
CO4	3	3	3	2	1							3	3	2	3
CO5	3	3	3	3	1							3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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Mapping Between Course Outcomes (Cos) and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD6
CO2	CD1, CD2, CD6
CO3	CD1, CD2, CD6
CO4	CD1, CD2, CD6
CO5	CD1, CD2, CD6

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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COURSE INFORMATION SHEET

Course code: PE 343
Course title: MODERN MANUFACTURING PROCESSES
Pre-requisite(s): PE213 MANUFACTURING PROCESSES
Co- requisite(s):
Credits: 4 L:4 T: P:
Class schedule per week: 4
Class: B. Tech
Semester / Level: V / Third
Branch: Mechanical Engineering (Minor in Production and Industrial Engineering)
Name of Teacher:

Course Objectives:
This course enables the students to:

1	Learn about the basic construction of the different non-conventional machines, and about the tools, equipment and consumable required
2	Understand the effects of different process parameters on part quality, and how the parameters are to be controlled
3	Learn about the fundamental principles, process parameters and application possibilities of different advanced welding processes
4	Understand importance of additive manufacturing in advance manufacturing process
5	Acquire knowledge, techniques, and skills to select relevant additive manufacturing process.

Course Outcomes:
After the completion of this course, students will able to:

CO1	Explain the fundamental principles, techniques, equipment, applications, advantages and limitations of different non-conventional machining processes.
CO2	Find solutions for meeting demand of machining hard-to-machine materials, producing complex shape and size with greater product accuracy and surface finish
CO3	Compare the fundamental principles, equipment, parameters and applications of different advanced welding processes
CO4	Analyse and select suitable process and materials used in Additive Manufacturing
CO5	Identify, analyse and solve problems related to Additive Manufacturing

SYLLABUS

Module 1: Non-conventional machining processes - I **[10]**
Non-conventional Machining Processes: Need and Classification; Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics of Abrasive Jet Machining (AJM), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM), and Electrochemical Machining (ECM)

Module 2: Non-conventional machining processes - II **[10]**

Fundamental principles, application possibilities, process parameters, schematic layout of machine and operational characteristics of Electro Discharge Machining (EDM) and Wire Electro Discharge Machining (WEDM), Laser Beam Machining (LBM), Electron Beam Machining (EBM), and Plasma Arc Machining (PAM)

Module 3: Advanced welding processes **[12]**

Fundamental principles, process parameters, machines and equipment, and application possibilities of cold welding, diffusion welding, forge welding, friction and inertia welding, explosive welding, and ultrasonic welding; Fundamental principles, process parameters, machines and equipment, and application possibilities of electron beam welding and laser beam welding; Laser arc hybrid welding

Module 4: Additive manufacturing processes – I **[8]**

Overview, fundamental principle, need and advantages of additive manufacturing; Procedure of product development in additive manufacturing; Classification of additive manufacturing processes; Materials used in additive manufacturing; Challenges in Additive Manufacturing

Module 5: Additive manufacturing processes – II **[10]**

Additive manufacturing processes: Stereo-lithography apparatus (SLA), Fused deposition modeling (FDM), Laminated object manufacturing (LOM), Selective deposition lamination (SDL), Ultrasonic consolidation, Selective laser sintering (SLS), Laser engineered net shaping (LENS), Electron beam free form fabrication (EBFFF), Electron beam melting (EBM), Plasma transferred arc additive manufacturing (PTAAM), Tungsten inert gas additive manufacturing (TIGAM), Metal inert gas additive manufacturing (MIGAM).

