

Integral University Lucknow
Study & Evaluation Scheme
M.Tech. (Production & Industrial Engg.) Full Time
(w.e.f. session 2020-21)

Semester -I

Sl. No.	Subject Code	Category	Subject	Periods				EvaluationScheme				Subject Total
				L	T	P	C	C A			Exam.	
								CT	TA	Total	ESE	
1	ME501	DC	Statistical Methods in Engg.	3	1	0	4	40	20	60	40	100
2	ME502	DC	Advanced Materials Science	3	1	0	4	40	20	60	40	100
3	ME503	DC	Production Operations Management	3	1	0	4	40	20	60	40	100
4	ME504	DC	Production Engineering I	3	1	0	4	40	20	60	40	100
5	ME505	DC	Production Engineering I Lab	0	0	3	2	40	20	60	40	100
Total				12	4	3	18	200	100	300	200	500

L-Lecture T-Tutorial P-Practical C-Credits CT-ClassTest

TA-Teacher Assessment

CA - Continuous Assessment

Continuous Assessment = ClassTest +TeacherAssessment

Subject Total = Continuous Assessment (CA) + End Semester Examination (ESE)

DC- Departmental Core

DE- Departmental Elective

Integral University Lucknow
Study & Evaluation Scheme
M.Tech. (Production & Industrial Engg.) Full Time
(w.e.f. session 2020-21)

Semester -II

Sl. No.	Subject Code	Category	Subject	Periods				EvaluationScheme				Subject Total
								C A			Exam.	
				L	T	P	C	CT	TA	Total	ESE	
1	ME506	DC	Work Science	3	1	0	4	40	20	60	40	100
2	ME507	DC	Total Quality Management	3	1	0	4	40	20	60	40	100
3	ME508	DC	Plant Layout & Material Handling	3	1	0	4	40	20	60	40	100
4	ME509	DC	Production Engineering II	3	1	0	4	40	20	60	40	100
5	ME510	DC	Production Engineering II Lab	0	0	3	2	40	20	60	40	100
Total				12	4	3	18	200	100	300	200	500

L-Lecture T-Tutorial P-Practical C-Credits CT-Class Test

TA-Teacher Assessment

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Continuous Assessment =Class Test +Teacher Assessment

Subject Total=Continuous Assessment(CA)+End Semester Examination (ESE)

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Integral University Lucknow
Study & Evaluation Scheme
M.Tech. (Production & Industrial Engg.) Full Time
(w.e.f. session 2021-22)

Semester –III

Sl. No.	Subject Code	Category	Subject	Periods				Evaluation Scheme				Subject Total
				L	T	P	C	C A			Exam.	
								CT	TA	Total	ESE	
1	ME601	DC	Advanced Manufacturing Processes	3	1	0	4	40	20	60	40	100
2		DE	Elective-1	3	1	0	4	40	20	60	40	100
3		DE	Elective-2	3	1	0	4	40	20	60	40	100
4		DE	Elective-3	3	1	0	4	40	20	60	40	100
5	ME690	DC	M. Tech. Dissertation	-	-	-	4	-	100	100	-	100
			Total	12	4	0	20	160	180	340	160	500

L-Lecture T-Tutorial P-Practical C-Credits CT-ClassTest

TA-TeacherAssessment

CA - Continuous Assessment

Continuous Assessment =ClassTest +TeacherAssessment

Subject Total=Continuous Assessment(CA)+EndSemesterExamination (ESE)

DC- Departmental Core

DE- Departmental Elective

List of Elective

Elective –1

- ME602 Flexible Manufacturing System
- ME603 Advanced Welding Technology
- ME604 Advanced Metal Casting Technology
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Elective –2

- ME605 Friction and Wear
- ME606 Design for Manufacture
- ME607 Optimization techniques in engineering

Elective –3

- ME608 Maintenance Management
- ME609 Product Design and Development
- ME610 Industrial Automation & Robotics

Integral University Lucknow
Study & Evaluation Scheme
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(w.e.f. session 2021-22)

Semester -IV

Sl. No.	Subject Code	Category	Subject	Periods				EvaluationScheme				Subject Total
								C A			Exam.	
				L	T	P	C	CT	TA	Total	ESE	
1	ME600	DC	M. Tech. Dissertation	-	-	-	4	-	60	60	40	100
				-	-	-	4	-	60	60	40	100
				-	-	-	4	-	60	60	40	100
				-	-	-	4	-	60	60	40	100
			Total	-	-	-	16	-	240	240	160	400
Grand Total												1900

L-Lecture T-Tutorial P-Practical C-Credits CT-ClassTest

TA-Teacher Assessment

CA - Continuous Assessment

Continuous Assessment =ClassTest +TeacherAssessment

Subject Total=Continuous Assessment(CA)+EndSemesterExamination (ESE)

DC- Departmental Core

DE- Departmental Elective

STATISTICAL METHODS IN ENGINEERING

ME501

(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit-I

Frequency Distributions:

Graphic Representation of a Frequency Distribution-Histogram, Frequency Polygon, Cumulative Frequency Curves, Diagrammatic Representation of Data-Bar diagrams, Pie diagram. Measures of Central Tendency. Measures of Dispersion. 8

Unit-II

Bivariate Distribution, Correlation :

Scatter Diagram, Karl Pearson's Coefficient of correlation, Limits of correlation coefficient, Spearman's Rank Correlation. Regression: Lines of Regression, Regression Curves, Regression Coefficient, Properties of Regression Coefficients, Angle between two Regression Lines. 8

