

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 Recognised 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. programmes 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 Team Work:** 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.

PROGRAMME 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) PROGRAMME 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 team work:** 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) PROGRAMME 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.

PROGRAMME 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)	Course Level	Category of Course	Course Code	Courses	Mode of delivery & credits L-Lecture; T-Tutorial; P-Practicals			Total Credits C- Credits	
					L (Periods/ week)	T (Periods/ week)	P (Periods/ week)	C	
	THEORY								
FIRST Monsoon	FIRST	FS Foundation Sciences	MA103	Mathematics - I	3	1	0	4	
			PH113	Physics	3	1	0	4	
			BE101	Biological Sciences	2	0	0	2	
		GE General Engineering	EE101	Basics of Electrical Engineering	3	1	0	4	
			CS101	Programming for Problem Solving	3	1	0	4	
	LABORATORIES								
	FIRST	FS	PH114	Physics Lab	0	0	3	1.5	
		GE	CS102	Programming for Problem Solving Lab	0	0	3	1.5	
		GE	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								23.5
	SECOND Spring	THEORY							
FIRST		FS	MA107	Mathematics - II	3	1	0	4	
			CH101	Chemistry	3	1	0	4	
		MC	CE101	Environmental Sciences	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									
FIRST		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								47.5	

THIRD Monsoon	THEORY							
	SECOND	FS	MA203	Numerical Methods	2	0	0	2
	FIRST	HSS <i>Humanities & Social Sci.</i>	MT131	Understanding Harmony	3	0	0	3
	SECOND	PC <i>Programme Core</i>	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							
	SECOND	GE	IT202	Basic IT Workshop	0	0	2	1
		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								24
FOURTH Spring	THEORY							
	SECOND	GE	IT201	Basics of Intelligent Computing	3	0	0	3
	FIRST	FS	PE216	Foundry, Forming and Welding Technologies	3	0	0	3
	SECOND	PC	PE218	Metrology & Statistical Quality Control	3	0	0	3
			ME207	Kinematics and Dynamics of Machines	3	0	0	3
		PE <i>Programme Elective</i>		Programme Elective - I	3	0	0	3
		OE <i>Open Elective</i>		Open Elective - I / MOOC - I	3	0	0	3
	LABORATORIES							
	FIRST	GE	EE102	Electrical Engineering Lab	0	0	3	1.5
	SECOND	PC	PE217	Foundry, Forming and Welding Lab	0	0	3	1.5
			PE219	Metrology and Measurement Lab	0	0	3	1.5
		MC	MC205/206/207/208	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1
	TOTAL							
FIFTH Monsoon	THEORY							
	FIRST	HSS	MT123	Business Communications	2	0	2	3
	THIRD	PC	PE304	Production and Operations Management	4	0	0	4
			PE326	Design of Machine Elements	3	0	0	3
			PE327	Machining Science and Machine Tools	3	0	0	3
		PE		Programme Elective - II	3	0	0	3
		OE		Open Elective - II / MOOC - II	3	0	0	3
	LABORATORIES							
	THIRD	PC	PE328	Machine Tools Lab	0	0	3	1.5
			PE329	Machine Drawing and CAD Lab	0	0	3	1.5
TOTAL								22

