CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM (CBCS)

FOR

MASTER OF TECHNOLOGY (M.Tech.)

(2 Year Postgraduate Degree Programme)

IN

PRODUCTION ENGINEERING

[w. e. f. 2019-20]

FACULTY OF ENGINEERING AND TECHNOLOGY
SRM UNIVERSITY DELHI-NCR, SONEPAT
Plot No.39, Rajiv Gandhi Education City, P.S. Rai, Sonepat
Haryana-131029

Semester -I

Code	Subject	L	P	Credits
PE0101	Theory of Metal Cutting	3	0	3
PE0102	Advanced Metal Forming	3	0	3
PE0103	Advanced Casting and Welding Technologies	3	0	3
CS0101	Object Oriented Programming C++	3	0	3
19PE0128	Research Methodology	3	0	3
	Elective –I	3	0	3
PE0107	Production Engineering Lab	0	4	2
	Total Credits	**18**	**4**	**20**

Semester -II

Code	Subject	L	P	Credits
PE0109	Precision Engineering	3	0	3
PE0110	Rapid Prototyping Technologies	3	0	3
PE0111	Optimization Techniques and Applications	3	0	3
PE0112	Automation in Manufacturing	3	0	3
	Elective –II	3	0	3
PE0119	Computer Aided Engineering Lab	0	4	2
PE0120	Seminar-II	2	0	2
	Total Credits	**17**	**4**	**19**

Semester -III

Code	Subject	L	P	Credits
	Elective –III	3	0	3
	Elective – IV	3	0	3
PE0201	Project Work Phase - I	0	16	8
	Total Credits	**6**	**16**	**14**

Semester -IV

Code	Subject	L	P	Credits
PE0202	Project Work Phase - II	0	32	16
	Total Credits	**0**	**32**	**16**

Semester	I	II	III	IV	Total	%
Total Credits	**20**	**19**	**14**	**16**	**69**	**100**

List of Elective Subject

Code	Subject	L	P	Credits
	Elective I			
19PE0121	Tool Design	3	0	3
PE0105	Advanced Manufacturing Processes	3	0	3
PE0106	Composite Materials	3	0	3
	Elective II			
PE0116	Mechatronics	3	0	3
PE0117	Industrial Robotics	3	0	3
PE0118	Design for Manufacture & Assembly	3	0	3
	Elective III			
19PE0122	Production Planning & Control	3	0	3
19PE0123	Supply Chain Management	3	0	3
19PE0124	Advanced Operations Research	3	0	3
	Elective IV			
19PE0125	Total Quality Management	3	0	3
19PE0126	Entrepreneurship Development	3	0	3
19PE0127	Ergonomics	3	0	3

		L	T	P	C
PE0101	**THEORY OF METAL CUTTING**	3	**0**	**0**	3
	Prerequisite				
	Nil				

PURPOSE
On completion of this course - the students will be in a position to apply their knowledge to solve problems in basic Metal cutting mechanism.

INSTRUCTIONAL OBJECTIVES
After learning the course the students should be able to:

1. Understand mechanism of chip formation in different machining condition.
2. Estimate the tool life for different tool materials.
3. Select the appropriate tool material and design for the given cutting conditions.
4. Understand the principles and applications of various modern machining and manufacturing processes.

Mechanics of Metal Cutting
Mechanism of chip formation, Orthogonal & Oblique cutting, Types of chips, Built-up edge, Determination of shear plane angle, Forces on the chips, forces in orthogonal cutting, Merchant circle diagram and analysis, Theory of Lee & Shaffer, Co-efficient of friction, Power & Energy Relationship, Velocity Relationship, Shear-Strain, Factors affecting forces and power, Problems.

Geometry of Cutting Tools:
Single point and Multi point cutting tools, Tools nomenclature, Tool point reference systems, Tool angle specifications –ISO and ASA systems, Conversion from one system to another. Recommended tool angles, Effect of cutting parameters on tool geometry.

Tool Materials and Their Properties:
Characteristics of Tool Materials, Types of tool materials – Carbon tool steels, High speed steels, Cast alloys, Cemented carbides, Ceramics, Diamonds, SIALON, CBN, UCON, Recommended Cutting Speeds for the above Tools, Water, Oil hardening of Tools and their applications.
Measurement of Cutting Forces:Reasons for measuring cutting forces, Classification of cutting force dynamometers – Mechanical, Hydraulic, Strain gage type Dynamometers.

Tool Wear, Tool Life:
Mechanisms of tool wear, Sudden & gradual wear, crater wear, Flank wear, Tool failure criteria, tool life equations, Effect of process parameters on tool life, Tool life tests, conventional & Accelerated tool wear measurement, Machinability index.
Thermal Aspects in Metal Cutting:Heat sources in metal cutting, Temperature in chip formation, Temperature Distribution, Experimental Determination of Tool Temperatures.

Cutting Fluids:
Basic actions of cutting fluids, properties of cutting fluids, Selection of cutting fluids, application of cutting fluids, Filtration of fluids, recommended cutting fluids.
Economics of Machining:Introduction, Elements of total production cost, Optimum cutting speed and tool life for Minimum cost, Optimum cutting speed and Tool life for Maximum Production, Problems.

TEXT BOOKS
1. M.C. Shaw, *Metal Cutting Principles*, Oxford Publication, 1985.
2. B.L.Juneja& G.S Sekhar,*Fundamentals of Metal Cutting & Machine Tools*, Wiley Eastern.

REFERENCES BOOKS :
1. V.C.Venkatesh&S.Chandrasekhanan,Metal *Cutting*, Pantice Hall – 1991.
2. Dr. B.J.Ranganath, *Metal Cutting*, Vikas Publications

		L	T	P	C
PE 0102	**ADVANCED METAL FORMING**	**3**	**0**	**0**	3

PURPOSE

To develop the ability to understand the Advanced Metal Forming techniques evolved in metal forming processes

INSTRUCTIONAL OBJECTIVES

1. The basics of metal forming analysis
2. Forging and strip rolling processes
3. Extrusion and drawing of metals
4. Sheet metal forming

MATERIALS BEHAVIOUR

Structure of metals, Plastic deformation on work Hardening , strain Hardening, Recovery, Recrystallization and grain Growth Cold, Warm& Hot Working , True Stress and True Strain Rate of deformation , Super plasticity, Ductile & Brittle Fracture, Residual stresses , Ductility & Formability

ANALYSIS OF STRESSES AND STRAIN

Principal stresses, Maximum shear stresses, Yield condition, Von Misses Hypothesis of yielding, Tresca's Hypothesis of Yielding Graphical Representations of Yield Criteria , Constriction of slip Lines

FORGING AND STRIP ROLLING PROCESSES

Forging Machines, Upsetting and Swaging, Analysis of Plain strain compression, Sticking friction, Slipping and Sticking Friction, Analysis of compression of circular dies with slipping friction- with sticking friction , longitudinal rolling of strips and sheets Rolling load and power elastic deformation of rolls Rolls camber Rolling process and mills

EXTRUSINON AND DRAWING OF METALS

Cold and hot, impact and hydrostatic extrusion, die design and lubrication analysis of extrusion load, Empirical formulation for extrusion pressure, lubrication in wire drawing , drawing stresses , optimum die angle , analysis of tube drawing.

