

BIRLA INSTITUTE OF TECHNOLOGY



CHOICE BASED CREDIT SYSTEM (CBCS) CURRICULUM

(NEW COURSE STRUCTURE - Effective from Academic Session 2021-22)

B.TECH IN PRODUCTION AND INDUSTRIAL ENGINEERING

PRODUCTION AND INDUSTRIAL ENGINEERING DEPARTMENT

INSTITUTE VISION

- ❖ To become a Globally Recognized Academic Institution in consonance with the social, economic, and ecological environment, striving continuously for excellence in education, research, and technological service to the National needs.

INSTITUTE MISSION

- ❖ To educate students at Undergraduate, Postgraduate, Doctoral, and Post-doctoral levels to perform challenging engineering and managerial jobs in industry.
- ❖ To provide excellent research and development facilities to take up Ph.D. programs and research projects.
- ❖ To develop effective teaching learning skills and state of art research potential of the faculty.
- ❖ To build national capabilities in technology, education, and research in emerging areas.
- ❖ To provide excellent technological services to satisfy the requirements of the industry and overall academic needs of society.

DEPARTMENT VISION:

- ❖ To become a Centre of Repute striving continuously towards providing Quality Education, Research and Innovation in the field of Production and Industrial Engineering

DEPARTMENT MISSION

- ❖ To provide quality education at both Undergraduate and Postgraduate levels
- ❖ To provide opportunities and facilities for research and innovation in Production and Industrial Engineering
- ❖ To produce industry-ready graduates to meet the demands of manufacturing industries, knowledge-based software firms, supply chain and logistic firms, and R&D organizations
- ❖ To integrate skills on state-of-the-art manufacturing technology with industrial engineering and operations management
- ❖ To impart latest knowledge in the domain area to students by continuous up-gradation of curricula and faculty

GRADUATE ATTRIBUTES

1. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems** using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Teamwork:** Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- ✓ **PEO 1:** Developing capability for continuous learning and problem identification in the field of Production and Industrial Engineering
- ✓ **PEO 2:** To be more explorative in finding state-of-art solutions and implementations for complex real-life problems
- ✓ **PEO 3:** Inculcating managerial aptitude for communication, problem solving and decision making
- ✓ **PEO 4:** To enhance inter-personal skill, team spirit and employability while believing on the ethical values
- ✓ **PEO 5:** To develop a strong foundation for building an engineering career with societal and humanitarian responsibility

(A) PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(B) PROGRAM SPECIFIC OUTCOMES (PSO)

13. **PSO 1:** To empower with comprehensive knowledge in the wide domain of sciences of manufacturing, technologies for present and future industries, industrial engineering and operations management while emphasizing professional ethics and societal responsibility to face the evolution in industry.
14. **PSO 2:** To develop expertise in solving complex technical, industrial engineering or managerial problems related to industries through innovative solutions using technological skills, analytical aptitude, communication flair and team spirit.
15. **PSO 3:** Enable to apply the attained theoretical and practical knowledge to solve the industrial and societal problems in the broad areas of production and industrial engineering.