SIXTH Spring	THEORY							
	THIRD	PC	PE330	Machine Tool Design	3	0	0	3
			PE332	Project Engineering	3	0	0	3
			PE333	Production Economics and Financial Management	3	0	0	3
			PE334	Work System Design	3	0	0	3
	PE		Programme Elective - III	3	0	0	3	
	OE		Open Elective - III / MOOC - III	3	0	0	3	
	LABORATORIES							
	THIRD	PC	PE331	Machine Tool Design Sessional	0	0	3	1.5
			PE335	Work Study and Ergonomics Lab	0	0	3	1.5
PROFESSIONAL TRAINING								
	MC	MC300	Summer Training	NA	NA	NA	3	
TOTAL								24
THEORY								
SEVENTH Monsoon	FOURTH	HSS	PE401	Computer Integrated Manufacturing & Cyber-Physical Systems	3	0	0	3
		PC	PE410	Supply Chain Management	3	0	0	3
		PE		Programme Elective - IV	3	0	0	3
		OE		Open Elective - IV / MOOC - IV	3	0	0	3
	SECOND	MC	MT204	Constitution of India	2	0	0	NIL
	LABORATORIES							
	FOURTH	PC	PE404	Modelling and Simulation Lab	0	0	3	1.5
			PE411	Manufacturing Automation Lab	0	0	3	1.5
TOTAL								15
EIGHTH Spring	FOURTH		PE400	Research Project / Industrial Internship	Total			12
GRAND TOTAL Minimum requirement for Degree award								168

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING PROGRAMME ELECTIVES (PE)**								
LEVEL		Course Code	Name of the PE courses	Prerequisites courses with code	L	T	P	C
SECOND	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	Circular Economy-Sustainable Materials Management	None	3	0	0	3
THIRD	PE - II (Any one)	PE306	Advanced Operations Research	PE 203 Operations Research	3	0	0	3
		PE307	Competitive Manufacturing Strategies	None	3	0	0	3
		PE317	Advanced Welding Technology	PE 214 Metallurgical and Materials Engineering, PE216 Foundry, Forming & Welding Technologies	3	0	0	3
		PE318	Rapid Prototyping and Tooling	None	3	0	0	3
	PE - III (Any one)	PE319	Material Deformation Processes	ME 205 Strength of Materials, PE216 Foundry, Forming & Welding Technologies	3	0	0	3
		PE324	Surface Engineering and Laser Additive Manufacturing	None	3	0	0	3
		PE336	Tooling for Manufacturing	PE216 Foundry, Forming & Welding Technologies, PE327 Machining Science and Machine Tools	3	0	0	3
		PE337	Manufacturing Science	PE216 Foundry, Forming & Welding Technologies, PE327 Machining Science and Machine Tools	3	0	0	3
FOURTH	PE - IV (Any one)	PE406	Non-conventional Machining Processes	PE327 Machining Science and Machine Tools	3	0	0	3
		PE407	Advanced Manufacturing Processes	PE216 Foundry, Forming & Welding Technologies, PE327 Machining Science and Machine Tools	3	0	0	3
		PE412	Material Handling Systems	None	3	0	0	3
		PE413	AI and Data Analytics	IT201 Basics of Intelligent Computing	3	0	0	3

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

DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING OPEN ELECTIVES (OE)*								
Semester / Session of Study (Recommended)	Course Level	Code no.	Name of the OE courses	Prerequisites courses with code	L	T	P	C
FOURTH/ Spring	SECOND	PE209	Engineering Economy, Costing and Accounting	None	3	0	0	3
FIFTH / Monsoon	THIRD	PE315	Work Study & Ergonomics	None	3	0	0	3
SIXTH / Spring	THIRD	PE338	Additive Manufacturing	None	3	0	0	3
SEVENTH / Monsoon	FOURTH	PE414	Automated Manufacturing Systems	None	3	0	0	3

* OPEN ELECTIVES TO BE OFFERED TO THE STUDENTS OF OTHER DEPT.

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 DEPERTMENTAL 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.

Above minimum requirement for degree award:								
Semester/ Session of Study (Recommended)	Course Level	Category of course	Course Code	Courses	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							
	THIRD	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							
	THIRD	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							
	FOURTH	PE (any one)	PE409	Finite Elements in Manufacturing Engineering Applications	4	0	0	4
			PE415	Micro and Nano Manufacturing	4	0	0	4
	PROJECT							
	FOURTH	PC	PE450	Applications-based Project				4
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)	Course Level	Category of course	Course Code	Courses	Prerequisites courses with code	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								
	SECOND	PC	PE223	Operation Research and Quantitative Techniques	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 & 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