SHEET METAL FORMING

Fine blanking , High energy rate forming processes – Explosive forming , Electro hydraulic forming , Magnetic pulse forming , Bending , spring back , deep drawing , Redrawing , strip development , component & progressive dies.

TEXT BOOKS

1. Joneja, B.L, *Fundamental of Metal Forming Processes*, New Age International Publishers, New Delhi, 2018.
2. Surinder Kumar, *Technology of metal forming processes*, PHI Learning Pvt Ltd, Delhi, 2015.

REFERENCE BOOKS

1. Sharma P.C, *A textbook of Production Technology*, .S Chand and Co, New Delhi.
2. A S T M E., *Fundamentals of Tool design*, Prentice Hall of India.
3. Kalpakjian. *"Manufacturing Eng. and Technology*", Pearson.

		L	T	P	C
PE0103	**ADVANCED CASTING AND WELDING TECHNOLOGIES**	3	**0**	**0**	3

PURPOSE

To provide the knowledge Casting and Welding process.

INSTRUCTIONAL OBJECTIVES

1. Introduction to Casting and its gating system
2. Knowledge of Special casting methods
3. Study of Welding Processes
4. Detailed study Welding Metallurgy
5. Knowledge of Design of Weldments and Testing of Welded Joint.

Casting

Patterns, pattern allowances, mould and core making, melting practice and furnaces, cooling and solidification, Elements of gating system, design of gating system, Theoretical consideration, Directional solidification, Design of risers, Modulus Caine's and shape factor methods, application of chills.

Different moulding and casting processes

Permanent mould casting, shell moulding, die casting, vacuum die casting, squeeze casting, centrifugal casting, investment casting-die casting continuous casting-low pressure casting, Casting defects and their remedies, Fettling and testing of casting.

Welding Processes

Classification, structure and characteristics of welding arc, Arc blow, Methods of arc initiation and maintenance, arc stability, arc welding power sources, Duty cycle, Metal transfer, Selection of Welding process, Different welding processes: Shielded Metal Arc Welding (SMAW), Submerged Arc Welding (SAW), Gas Tungsten Arc Welding (GTAW/TIG), Gas Metal Arc Welding (GMAW), Welding Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding and Thermit welding.

Welding Metallurgy

Heat flow in welding, Metallurgical transformation in and around weldment, Implication of cooling rates, Heat affected zone (HAZ), Weldability of plain carbon steels, Stainless steels, Cast iron, Aluminium and its alloys.

Design of weldments

Joint design, Residual stresses and distortion, Testing of welded joints, Destructive Tests and Non-destructive tests (NDT)

Text Books:

1. P. L. Jain, *Principles of Foundry Technology, 5th edition*, TMH Publications, 2009.
2. Richard Heine, Carl Loper, Philip Rosenthal, *Principles of Metal Casting*, TMH Publications, 2004.
3. R. S. Parmar, *Welding Processes and Technology*, 3 rd Edition, Khanna Publishers, New Delhi, 2011.

References:

1. A. Ghosh and A. K. Mallik, *Manufacturing Science*, East west press, New Delhi, 2006,
2. H.S.Bawa, *Manufacturing Technology-I*, TMH Publications, New Delhi, 2007.
3. SeropeKalpakjian and Steven R. Schmid, *Manufacturing Processes for Engineering Materials*, Pearson Education, 2007
3. Richard L. Little,*Welding and Welding Technology*, TMH Publications.

		L	T	P	C
CS0101	Object Oriented Programming **C++**	**3**	**0**	**0**	**3**

PURPOSE

To impart a sound knowledge on working of the computer involving the different basic concepts of programming oriented topics required for developing computer software.

INSTRUCTIONAL OBJECTIVES

The students should be conversant with

1. The working of OOPS programming approach.
2. The knowledge of object oriented programming style.
3. The basic concepts involved in computer programming.
4. Important programming aspects i.e object, class, inheritance and polymorphism.
5. Knowledge with respect to the software development phase of OOPS.

INTRODUCTION

Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming- abstraction, encapsulation, data hiding

OBJECT & CLASS

concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, specifying a class, creating class objects, accessing class members, access specifiers, static members, use of const keyword, friends of a class, empty classes, nested classes, local classes, abstract classes,
Need for constructors and destructors, destructors

INHERITANCE

Introduction, Base Classes and Derived Classes, Protected Members, type of inheritance, Using Member Functions, Overriding Base -Class Members in a Derived Class, Using Constructors and Destructors in derived Classes, Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract classes

POLYMORPHISM

Polymorphism: Overloading, Overriding, Abstract Classes, Operator Overloading: Introduction, Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions

EXCEPTION HANDLING AND I/O

Basics of C++ Exception Handling: Try Throw, Catch, Throwing an Exception;- Catching an Exception, Re-throwing an Exception, Processing Unexpected Exceptions,
Files and I/O Streams and various operation on files.

TEXT BOOK

1. Object Oriented Programming in Turbo C++ by Robert Lafore , 1994, The WAITE Group Press.
2. Programming with C++ By D Ravichandran, 2003, T.M.H
3. Object oriented Programming with C++ by E Balagurusamy, 2001, Tata McGraw-Hill

REFERNCE BOOKS

1. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall
2. Computing Concepts with C++ Essentials by Horstmann, 2003, John Wiley,
3. The Complete Reference in C++ By Herbert Schildt, 2002, TMH.
4. C++ Programming Fundamentals by Chuck Easttom, Firewall Media

		L	T	P	C
19PE0128	**Research Methodology**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course develop a research orientation among the scholars and to acquaint them with fundamentals of research methods.

INSTRUCTIONAL OBJECTIVES

1. To give an overview of the research methodology and explain the technique of defining a research problem
2. To explain the functions of the literature review in research.
3. To explain carrying out a literature search, its review, developing theoretical and conceptual frameworks and writing a review.
4. To explain various research designs and their characteristics.
5. To explain the details of sampling designs, and also different methods of data collections.
6. To explain the art of interpretation and the art of writing research reports.

UNIT-I

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process

Problem Identification & Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance

UNIT-II

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.

Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

UNIT-III

Measurement: Concept of measurement– what is measured? Problems in measurement in research – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio.

Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

UNIT-IV

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

UNIT-V

Use of Encyclopedias, Research Guides, Handbook etc., Academic Databases for Computer Science Discipline.

Use of tools / techniques for Research: methods to search required information effectively, Reference Management Software like Zotero/Mendeley, Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

Books Recommended:-

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman& Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Select references from the Internet

		L	T	P	C
PE0107	**Production Engineering Lab**	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

To expose hands-on training to the students on various machines like lathe, Shaper, Milling, grinding machines

INSTRUCTIONAL OBJECTIVES

1. Study of various types of lathe operations.
2. To produce flat surface and contour shapes on the given component.
3. To know the various methods of making gears.
4. To get an idea for making good quality products with good surface finish.