Unit-III

Tests of Significance :

Null hypothesis, Alternative Hypothesis, Errors in sampling, Z-Test, Student's t-Test, χ^2 -Test for Goodness of Fit and Independence of Attributes, F- test for Equality of Population Variances. 8

Unit-IV

Probability Distributions :

Discrete Probability Distributions, Binomial, Poisson, Geometric and uniform. Continuous Probability Distributions- Normal, Gamma & Beta. Introduction to Central Limit Theorem (Without Proof) 8

Unit-V

Non-Parametric Tests :

Wilcoxon –Rank Sum Test, Mann-Whitney –Wilcoxon U-Test, Wilcoxon signed Rank Test, Kruskal-Wallis test. 8

Books:

1. Fundamentals of Mathematical Statistics: Gupta and Kapoor Sultan Chand & Sons.
2. An Introduction to probability and Mathematical Statistics: Rohatgi V.K., Wiley Eastern Limited.
3. Non-Parametric Statistical Inference: Gibbons, J.D; McGraw Hill Inc.
4. Fundamentals of Applied Statistics: Gupta and Kapoor Sultan Chand & Sons.
5. Biostatistics: Qazi Shoeb Ahmed, Laxmi Publications.

Prerequisite-None

Corequisite-None

ADVANCED MATERIALS SCIENCE
ME502
(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit-I

Crystalline Structures:

Lattice Positions, planes and directions, Metal structures, Ceramic structures, Polymeric structures, Semiconductor structures. 6

Unit-II

Imperfections in Crystalline Solids:

Vacancies, dislocations: edge and screw dislocation, elementary treatment of strain field and stress field, strain energy and line tension associated with a dislocation, partial dislocation, dislocation climb, cross slip, Lomer Cottrell barriers.

Fracture:

Types and their characteristics, nucleation of cracks, growth and failure, variables influencing fracture. 10

Unit-III

Polymers:

Polymerization, Structural features, thermo plastics and thermosetting plastics, additives, mechanical properties, optical properties.

Advances in Material Processing:

Advance in Powder Metallurgy, hot isostatic pressing, super plastic forming sol-gel process, self propagating high temperature synthesis, crystal growth techniques, epitaxy. 8

Unit-IV

Composite Materials:

Method of preparation of fibers and fiber reinforced composites, micromechanics of composites, prediction of composite properties from its constituents, laminates and their applications, Basic stress-strain relationships, failure behaviours. 6

Unit-V

Ceramics:

Types, structures, development and fabrication techniques, mechanical properties, optical properties.

Powder Metallurgy:

Sintering, process description, various process developments of W, Mo & heavy based materials e.g. cemented carbides, cermets, selection of contact materials for tool materials. 10

Books:

1. Mechanical Metallurgy : Dieter CE
2. Physical Metallurgy Principles : Reed-Hill RE
3. Dislocation & Plastic in Crystals: Cottrell AH
4. Mechanics of Composite Materials: Jones RM
5. Physical Methods for Materials characterization Method: PEJ & Wild RK

Prerequisite-None

Corequisite-None

PRODUCTION OPERATIONS MANAGEMENT

ME503

(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit-I

Sales Forecasting:

Techniques used judgmental and causal forecasting. Market survey. Trend lines, time series, Moving average, Exponential Smoothing, Forecast error, Confidence limits for seasonal variations, Analysis of actual order forecasting under fluctuating demands. Cost and accuracy of forecast. 6

Unit-II

Product and Process Design:

Product Life cycle, Product Policy and selection. Product development and design process. Product analysis. Cost estimation and cost reduction. Standardization, Process planning, manpower requirements, line balancing. Problems of production planning and control. Break-Even Analysis.

Capacity Planning:

Capacity measures, capacity planning, estimating future capacity needs, aggregate planning, guidelines for aggregate planning. Linear programming approach to aggregate planning. Master production schedule. 10

Unit-III

Material Requirement Planning (MRP):

Introduction, MRP objectives, Functions served by MRP. Terminology, System outputs and MRP logic. Manufacturing resource planning (MRP-II), Capacity requirement planning (CRP).

Project Scheduling with CPM and PERT:

Introduction, CPM and PERT, Time-cost tradeoff (Crashing). Resource allocation. 8

Unit-IV

Production Control:

Introduction, Loading sequencing and scheduling. Priority sequencing, Assignment models, Scheduling, Dispatching, Expediting and Progress reporting (follow-up). In-process order control. Machine load control by use of Gantt chart, Schedule boards, Machine allocation methods, Manpower loading and scheduling. 6

Unit-V

Inventory Control:

Introduction, Meaning and types of Inventories, Inventory control objectives, Models, Inventory cost relationships. Inventory control systems, selective control of inventory. ABC analysis, Reorder point. Consideration of quantity discounts, Treatment of back orders. Probabilistic models with constant lead time.

Computer Aided Production Planning and Control:

Information processing, JIT system, Designing fast response organizations. 10

Books:

1. Production and Operation Analysis: Steven Nahmias, McGraw Hill.
2. Schaum's Outline of Operations Management: Joseph Monks, TMH.
3. Production and Operations Management: Chary, TMH.
4. Production Planning and Inventory Control, Narsimhan,;McLeavy and Billington P.H.I.
5. Production Operations Management, Adam and Evert, PHI.