COURSE STRUCTURE

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING								
Course Structure - Based on CBCS system & OBE model								
Recommended scheme of study								
(B. TECH in PRODUCTION AND INDUSTRIAL ENGINEERING)								
Semester/ Session of Study (Recommended)	Category of Course	Course Code	Courses	Mode of delivery & credits <i>L-Lecture; T-Tutorial; P-Practicals</i>			Total Credits C- Credits	
				L (Periods/ week)	T (Periods/ week)	P (Periods/ week)	C	
THEORY								
FIRST Monsoon	FS Foundation Sciences	MA103	Mathematics - I	3	1	0	4	
		PH113	Physics	3	1	0	4	
		BE101	Biological Science for Engineers	2	0	0	2	
	GE General Engineering	EE101	Basic Electrical Engineering	3	1	0	4	
		CS101	Programming for Problem Solving	3	1	0	4	
	LABORATORIES							
	HSS Humanities & Social Sci.	MT 132	Communication Skills – I	0	0	3	1.5	
	FS	PH114	Physics Lab	0	0	3	1.5	
	GE	CS102	Programming for Problem Solving Lab	0	0	3	1.5	
		PE101	Workshop Practice	0	0	3	1.5	
MC Mandatory Course	MC101/102/103/ 104	Choice of: NCC/NSS/PT & Games/ Creative Arts (CA)	0	0	2	1		
TOTAL							25	
THEORY								
SECOND Spring	FS	MA107	Mathematics - II	3	1	0	4	
		CH101	Chemistry	3	1	0	4	
	MC	CE101	Environmental Science	2	0	0	2	
	GE	ME101	Basics of Mechanical Engineering	3	1	0	4	
		EC101	Basics of Electronics & Communication Engineering	3	1	0	4	
	LABORATORIES							
	FS	CH102	Chemistry Lab	0	0	3	1.5	
	GE	EC102	Electronics & Communication Lab	0	0	3	1.5	
		ME102	Engineering Graphics	0	0	4	2	
MC	MC105/106/107/ 108	Choice of: NCC/NSS/PT & Games/ Creative Arts (CA)	0	0	2	1		
TOTAL							24	
GRAND TOTAL FOR FIRST YEAR							49	

Introduced and Approved in Meetings of Board of Studies, dated 23/03/2021, and 21/06/2021;
Revised and Approved in Meeting of Board of Studies, dated 15/02/2022.

THIRD Monsoon	THEORY						
	FS	MA203	Numerical Methods	2	0	0	2
	HSS	MT131	UHV2: Understanding Harmony	3	0	0	3
	PC Program Core	PE203	Operations Research	3	0	0	3
		PE214	Metallurgical and Materials Engineering	3	0	0	3
		ME205	Strength of Materials	3	1	0	4
		ME289	Thermal and Fluid Engineering	3	0	0	3
	LABORATORIES						
	FS	MA204	Numerical Methods Lab	0	0	2	1
	PC	PE215	Metallurgical and Materials Engineering Lab	0	0	3	1.5
ME204		Mechanical Engineering Lab - I	0	0	3	1.5	
MC	MC201/202/ 203/204	Choice of: NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1	
TOTAL							23
FOURTH Spring	THEORY						
	PC	ME207	Kinematics and Dynamics of Machines	3	0	0	3
		PE216	Foundry, Forming and Welding Technologies	3	0	0	3
		PE218	Production and Operations Management	4	0	0	4
		PE219	Project Engineering	3	0	0	3
	PE Program Elective		Program Elective - I	3	0	0	3
	OE Open Elective		Open Elective - I / MOOC - I	3	0	0	3
	LABORATORIES						
	GE	EE102	Electrical Engineering Lab	0	0	3	1.5
	PC	PE217	Foundry, Forming and Welding Lab	0	0	3	1.5
PE225		Modeling and Simulation Lab	0	0	2	1	
MC	MC205/206/ 207/208	Choice of: NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1	
TOTAL							24
FIFTH Monsoon	THEORY						
	PC	PE326	Metrology & Statistical Quality Control	3	0	0	3
		PE328	Design of Machine Elements	3	0	0	3
		PE329	Machining Science and Machine Tools	3	0	0	3
	PE		Program Elective - II	3	0	0	3
			Program Elective - III	3	0	0	3
	OE		Open Elective - II / MOOC - II	3	0	0	3
	LABORATORIES						
	HSS	MT133	Communication Skills – II	0	0	3	1.5
	PC	PE327	Metrology and Measurement Lab	0	0	3	1.5
PE330		Machine Tools Lab	0	0	3	1.5	
PE331		Machine Drawing and CAD Lab	0	0	3	1.5	
TOTAL							24