LIST OF EXPERIMENTS

1. Exercises involving plain turning, step turning, knurling, chamfering, taper turning, facing, free hand turning and "V" & Square thread cutting.
2. Demonstrations on eccentric turning, internal threading, taper turning by taper turning attachment and tail stock set over method, Capstan and turret lathe etc.
3. Milling Practice: Preparing milling models. Exercises on spur gear, helical gear, Slot milling
4. Shaping Practice: Preparing Shaping models. Shaping of flat surfaces, inclined surfaces, cutting of slots etc.
5. Grinding Practice: Exercises on Surface grinding and cylindrical grinding
6. Demonstrations on various advanced machines and machining operations.
7. To study the characteristics and output of vibratory feeder.
8. To study the characteristics and output of hook type feeder.
9. To study the escapement device.

Text Book:

1. N. Acherkan , Machine Tool Design, MIR Publishers MOSKOW.
2. S.K.H. Choudhary and A.K.H. Choudhary, Elements of Workshop Technology Vol. 2, Media Promoters & Publications Pvt Ltd., 2010.

Reference Book:

1. B.S. Raghuvanshi, A course in Workshop Technology Vol. 2, DhanpatRai, 2015.

		L	T	P	C
PE0109	**PRECISION ENGINEERING AND TECHNOLOGY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering

INSTRUCTIONAL OBJECTIVES

1. The basics of precision engineering
2. The various techniques of precision engineering like Nano technology etc,
3. The accuracy, influence of static stiffness, vibration accuracy etc

ACCURACY

General concept of accuracy – Spindle rotation accuracy – Test methods-Displacement accuracy – Dimensional wear of cutting tools - Accuracy of NC systems - Clamping errors - Setting errors - Errors due to Location - Location of rectangular prism, cylinder.

ACCEPTANCE TESTS FOR MACHINE TOOLS

Basic type of tests – Measuring instruments used for testing machine tools - Alignment tests-Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

INFLUENCE OF STATIC STIFFNESS, THERMAL EFFECTS

Static stiffness – Nature of deformation in a machine tool – Overall stiffness of a lathe – Compliance of work piece-Errors due to the variation of the cutting force and total compliance – Inaccuracies due to thermal effects – Methods of decreasing thermal effects-Influence of vibration on accuracy.

NANOTECHNOLOGY

Introduction - Top down and bottom up approach - Development of Nanotechnology - Precision and micro-machining - Micro EDM. Diamond turning of parts to nanometer accuracy - Stereo microlithography. Carbon nanotubes - Production methods, applications. Nanomanufacturing.

NANOMEASURING SYSTEMS

In - Process measurement of position of processing point - Post process and on line measurement of dimensional features - Mechanical measuring systems - Optical measuring systems - Electron beam measuring systems - SEM and TEM - pattern recognition and inspection systems.

Applications of Nanotechnology: Nano–Lithography–Photolithography - Electorn beam lithography–Ion -Beam lithography - Nanocoatings - AFM applic

TEXT BOOKS

1. Murthy R. L., *Precision Engineering in Manufacturing*, New Age International, New Delhi, 1996.
2. Norio Taniguchi, *Nanotechnology*, Oxford university press, Cambridge, 1996.

REFERENCE BOOKS

1. Lee Tong Hong, *Precision Motion control, Design and Implementation*, Springer Verlag, U.K., 2001.
2. Liangchi Zhang, *Precision Machining of Advanced Materials*, Trans Tech Publications Ltd., Switzerland, 2001.
3. HiromuNakazawa, *Principles of precision engineering*, Oxford university press,1994.

		L	T	P	C
PE0110	**RAPID PROTOTYPING TECHNOLOGIES**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology

INSTRUCTIONAL OBJECTIVES

1. The fundamental Theory behind RP process.
2. Study the Process parameters of different machine.
3. Study different types of Rapid tooling.
4. Based on the industrial standards, learn how Prepare manufacturing DATA.
5. The basics concept of different software used in RP system.

Introduction & History of Rapid Prototyping - Need for the compression in Product development Growth of RP Industry, Classification of RP, Stereo lithography(SLA) system & principle, Process parameter, process details of SLA, Data preparation, data files of SLA , Machine details & Application of SLA

Selective Laser Sintering (SLS)- Introduction, SLS Machine Type – Details, SLS principle of operation, Process parameters of SLS, Data preparation for SLS, Fused Deposition Modeling (FDM) – Introduction, FDM Principles, Process Parameters, Path generation & Application of FDM, Solid Ground curing (SGC) - Principle of operation, SGC machine details & application,

Laminate Object Manufacturing (LOM) - Principle of operation, LOM materials, LOM Process details & Application, Concepts modelers – Principle, Thermal Jet Printer, Sander model maker – Explanation, 3-D Printer, Genesis Printer & HP Systems, Object Qudra system

Rapid tooling -Indirect rapid tooling, Silicon Robber tooling, Aluminium filling epoxy tooling, Spray metal tooling, Direct rapid tooling, Quick cast process, copper Polyamide, DMILS – explanation, Prometals, sand casting tooling, Soft tooling & hard tooling,

STL files, Solid View, Magics, Imics, Magic communicator, Internet based software, Rapid Manufacturing – Introduction, Factors influencing accuracy, Data preparation errors, Part building errors, Errors in finishing, Influence of build orientation

TEXT BOOKS:

1. Paul F. Jacobs: "*Stereo lithography and other RP & M Technologies*", SME, NY 1996.
2. Flham D. T &Dinjoy S.S "*Rapid Manufacturing*" Verlog London 2001.
3. Lament wood, *Rapid automated*, Indus press New York

REFERENCES BOOKS:

1. Terry Wohlers "*Wohler's Report 2000*" Wohler's Association 2000.
2. Gurumurthi, *Rapid prototyping materials*, IISc Bangalore.

		L	T	P	C
PE0111	**OPTIMIZATION TECHNIQUES AND APPLICATIONS**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enlighten the students with the various optimization techniques

INSTRUCTIONAL OBJECTIVES

At the end of the course the students will be able to know

1. Concepts of Engineering Optimization Problems
2. Applications and use of Multivariable Optimization Algorithms
3. Applications and use forecasting

Introduction:

Optimization Problem Formulation, Design Variables, Constraints, Objective Function, Variable Bounds, Engineering Optimization Problems, Optimization Algorithms

Single Variable Optimization Problems:

Optimality Criterion, Bracketing Methods: Exhaustive Search Method, Bounding Phase Method. Region Elimination Methods: Interval Halving Method, Fibonacci Search Method, Golden section Search Method, Gradient Based Methods: One of the followings-Newton-Raphson Method, Bisection Method, Cubic Search Method

Multivariable Optimization Algorithms

Optimality Criteria, Unidirectional search, Direct Search Methods: Any two of the followings-Evolutionary optimisation method, Simplex Search Method, Hooke-Jeeves pattern search method.

