

# BIRLA INSTITUTE OF TECHNOLOGY



## CHOICE BASED CREDIT SYSTEM (CBCS) CURRICULUM

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

### B.TECH IN PRODUCTION 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 post graduate 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 (PSOs)**

13. **PSO 1:** To empower with comprehensive knowledge in the wide domain of sciences of manufacturing, technologies for present and future industries 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 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 ENGINEERING)

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 C- Credits	
					L (Periods/ week)	T (Periods/ week)	P (Periods/ week)	C	
<b>THEORY</b>									
FIRST Monsoon	FIRST	FS <i>Foundation Sciences</i>	MA103	Mathematics - I	3	1	0	4	
			PH113	Physics	3	1	0	4	
		GE <i>General Engineering</i>	EE101	Basics of Electrical Engineering	3	1	0	4	
			CS101	Programming for Problem Solving	3	1	0	4	
	<b>LABORATORIES</b>								
	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	
	<b>TOTAL</b>								<b>21.5</b>
<b>THEORY</b>									
SECOND Spring	FIRST	FS	MA107	Mathematics - II	3	1	0	4	
			CH101	Chemistry	3	1	0	4	
		GE	ME101	Basics of Mechanical Engineering	3	1	0	4	
			EC101	Basics of Electronics & Communication Engineering	3	1	0	4	
	<b>LABORATORIES</b>								
	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	
	<b>TOTAL</b>								<b>22</b>
<b>GRAND TOTAL FOR FIRST YEAR</b>								<b>43.5</b>	

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

<b>THIRD Monsoon</b>	<b>THEORY</b>							
	<b>SECOND</b>	<b>FS</b>	MA203	Numerical Methods	2	0	0	2
	<b>FIRST</b>		CE101	Environmental Sciences	2	0	0	2
	<b>FIRST</b>	<b>HSS Humanities &amp; Social Sciences</b>	MT131	Understanding Harmony	3	0	0	3
	<b>SECOND</b>	<b>PC Programme Core</b>	PE214	Metallurgical and Materials Engineering	3	0	0	3
			ME203	Fluid Mechanics and Hydraulic Machines	3	0	0	3
			ME205	Strength of Materials	3	1	0	4
			PE203	Operations Research	3	0	0	3
	<b>LABORATORIES</b>							
	<b>SECOND</b>	<b>GE</b>	IT202	Basic IT Workshop	0	0	2	1
		<b>FS</b>	MA204	Numerical Methods Lab	0	0	2	1
<b>PC</b>		PE215	Metallurgical and Materials Engineering Lab	0	0	3	1.5	
		ME204	Mechanical Engineering Lab - I	0	0	3	1.5	
<b>MC</b>		MC201/202/203/204	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1	
<b>TOTAL</b>								<b>26</b>
<b>FOURTH Spring</b>	<b>THEORY</b>							
	<b>SECOND</b>	<b>GE</b>	IT201	Basics of Intelligent Computing	3	0	0	3
	<b>FIRST</b>	<b>FS</b>	BE101	Biological Sciences for Engineers	2	0	0	2
	<b>SECOND</b>	<b>PC</b>	PE204	Manufacturing Processes - I	3	0	0	3
			ME207	Kinematics and Dynamics of Machines	3	0	0	3
		<b>PE Programme Elective</b>		Programme Elective - I	3	0	0	3
		<b>OE Open Elective</b>		Open Elective – I / MOOC - I	3	0	0	3
	<b>LABORATORIES</b>							
	<b>FIRST</b>	<b>GE</b>	EE102	Electrical Engineering Lab	0	0	3	1.5
	<b>SECOND</b>	<b>PC</b>	PE205	Manufacturing Processes - I Lab	0	0	3	1.5
			PE212	Computer Aided Design and Drafting Lab	0	0	3	1.5
<b>MC</b>		MC205/206/207/208	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA)	0	0	2	1	
<b>TOTAL</b>								<b>22.5</b>
<b>FIFTH Monsoon</b>	<b>THEORY</b>							
	<b>FIRST</b>	<b>HSS</b>	MT123	Business Communications	2	0	2	3
	<b>SECOND</b>	<b>PC</b>	PE206	Metrology & Measurement	3	0	0	3
	<b>THIRD</b>		PE301	Manufacturing Processes - II	3	0	0	3
			PE304	Production & Operations Management	4	0	0	4
			<b>PE</b>		Programme Elective - II	3	0	0
		<b>OE</b>		Open Elective – II / MOOC - II	3	0	0	3
	<b>LABORATORIES</b>							
	<b>SECOND</b>	<b>PC</b>	PE207	Metrology & Measurement Lab	0	0	3	1.5
	<b>THIRD</b>		PE302	Manufacturing Processes - II Lab	0	0	3	1.5
<b>TOTAL</b>								<b>22</b>

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THEORY								
SIXTH Spring	THIRD	PC	PE303	Design of Machine Elements	3	1	0	4
			PE313	Tool Design	3	1	0	4
			PE314	Statistical Quality Control	3	0	0	3
			PE315	Work Study & Ergonomics	3	0	0	3
	PE		Programme Elective - III	3	0	0	3	
	OE		Open Elective – III / MOOC - III	3	0	0	3	
	MC	MC300	Summer Training	NA	NA	NA	3	
LABORATORIES								
THIRD	PC	PE316	Work Study & Ergonomics Lab.	0	0	3	1.5	
		PE325	Modelling and Simulation Lab	0	0	3	1.5	
TOTAL								26
THEORY								
SEVENTH Monsoon	THIRD	PC	PE311	Machine Tool Design	3	1	0	4
			PE402	Automation in Manufacturing	3	0	0	3
	FOURTH	PE		Programme Elective - IV	3	0	0	3
		OE		Open Elective - IV / MOOC-II	3	0	0	3
	SECOND	MC	MT204	Constitution of India	2	0	0	NIL
	LABORATORIES							
THIRD	PC	PE312	Machine Tool Design Sessional	0	0	3	1.5	
		FOURTH	PE403	Automation in Manufacturing Lab	0	0	3	1.5
TOTAL								16
EIGHT Spring	FOURTH		PE400	Research Project / Industrial Internship	Total			12
GRAND TOTAL								168
<i>Minimum requirement for Degree award</i>								

