

**DEPARTMENT OF PRODUCTION ENGINEERING**  
**BIRLA INSTITUTE OF TECHNOLOGY, MESRA RANCHI-835215**

**RESEARCH AREAS OF THE DEPARTMENT**

1. Machining
2. *Welding*
3. *Metal Casting and Powder Metallurgy*
4. *Nontraditional manufacturing*
5. *Precision Forming*
6. *CAD/CAM/ FMS/ Robotics*
7. *Product Development and Rapid Prototyping*
8. *Design of Manufacturing Systems*
9. *Lean and Six Sigma*
10. *Green Manufacturing*
11. *Planning and scheduling in manufacturing environment*
12. *Supply Chain*
13. *AI application in Manufacturing Engineering*
14. *Quality Engineering and reliability*
15. *Work Design and Human Factor Engineering.*

**DEPARTMENT OF PRODUCTION ENGINEERING**  
**BIRLA INSTITUTE OF TECHNOLOGY, MESRA RANCHI-835215**

**SYLLABUS FOR PhD ADMISSION PROGRAMMES: (PRODUCTION ENGINEERING)**

**Metal Casting:** Casting processes – types and applications; patterns – types and materials; allowances; moulds and cores – materials, making, and testing; casting techniques of cast iron, steels and nonferrous metals and alloys; solidification; design of casting, gating and risering; casting inspection, defects and remedies.

**Metal Forming:** Stress-strain relations in elastic and plastic deformation; concept of flow stress, deformation mechanisms; hot and cold working – forging, rolling, extrusion, wire and tube drawing; sheet metal working processes such as blanking, piercing, bending, deep drawing, coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metal working defects.

**Metal Joining Processes:** Welding processes – manual metal arc, MIG, TIG, plasma arc, submerged arc, electroslag, thermit, resistance, forge, friction, and explosive welding; other joining processes – soldering, brazing, braze welding; inspection of welded joints, defects and remedies; introduction to advanced welding processes – ultrasonic, electron beam, laser beam; thermal cutting.

**Machining and Machine Tool Operations:** Basic machine tools; machining processes – turning, drilling, boring, milling, shaping, planing, gear cutting, thread production, broaching, grinding, lapping, honing, super finishing; mechanics of machining – geometry of cutting tools, chip formation, cutting forces and power requirements, Merchant's analysis; selection of machining parameters; tool materials, tool wear and tool life, economics of machining, thermal aspects of machining, cutting fluids, machinability; principles and applications of nontraditional machining processes – USM, AJM, WJM, EDM and Wire cut EDM, LBM, EBM, PAM, CHM, ECM.

**Tool Engineering:** Jigs and fixtures – principles, applications, and design; press tools – configuration, design of die and punch; principles of forging die design.

**Metrology and Inspection:** Limits, fits, and tolerances, interchangeability, selective assembly; linear and angular measurements by mechanical and optical methods, comparators; design of limit gauges; interferometry; measurement of straightness, flatness, roundness, squareness and symmetry; surface finish measurement; inspection of screw threads and gears; alignment testing of machine tools.

**Powder Metallurgy:** Production of metal powders, compaction and sintering.

**Manufacturing Analysis:** Sources of errors in manufacturing; process capability; tolerance analysis in manufacturing and assembly; process planning; parameter selection and comparison of production alternatives; time and cost analysis; manufacturing technologies – strategies and selection.

**Computer Integrated Manufacturing:** Basic concepts of CAD, CAM, CAPP, cellular manufacturing, NC, CNC, DNC, Robotics, FMS, and CIM.

**Product Design and Development:** Principles of good product design, tolerance design; quality and cost considerations; product life cycle; standardization, simplification, diversification, value engineering and analysis, concurrent engineering.

**Engineering Economy and Costing:** Elementary cost accounting and methods of depreciation; break-even analysis, techniques for evaluation of capital investments, financial statements.

**Work System Design:** Taylor's scientific management, Gilbreth's contributions; productivity – concepts and measurements; method study, micro-motion study, principles of motion economy; work measurement – stop watch time study, work

**DEPARTMENT OF PRODUCTION ENGINEERING**  
**BIRLA INSTITUTE OF TECHNOLOGY, MESRA RANCHI-835215**

sampling, standard data, PMTS; ergonomics; job evaluation, merit rating, incentive schemes, and wage administration; business process reengineering.

**Facility Design:** Facility location factors and evaluation of alternate locations; types of plant layout and their evaluation; computer aided layout design techniques; assembly line balancing; materials handling systems.

**Production Planning and Inventory Control:** Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality; aggregate production planning; master production scheduling; MRP and MRP-II; order control and flow control; routing, scheduling and priority dispatching; push and pull production systems, concept of JIT manufacturing system; logistics, distribution, and supply chain management; Inventory – functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

**Operation Research:** Linear programming – problem formulation, simplex method, duality and sensitivity analysis; transportation and assignment models; network flow models, constrained optimization and Lagrange multipliers; simple queuing models; dynamic programming; simulation – manufacturing applications; PERT and CPM, time-cost trade-off, resource leveling.

**Quality Engineering:** Quality – concept and costs, quality circles, quality assurance; statistical quality control, acceptance sampling, zero defects, six sigma; total quality management; ISO 9000; design of experiments – Taguchi method.

**Reliability and Maintenance:** Reliability, availability and maintainability; distribution of failure and repair times; determination of MTBF and MTTR, reliability models; system reliability determination; preventive maintenance and replacement, total productive maintenance – concept and applications.