JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech in PRODUCTION ENGINEERING.
Effective from Academic Year 2017- 18 admitted batch

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Theory of Metal Cutting	25	75	4	0	0	4
PC-2	Theory of Metal Forming	25	75	4	0	0	4
PC-3	Advanced Casting & Welding Technologies	25	75	4	0	0	4
PE-1	1. Machine Tool Design 2. Precision Engineering 3. Automation in Manufacturing	25	75	**3**	0	0	3
PE-2	1. Design for Manufacturing & Assembly 2. Quality Engineering in Manufacturing Systems 3. Production & Operations Management	25	75	**3**	0	0	3
OE-1	*** Open Elective - I**	25	75	3	0	0	3
Laboratory I	Production Engineering Lab	25	75	0	0	3	2
Seminar I	Seminar-I	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Advanced Manufacturing Processes	25	75	4	0	0	4
PC-5	Advanced Tool Design	25	75	4	0	0	4
PC-6	Computer Aided Process Planning	25	75	4	0	0	4
PE-3	1. Vibration Analysis & Condition Monitoring 2. Additive manufacturing Technologies 3. Material Technology	25	75	**3**	0	0	3
PE4	1. Performance Modeling& Analysis of Manufacturing Systems 2. Experimental Techniques & Data Analysis 3. Advanced Finite Element Analysis	25	75	**3**	0	0	3
OE-2	*** Open Elective - II**	25	75	3	0	0	3
Laboratory II	Computer Aided Engineering Lab	25	75	0	0	3	2
Seminar II	Seminar-II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review II	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review III	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	100	0	0	0	16
Total	**100**	**100**	**0**	**0**	**24**	**24**

***Open Elective subjects must be chosen from the list of open electives offered by OTHER departments.**

 # For Project review I, please refer 7.10 in R17 Academic Regulations.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

THEORY OF METAL CUTTING
(P C – 1)

Unit -I

Mechanics of Metal Cutting: Geometry of Metal Cutting Process, Chip formation, Chip thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut – Types of chips chip breakers. Orthogonal and Oblique cutting processes – definition, Forces and energy calculations (Merchant's Analysis) – Power consumed – MRR- Effect of Cutting variables on Forces, Force measurement using Dynamometers.

Unit - II

Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation. Theories of formation of built-up edge and their effect, design of single point contact tools throwaway inserts.

Unit - III

Multipoint Cutting Tool: Drill geometry, design of drills, Rake& Relief angles of twist drill, speed, feed and depth of cut, machining time, forces, milling cutters, cutting speed &feed machining time-design – from cutters.

Grinding: Specifications of grinding of grinding wheel, mechanics of grinding, Effect of Grinding conditions on wheel wear and grinding ratio. Depth of cut, speed, machining time, temperature power.

Unit - IV

Tool Life and Tool Wear: Theories of tool wear – adhesion, abrasive and diffusion wear mechanisms, forms of wear, Tool life criteria and machinability index.

Types of sliding contact, real area of contact, laws of friction and nature of frictional force in metal cutting. Effect Tool angle, Economics, cost analysis, mean co-effect of friction.

Unit - V

Cutting Temperature: Sources of heat in metal cutting, influence of metal conditions, Temperature distribution, zones, experimental techniques, analytical approach. Use of tool- work thermocouple for determination of temperature. Temperature distribution in Metal Cutting.

Cutting fluids: Functions of cutting fluids, types of cutting fluids, properties, selection of cutting fluids**.**

Cutting tool materials: Historical developments, essential properties of cutting tool materials, types, composition and application of various cutting tool materials, selection of cutting tool materials.