Text books:

1. P. C. Pandey and H. S. Shan, Modern Machining Processes, Tata McGraw-Hill **[T1]**
2. P. K. Mishra, Non-conventional Machining, Narosa Publishing House **[T2]**
3. H.B. Cary and S.C. Helzer, Modern Welding Technology, Pearson/Prentice Hall. **[T3]**
4. Gibson, I, Rosen, D W., and Stucker,B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer **[T4]**

Reference books:

1. Ghosh and A.K. Mallik, Manufacturing Science, Affiliated East- West Press **[R1]**
2. M P. Groover, Fundamentals of Modern Manufacturing, John Wiley & Sons, Inc. **[R2]**
3. R.S. Parmar, Welding Process and Technology, Khanna Publishers **[R3]**
4. C. K. Chua, K. F. Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, World Scientific Publishers **[R4]**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√	√		
Quiz 1	√	√	√		
Quiz 2	√	√	√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2								3	3	2	3
CO2	3	3	3	2								3	3	2	3
CO3	3	3	3	2								3	3	2	3
CO4	3	3	3	2								3	3	2	3
CO5	3	3	3	2								3	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
Revised and approved in Meeting of Board of Studies, dated 21/06/2021

Mapping Between Course Outcomes (Cos) and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD6
CO2	CD1, CD2, CD6
CO3	CD1, CD2, CD6
CO4	CD1, CD2, CD6
CO5	CD1, CD2, CD6

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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COURSE INFORMATION SHEET

Course code: PE 344
Course title: MECHANICAL MEASUREMENT & QUALITY CONTROL
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 L:4 T: P:
Class schedule per week: 4
Class: B. Tech
Semester / Level: VI/Third
Branch: All (Minor in Production and Industrial Engineering)
Name of Teacher:

Course Objectives:
This course enables the students to:

1	Understand and analyse different measurement systems, Standards of Measurement, Measurement Errors
2	Know about Limits, Fits, tolerance and gauges used in measurement and designing aspects for those
3	Understand the philosophy of quality improvement and use of statistics in quality control.
4	Understand and use various control charts for attributes and variables.
5	Learn the concept of process capability analysis.
6	Understand the concept of acceptance sampling, OC curves and preparation of acceptance sampling plans for attributes.

Course Outcomes:
After the completion of this course, students will able to:

CO1.	Distinguish between accuracy and precision, identify different measurement errors, able to select linear or angular measuring instrument for measurement of various components
CO2.	Design limit gauges used for various components and purposes
CO3.	Understand the philosophy of quality improvement, basic concept of statistical quality control, TQM and six sigma.
CO4.	Demonstrate the ability to design, use, and interpret control charts and perform analysis of process capability.
CO5	Prepare and analyse sampling plans for attributes

SYLLABUS

Module – I: Introduction to metrology **[10]**

Historical development, Basics of Metrology, Need for Inspection, Accuracy and Precision, Standards of measurements, system of measurement, line, end & wavelength standards, type and source of measurement errors.

Linear metrology: Steel rule, callipers, Vernier calliper, Vernier height gauge, Vernier depth gauge, micrometres, universal calliper. Miscellaneous measurements: Taper measurement, angle measurement, radius measurement, sine bar & Angle gauges.

Module – 2: Limits, fits and gauges **[10]**

Interchangeable manufacture, selective assembly, concept of limits, fits and tolerances, Types of fit, Basic-Hole System, Basic-Shaft System, Problems, Tolerance grades, Metric fits, Indian standard system, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials, Considerations of gauge design, Taylor's principle of gauging, Wear allowance on gauges.

Module 3: Introduction to quality control **[10]**

Introduction to Quality Control, Cost of Quality, Quality Circle, Concept of TQM and Six Sigma.

Statistical Quality Control, Graphical and Analytical Methods for Central Tendency and Dispersion.

Module 4: Control charts for variables and attributes **[10]**

General Theory of Control Charts, Theory and Application of Control Charts for Averages, Range, Standard Deviation, Fraction Defective and Number of Defects, Process Capability Study, Interpretation of Control Chart

Module 5: Acceptance sampling plans **[10]**

Elementary Concepts of Acceptance Sampling by Attributes, Concept and Characteristics of O.C. Curves, Single, Double and Multiple Sampling Plans, Construction and Use of O.C. Curves for Sampling Plans, MIL – STD Plans, Sequential Sampling Plan.