PRODUCTION ENGINEERING-I
ME504
(w.e.f. session 2016-17)

L T P C
3 1 0 4

METAL CUTTING**Unit –I****Introduction:**

Types of cutting tools, tool geometry in ASA system, continental system and British maximum rake system, Cutting tool materials, Orthogonal and oblique cutting. Orthogonal rake and angle of inclination calculations.

7

Unit –II

Mechanics of chip formation, Maximum orthogonal rake, Types of chips, Merchant's force circle, Shear angle relation, Tool wear and Tool life, Variables affecting tool life, Thermal aspects of metal machining. Cutting tool temperature calculation. Limits of tool wear.

8

Unit-III

Economics of metal machining, Design of a single point cutting tool, Friction in metal cutting, Grinding: Wheel specifications, Grinding ratio, Wheel wear, Buffing and Honing, Machine Tool vibrations and chatter.

7

METAL FORMING**Unit –IV**

Yield criteria, and theory of plasticity, Wire drawing with friction and back-pull, Extrusion with friction and back pull for circular rods.

8

Unit –V

Sheet Metal working, Dies, Shear angle on punch. Direct compression processes, Forming and Rolling Analysis, Analysis of sheet metal forming processes, Discussion on defects in metal forming processes. CAD/CAM applications in forming.

10

Books :

1. Manufacturing Science Vol I and II M.I. Khan, P.H.I. New Delhi.
2. Manufacturing Science: Ghosh and Mallick. East West Press.
3. A Text Book of Production Engineering Sciences, PC. Pandey & C.K. Singh, Standard Publishers / Distributors, NaiSarak, New Delhi.

PRODUCTION ENGINEERING - I LAB
ME505
(w.e.f. session 2016-17)

L	T	P	C
0	0	3	2

List of Practical:

1. Study of Orthogonal cutting process and determination of shear plane angle.
2. Study of variation of diameter of a cylinder along its axis.
3. Study of roundness of a turned mild steel cylinder.
4. Measurement of Pitch Circle Diameter of a V-thread using 3 wire methods.
5. Measurement and comparison of Flank Wear on C.S. H.S.S. and Carbide Tip.

Prerequisite-None

Corequisite-None

WORK SCIENCE
ME506
(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit –I

Introduction: Introduction to work science, Basic concepts, work organization, work study, Objective benefits and scope of work study, Purpose and Advantages of work study, Fitting the tack to the characteristics, Capabilities and Limitations of the Person. 6

Unit –II

Method Study: Objectives and scope, Basic procedure in conducting method study, Steps involved in Method Study: Select, record, examine develop, install and Maintain, Job selection for study, Recording techniques, Micro-and memo-motion study, Fundamental hand motions (therbligs), Principles of motion economy, Critical Examination, Development of proposed method, its installation and maintenance. 8

Unit-III

Work Measurement: Objectives, Work measurement procedures (steps), Work measurement systems, Concept of standard rating, Breaking the task into elements, Rating and Basic Time, Requirements of satisfactory rating, Time study procedure, Tools for time study, Number of cycles to be timed, Synthesis of standard time from elemental data, Activity sampling, sample size, Standard time by work sampling, Control charts applied to work sampling. 8

Unit –IV

Workplace design : Muscular work, Nervous control of movements, Anthropometric data, Reach and clearance dimensions, percentiles to be accommodated, workplace design comfortable work postures, Room to grasp and moves things and operate controls, sedentary work, sedentary workplace design, Design of tools for skilled work, VDT workstation design and design of keyboards, Heavy work, Handling loads, skilled work. 8

Unit –V

Man-Machine System, Display equipment, controls, Relation between control and display instruments, Human visual system, eye movements, artificial lighting, light for manual fine work and VDT workstations, Noise Physiological and psychological effects of noise, damage to hearing, Protection against noise, Effects of vibrations on human performance, Thermo-regulation in human body, comfort indoors, Air quality and dryness, Air pollution and ventilation at work, Recommendations for comfort in-doors. 10

References :

1. Khan, Industrial Engineering, New-Age
2. Barnes, Motion and Time study, Wiley India.
3. Khan, Industrial Ergonomics, PHI
4. McCormic, Human Factors in Engg. & Design. McGraw Hill.
5. Grandjean, Fitting the task to the man, Taylor and Francis, London.

Prerequisite-None

Corequisite-None

TOTAL QUALITY MANAGEMENT

ME507

(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit-I

Fundamentals of Quality Management :

Quality as the new competitive weapon, Evolution of quality management, Definition of quality, Dimensions of quality in production system, Quality and Profitability, Quality Costing.

Quality Management Philosophies:

Deming Philosophy, Crosby Philosophy, Taguchi quality loss functions, Six sigma approach for quality.

8

Unit-II

Managing Quality:

Quality control, Quality assurance, Total quality control, Total quality management (TQM), Basic concept of TQM, Overview of TQM, Necessity for TQM, Elements of TQM, Benefits of TQM.

Tools for the Quality Journey :

Check sheet, Pareto diagram, Cause-and -effect diagram, Histogram, Scatter diagram, Flow Chart, Relationship between the tools and the PDCA Cycle, Design of experiments. Quality function Deployment.

8

Unit-III

Leadership and Strategic planning for TQM :

Leadership for quality, quality and organizational structure, Role of quality in strategic planning, Strategic quality management (SQM)

Human Resources Development & Strategic Information Management for TQM. :

Human Resources Development for TQM, Strategic Information management for TQM. The strategic value of information, The scope of quality and operational performance, Role of Information, Technology. 8

Unit-IV

Organizing for TQM:

Organizing for TQM, Teams, Quality circles, Developing a quality culture, Change management.