REFERENCES:

1. Metal Cutting Principles/ MC Shaw / Oxford and IBH Publications, New Delhi, 1969
2. Fundamentals of Machining /Boothryd/ Edward Amold publishers Ltd 1975
3. 'Tool Design' by David Son / Lacain/ Goud, Tata Me Graw Hill
4. Fundamentals of Tool Design by Wilson fw , ASTME PHI 2010.
5. Technology of machine tools, Steve F. Krar, Arthur R. Gill and Peter Smid, Mcgraw Hill Education (India) Pt. Ltd., 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

THEORY OF METAL FORMING
(PC – 2)

Course Outcomes: Student will be able to:

1. Understand fundamentals of metal forming and stress curves.
2. Know various process parameters and applied loads in sheet metal working.
3. Understand various forging techniques and defects in forging.
4. Understand principles of rolling and stresses developed under rolling loads.
5. Analyze Extrusion and drawing processes and associated stresses developed.

UNIT - I:

Fundamentals of Metal Forming: Classification of forming processes, mechanisms of metal forming: slab method, Upper and lower bound analysis, Deformation energy method and finite element method temperature of metal working, hot working, cold working, friction and lubricants.

UNIT - II:

Rolling of metals: Rolling processes, forces and geometrical relationship in rolling, simplified analysis, rolling load, rolling variables, theories of cold and hot rolling, problems and defects in rolling, torque and power calculations, Problems.

UNIT - III:

Forging: Classification of forging processes, forging of plate, forging of circular discs, open die and closed-die forging, forging defects, and powder metallurgy forging. problems on flow stress ,true strain and forging load.

Press tool design: Design of various press tools and dies like piercing dies, blanking dies, compound dies and progressive blanking dies, design of bending, forming and drawing dies.

UNIT - IV:

Extrusion: Classification, Hot Extrusion, Analysis of Extrusion process, defects in extrusion, extrusion of tubes, production of seamless pipes. Problems on extrusion load.

Drawing: Drawing of tubes, rods, and wires: Wire drawing dies, tube drawing process, analysis of wire, deep drawing and tube drawing .Problems on draw force.

UNIT - V:

Sheet Metal forming: Forming methods, Bending, stretch forming, spinning and Advanced techniques of Sheet Metal Forming, Forming limit criteria, defect in formed parts.

Advanced Metal forming processes: HERF, Electromagnetic forming, residual stresses, in-process heat treatment, and computer applications in metal forming. problems on Blanking force, Blank diagram in Cup Diagram, Maximum considering shear.

REFERENCES:

1. Fundamentals of Metal Forming Processes – B.L. Juneja
2. Principles of Metal Working processes - G.W. Rowe
3. ASM Metal Forming Hand book.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

ADVANCED CASTING AND WELDING TECHNOLOGIES
(P C – 3)

Unit - I

Laser Beam Welding: Types of lasers, equipment, power calculation, applications, dual laser beam welding, use of fibre optics in LBW.

Friction Stir Welding; Details of process and process parameters, specific applications.

Electron Beam Welding; The interaction of electron beam with matter, mode of heat generation, mode of energy losses, details of the equipment, product design for EBW, case studies.

Ultrasonic Welding; Propagation of ultrasonic waves in matter, mode of joint formation, joint types and design of product for ultrasonic welding, details of equipment and case studies cutting and gauging, flame cutting plasma arc welding, laser assisted cutting.

Unit - II

Heat flow in Welding: Significance, theory of heat flow cooling rate determination, selection of welding parameters based on heat flow analysis, residual stresses and distortion. Joint design, analysis of fracture and fatigue of welded joints. Automated welding systems.

Unit - III

Investment casting, shell moulding, squeeze casting, vacuum casting, counter-gravity flow-pressure casting, directional and monocrystal solidification, squeeze casting, semisolid metal casting, rheocasting.

Unit - IV

Solidification Gating and Risering, Nucleation and grain growth, solidification of pure metals, short and long freezing range alloys. Gating and risering design calculations, Fluidity and its measurement.

Unit - V

CAE Of Welding And Casting: Design of weldment, application of finite element method in welding – determination of distortion in weldments, modeling of temperature distribution – case studies. Design for casting, application of finite element method in casting- determination of hot spots, location of turbulence, and other defects, modeling of flow in molds, modeling of heat transfer in castings-case studies.