Text Books:

1. Introduction to Statistical Quality Control, Douglas C. Montgomery, Wiley [T1]
2. Fundamentals of quality control and improvement, A Mitra, Wiley [T2]
3. Total Quality Management, D.H. Besterfield, Prentice HallStatistical, [T3]
4. Quality control, M. Mahajan, Dhanpat Rai & Sons, [T4]
5. R.K. Jain, Engineering Metrology Khanna Publications, New Delhi (T5)
6. I. C. Gupta, A Text book of Engineering Metrology, Dhanpat Rai, New Delhi **(T6)**

Reference books:

1. Manufacturing Excellence in Global Markets, W. Euershelm [R1]
2. Manufacturing Systems Design & Analysis, B. Wa. [R2]
3. Computer Automation in Manufacturing, T.O.Boucher [R3]
4. Intelligent Manufacturing Planning, P. Gu. [R4]
5. K. J. Hume, Engineering Metrology **(R5)**

Gaps in the syllabus (to meet Industry/Profession requirements):

Sampling plan for variables

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	√
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√	√		
Quiz 1	√	√	√		
Quiz 2			√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

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Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3		1					1	1	3	1	3	2
CO2	3	2	1		2					1	2	2	1	3	3
CO3	3	3	3		2		1			1	1	3	2	2	2
CO4	3	2	1				1	1		1	2	2	1	3	3
CO5	3	2	1							1	2	2	1	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between Course Outcomes (Cos) and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6
CO2	CD1, CD2, CD3, CD6
CO3	CD1, CD2, CD3, CD6
CO4	CD1, CD2, CD3, CD6
CO5	CD1, CD2, CD3, CD6

COURSE INFORMATION SHEET

Course code: PE 304
Course title: PRODUCTION AND OPERATIONS MANAGEMENT
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 L:4 T: P:
Class schedule per week: 4
Class: B. Tech
Semester / Level: VII / Third
Branch: All (MINOR in "Production and Industrial Engineering")
Name of Teacher:

Course Objectives:
This course enables the students:

1	To introduce to various inherent concepts of production systems, planning and control systems of Manufacturing Industry.
2	To introduce of forecasting models, Product mix and aggregate planning.
3	To make routine process, scheduling process and identify different strategies employed in manufacturing industries to production planning.
4	To give basic concept of inventory control and its technique, EOQ, ABC analysis.
5	To know Facility design process and its all component.

Course Outcomes:
After the completion of this course, students will:

CO1	Able to understand the functions of production system its planning and control.
CO2	Able to make demand forecasts in the manufacturing sectors using selected quantitative and qualitative techniques.
CO3	Able to explain the importance and function of pre planning and post planning of production system.
CO4	Able to solve inventory problems and to be able to apply selected techniques for its control and management under dependent and independent circumstances.
CO5	Understand plant layout, building layout and location theory.

SYLLABUS

Module 1: Introduction to production and operation management **[8]**
Difference between manufacturing and service operations, Objectives and functions of production and operation management, historical evolution of production and operations management. type of Production systems and their characteristics, selection of a production system, concept of productivity.

Module 2: Preplanning **[10]**
Demand forecasting, common techniques of demand forecasting, Capacity management, aggregate planning and master scheduling.

Module 3: Production Planning **[10]**

Routing, loading and scheduling with their different techniques, dispatching, Progress Report, Expediting and corrective measures.

Module 4: Inventory Control **[10]**

Field and scope of inventory control, inventory types and classification, Inventory control models, static model, dynamic model both deterministic and stochastic, Economic lot size, reorder point and their application, ABC analysis, VED analysis, modern practices in purchasing and store Management.

Module 5: Facility design **[12]**

Facility design problems and their analysis.
Facility location- Need of location, Factors affecting the location and site selection, multi-plant location, location theories and models.
Facility layout- Objectives, principles and classification of layouts; Factors affecting plant layout; models of product layout, process layout and service layout.

