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.*

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 tubedrawing; sheet metal working processes such as blanking, piercing, bending, deep drawing,coining and embossing; analysis of rolling, forging, extrusion and wire /rod drawing; metalworking defects.

Metal Joining Processes: Welding processes – manual metal arc, MIG, TIG, plasma arc,submerged arc, electroslag, thermit, resistance, forge, friction, and explosive welding;otherjoining processes – soldering, brazing, braze welding; inspection of welded joints, defects andremedies; 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, chipformation, cutting forces and power requirements, Merchant's analysis; selection of machiningparameters; tool materials, tool wear and tool life, economics of machining, thermal aspects ofmachining, cutting fluids, machinability; principles and applications of nontraditional machiningprocesses – 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 oflimit gauges; interferometry; measurement of straightness, flatness, roundness, squareness andsymmetry; surface finish measurement; inspection of screw threads and gears; alignment testingof machine tools.

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

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

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; qualityand cost considerations;product life cycle; standardization, simplification, diversification, valueengineering 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, Gilbreths's contributions; productivity –concepts and measurements;methodstudy, micro-motion study,

principles of motion economy;work measurement – stop watch time study, work sampling, standard data, PMTS; ergonomics;job evaluation, merit rating, incentive schemes, and wage administration; business processreengineering.

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

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

Operation Research: Linear programming – problem formulation, simplex method, duality andsensitivity analysis; transportation and assignment models; network flow models, constrainedoptimization 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; statisticalquality control, acceptance sampling, zero defects, six sigma; total quality management; ISO9000; design of experiments – Taguchi method.

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