REFERENCES:

1. Ravi B, “Metal Casting: Computer Aided Design and Analysis” Prentice Hall ,2005.
2. Richard L Little, “Welding and Welding Technology” Tata McGraw Hill, 2004.
3. John Campbell, “Casting Practice” Elsevier Science Publishing C0.,2004
4. Larry Jeffus, “Welding Principles and Applications” Delmar Publishers, 2004.
5. John Campbell “Casting Butterworth Heinemann, 2003.
6. Klas Weman, Welding Processes Handbook”, 2003.
7. Howard B Cary, “ Modern Welding Technology” Prentice Hall, 2002
8. Larry Jeffus, “ Welding for Collision Repair “, Delmar Publishers, 1999
9. ASM Hand Book “Casting”, ASM International 1998.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

MACHINE TOOL DESIGN
(P E – I)

Unit –I

Kinematics of Machine Tools:- shaping of geometrical and real surfaces, Developing and designing of kinematic schemes of machine tools, kinematics structures of lathe, drilling, milling, grinding, gear shaping and gear hobbing machines. Kinematic design of speed and feed boxes. Productivity loss. Stepped and stepless regulation, clutched drive.

UNIT – II

Strengths and Rigidity of Machine tool Structures: Basic principles of design for strength. Different types of structures. Overall compliance of machine tools. Design of beds, bases, columns, tables, cross rail for various machines. Various types of guide ways, their relative advantages. Materials for machine tool components including plastic guide way (PTFE)

UNIT – III

Analysis of Spindles, Bearings, and Power Screws: Design of spindles subjected to combined bending and torsion. Layout of bearings. Pre-loading. Anti-friction slide ways. Rolling contact hydrodynamic, hydrostatic, Hydrodynamic design of Journal bearings, Magneto bearings.
Machine Tool Vibrations: Effect of vibrations on machine tool. Free and Forced vibrations. Machine tool chatter.

UNIT – IV

Computer- Aided Programming: General information, APT programming, Examples apt programming problems (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors introduction to CAD/CAM software, automatic Tool Path generation.

UNIT - V

Tooling for CNC Machines: Interchangeable tooling system, present and qualifies tools, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control; Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

REFERENCES:

1. N.K. Mehta, Machine Tool Design and Numerical Control, Tata McGraw Hill, 1997.
2. Sen and Battacharya, Principles of Machine Tools, Central book publishers, Calcutta 1995.
3. SK BASU " Principles of Machine Tool Design" Oxford & IBH Publishing
4. McGraw "CAD/CAM"
5. Yoramkoren "Computer Control of Manufacturing Systems" Tata McGraw Hill, 2009.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

PRECISION ENGINEERING
(P E – I)

Unit-I:
Concepts of Accuracy: Introduction-Concepts of Accuracy of Machine Tools-Spindle and Displacement Accuracies-Accuracy of Numerical Control Systems-Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags

Unit-II:
Goemetric Dimensioning and Tolerancing: Tolerance Zone Conversions-Surfaces, Features of Size, Datum features-Datum Oddly Configured and Curved Surfaces as Datum Features, Equalising Datums-Datum Feature of Representation-Form Controls, Orientation Controls-Logical Approach to Tolerancing.

Unit-III:
Datum Systems: Design of Freedom, Grouped Datum systems-Different types, Two and Three mutually perpendicular grouped datum planes, Grouped Datum System with spigot and recess, pin and hole, Grouped Datum System with spigot and recess pair and Tongue-Slot Pair-Computation of Transnational and Rotational accuracy, Geometric Analysis and Application.

Unit-IV:
Tolerance Analysis: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost Aspects, Feature Tolerances, Geometric Tolerances.
Surface Finish, Review of relationship between attainable tolerance grades and different Machining Process. Cumulative effect of Tolerances sure fit law, normal law and truncated normal law.