Specialized Algorithms Integer Programming: Penalty Function Method, Branch and Bound Method, Geometric Programming.

Forecasting Introduction to forecasting, forecasting models, qualitative models of forecasting, time series model of forecasting.

Text Books:

1. S.S. Rao, Engineering Optimization: Theory and Practice, New Age International Publishers, 3rd Edition, 2013.
2. 2. H.A Taha, Operations Research; An Introduction, Pearson Publication, 9th Edition2014.
3. R.L Fox, Optimization Methods for Engineering Design, Addison-Wesley Publication Co., 1971.
4. K. Deb, Optimization for Engineering Design Algorithms and Examples, Prentice Hall Publishers, 2nd Edition, 2012.

Reference Book:

1. J.C Pant, Introduction to Optimization techniques, Jain Brothers, 7 th Edition, 2008.

		L	T	P	C
PE0112	**Automation in Manufacturing**	3	**0**	**0**	3
	Prerequisite				
	Nil				

PURPOSE

To provide the knowledge about automation in manufacturing industries.

INSTRUCTIONAL OBJECTIVES

1. Introduction to Automation
2. Knowledge of group technology(GT) & FMS
3. Study of control technologies in automation
4. Detailed study of material handling systems
5. Study of Pneumatic and hydraulic components used in Industries

Introduction to Automation

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations, introduction to automation productivity.

Automated Manufacturing Systems

Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Flow lines & Transfer Mechanisms, Fundamentals and Analysis of Transfer Lines, product design for automatic assembly.

Control Technologies in Automation

Industrial Control Systems, Process Industries Verses Discrete-Manufacturing Industries, Continuous Verses Discrete Control, Computer Process and its Forms. Sensors, Actuators and other Control System Components.

Material handling systems and Evaluation of automatic production

Overview of Material Handling Systems- Rotary feeders, oscillating force feeder, vibratory feeder, elevator type and Centrifugal type feeders, Principles and Design Consideration, Material Transport Systems, Storage Systems. Product manufacturability, orientation devices- active and passive devices, parts orientation and Rocapement.

Pneumatic and hydraulic components and circuits

Boolean algebra, pneumatic sensors and amplifiers, jet destruction devices, logic devices, schimit triggering devices, developing pneumatic circuits for automatic die casting machine.

TEXT BOOKS

1. Mikell P. Groover, *Automation Production Systems &Computer Integrated manufacturing*, Prentice Hall of India, New Delhi, 1989.
2. W.P. David, *Industrial Automation*, John Wiley and Sons.

REFERENCE BOOKS

1. R.C. Dorf, *Flexible Manufacturing*, Butterworth-Heinemann, John Wiley and Sons.
2. Krishna Kant, *Computer Based Industrial Control*, EEE-PHI.
3. Jha, N.K. *" Handbook of Flexible Manufacturing Systems "*, Academic Press Inc., 1991.
4. Amber G.H & P. S. Amber, *Anatomy of Automation*, Prentice Hall.
5. N. Viswanandham, *Performance Modeling of Automated Manufacturing Systems*, PHI.
6. R.P. Hunter, *Automatic process control system and Hardware*, Prentice Hall.
7. W Bolton., *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering*, Prentice Hall.

		L	T	P	C
PE0119	**Computer Aided Engineering Lab**	**0**	**0**	4	**2**
	Prerequisite				
	Nil				

Purpose
To provide hands on training to the students on various software design and manufacturing.

Instructional Objectives:
To familiarise with
1. Drafting Practice
2. Modelling
3. Assembly
4. Analysis
5. Part Programming

Drafting
Development of part drawings for various components in the form of orthographic and isometric. Representation of dimensioning and tolerances.

Part Modeling& Assembly
Generation of various 3D Models through Protrusion, revolve, sweep. Creation of various features. Study of parent child relation. Feature based and Boolean based modeling and Assembly Modeling. Study of various standard Translators. Design of simple components

Analysis
Deflection and stresses in 2D and 3D trusses and beams, deflections, principal and Von-mises stresses in plane stress, plane strain and Axi-symmetric components, Determination of stresses in 3D and shell structures (at least one example in each case)

Part Programming
Study of various post processors used in NC Machines, Development of NC code for free form and sculptured surfaces using CAM software and Machining of simple components on NC lathe and Mill by transferring NC Code / from CAM software.

		L	T	P	C
PE0201	**PROJECT WORK PHASE - I**	**0**	**0**	**16**	**8**
	Prerequisite				
	Nil				

M.Tech students, M.Tech Thesis / Project will be done in **IIIrd** & **IVth** semester either in Department / Institute or outside (Department / Institute with the prior permission of the department). The project will be carried out under the supervision/ guidance of the faculty member designated as Supervisor/ Guide as assigned by the Department. The topic should be decided at the end of **IInd**semester. The student(s) will submit a synopsis at the beginning of **IIIrd**semester and make a progress presentation at the end of **IIIrd**semester.

		L	T	P	C
PE0202	**PROJECT WORK PHASE - II**	**0**	**0**	**32**	**16**
	Prerequisite				
	Nil				

M.Tech students, M.Tech Thesis / Project will be done in **IIIrd** & **IVth** semester either in Department / Institute or outside (Department / Institute with the prior permission of the department). The project will be carried out under the supervision/ guidance of the faculty member designated as Supervisor/ Guide as assigned by the Department. The topic should be decided at the end of **IInd**semester. The student(s) will submit a synopsis at the beginning of **IIIrd**semester and make a progress presentation at the end of **IIIrd**semester. The final internal and external evaluation for the thesis will be done at the end of **IVth** semester. For external evaluation an external examiner from outside the institution is required.

LIST OF ELECTIVES

		L	T	P	C
19PE0121	**TOOL DESIGN**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To develop in the engineering student the ability to design cutting tools and press tools for given condition.

INSTRUCTIONAL OBJECTIVES

At the end of this course the student should be able to understand

1. Tool materials and their properties
2. Design of single point cutting tools and twist drills
3. Design of various types of dies
4. Blank development for different components
5. Design of jigs and fixtures for simple components

TOOL DESIGN

Different tool materials: cemented carbides, coated carbides, cermets, ceramics and polycrystalline tool materials – compositions - properties of tool materials - Selection and treatments - Plastics as tooling materials - New tooling materials Design of single point turning and threa
ding tools - Selection of tool holders and inserts for turning - Chip breakers - Design of twist drill and reamers.

PRESS TOOL DESIGN

Press working terminology - Presses and press accessories - Computation of capacities and tonnage requirements - Strip layout - Types of dies – Design and development of various types of cutting, forming, bending and drawing dies - Progressive dies, Combination dies and compound dies - Blank development for cylindrical and non cylindrical shells, Simple problems.

DESIGN OF JIGS

Principles of jigs and fixtures - Locating elements - Drill bushes - Different types of jigs - Plate, latch, channel, post, angle plate, turn over, and pot jigs - Automatic drill jigs, Design and development of jigs for given components.