Statistical Quality Control:

Theory of Control Chart for variable and attribute acceptance sampling plans for attribute and variable. 8

Unit-V

Quality system and ISO 9000 Series:

ISO 9000 Pre-requisites, different quality system and their structure, Quality policies and objectives, management responsibility, documentation methodology of implementation, quality audit and assessments.

Miscellaneous:

Relevance of JIT to TQM, Benchmarking, Relevance of TQM to world class manufacturing. 8

Books:

1. Quality Planning and Analysis, Juran J.M., EGryan Jr., TMH, New Delhi.
2. Total Quality Management, Dr. K. Raja, Eswar Press.
3. Total Quality Management, A practical Approach, H. Lal, New Age.
4. Total Quality Management, K Shridhar Bhatt, PHI

Prerequisite-None

Corequisite-None

PLANT LAYOUT AND MATERIALS HANDLING

ME508

(w.e.f. session 2016-17)

L T P C
3 1 0 4

Unit-I

Introduction :

Definition, objective, principles of plant layout, need for re-layout decisions, types of layout problems, factors influencing plant layout, Types of layout-product, process, fixed, combination and group layout. 8

Unit-II

Procedure for Plant Layout:

Basic Steps in layout procedure; procuring basic data, product analysis and design of production process, calculation for equipment requirements, plan general flow pattern, selection of material handling equipment, determine the space required, construct master layout. 8

Unit-III

Techniques and Tools for Planning Layout:

Assembly chart, operation process chart, multi product process chart, flow diagram, Man machine chart, string diagram, travel diagram, drafting, template and block.

Quantitative Layout Analysis:

Techniques of analysis, computerized layout planning, allocation method, activity relationships chart. 9

Unit-IV

Improving and Revising Existing Layout:

Need for changing layout, reasons for redesign, procedure for revision and improvement.

Evaluation for an Effective Layout:

Evaluation of a layout, measurement of effectiveness, methods of evaluation. 8

Unit-V

Material Handling:

Material handling principles, analysis of material handling system, unit load concept, factor-affecting selection of material handling equipment, layout and materials handling system. 7

Books:

1. Facility layout and Location, An Analytical Approach: Francis. Etal., 2nd ed., PHI
2. Material Handling Handbook: David E. Mulcahy, 1999, TMH.
3. Facilities Planning: Tompkins, J.A and White, J. A Eds., 1st ed., John Wiley & Sons, New York, 1996.
4. Handling of Bulk Solid: Theory and Practice: Shamlou, P.A. butter Worths, London, 1998.
5. Handbook of Commercial and Facilities Managemetn: Wrenmall, W., and Q. Lee, edsMcGraw Hill, New York, 1994, pp 201-240.
6. Plant Layout and Materials Handling: S.C Sharma, Khanna Publishers., Delhi.
7. Plant Layout and Material Handling: G.K. Agarwal, Jain Brothers, Delhi.

Prerequisite-None

Corequisite-None

PRODUCTION ENGINEERING - II

ME509

(w.e.f. session 2016-17)

L	T	P	C
3	1	0	4

Unit –I

Introduction: Casting compared with other processes, steps involved in a casting process. Basic factors involved in casting processes, Patterns: Design (Allowances) and design considerations. Sand Testing.

Fluidity of molten metal and its measurement, Molten metal characteristics, Casting parameters, mould design, sprue, runner, riser, degree of superheat and rate of pouring. Comparative study of various casting processes. **8**

Unit –II

Principles of Gating Design: Types of gates, pouring basins design, Metal flow-rate and velocity calculations, Sprue terminology and design. Design of runners and gates.

Principles of Riser (Feeder heads): Design of Risers, Chvorinow's rule and solidification time calculations for different shapes, Caines method, shape Factor method of riser size calculations Solidification of castings: Large casting in insulated mould, Directional solidification, Calculations for top and bottom gating systems. **8**

Unit-III

Casting Design considerations: Metallurgical, mechanical and economic considerations, Casting defects and inspection, Finishing and cleaning of castings.

Metal joining Processes: Introduction: Classification of welding Processes conditions for obtaining satisfactory welds, Importance of welding, selection of a welding process,

Welding Science: Arc Characteristics. Arc Length control and welding power sources characteristics, constant current and constant potential power sources and their applications, Arc welding Power Supply Equipments, Power source selection, Welding Energy Input, Energy sources(types), Metal Transfer. **8**

Unit –IV

Welding Parameters and their effects: Metallurgical aspects in Welding, Weld-microstructures: fusion zone, Heat affected-zone (HAZ) and base metal. Weld-metal solidification, Residual stresses and distortion of welds, Stress-relieving methods, Thermal and mechanical treatment of welds. **8**

Unit –V

Advanced welding processes : Laser beam welding, Electron Beam Welding, Plasma Arc Welding, High Frequency Welding and Underwater welding processes, Analytical and Mathematical analysis: Calculation of heat input and relation between weld cross-section and energy input, Heat flow equations, width of heat affected zone, cooling rates, contact resistance, heat source, weld quality: undercuts, cracks, porosity, slag inclusion, Lack of fusion, Lack of penetration Faulty weld profile Testing and Inspection of welds.