Unit-V:
Tolerance Charting Techniques: Operation Sequence for typical shaft type of components, Preparation of Process drawings for different Operations, Tolerance Worksheets and centrally analysis, Examples. Design features to facilitate Machining: Datum Features-functional and Manufacturing. Components design-Machining considerations, Redesign for Manufactured Examples.

REFERENCES:

1. Precision Engineering in Manufacturing – Murthy R.L., New Age International (p) Limited, 1996.
2. Geometric Dimensioning and Tolerancing – James D. Meadows, Marcel Dekker Inc. 1995.
3. Precision Manufacturing – David Dorifield, DaeEur Lee, Springer Publishers, 2008.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

AUTOMATION IN MANUFACTURING
(P E – I)

UNIT-I:

Introduction to Automation: Automation in Production Systems-Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Principles and Strategies. Manufacturing operations, Production Concepts and Mathematical Models. Costs of Manufacturing Operations, , Basic Elements of an Automated Systems, Advanced Automation Functions, Levels of automation.

UNIT-II:

Introduction to Material Handling, Overview of Material Handling Equipment, Considerations in Material Handling System Design, The 10 Principles of Material Handling. Material Transport Systems, Automated Guided Vehicle Systems, Monorails and other Rail Guided Vehicles, Conveyor Systems, Analysis of Material Transport Systems. Storage Systems, Storage System Performance, Storage Location Strategies, Conventional Storage Methods and Equipment, Automated Storage Systems, Engineering Analysis of Storage Systems. Automatic data capture-overview of Automatic identification methods, bar code technology, other ADC technologies.

UNIT -III:

Manual Assembly Lines - Fundamentals of Manual Assembly Lines, Alternative Assembly Systems, Design for Assembly, Analysis of Single Model Assembly Lines, Line balancing problem, largest candidate rule, Kilbridge and Wester method, and Ranked Positional Weights Method, Mixed Model Assembly Lines, Considerations in assembly line design.

UNIT-IV:

Transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of Transfer Lines with no Internal Storage, Analysis of Transfer lines with Storage Buffers.

UNIT-V:

Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Design for Automated Assembly, and Quantitative Analysis of Assembly Systems - Parts Delivery System at Work Stations, Multi- Station Assembly Machines, Single Station Assembly Machines , Partial Automation.

REFERENCES:

1. Automation, Production systems and computer integrated manufacturing, Mikel P. Groover/ Pearson Education.
2. CAD CAM : Principles, Practice and Manufacturing Management / Chris Mc Mohan, Jimmie Browne / Pearson edu. (LPE)
3. Automation, Buckinghsm W, / Haper & Row Publishers, New York, 1961
4. Automation for Productivity, Luke H.D, John Wiley & Sons, New York, 1972.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

DESIGN FOR MANUFACTURING AND ASSEMBLY
(P E - 2)

UNIT - I:
Introduction: Design philosophy steps in Design process — General Design rules for manufacturability — basic principles of design Ling for economical production — creativity in design. Materials: Selection of Materials for design Developments in Material technology -- criteria for material selection — Material selection interrelationship with process selection process selection charts.

UNIT - II:
Machining Process: Overview of various machining processes -- general design rules for machining - Dimensional tolerance and surface roughness — Design for machining — Ease — Redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.
Metal Casting: Appraisal of various casting processes, selection of casting process, - general design considerations for casting — casting tolerances — use of solidification simulation in casting design — product design rules for sand casting.

UNIT - III:
Metal Joining: Appraisal of various welding processes, Factors in design of weidments — general design guidelines — pre and post treatment of welds — effects of thermal stresses in weld joints — design of brazed joints. Forging — Design factors for Forging — Closed die forging design — parting lines of die5 drop forging die design — general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing — Keeler Goodman Forming Line Diagram — Component Design for Blanking.