DESIGN OF FIXTURES

Design principles of fixtures - Design of fixtures for milling, boring. Design of fixture for assembly, inspection and welding. Design and development of fixtures for given components.

TERM PROJECT

Submission of an industrial report on observation training in Jigs, fixture and press tools. (A group comprising of 3 or 4 students should identify a component from an industry and should design jig and fixture or press tool as per the requirement).

TEXT BOOKS

1. Sadasivan, T. A., and Sarathy, D., *Cutting tools for Productive machining* , 1st edition, Widia (India) Ltd, Bangalore, 1999.
2. Donaldson, C., Lecain, G. H. and Goold, V. C., *Tool Design*, Tata McGraw Hill publishing company limited, New Delhi, 2002.
3. Edward G. Hoffman, *Jigs and Fixture design*, 2nd edition, Galgotia publication Pvt. Ltd., New Delhi, 1987.

REFERENCE

1. Hiram E. Grant, *Jigs and Fixtures - Non standard clamping device*, Tata McGraw Hill, New Delhi, 1971.
2. Prakash H. Joshi, *Press tool design and construction*, 1st edition, Wheeler Publishing, New Delhi, 2000.
3. Kempster, M. H. A., An *Introduction to Jig and tool design*, 3rd edition, ELBS, 1987.
4. Prakash H. Joshi, *Cutting tools*, 1st edition, Wheeler Publishing, New Delhi, 1997.
5. Prakash H. Joshi, *Tooling Data*, 1st edition, Wheeler Publishing, New Delhi, 2000.
6. ASTME, *Fundamentals of Tool design*, 11th Edition, Prentice Hall of India, New Delhi, 1987.

		L	T	P	C
PE0105	**ADVANCE MANUFACTURING PROCESSES**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To impart clear knowledge about different unconventional processes and the latest developments to the students.

INSTRUCTIONAL OBJECTIVES

To enable the students to understand the

1. Basic concepts of non- traditional machining techniques
2. Factors influencing the processes and their applications

INTRODUCTION

Introduction to non- traditional machining methods – Need for non - traditional machining - Sources of metal removal – Classification on the basis of energy sources – Merits and demerits-Parameters influencing selection of process.

MECHANICAL ENERGY TECHNIQUES

Abrasive Jet Machining (AJM): Operating principles – Equipment – Parameters influencing metal removal Benefits – Applications – Advantages and Limitations.

Water Jet Machining (WJM): Operating principles – Equipment – Parameters influencing metal removal – Benefits – Applications – Advantages and limitations.

Abrasive Water Jet Machining (AJM): Operating principles – Equipment – Parameters influencing metal removal –Benefits – Applications – Advantages and Limitations.

Ultra Sonic Machining (USM): Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits and Applications – Advantages and limitations

ELECTRICAL ENERGY TECHNIQUES

Electro Chemical Machining (ECM): Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits and applications – Advantages and limitations – Current developments in ECM.

Electro Chemical Grinding (ECG): Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and limitations

THERMO ELECTRICAL ENERGY TECHNIQUES

Electrical Discharge Machining (EDM) and Wire Cut Electrical Discharge Machining (WCEDM): Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and limitations.

Electrical Discharge Grinding (EDG): Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and limitations

THERMAL ENERGY TECHNIQUES

Operating principles – Equipment and sub systems – Parameters influencing metal removal – Benefits – Applications – Advantages and limitations of Electron beam machining (EBM), Plasma ARC Machining (PAM) and laser beam machining (LBM).

TEXT BOOKS

1. Mishra, P. K., *Non-Conventional Machining*, The Institution of Engineers (India), Text Book Series, New Delhi, 1997.
2. Garry F. Benedict, *Unconventional Machining Process*, Marcel Dekker Publication, New York, 1987.

REFERENCE BOOKS

1. Bennedict, G. F., *Non Tradtional Machining Techniques*, Marcel Decker, New York, 1990.
2. Sharma, P. C., *A Text book of Production Engineering*, New Delhi, 1995.
3. Pandey and Sha, *Modern Manufacturing Process*, Prentice Hall, New Jersey.

		L	T	P	C
PE0106	**COMPOSITE MATERIALS**	**3**	**0**	**0**	**3**
	Prerequisite				

	Nil				

PURPOSE

Toimpart clear knowledge about different types of composite materials, their properties and applications.

INSTRUCTIONAL OBJECTIVES

To enable the students to understand the

1. Basic of Composites
2. Polymer Matrix Composite
3. Metal Matrix Composites
4. Ceramic Matrix Composites
5. Advanced Composites

INTRODUCTION TO COMPOSITES

Fundamentals of composites - need for composites – Enhancement of properties - classification of composites –Matrix- Polymer matrix composites (PMC), Metal matrix composites (MMC). Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites.

POLYMER MATRIX COMPOSITES

Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibres – Rovings – Woven fabrics – Non woven random mats – various types of fibres. PMC processes - Hand lay up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament winding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics (GRP).

METAL MATRIX COMPOSITES

Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibres. Effect of reinforcement - Volume fraction – Rule of mixtures. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting.

CERAMIC MATRIX COMPOSITES

Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminium oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing).

ADVANCES IN COMPOSITES

Carbon / carbon composites – Advantages of carbon matrix – limitations of carbon matrix Carbon fibre – chemical vapour deposition of carbon on carbon fibre perform. Sol gel technique. Composites for aerospace applications.

TEXT BOOKS

1. Mathews F.L. and Rawlings R.D., *Composite materials: Engineering and Science*, Chapman and Hall, London, England, 1st edition, 1994.
2. Chawla K.K., *Composite materials*, Springer – Verlag, 1987

REFERENCES

1. Clyne T.W. and Withers P.J., *Introduction to Metal Matrix Composites*, Cambridge University Press, 1993.
2. Strong A.B., *Fundamentals of Composite Manufacturing*, SME, 1989.
3. Sharma S.C., *Composite materials*, Narosa Publications, 2000.

		L	T	P	C
PE0116	**MECHATRONICS**	**3**	**0**	**0**	**3**

	Prerequisite				
	Nil				

PURPOSE

To present the concept and components of mechatronics systems in a structured way.

INSTRUCTIONAL OBJECTIVES

To Study

1. Combination of mechanical, electrical, electronics and information engineering
2. The understanding ability of microelectronics to reduce the demand on mechanical systems
3. To have cognizance of performance of commonly used sensors and actuation system
4. Design of Mechatronics System

Introduction to Mechatronics systems and components, Principles of basic electronics – Digital logic, number system logic gates, Sequence logic flip flop system, JK flip flop, D-flip flop.

Microprocessors and their applications – Microcomputer computer structure/microcontrolles, Integrated circuits – signal conditioning processes, various types of amplifiers, low pass and high pass filters.