Welding of materials: Cast Iron, Aluminium and its alloys, Stainless steels, Dissimilar Metals welding, Cladding and Hard facing, Welding of plastics. **8**

Books :

1. Flinn, R.A., Fundamentals of Metal Casting, Addison-wesley, Reading, Mass.
2. Little, Welding and Welding Technology, McGraw Hill; 2004
3. Khan, M.I. Welding Science and Technology, New –Age Int. 2007
4. Heine, Principles of Metal casting, McGraw Hill, 2nd Ed. 2001
5. Jain, P.L. Principles of Foundry Technology McGraw Hill 5th Ed. 2009

Prerequisite-None

Corequisite-None

PRODUCTION ENGINEERING -II LAB
ME510
(w.e.f. session 2016-17)

L T P C
0 0 3 2

1. Study of weld-bead geometry of air weld and underwater weld made by rutile electrodes.
2. Study of the effect of moisture and clay content variation on mould hardness.
3. Study of weld-bead microstructure in weld-zone HAZ and microstructure of the base metal for Air Welded Specimen.
4. Study of weld-bead microstructure in weld-zone HAZ and microstructure of the base metal for underwater welded specimen.
5. Study of weld defects through X-ray reference radiographs.
6. Conducting time and motion study using pin board setup.
7. Experimental Study of different welding parameters on weld bead using TIG welding apparatus.

Prerequisite-None

Corequisite-None

ADVANCED MANUFACTURING PROCESSES

ME601

(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Machining processes:

Classification of advanced machining processes; consideration in process selection.

Mechanical Metal Removal Process:

Ultrasonic machining; elements of the process; mechanics of metal removal; tool design economic consideration; applications and limitations. 8

Unit-II

Abrasive Jet and Abrasive Water Jet Machining:

Basic principles; mechanism of metal removal; variables governing the processes; design of nozzles; applications.

Electro-chemical Process:

Fundamentals of the ECM and ECG techniques; mechanism of metal removal; design of tooling; choice of process parameters; surface finish and accuracy; economic aspects of ECM; electro-chemical deburring; and honing. 8

Unit-III

Thermal Metal Removal Processes:

Classification; general principles and applications of EDM, EBM, PAM and LBM, power circuits of EDM; mechanism of metal removal EDM; selection of EDM pulse generator, tool electrode and dielectric; machining accuracy, surface finish and surface damage in EDM; process parameters, wire EDM.

Generation and control of electron beam for machining; applications; advantages and limitations. 8

Unit-IV

Generation and application of plasma for metal cutting; plasma torches.

Basics of laser beam machining; thermal phenomenon due to laser work surface interaction; cutting speeds and accuracy of cut; applications and limitations. Improving the efficiency of laser machining process.

Process details of ion beam machining and its applications.

Introduction to hybrid unconventional machining processing. ECDM, ECAM, Abrasive EDM, etc. 8

Unit-V

Metal Forming:

Theory and application of Contour roll forming, stretch forming explosive forming etc.

Welding:

Theory and applications of electron beam welding, Laser beam welding, Ultrasonic welding, Solid state diffusion and explosive welding process. 8

Books:

1. Non Traditional Machining Processes Springborn: ASTME Michigam
2. Modern Machining Processes: Pandey and Shan, THM
3. Electrochemical Machining: De Bar, Mc Donald
4. Metals Handbook Forming: - ASM
5. Advance Machining Processes : Jain, Allied Publishers.

Prerequisite-None

Co-requisite-None

FLEXIBLE MANUFACTURING SYSTEM
ME602
(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Introduction:

Concepts of flexibilities and its importance in batch manufacturing Various type of FMS configurations, their planning and control.

FMS definition and Classification of manufacturing systems Fundamentals of automated Production Cycle, Need of Flexibility, Concept of Flexibility, various Types of Flexibility and Measures of Flexibility. 8

Unit-II

FMS Equipment:

FMS and its importance, Factors responsible for the growth of the FMS, FMS types, Application of FMS, Economic Justification for FMS and FMC Functional requirements of FMS equipment, FMS processing and Q.A. Equipment e.g. turning and machining centers, 8

Unit-III

Co-ordinate measuring machines, cleaning and deburring machines. FMS system support equipment: automated material handling and storage equipment, cutting tools and tools management, work-holding considerations, fixture consideration in FMS environment.

Unit-IV

Group Technology and FMS:

GT concepts, advantages of GT, part family formation-coding and classifications systems; Part-machine group analysis; methods for cell formation, model of different algorithms, mathematical programming and graph theoretic model approach for part grouping, cellular production. 8

Unit-V

FMS planning problems: Strategic planning, part type, selection, machine grouping, production ratio and resource allocation, machine loading problems.

Operational & Controls problems: Scheduling of parts, machines, robots and AGVS. Process monitoring and control.

FMS Implementation: Objectives, Acceptance Testing Performance Goals and Expectations, Maintenance Concerns. 8

Books:

1. Automation, Production System and CAM : Grover, Englewood
2. Design and Operation of FMS: Rankey, IFS
3. Flexible Manufacturing System: Wernecks, Springer-Gerlag
4. FMS in Practice: Bonctto, Northox Ford
5. Flexible Manufacturing Cells and System: W.W. Luggen, Prentice Hall
6. Performance Modeling of Automated Manufacturing System: ViswanathanNarahari, Prentice Hall.
7. Flexible Manufacturing Systems in Practice: Talavage and Hamman

Prerequisite-None

Co-requisite-None

ADVANCED WELDING TECHNOLOGY
ME603
(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Introduction:

Welding as compared with other fabrication processes, Classification and review of conventional Welding Processes.