Text books:

1. Production & Operations management, Jay Heizer and Barry Render, Prentice Hall **[T1]**
2. William J. Stevenson, Operations Management, McGraw-Hill, 13th edition **[T2]**
3. S. N. Chary, Production and operations management, Tata McGraw-Hill Education, 5th Edition **[T3].**
4. P K Gupta, D.S Hira, Operations Research, S chand 7th edition **[T4]**

Reference books:

1. R. Panneerselvam, Production and operations management, PHI Learning Pvt. Ltd **[R1]**
2. Richard B. Chase, Nicholas J. Aquilano, Production & Operations Management: Manufacturing and Services, Publisher: Richard D Irwin; 7th edition **[R2]**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:
Logistics and supply chain management, Inventory model design

POs met through Topics beyond syllabus/Advanced topics/Design:
POs 1 -4, 9, 11, 12

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	√
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√			
Quiz 1	√	√			
Quiz 2			√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CO1	3	3	3	2	2		1		1	2	3	3	3	2	3
CO2	3	3	1	2	2		1		1	2	3	2	3	2	3
CO3	3	3	3	2	2		1		1	2	2	3	3	2	3
CO4	3	3	1	2	2		1		1	2	2	2	3	2	3
CO5	3	3	1	3	2		1		1	2	2	2	3	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Mapping Between Course Outcomes (Cos) and Course Delivery Method

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3, CD6
CO2	CD1, CD2, CD3, CD6
CO3	CD1, CD2, CD3, CD6
CO4	CD1, CD2, CD3, CD6
CO5	CD1, CD2, CD3, CD6

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
Revised and approved in Meeting of Board of Studies, dated 21/06/2021

COURSE INFORMATION SHEET

Course code: PE 416
Course title: LOGISTICS AND SUPPLY CHAIN MANAGEMENT
Pre-requisite(s): None
Co- requisite(s): None
Credits: 4 L: 4 T: P:
Class schedule per week: 4
Class: B. Tech
Semester / Level: VII /Fourth
Branch: All (MINOR in "Production and Industrial Engineering")
Name of Teacher:

Course Objectives:
This course enables the students to:

1	Provide an insight on the fundamentals of supply chain strategy
2	Know the various distribution and transportation networks and their applications
3	Acquire the concepts of logistics in improving the supply chain and other functional areas of an organization
4	Understand the role of sourcing, information technology, and coordination in a supply chain
5	Know the recent trends in supply chain management

Course Outcomes:
After the completion of this course, students will able to:

CO1	Define the goal of a supply chain and analyse the impact of supply chain decisions on the success of a firm
CO2	Develop a framework for making supply chain network design decisions
CO3	Apply logistics concepts to improve supply chain operations.
CO4	Evaluate and select the best supplier for a firm or organisation
CO5	Discuss the recent trends in supply chain management

SYLLABUS

Module 1: Introduction to Supply Chain Management **[10]**
Understanding the supply chain, Supply Chain Performance- Achieving strategic fit and scope, key issues, Supply chain modelling, Supply Chain Drivers and Metrics, Centralized vs. decentralized systems, Digital Supply Chain Transformation

Module 2: Designing the Supply Chain Network **[10]**
Distribution Networks– Design options for a distribution network, e-Business and the distribution network, Network design in an uncertain environment. Transportation Networks- Design options for a transportation network, Trade-offs in transportation design, Vehicle

routing and scheduling, Supply Chain Optimization, Manufacturing Systems and Supply Chain Design, Supply chain risk pooling: centralization, postponement, Omni channel

Module 3: Logistics Management **[10]**

Logistics Management: Logistical operation, integration, network design, logistical performance cycle, customer service global logistics, logistical resources, logistics planning, Third- and fourth-party logistics providers, Measuring logistics costs and performance, e-logistics, Reverse logistics.