Sensors –sensors and transducers. Displacement, position proximity sensors , velocity, force sensors. Fluid presence temperature, liquid level and light sensors. Selection of sensors., Actuators, Pneumatic and hydraulic systems, Mechanical actuation system, Electrical actuation system.Other Electrical/Electronic hardware in Mechatronic system

Principles of Electronic system communication, Interfacing, A.D. and D.A.convertors, Software and hardware principles and tools to build mechatronic systems., Basic system models mathematical models, mechanical and other system , Building blocks, System models – Engg. Systems, rotational, translation, elected mechanical, Hydraulic mechanical system., System Transfer functions, First-second order system in series.

Design and selection of Mechatronics statements namely sensors line encoders and revolvers, stepper and servomotors Ball screws, solenoids, line actuators and controllers with application to CNC system, robots, consumer electronics products etc, Design of a Mechatronic Product using available software CAD packages MATLAB and SIMULINK

TEXT BOOKS

1. Bolton, W., *Mechatronics*, Addison Wesley, 2nd Edition, New Delhi, 1999.
2. Bradley, D.A., Dawson D., Dawson, D. BurdN.C.and Loader A.J.,*Mechatronics*, Chapman and Hall Publications, New York, 1993.
3. GalopVisoy, A., and Devries, W.R., *Microcomputer Applications in Manufacturing*, John Wiley, New York, 1989.
4. David G. Alciatore, Michael B. Histand,*Introduction to Mechatronics and Measurement Systems* ,McGraw Hill

REFERENCE BOOKS

1. James Harter, *Electromechanics, Principles and Concepts and Devices*, Prentice Hall, New Delhi.
2. David W. Pessen, *Industrial Automation Circuit Design and Components*, John Wiley, New York, 1990.
3. Rohner, P., *Automation with Programmable Logic Controllers*, Macmillan / McGraw Hill, New York, 1996.
4. Brian Morris, *Automatic Manufacturing Systems Actuators, Controls and Sensors*, McGraw Hill, New York, 1994.
5. Goankar, R. S., *Microprocessor Architecture Programming and Applications*, Wiley Eastern, New Delhi, 1997.
6. Godfrey C. Onwuvolu, *Mechatronics Principles and applications*, Butterworth-Heinemann, New Delhi, 2006.
7. F.H.Raven, *AutomaticControl Engineering*, McGrawHill International.

		L	T	P	C
PE0117	**INDUSTRIAL ROBOTICS**	**3**	**0**	**0**	**3**

	Prerequisite				
	Nil				

PURPOSE

To impart knowledge about the engineering aspects of Robots and their applications.

INSTRUCTIONAL OBJECTIVES

To familiarize the
1. Basics of robots
2. Control system and end effectors
3. Sensor technology
4. Industrial application of robot

Introduction

Definition of a Robot - Basic Concepts - Robot configurations - Types of Robot drives - Basic robot motions - Point to point control - Continuous path control.

Components and Operations

Basic control system concepts - control system analysis - robot actuation and fed back, Manipulators - director and inverse kinematics, Coordinate transformation - Brief Robot dynamics. Types of Robot and effectors - Grippers - Tools as end effectors - Robot/End - effort interface.

Sensing and Machine Vision

Range sensing - Proximity sensing - Touch sensing - Force and Torque sensing. Introduction to Machine vision - Sensing and digitizing - Image processing and analysis.

Robot Programming

Methods - languages - Capabilities and limitation - Artificial intelligence - Knowledge representation - Search techniques - A1 and Robotics.

Industrial Applications

Application of robots in machining - Welding - Assembly - Material handling - Loading and unloading - CIM - Hostile and remote environments.

Text Book:

1. K.S. Fu., R.C.Gonalez, C.S.G.Lee, " Robotics Control sensing ", Vision and Intelligence, McGraw Hill International Edition, 1987.
2. Mikell P. Groover, *Industrial Robotics Technology Programming and Applications*, McGraw Hill Co., Singapore, 1995.

References:

1. Fu, K. S., Gonzalez, R. C., & Lee, C.S.G., *Robotics control, sensing, vision and intelligence*, McGraw Hill Book Co., Singapore, 1987.
2. Craig, J. J., *Introduction to Robotics mechanics and control*, Addison-Wesley, London, 1999.
3. Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, " Robotic engineering - An Integrated Approach ", Prentice Hall Inc, Englewoods Cliffs, NJ, USA, 1989.

		L	**T**	**P**	**C**
PE0118	**DESIGN FOR MANUFACTURE AND ASSEMBLY**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To study how a design can be made suitable for various manufacturing and assembly process requirements.

INSTRUCTIONAL OBJECTIVES

1. To study the various factors influencing the manufacturability of components and the use of tolerances in manufacturing
2. Application of this study to various forging, casting, welding and machining processes
3. To study about the various assembly methods and processes and design for assembly guidelines

INTRODUCTION TO DFM

Qualities of a designer - Systematic working plan - Factors influencing choice of materials - Manufacturing methods. Process capability. Tolerances – Relevant to manufacturing, assembly. Tolerance stack – effects on assembly – Methods of eliminating tolerance stack.

FORM DESIGN – CASTING AND WELDING

Influence of loading, materials, production methods on form design. Casting considerations – Requirements and rules. Welding considerations – Requirements and rules. Redesign of components for castings. Redesign of components for welding. Case studies.

FORM DESIGN – FORGING AND MACHINING

Forging considerations – Requirements and rules. Choice between casting, forging and welding. Machining considerations – Requirements and rules. Redesign of components for forging. Redesign of components for machining. Case studies.

INTRODUCTION TO DFA

Distinction between assembly methods and processes. Factors determining assembly methods and processes. Design factors independent of methods and processes. Design factors dependent on methods. Design factors dependent on processes.

DESIGN FOR ASSEMBLY METHODS

Approaches to design for assembly – Approaches based on design principles and rules - Qualitative evaluation procedures, knowledge based approach, Computer aided DFA methods. Assemblability measures. Boothroyd – Dewhurst DFA method – Redesign of a simple product. Case studies.

TEXT BOOKS

1. Harry Peck., *Design for Manufacture*, Pittman Publication, 1983.
2. Alan Redford and Chal, *Design for Assembly–Principles and Procedures*, McGraw Hill International Europe, London, 1994.

REFERENCE BOOKS

2. Robert Matousek., *Engineering Design–A Systematic Approach*, Blackie & Sons Ltd., 1963.
3. James G. Bralla, *Hand Book of Product Design for Manufacturing*, McGraw Hill Co., 1986
4. Swift, K. G., *Knowledge Based Design for Manufacture*,Kogan Page Ltd., 1987.

PURPOSE

To plan and optimize facilities, man power, materials and market demand.

INSTRUCTIONAL OBJECTIVES

		L	T	P	C
19PE0122	**PRODUCTION PLANNING AND CONTROL**	**3**	**1**	**0**	**3**
	Prerequisite				
	Nil				

At the end of the course the students will be able to know

1. To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
2. To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

Demand forecasting: Long and Short term demand forecasting methods, Regression analysis and smoothing methods, Estimation of trend, cycle, and seasonality components, Analysis of forecast error and computer control of forecasting systems.