Physics of Welding Arc:

Welding arc, arc initiation and maintenance voltage distribution along the arc, cathode and anode drops, Arc column. Characteristics of welding power sources, arc characteristics, arc efficiency, heat generation at cathode and anode. Effect of shielding gas on metal transfer, isotherms of arcs. 8

Unit-II

Metal Transfer:

Mechanism and types of metal transfer in various arc welding processes, arc length regulation in mechanized welding processes, Transformer, rectifier and generators, Duty cycle and power factor, Static and dynamic characteristics of welding power sources. 8

Unit-III

Welding Processes:

Critical review and analysis of MMA; TIG MIG and CO₂ welding processes plasma arc, submerged arc welding, electro-gas and electro-slag welding; resistance welding. Theory and mechanism of solid state welding; technique and scope of friction welding, diffusion welding; cold pressure welding and ultrasonic welding, scope and application of electron beam and laser beam welding processes. 8

Unit-IV

Heat Flow in Welding:

Analysis of Heat transfer and temperature distribution in electric arc welding; width of Heat Affected Zone; cooling rate and solidification rates; weld thermal cycles; residual stresses and their measurement; weld distortion and its prevention. 8

Unit-V

Weldability of Metals:

Effects of alloying elements on weldability, welding of plain carbon steel, stainless steel, Cast Iron and aluminium. Evaluation of weldability. Testing and inspection of welds. Welding of PVC plastics. Welding under the influence of Magnetic field. 8

Books:

1. Welding Handbook-AWS, Vol. 1-5
2. Welding Science and Technology-M.I. Khan, New-Age International.
3. Welding For Engineer. Udin, Fruk and Wulif, John Wiley.
4. Welding Technology, Rossi, McGraw Hill.

Prerequisite-None

Co-requisite-None

ADVANCED METAL CASTING TECHNOLOGY

ME604

(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Introduction:

The features of casting problem; a survey and scope of foundry industry.

Solidification:

Solidification of pure metals and alloys; nucleation and growth in alloys; solidification of actual castings; progressive and directional solidification; centerline feeding resistance; rate of solidification; Chvorinov's Rule, electrical analog of solidification problem.

Patterns :

Pattern design; developments in pattern design; materials and construction.

8

Unit-II

Risering :

Riser design; risering curves; method of riser design; feeding distance; risering of complex casting; risering of alloys other than steel; recent developments e.g. riser design by the application of geometrical programming.

Gating :

Gating systems and their characteristics; the effect of gates on aspiration; turbulence and dross trap; recent trends.

8

Unit-III

Molding and Core Making processes:

Review and critical comparison of various established processes; recent developments eg. Low pressure and ferrous die casting; high pressure molding; full mold process; flaskless-molding, hot and coldboxmolding; ceramic shell molding; V-preprocess; continous casting squeeze and pressed casting; New moulding and core making process.

8

Unit-IV

Melting:

Selection and control of melting furnaces; melting, refining and pouring; recent trends: cupola design.

Fluidity:

Measurement of fluidity; effects of various parameters on fluidity.

Internal Stress, Defects and Surface Finish:

Residual stresses; hot tears and cracks in castings; stress relief; defects causes and remedies; various parameters affecting surface finish and related defects e.g. rough casting, sand bum-on sand bum-in and metal penetration; facting and washes; mold wall movement; vapor transport zones; expansion scabbing etc.

8

Unit-V

Gases in Metal:

Methods of elimination and control of dissolved gases in castings.

Foundry Practice:

Casting of different types of cast irons; aluminum; zinc; brass etc; mechanization in factory; use of computer in foundry.

Inspection and Quality Control:

Review of x-ray radiography; magnetic particle; penetrant and ultrasonic inspections; use of statistical quality control in foundry.

8

Books:

1. Metal Casting Computer Aided Design and Analysis: Ravi B. Prentice Hall of India.
2. Fundamentals of Metal Casting: Flinn, R.A., Addison-wesley Reading, Massachusetts, 1963.
3. Transport Phenomena in Metallurgy: Geiger, G.H. and Poirier, D.R. Addison Wesley, Reading.
4. Thermodynamics for the Foundaryaman: Veynik, A.I. Mac Laren, London, 1968.

FRICITION AND WEAR
ME605
(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit -I

Introduction: Concept of a surface and surface topography of engineering surfaces; Interaction between contacting surfaces, concept of elastic and plastic deformation, Hertz's contact theory; Concept of surface forces electrostatic forces, capillary forces and van der Waal forces.

8

Unit -II

Friction and Engineering Materials: Concept and laws of friction; Theories of friction, rolling friction, sliding friction, Coulomb model, junction growth, asperity deformation, stresses in friction; Temperature in friction. Friction of metallic materials, ceramics, polymers and lamellar solids.

8

Unit -III

Assessment and Control of Friction: Assessment of coefficient of friction, measurement of friction force and contact temperature, assessment of surface forces, tribometer and atomic force microscope (AFM); Lubricants in reducing friction.

8

Unit -IV

Wear and its Mechanisms: Concept of wear of engineering surfaces; Types of wear; Sliding wear, dry and lubricated wear of surfaces, chemical wear. Abrasion; Adhesion; Erosion; Fatigue; Corrosion, Other forms of wear.

4

Wear Characteristics of Engineering Materials: Wear of metallic materials, ceramics, composites and polymers.

4

Unit -V

Wear estimation and Control: ASTM standards for estimation of wear of engineering surfaces, Modification of functional surfaces for minimization of wear, selection of materials and techniques.