SIXTH Spring	THEORY						
	PC	PE334	Machine Tool Design	3	0	0	3
		PE338	Production Economics and Financial Management	3	0	0	3
		PE345	Work System Design	3	0	0	3
	PE		Program Elective - IV	3	0	0	3
			Program Elective - V	3	0	0	3
	OE		Open Elective - III / MOOC - III	3	0	0	3
	LABORATORIES						
	PC	PE335	Machine Tool Design Sessional	0	0	2	1
		PE346	Work Study and Ergonomics Lab	0	0	2	1
PROFESSIONAL TRAINING							
PROJ Project	MC300	Summer Internship	NA	NA	NA	2	
TOTAL						22	
THEORY							
SEVENTH Monsoon	PC	PE401	Computer Integrated Manufacturing & Cyber-Physical Systems	3	0	0	3
		PE411	Supply Chain Management	3	0	0	3
	PE		Program Elective - VI	3	0	0	3
	OE		Open Elective - IV / MOOC - IV	3	0	0	3
	MC	MT204	Constitution of India	2	0	0	NC
	LABORATORIES						
	PC	PE410	Manufacturing Automation Lab	0	0	2	1
	PROJECT						
PROJ	PE400M	Minor Project				3	
TOTAL						16	
EIGHTH Spring	PROJ	PE400	Research Project / Industrial Internship	Total			10
GRAND TOTAL <i>Minimum requirement for Degree award</i>						168	

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING								
PROGRAM ELECTIVES (PE)**								
Semester/ Session of Study (Recommended)		Course Code	Name of the PE Courses	Prerequisite Courses	L	T	P	C
FOURTH Spring	PE - I (Any one)	PE210	Reliability and Maintenance Engineering	None	3	0	0	3
		PE220	Industrial Statistics	None	3	0	0	3
		PE221	Quantitative Techniques	None	3	0	0	3
		PE222	Discrete-event System Simulation	None	3	0	0	3
FIFTH Monsoon	PE - II (Any one)	PE306	Advanced Operations Research	Operations Research	3	0	0	3
		PE307	Competitive Manufacturing Strategies	None	3	0	0	3
		PE317	Advanced Welding Technology	Metallurgical and Materials Engineering; Foundry, Forming & Welding Technologies	3	0	0	3
		ME351	Finite Element Methods	Mathematics; Strength of Materials	3	0	0	3
	PE - III (Any one)	PE318	Rapid Prototyping and Tooling	None	3	0	0	3
		PE319	Material Deformation Processes	Strength of Materials; Foundry, Forming & Welding Technologies	3	0	0	3
		PE322	Circular Economy-Sustainable Materials Management	None	3	0	0	3
ME377	Mechatronics	None	3	0	0	3		
SIXTH Spring	PE - IV (Any one)	PE323	Product Design and Manufacturing	Foundry, Forming & Welding Technologies	3	0	0	3
		PE324	Surface Engineering and Laser Additive Manufacturing	None	3	0	0	3
		PE333	Tribology in Engineering	Foundry, Forming & Welding Technologies	3	0	0	3
		PE336	Tooling for Manufacturing	Foundry, Forming & Welding Technologies; Machining Science and Machine Tools	3	0	0	3
	PE - V (Any one)	PE337	Manufacturing Science	Foundry, Forming & Welding Technologies; Machining Science and Machine Tools	3	0	0	3
		PE348	Engineering Optimization	None	3	0	0	3
		PE349	Lean Manufacturing & Six-sigma	None	3	0	0	3
		PE350	Material Handling Systems	None	3	0	0	3
SEVENTH Monsoon	PE - VI (Any one)	PE406	Non-conventional Machining Processes	Machining Science and Machine Tools	3	0	0	3
		PE407	Advanced Manufacturing Processes	Foundry, Forming & Welding Technologies; Machining Science and Machine Tools	3	0	0	3
		PE412	Experimental Methods and Measurements	Metallurgical and Materials Engineering;	3	0	0	3
		PE413	AI and Data Analytics	None	3	0	0	3