UNIT-IV
Assemble Advantages: Development of the assemble process, choice of assemble method assemble advantages social effects of automation.
Automatic Assembly Transfer Systems : Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

UNIT-V:
Design of Manual Assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, classification system for manual handling, classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

REFERENCES:
1. Geoffrey Boothroyd, “Assembly Automation and Product Design", Marcel Dekker Inc., NY, 1992.
2. Engineering Design – Material & Processing Approach – George E. Deiter, McGraw Hill Intl. 2nd Ed. 2000.
3. Geoffrey Boothroyd, "Hand Book of Product Design" Marcel and Dekken, N.Y. 1990.
4. A Delbainbre "Computer Aided Assembly London, 1992.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

QUALITY ENGINEERING IN MANUFACTURING SYSTEMS
(P E - 2)

UNIT - I:
Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT - II:
Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT - III:
Analysis of Variance (ANOVA): NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV:
Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT V:
IS[)-9000 Quality System, BDRE, 6.-sigma, Bench making, Quality circles Brain Storming — Fishbone diagram — problem analysis.

REFERENCE BOOKS:

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill, Intl. II Edition, 1995.
2. Quality Engineering in Production systems **/** G. Taguchi, A. Elsayed et al **/** Mc.Graw Hill Intl. Edition, 1989.
3. Taguchi Methods explained: Practical steps to Robust Design **/** Papan P. Bagchi**/** Prentice Hall md. Pvt. Ltd., New Delhi.
4. Design of Experiments using the Taguchi Approach/Ranjit K. Roy, John wiley& sons. Inc. 2001.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (Production Engg.)

PRODUCTION AND OPERATIONS MANAGEMENT
(PE - 2)

UNIT -I

Operation Management – Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management.

Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization – simplification – Speed to market – Introduction to concurrent engineering.

UNIT - II

Alue engineering – objective – types of values – function & cost – product life cycle- steps in value engineering – methodology in value engineers – FAST Diagram – Matrix Method.

Location – Facility location and layout – Factors considerations in Plant location- Comparative Study of rural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout – line balancing.

UNIT - III

Aggregate Planning – definition – Different Strategies – Various models of Aggregate Planning – Transportation and graphical models.

Advance inventory control systems push systems – Material Requirement – Terminology – types of demands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP –Manufacturing Resources Planning (MRP –II), Pull systems – Vs Push system – Just in time (JIT) philosophy Kanban System – Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

UNIT - IV

Scheduling – Policies – Types of scheduling – Forward and Backward Scheduling – Grant Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance.

UNIT - V

Project Management – Programming Evaluation Review Techniques (PERT) – three times estimation – critical path – probability of completion of project – critical path method – crashing of simple nature.

REFERENCE BOOKS:

1. Production and Operations Management " by E.S. Buffa, Jhon Wiley & sons
2. Operations Management Theory and Problems - Joseph G. Monks.
3. Production Systems Management - James I. Riggs.
4. Production and Operations Management –S N Chary, McGraw Hill. 2016

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M. Tech – I Year – I Sem. (Production Engg.)

PRODUCTION ENGINEERING LAB

List of Experiments:

1 Study of the morphology of chips produced from different materials sand machining processes.
2 Effect of tool geometry on chip flow direction in simulated orthogonal cutting conditions.
3 Study of cutting ratio/chip thickness ratio in simulated orthogonal cutting with different materials and tool geometry.
4. Evaluations of tool face temperature with thermocouple method.
5. Roughness of machined surface. Influence of tool geometry and feed rate.
6 Study of the construction and operating parameters of metal spinning Lathe.
7 Study of the water hammer equipment and hydrostatic extrusion setup.
8. Extrusion of cylindrical billets through dies of different included angles and exit diameters and their effect on extrusion pressure.
9. Practice and study of blanking and punching process and their characteristic features on mechanical press with existing dies.
10. Experiments on TIG and MIG welding to find out the mechanical properties of metals hydraulic and Pneumatic circuits
11. Study of operation of tool and cutter grinder, twist drill grinder, Centreless grinder
12. Determination of cutting forces in turning
13. Inspection of parts using tool makers microscope, roughness and form tester
14. Studies on PLC programming