4

Lubrication

Definition & Scope. Flow and shear stress, energy equation. Mechanism of pressure development in bearings. Concept of Boundary Layer.

4

REFERENCE BOOKS:

1. Rabinowicz, E., "Friction and Wear of Materials", John Wiley and Sons, Inc., New York. 1965
2. Hutchings, I.M., "Tribology: Friction and Wear of Engineering Materials", Edward Arnold, London. 1992
3. Rigney, D.A.(ed.), "Fundamentals of Friction and Wear of Materials", American Society for Metals, Ohio, USA.
4. ZumGahr, K. H., "Microstructure and Wear of Materials", Elsevier, Amsterdam. 1987

DESIGN FOR MANUFACTURE

ME606

(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Introduction:

Introduction, concept of concurrent engineering, need of concurrent engineering, Automation of design and manufacturing functions in CIM, computer aided process panning, Design for Manufacture , Approaches to DFM & DFM, Design for Automated Manufacturing and Design for Economic Manufacturing. 8

Unit-II

Design Quality:

Quality by Design, QFD, Taguchi's concept of Quality Loss function parameter design, comparing alternative design, tolerance design, system optimization, Robust design. 8

Unit-III

Design for Reliability:

Basic concepts, reliability analysis during design phase, failure mode analysis, reliability analysis of mechanical systems, design guidelines for reliability, maintainability and testability, reliability tests, quality reliability assurance during production phase. 8

Unit-IV

Design Knowledge Representation:

Design for manufacturing and re-design considerations in automated CAD/CAM systems, Design and manufacturing knowledge representation, knowledge representation for DFM support, intelligent evaluation of design for manufacturing cost. 8

Unit-V

Evaluation of Manufacturability:

Evaluation of the manufacturability of a part design, various methods of defining manufacturability index, interpretation of the MI value, Manufacturability evaluation; a multi criteria approach. 8

Books:

1. Integrated Product Development : M.M. Andersen and L. Mein, IFS Pub.
2. Product Design for manufacture: G Boothroyd, P Dewhurst and W. Knight, Marcel Dekker
3. Handbook of Product Design for Manufacture, A practical Guide to low Cost Production: J. G. Bralla, McGraw Hill
4. G.D. Huang, Chapman & Hall
5. Concurrent Engineering: Kusiak, Wiley
6. Competitive Product Design for Manufacturability: Barkan and IshuiMcMillon.

Prerequisite-None

Co-requisite-None

**OPTIMIZATION TECHNIQUES IN ENGINEERING
ME607**

(w.e.f. Session 2017-18)

L T P C
3 1 0 4

Unit-I

Unconstrained Optimization: Optimizing Single-Variable Functions, conditions for Local Minimum and Maximum, Optimizing Multi-Variable Functions.

Constrained Optimization: Optimizing Multivariable Functions with Equality Constraint: Direct Search Method, Lagrange Multipliers Method. 8

Unit-II

Constrained Optimization: Constrained Multivariable Optimization with inequality constrained: Kuhn-Tucker Necessary conditions, Kuhn – Tucker Sufficient Conditions.

Optimization: Quasi-Newton Methods and line search, least squares optimization, Gauss-Newton, Levenberg-Marquardt, Extensions of LP to Mixed Integer Linear Programming (MILP). 8

Unit-III

Optimization: Non-Linear Programming, the Newton Algorithm, Non-Linear Least Squares, Sequential Quadratics Programming (SQP), Constrained Optimization,

Multi-Objective Optimization, Branch and Bound Approaches, Genetic Algorithms and Genetic Programming, 8

Unit-IV

Optimization and Functions of a Complex Variable and Numerical Analysis: The Finite Difference Method for Poisson's Equation in two Dimensions and for the Transient Heat Equation, Eulers Method, The Modified Euler Method and the Runge-Kutta Method for Ordinary Differential Equations, Gaussian Quadrature Trapezoidal Rule and Simpson's 1/3 and 3/8 Rules, the Newton Raphson in one and two Dimensions 8

Unit-V

Evolution of neural networks; Artificial Neural Network: Basic model, Classification, Feed forward and Recurrent topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement.

Classical and fuzzy sets: Introduction, Operations and Properties, Fuzzy Relations: Cardinality, Operations and Properties, Equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method. 8

Books.

1. Winston W L: Operations Research: Applications and Algorithms
2. Rao S.S., Optimization: Theory and Applications.
3. Walsh G R: M methods of Optimization.
4. Williams H.P.: Model Building in Mathematics Programming.
5. Williams H.P.: Model Solving in Mathematics Programming
6. G.L. Nemhauser and L.A. Wolsey: Integer and Combinational Optimization.
7. R.G. Parker and R.L. Rardin: Discrete Optimization.
8. Limin Fu, "Neural Networks in Computer Intelligence," McGraw Hill, 2003.
9. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," McGraw Hill, 1995.
10. B. Yegnanarayana, "Artificial Neural Networks," PHI, India, 2006.

Prerequisite-None

Co-requisite-None

MAINTENANCE MANAGEMENT

ME608

(w.e.f. session 2017-18)

L T P C
3 1 0 4

Unit-I

Introduction:

Importance, definition, meaning and scope of maintenance, objectives, duties, functions and responsibilities of maintenance engineering department, organization and structure of maintenance systems, types of maintenance, replacement need, case studies and simple probabilistic models for items that fail completely, crew size determination.