Module 4: Managing Cross-Functional Drivers in a Supply Chain **[10]**

Sourcing Decisions- Make or buy decisions, Sourcing Processes. Information Technology in a Supply Chain, Supply chain 4.0, Coordination in a Supply Chain-Bullwhip effect, Data Analysis for Supply Chain Management, Supply chain strategy: achieving strategic fit, dual sourcing; network design

Module 5: Recent Trends in Supply Chain Management **[10]**

Lean Supply Management, Agile Supply Management, Green and Sustainable Practices of Supply Chain, Supply Chain Digitization, Circular Supply Chains, Global supply chain: buy-sell, turnkey, transfer price, Supply chain cases.

Text Book

1. Chopra, S., and Meindl, P. "Supply Chain Management, strategy, planning, and operation" 6/e – PHI, second edition, 2014. **[T1]**
2. Christopher, M., "Logistics and Supply Chain Management", Pearson Education Asia, New Delhi. **[T2]**

Reference Book

1. Taylor and Brunt, "Manufacturing Operations and Supply Chain Management (The Lean Approach)", Business Press Thomson Learning, NY. **[R1]**
2. Arjan J. Van Weele, "Purchasing and Supply Chain Management (Analysis Planning and Practice)", Engineering, Business Press, Thomson Learning NY. **[R2]**
3. Shah, J. "Supply Chain Management, text and cases", Pearson Education South Asia,2009. **[R3]**
4. Balkan Cetinkaya, Richard Cuthbertson, Graham Ewer, "Sustainable Supply Chain Management: Practical ideas for moving towards best practice", Springer, 2011. **[R4]**
5. Sople, V.V "Supply Chain Management, text and cases", Pearson Education South Asia, 2012. **[R5]**
6. Donald B., "Logistic Management - The Integrated Supply Chain process", McGraw Hill. **[R6]**

Gaps in the syllabus (to meet Industry/Profession requirements):

POs met through Gaps in the Syllabus:

Topics beyond syllabus/Advanced topics/Design:

Mathematical Modelling of Supply Chain

Application of meta-heuristics for supply chain optimization

Introduced and approved in Meeting of Board of Studies, dated 23/04/2018

Revised and approved in Meeting of Board of Studies, dated 21/06/2021

POs met through Topics beyond syllabus/Advanced topics/Design:

Course Delivery Methods:

CD1	Lecture by use of boards/LCD projectors/OHP projectors	√
CD2	Assignments/Seminars	√
CD3	Laboratory experiments/teaching aids	
CD4	Industrial/guest lectures	
CD5	Industrial visits/in-plant training	
CD6	Self- learning such as use of NPTEL materials and internets	√
CD7	Simulation	

Course Evaluation:

Direct Assessment-

Assessment Tool	% Contribution during CO Assessment
Progressive Evaluation	50
End Semester Examination	50

Progressive Evaluation	% Distribution
Mid Semester Examination	25
Quizzes	10 + 10
Assignment	5
End Semester Examination	**% Distribution**
End Semester Examination	50

Assessment Components	CO1	CO2	CO3	CO4	CO5
Mid Semester Examination	√	√	√		
Quiz 1	√	√			
Quiz 2			√	√	√
Assignment	√	√	√	√	√
End Semester Examination	√	√	√	√	√

Indirect Assessment –

1. Student Feedback on Faculty
2. Student Feedback on Course Outcome

Mapping of Course Outcomes (Cos) onto Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs		
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CO1	2	2	2	2	2	3	2	2	2	1	3	1	3	3	3
CO2	2	2	2	2	2	3	2	2	2	1	3	1	3	3	3
CO3	2	2	3	2	3	3	2	2	2	1	3	2	3	3	3
CO4	2	2	3	2	3	3	3	2	1	1	3	2	3	3	3
CO5	2	2	3	2	3	3	3	2	1	1	3	1	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Course Outcomes	Course Delivery Method
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Introduced and approved in Meeting of Board of Studies, dated 23/04/2018
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