Design of production planning and control systems: system design for continuous and intermittent production systems, Integration of master production, Material requirement and Shop scheduling systems

System design: Plant location and capacity scheduling, Multiple plant production facility design.Aggregate planning and master production scheduling, Aggregation techniques, Aggregate capacity scheduling, Disaggregation of aggregate plan. Master production scheduling: Analytical and computer integrated solution techniques, Operations scheduling and control: Basic sequencing and scheduling techniques, dispatching rules, Progress chasing and Updating of production schedules.

Production Planning & Control Systems, Classification, activities and matching of PPC system with the Firm. Basic material and Information Flow. Material Requirements Planning and Lot Sizing. Just-In-Time Production.

Capacity planning: tools and techniques. Production Control principles and techniques. Short-range forecasting techniques. Independent demand Inventory Management. EOQ Models and order timing decisions, Safety Stock and reorder level decisions. Order quantity and reorder point. Interactions with other functions and multi-item management. Distribution Requirement Planning. Spare parts inventory control

Text Books:

1. S.L. Narasimhan, D.W. McLeavy, and P.J. Billington, Production Planning and Inventory Control, PHI, 2nd Edition.
2. R.Peterson, and E.A. Silver, Decision Systems for Inventory Management and Production Planing, John Wiley & Sons.
3. C.C. Holt, F. Modigliani, J.F. Muth, and H.A. Simon, Planning Production, Inventories, and Workforce, Prentice Hall, NJ.
4. G.W. Plossi, and O.W. Wright, Production and Inventory Control, Prentice Hall, NJ.
5. Starr, K. K. and D. W. Miller, Inventory Control: Theory and Practice, Prentice Hall.

Reference Book:

1. Silver, E. A., D. F. Pyke and R. Peterson, Inventory Management and Production Planning and Scheduling, John Wiley, 3rd ed., 1998.
2. Production, Inventories, and Workforce, Prentice Hall, NJ.G.W. Plossi, and O.W. Wright

		L	T	P	C
19PE0123	**SUPPLY CHAIN MANAGEMENT**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To expose the students to the logistics approaches of supply chain management.

INSTRUCTIONAL OBJECTIVES

After completion of this course the students will be able to

1. Understand the role of logistics.
2. Understand the phases of supply chain
3. Understand the models and activities of SCM

INTRODUCTION TO LOGISTICS

Logistics - concepts, definitions and approaches, factors influencing logistics - Supply chain: basic tasks, definitions and approaches, influencing supply chain – a new corporate model.

PHASES OF SUPPLY CHAIN

The new paradigm shift - The modular company - The network relations - Supply processes - Procurement processes – Distribution management.

EVOLUTION OF SUPPLY CHAIN MODELS

Strategy and structure – Factors of supply chain – Manufacturing strategy stages - Supply chain progress – Model for competing through supply chain management – PLC grid, supply chain redesign – Linking supply chain with customer.

SUPPLY CHAIN ACTIVITIES

Structuring the SC, SC and new products, functional roles in SC - SC design frame- work - Collaborative product commerce (CPC)

SCM ORGANISATION AND INFORMATION SYSTEM

The management task - Logistics organization - The logistics information systems – Topology of SC application - Product Data Management - Warehouse management system MRP- I, MRP - II, ERP,. – Case study, ERP Software‘s

TEXT BOOKS

1. Shari, P. B. and Lassen, T. S., *Managing the global supply chain* , Viva books, New Delhi, 2000.
2. Ayers, J. B., *Hand book of supply chain management*, The St. Lencie press, 2000.

REFERENCE BOOKS

1. Nicolas, J. N., *Competitive manufacturing management–continuous improvement, Leanproduction, customer focused quality*, McGrawHill, New York, 1998.
2. Steudel, H. J. and Desruelle, P., *Manufacturing in the nineteen–How to become a mean, leanand world class competitor*, Van No strand Reinhold, New York, 1992.

		L	T	P	C
19PE0124	**ADVANCE OPERATIONS RESEARCH**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enlighten the students with the various operations research technique

INSTRUCTIONAL OBJECTIVES

At the end of the course the students will be able to know

4. Concepts of Engineering Optimization Problems
5. Applications and use of Non-Linear Programming
6. Applications and use Dynamic Programming

Linear Programming: Introduction, Revised Simplex Algorithm, Simplex Method for Bounded Variables, One Dimensional Cutting Stock Problem, Dantzig-Wolfe Decomposition Algorithm (Primal-Dual), Primal-Dual Algorithm

Goal Programming – Formulations, Solutions Complexity of Simplex Algorithm. Integer Programming: Formulations, Solving Zero-One Problems, Branch and Bond Algorithm, Cutting Plane Algorithm, All Integer Primal Algorithm, All Integer Dual Algorithm.

Network Models: Shortest Path Problem, Successive Shortest Path Problem, Maximum Flow Problem, Minimum Cost Flow Problem.

Travelling Salesman Problem and Extensions: Travelling Salesman Problem (TSP), Branch and Bond Algorithms for TSP, Heuristics for TSP, Chinese Postman Problem, Vehicle Routeing Problem.

Non-Linear Programming: Kuhn-Tucker Conditions, Constrained and Unconstrained Optimization, Search Techniques**. Dynamic Programming:** Principle of Optimality, Concepts of State and Stage, Solution of Discrete Problems through Backward Dynamic Programming, Continuous and Multi-Stage Dynamic Programming Problems.

Text Books:

1. Quantitative Techniques in Management - N.D. Vohra
2. Engineering Optimization: Theory and Practice - S.S. Rao
3. Operations Research - Hamdy A. Taha, PHI

Reference Book:

1. Elements of Production, Planning and Control - Samuel Elion
2. Operations Research - Prem Kr. Gupta & D.S. Hira
3. Operations Research - S.D. Sharma, KedarNath and Ram Nath&Co.

		L	T	P	C
19PE0125	**Total Quality Management**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To provide knowledge about Total Quality Management (TQM), TQM tools and techniques applied to Manufacturing and also about reliability and maintainability of different systems.

INSTRUCTIONAL OBJECTIVES

At the end of the course students will be able to know

1. Meaning of TQM and Theories about TQM
2. Planning and manufacturing for quality its tools and techniques
3. Human involvement to improve quality and the development and transformation due to such involvement.
4. About failure models, component reliability & system reliability
5. About mean down time, maintainability of systems & condition monitoring.

BASIC CONCEPTS

Evolution of total quality Management - Definition of quality - Comparison between traditional approach and TQM, Deming – Crosby – Juran - Taguchi, Ishikawa theories - Quality costs - Product quality Vs Service quality Strategic planning - Goal setting - Steps involved in strategic planning - TQM implementation.

TQM PRINCIPLES & BASIC TOOL

Customer Satisfaction – Types of customers, customer supplier chain, Customer perception of quality customer feed back - Customer complaints - Customer retention - Service quality.

Employee involvement – Employee motivation - Maslow‘s hierarchy of needs - Herzberg theory - Empowerment and team work.

Basic Tools: Introduction to seven basic tools–Check sheets, histograms - Control charts, Pareto diagram -Cause and effect diagram – Stratification - Scatter diagrams.