Management Policies for Maintenance: Policies for work allocation, interplant relations, workforce and control. **8**

Unit-II

Maintenance Planning and Scheduling:

Maintenance planning, strategies and scheduling, reliability oriented maintenance systems, reliability programme, reliability improvement, quantitative estimation of reliability, failure modes effects and critically analysis (FMECA), reliability models and indices.

Introducing standby unit into production system, optimum design of a series/parallel system, breakdown time distribution. **8**

Unit-III

Total Productive Maintenance (TPM): Objectives, waste elimination, equipment maintenance techniques. Benefits of TPM, pillars of TPM, performance measures of maintenance systems.

Maintenance Activities:

Optimal overhaul/repair or replacement, Maintenance budgeting and control, production maintenance integration. **8**

Unit-IV

Maintainability and Availability:

Economical aspects of maintainability and reliability, maintainability increment, overall equipment effectiveness, productivity and maintenance, condition based maintenance, equipment availability. **8**

Unit-V

Computer Aided Maintenance:

Introduction, benefits, selection process for software, use of computers in decision making for maintenance, system implementation, and key maintenance features, functions of computer maintenance management system (CMMS), Integration of CMMS with overall organizations network, Software and hardware failure, future course of CMMS. **8**

Books:

1. Maintenance Engineering and Management, K. Venkataraman, PHI
2. Reliability and Maintenance Engineering, R. C. Mishra, New Age International
3. Production and operations Management, R. Panneerselram, PHI
4. Maintenance Engineering Handbook, L R Higgins, Mcgraw Hill Inc.
5. Management of Industrial Maintenance, Kelly A and M J Harris, Butterworth & Co.

Prerequisite-None

Co-requisite-None

PRODUCT DESIGN AND DEVELOPMENT

ME609

(w.e.f. session 2017-18)

L T P C
3 1 0 4

UNIT-1

Introduction, Sources of new ideas, Development processes, Product planning, Identification for Customer needs and technology potentials, Innovation and intellectual property rights, Product and process Patents, Patents and patenting processes. 8

UNIT-2

Product specifications, Tolerance specifications, Taguchi loss factor concepts, Quality functions deployment, Functional specifications of products, Form and function, Development of alternatives. 8

UNIT-3

Design for manufacture, Design for Assembly and design for economy, Prototyping and analytical prototyping, Stage-gate process of product development. 8

UNIT-4

Holistic product development approaches-Form product concept to decommissioning, Environment requirements, Life cycle design, Product data management and Product life cycle management systems, Dependency and concurrent engineering in development of products. 8

UNIT-5

Internet based approach to product development involving users. Democratization of innovation, connecting products to services, Experience innovation, robust design, Patents and Intellectual properties, product Developments. 8

Books:

1. Production Management K K Ahuja CBS Publishers
2. Production Design and Manufacturing A.K. Chitale & A.K. Gupta Prentice Hall of India
3. Management Development Alan Mumford Jaico Publishing House

Prerequisite-None

Co-requisite-None

INDUSTRIAL AUTOMATION AND ROBOTICS

ME610

(w.e.f. session 2017-18)

L T P C

3 1 0 4

UNIT-1

Introduction to Automation: Automation production system, Mechanization and automation, Types of automation, Automation strategies, Mechanical, electrical, hydraulic and Pneumatic automation devices and controls, Economics

High Volume Manufacturing Automation: Classification and type of automatic transfer machines; Automation in part handling and feeding, Analysis of automated flow lines, design of single model, multimodal and mixed model production lines. 8

UNIT-2

Programmable Manufacturing Automation: CNC machine tools, Machining centers, Programmable robots, Robot time estimation in manufacturing operations.

Flexible Manufacturing Automation: Introduction to Group Technology, Grouping methods, Cell Design, Flexible manufacturing system. 8

UNIT-3

Assembly Automation: Assembly systems, Automatic transfer, feeding and orienting devices, Flexible assembly systems, Performance evaluation and economics of assembly systems

Robotics: Review of robotic technology and applications, Laws of robotics, Robot systems and anatomy, Robot classification, End Effectors, Robot kinematics, Object location 8

UNIT-4

Robotics: Homogeneous transformation, Direct and inverse kinematics, Manipulator motions, Robot drives, actuators and control, Drive systems, Hydraulic, Pneumatic Electrical DC and AC servo motors and stepped motors, Mechanical transmission method Rotary-to-rotary motion conversion, Robot motion and path planning control and Controllers, Robot sensing, Range sensing, Proximity sensing, touch sensing, Force and torque sensing etc., Robot vision, Image representation, Image recognition approaches. 8

UNIT-5

Robot Applications: Robot applications in manufacturing-Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Robot cell design and control, Robot cell layouts-Multiple robots & Machine interference, Economics and social aspects of robotics, Future applications. 8

Books:

1. Automation, Production System & Computer Integrated Manufacturing Groover Prentice Hall India
2. Principles of Automation & Automated Production Process Malov and Ivanov Mir Publication
3. Automation in Production Engineering Oates and Georgy Newness -
4. Stochastic Models of Manufacturing Systems Buzacott & shanty Kumar Prentice Hall India
5. Robotics K.S. Fu, R.C. Gonzalez, C.S.G. Lee McGraw Hill
6. Robotics J.J. Craig Addison-Wesely
7. Robot Engineering: An Integrated Approach R.D. Klafter, t.a. Chmielewski and M. Negin Prentice Hall India

Prerequisite-None

Co-requisite-None