****PROGRAM ELECTIVES TO BE OPTED ONLY BY THE B. TECH IN PRODUCTION AND INDUSTRIAL ENGINEERING**

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING OPEN ELECTIVES (OE)*							
Semester / Session of Study (Recommended)	Course Code	Name of the OE Courses	Prerequisites Courses	L	T	P	C
FOURTH/ Spring	PE209	Engineering Economy, Costing and Accounting	None	3	0	0	3
	PE227	Engineering Materials	None	3	0	0	3
FIFTH / Monsoon	PE309	Project Management	None	3	0	0	3
	PE315	Work Study & Ergonomics	None	3	0	0	3
SIXTH / Spring	PE332	Operation Research with Python	None	3	0	0	3
	PE347	Additive Manufacturing	None	3	0	0	3
SEVENTH / Monsoon	PE414	Automated Manufacturing Systems	None	3	0	0	3
	PE417	Production Management	None	3	0	0	3

*** OPEN ELECTIVES TO BE OFFERED ONLY TO THE STUDENTS OF OTHER DEPARTMENT.**

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING
IN-DEPTH SPECIALISATION in "Advanced Manufacturing and Production Management"
(OFFERED ONLY TO THE B. TECH IN PRODUCTION AND INDUSTRIAL ENGINEERING STUDENTS)

Students who have registered for DEPARTMENTAL SPECIALISATION (in-depth) in "Advanced Manufacturing and Production Management" 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)	Category of Course	Course Code	Course Name	Mode of delivery & credits <i>L-Lecture; T-Tutorial; P-Practicals</i>			Total Credits <i>C- Credits</i>
				L <i>(Periods/week)</i>	T <i>(Periods/week)</i>	P <i>(Periods/week)</i>	C
FIFTH / Monsoon	THEORY						
	PC	PE339	Material Characterizations and Non-destructive Testing	4	0	0	4
		PE340	Sustainable Manufacturing Technologies	4	0	0	4
TOTAL							8
SIXTH / Spring	THEORY						
	PE (any one)	PE310	Industrial Robotics	4	0	0	4
		PE341	Processing of Polymers, Composite and Advanced Materials	4	0	0	4
		PE342	Manufacturing Management and Cost Optimization	4	0	0	4
TOTAL							4
SEVENTH / Monsoon	THEORY						
	PE (any one)	PE409	Finite Elements in Manufacturing Engineering Applications	4	0	0	4
		PE415	Micro and Nano Manufacturing	4	0	0	4
	PROJECT						
	PC	PE450	Applications-based Project				
TOTAL							8
GRAND TOTAL							20

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

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)	Category of course	Course Code	Course Name	Prerequisite courses	Mode of delivery & credits <i>L-Lecture; T-Tutorial; P- Practicals</i>			Total Credits C- Credits	
					L (Periods /week)	T (Periods /week)	P (Period s/week)	C	
FIFTH / Monsoon	THEORY								
	PC	PE223	Operation Research and Quantitative Techniques	None	4	0	0	4	
	PE (any one)	PE224	Manufacturing Science and Technologies	None	4	0	0	4	
		Only for other than Mechanical Engg. Department students							
		PE343	Modern Manufacturing Processes	Manufacturing Processes	4	0	0	4	
Only for Mechanical Engg. Department students									
TOTAL								8	
SIXTH / Spring	THEORY								
	PC	PE344	Mechanical Measurement & Quality Control	None	4	0	0	4	
TOTAL								4	
SEVENTH / Monsoon	THEORY								
	PE (any one)	PE218	Production and Operations Management	None	4	0	0	4	
		PE416	Logistics and Supply Chain Management	None	4	0	0	4	
	PROJECT								
PC	PE450	Applications-based Project					4		
TOTAL								8	
GRAND TOTAL								20	