**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	<b>PE - I (Any one)</b> <i>(Industrial Engineering and Management)</i>	PE208	Project Engineering	None	3	0	0	3
		PE209	Engineering Economy, Costing and Accounting	None	3	0	0	3
		PE210	Reliability and Maintenance Engineering	None	3	0	0	3
THIRD	<b>PE - II (Any one)</b> <i>(Industrial Engineering and Management)</i>	PE306	Advanced Operations Research	PE 203 Operations Research	3	0	0	3
		PE307	Competitive Manufacturing Strategies	None	3	0	0	3
		PE308	Logistics and Supply Chain Management	PE 203 Operations Research	3	0	0	3
	<b>PE - III (Any one)</b> <i>(Advanced Manufacturing Technology)</i>	PE317	Advanced Welding Technology	PE 201 Metallurgy, PE 204 Manufacturing Processes - I	3	0	0	3
		PE318	Rapid Prototyping and Tooling	None	3	0	0	3
		PE319	Material Deformation Processes	PE 204 Manufacturing Processes - I, ME 205 Strength of Materials	3	0	0	3
		PE324	Surface Engineering and Laser Additive Manufacturing	None	3	0	0	3
FOURTH	<b>PE - IV (Any one)</b> <i>(Advanced Manufacturing Technology)</i>	PE405	Manufacturing Science	PE 204 Manufacturing Processes - I, PE 301 Manufacturing Processes - II	3	0	0	3
		PE406	Non-conventional Machining Processes	None	3	0	0	3
		PE407	Advanced Manufacturing Processes	PE 204 Manufacturing Processes - I, PE 301 Manufacturing Processes - II	3	0	0	3

**\*\* PROGRAMME ELECTIVES TO BE OPTED ONLY BY THE B.TECH IN PRODUCTION 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
<b>FOURTH / Spring</b>	<b>SECOND</b>	PE211	Engineering Economy	None	3	0	0	3
<b>FIFTH / Monsoon</b>	<b>THIRD</b>	PE309	Project Management	None	3	0	0	3
<b>SIXTH / Spring</b>	<b>THIRD</b>	PE338	Additive Manufacturing	None	3	0	0	3
<b>SEVENTH / Monsoon</b>	<b>FOURTH</b>	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 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)	Course Level	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
FIFTH / Monsoon	<b>THEORY</b>							
	THIRD	PC	PE339	Material Characterizations and Non-destructive Testing	4	0	0	4
			PE340	Sustainable Manufacturing Technologies	4	0	0	4
<b>TOTAL</b>								<b>8</b>
SIXTH / Spring	<b>THEORY</b>							
	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
<b>TOTAL</b>								<b>4</b>
SEVENTH / Monsoon	<b>THEORY</b>							
	FOURTH	PE (any one)	PE409	Finite Elements in Manufacturing Engineering Applications	4	0	0	4
			PE415	Micro and Nano Manufacturing	4	0	0	4
	<b>PROJECT</b>							
FOURTH	PC	PE450	Applications-based Project				4	
<b>TOTAL</b>								<b>8</b>
<b>GRAND TOTAL</b>								<b>20</b>

**DEPARTMENT OF PRODUCTION AND INDUSTRIAL ENGINEERING**  
**MINOR in "Production and Industrial Engineering"**  
**(OFFERED ONLY TO OTHER THAN B.TECH in PRODUCTION 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 C- Credits
						L (Periods/ week)	T (Periods/ week)	P (Periods/ week)	C
<b>FIFTH / Monsoon</b>	<b>THEORY</b>								
	<b>SECOND</b>	<b>PC</b>	PE223	Operation Research and Quantitative Methods	None	4	0	0	4
	<b>SECOND</b>	<b>PE (any one)</b>	PE224	Manufacturing Science and Technologies	None	4	0	0	4
	<b>THIRD</b>		PE343	Modern Manufacturing Processes	PE213 Manufacturing Processes	4	0	0	4
	Only for other than Mechanical Engg. Department students								
Only for Mechanical Engg. Department students									
<b>TOTAL</b>									<b>8</b>
<b>SIXTH / Spring</b>	<b>THEORY</b>								
	<b>THIRD</b>	<b>PC</b>	PE344	Mechanical Measurement and Quality Control	None	4	0	0	4
<b>TOTAL</b>									<b>4</b>
<b>SEVENTH / Monsoon</b>	<b>THEORY</b>								
	<b>THIRD</b>	<b>PE (any one)</b>	PE304	Production and Operations Management	None	4	0	0	4
	<b>FOURTH</b>		PE416	Logistics and Supply Chain Management	None	4	0	0	4
	<b>PROJECT</b>								
<b>FOURTH</b>	<b>PC</b>	PE450	Applications-based Project					4	
<b>TOTAL</b>									<b>8</b>
<b>GRAND TOTAL</b>									<b>20</b>