NEW SEVEN MANAGEMENT TOOLS & ADVANCED TOOLS

Affinity diagram - Relations diagram - Tree diagram - Matrix diagram - Matrix data analysis diagram - Process decision program chart - Arrow diagram.

Advanced QC tools: Advanced QC tools like QFD - Root cause analysis - Taguchi method - Mistake proofing(poka-yoke) - Failure mode and effects analysis (FMEAs), failure mode and effects criticality analysis (FMECAs) and Fault tree analysis (FTAs) etc. - Quality Management Systems, 7 QC Tools.

RELIABILITY

Definition - Probabilistic nature of failures - Mean failure rate - Meantime between failures - Hazard rate - Hazard models, Weibull model - System reliability improvement – Redundancy – Series - Parallel and Mixed configurations.

MAINTAINABILITY

Introduction - Choice of maintenance strategy - Mean time- to repair (MTTR) - Factors contributing to Mean Down Time (MDT) - Fault diagnosis, and routine testing for unrevealed faults - Factors contributing to Mean Maintenance Time - (MMT) on condition maintenance - Periodic condition monitoring - Continuous condition monitoring - Economics of maintenance.

TEXT BOOKS

1. Joel E. Rose, *Total Quality Management*, 2nd Edition, Kogan Page Ltd., USA 1993.
2. Srinath, L. S., *Reliability Engineering*, Affiliated East West Press, New Delhi 1995.

REFERENCE BOOKS

1. Balagurusamy, E., *Reliability Engineering* Tata McGraw Hill publishing Co., New Delhi, 1984.
2. Greg Bound, et.al, *Beyond Total Quality Management towards the emerging paradigm*, McGraw Hill Inc., 1994
3. Zeiri, *Total Quality Management for Engineers*, Wood Head Publishers, 1991.

		L	T	P	C
19PE0125	**ENTREPRENEURSHIP DEVELOPMENT**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course provides the basic knowledge on aspects of entrepreneurship and supports extended to entrepreneurs.

INSTRUCTIONAL OBJECTIVES

On completion of this course the student is expected to

1. Understand the broad spectrum of entrepreneurship.
2. Know about the prelims of setting up of a business unit.
3. Understand the purchasing and marketing basics of the business.
4. Aware of various supports extended by banks and institutions.

ENTREPRENEURSHIP

Historical perspective of entrepreneurship - Traits of Entrepreneurs - Types of Entrepreneurs – Intrerpreneur - Difference between entrepreneur and intrepreneur - entrepreneurship in Economic growth - Factors affecting entrepreneurial growth, Major motives influencing entrepreneur.

BUSINESS

Small Enterprises: - Definition Classification - Characteristics Web and e business - Ownership structure - Project formulation - Sources of information - Steps involved in setting up a business – Identifying, selecting a good business opportunity - Market survey and research - Techno economic feasibility assessment - Preliminary Project report – Project appraisal – Project implementation - Network analysis - Techniques of PERT/CPM

FINANCING AND ACCOUNTING

Sources of finance - Institutional Finance - Term loans - Capital structure - Management of working capital - Costing, Break even analysis – Taxation - Income Tax, Excise Duty - Sales Tax - Purchasing Policies and procedures - Methods of purchasing - Stores management - Book keeping

MARKETING & GROWTH STRATEGIES

Principles of marketing - Assessment of market needs - Demand forecasting, Product life cycle - Sales promotion Strategies - Product mix – Advertising - Distribution Channels - Growth strategies – Expansion – Diversification - Joint venture, Merger - Sub-contracting

INSTITUTIONAL SUPPORT TO ENTREPRENEURS

Institutional support to entrepreneurs - Government policy for small scale industries - Institutions for entrepreneurial growth – Various schemes - Self Help Group - Sickness in industry – Causes - Steps for correction and rehabilitation (Field work-Collection of information on schemes of Entrepreneurial Support and Presentation)

TEXT BOOKS

1. Khanka, S. S., *Entrepreneurial Development*, S.Chand and Co Ltd, New Delhi, 1999.
2. Philip Kotler, *Principles of Marketing*, Prentice Hall of India, 1995.
3. Lamer Lee and Donald W. Dobler, *Purchasing and Materials Management*, Tata McGraw Hill, 1996.

REFERENCE BOOKS

1. EDII–Faculty and External Experts, *A Hand Book of new Entrepreneurs*, Published by Entrepreneurship Development Institute of India, Ahmedabad, 1986.
2. Saravanavel, P., *Entrepreneurial Development*, Ess Pee Kay Publishing House, Chennai, 1997.
3. Gopalakrishnan, P., *Hand book of Materials Management*, Prentice Hall of India, 1996.

		L	T	P	C
19PE0127	**ERGONOMICS**	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To enlighten the students with the various Ergonomics Concepts

INSTRUCTIONAL OBJECTIVES

At the end of the course the students will be able to know

1. Concepts of Conventional and Micro-Ergonomics
2. Applications and use Cognitive Ergonomics

Ergonomics Concepts: Conventional and Micro-Ergonomics; Integration with ODAM; Divisions of Ergonomics - Environmental Ergonomics (Man-environment interface), Hardware Ergonomics (man-machine interface), Software Ergonomics (User-system interface), Macro-Ergonomics (Organization-machine interface)

Anthropometry and Workspace Analysis w.r.t. Physical Activities in Industry, Fields, Offices and Homes.

Health and Safety: Industrial Muscular-Skeletal Illness Evaluations and Management; Strain and Endurance.
Human-body Anatomy: Brief Exposure on Skeletal system; Muscular System; Nervous System; Action Potentials.

Basic Bio-medical Instruments: Sphygmomanometer, Stethoscope, ECG/EMG Working Principles, Ergometer, Maximum Energy Expenditures - Oxygen Analysis; Force Plate.
Kinesiology: Kinematics and Kinetic Analysis of Human - Body Motions; Modeling of Body Postures Associated with Movements. Exposure to Disturbances: Exposure to Vibration and Noise, Heat, Humidity, Radiation and Epidemiological Study.

Cognitive Ergonomics: Stereotypical Cognitive Styles; Interpretation of Human Information Processing or Cognitive Control Models; Information and Knowledge Representation, Human Abilities and Errors.

Text Books:

1. Introduction to work study- ILO, III Revised Edition, 1981.
2. Work Study and Ergonomics– S Dalela and Sourabh, Chand Publishers, 3rd edition.
3. Motion and Time study- Ralph M Barnes, John Wiley, 8th Edition, 1985.
4. Engineered work Measurement- Wledon, ELBS, 1991.
5. Motion and Time study- Marvin E. Mundel, PHI, 1st edition.

Reference Book:

1. Handbook of Human Factors and Ergonomics- GavrielSalvendy, John Willey & Sons. Inc, 2006.
2. Human Factors in Engineering Design- 6th Edition, M S Sanders and E J McCormic, McGraw Hill.
3. Industrial Engineering Hand book– Maynard.