B. Tech. Degree

IN

PRODUCTION ENGINEERING

SYLLABUS
FOR
CREDIT BASED CURRICULUM
(For students admitted in 2013-14)

DEPARTMENT OF PRODUCTION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI – 620 015
TAMIL NADU, INDIA

B TECH PRODUCTION ENGINEERING CURRICULUM

The total minimum credits required for completing the B.Tech. Programme in Production Engineering is First Year 45 and III to VIII Semester 140

SEMESTER III

CODE	COURSE OF STUDY	L	T	P	C
MA 207	Mathematics for Production Engineers	2	1	0	3
PR 201	Casting Technology	3	0	0	3
PR 203	Machining Technology	3	0	0	3
PR 205	Metallurgy and Materials Engineering	3	0	0	3
CE 282	Fluid Mechanics and Machinery	3	0	0	3
ME 325	Thermal Engineering	3	0	0	3
PR 207	Mechanics of Materials(Theory and Lab)	2	1	0	3
PR 211	Manufacturing Processes Lab-I	0	0	3	2
ME 331	Fluid Machinery and Thermal Engineering Lab	0	0	3	2
	TOTAL	**19**	**2**	**6**	**25**

SEMESTER IV

CODE	COURSE OF STUDY	L	T	P	C
MA 208	Probability and Statistics	2	1	0	3
PR 204	Kinematics and Dynamics of Machines	2	2	0	4
PR 206	Welding Technology	3	0	0	3
PR 208	Forming Technology	3	0	0	3
PR 210	Metrology (Theory and Lab)	2	0	2	3
EE 244	Electrical and Control Systems (Theory and Lab)	2	0	2	3
PR 212	Manufacturing Processes Lab-II	0	0	3	2
PR 214	Weldability and Formability Testing Lab	0	0	3	2
	TOTAL	**14**	**3**	**10**	**23**

SEMESTER V

CODE	COURSE OF STUDY	L	T	P	C
PR 301	Design of Machine Elements	2	2	0	4
PR 305	Tooling for Manufacturing	2	2	0	4
PR 307	Quality, Reliability and Safety Engineering	3	0	0	3
PR 309	Unconventional Machining Processes	3	0	0	3
PR 311	Professional Ethics and Psychology	3	0	0	3
PR 313	Computer integrated manufacturing (Theory and Lab)	2	0	2	3
-----	ELECTIVE 1[#]	3	0	0	3
PR 315	Machine Drawing Practice	2	0	2	3
	TOTAL	**20**	**4**	**4**	**26**

SEMESTER VI

CODE	COURSE OF STUDY	L	T	P	C
PR 302	Operations Research	2	2	0	4
PR 304	Work Design and Facilities Planning	3	0	0	3
PR 306	Precision Engineering (Theory and Lab)	2	0	2	3
PR 308	Computer Aided Design and Engineering (Theory and Lab)	2	0	2	3
PR 310	Mechatronics and Industrial Automation (Theory and Lab)	2	0	2	3
-----	ELECTIVE 2[#]	3	0	0	3
-----	ELECTIVE 3[#]	3	0	0	3
PR 312	Production Drawing and Cost Estimation	1	0	2	2
PR 314	Industrial Lectures	1	0	0	1
	TOTAL	**19**	**2**	**8**	**25**

SEMESTER VII

CODE	COURSE OF STUDY	L	T	P	C
PR 401	Supply Chain Management	3	0	0	3
PR 403	Analysis of Production Systems and IE Lab	2	0	2	3
PR 405	Manufacturing System Simulation (Theory and Lab)	3	0	2	4
PR 407	Sustainable Manufacturing (Theory and Lab)	2	0	2	3
-----	ELECTIVE 4[#]	3	0	0	3
-----	ELECTIVE 5*	3	0	0	3
PR 411	Colloquium	0	0	2	1
PR 447	Comprehensive Training	0	3	0	3
	TOTAL	**16**	**3**	**8**	**23**

SEMESTER VIII

CODE	COURSE OF STUDY	L	T	P	C
PR 402	Entrepreneurship Development	3	0	0	3
-----	ELECTIVE 6 [#]	3	0	0	3
-----	ELECTIVE 7*	3	0	0	3
-----	ELECTIVE 8*	3	0	0	3
PR 498	Project Work	-	-	12	6
	TOTAL	**12**	**0**	**12**	**18**

[#] **STREAM SPECIFIC ELECTIVES ONLY**

***APPROVED GLOBAL ELECTIVES** should be from Production Engineering and allied Departments with the consent of respective course Faculty, Staff Advisor and HOD

List of Electives:

CODE	SUBJECTS	L	T	P	CREDITS
Manufacturing Engineering Stream					
PR 001	Material Handling & Storage	3	0	0	3
PR 002	Manufacturing of Composite Materials	3	0	0	3
PR 003	Machine Tool Technology	3	0	0	3
PR 004	Industrial Robotics	3	0	0	3
PR 005	Plant Engineering	3	0	0	3
PR 006	Non Destructive Testing	3	0	0	3
PR 007	Micro Fabrication Processes	3	0	0	3
PR 008	Surface Engineering	3	0	0	3
PR 009	Processing of Polymeric Composites	3	0	0	3
Design Stream					
PR 021	Rapid prototyping, Tooling& Manufacturing	3	0	0	3
PR 022	Finite Element Methods	3	0	0	3
PR 023	Product Development Strategies	3	0	0	3
PR 024	Design for Manufacture and Assembly	3	0	0	3
PR 025	Vibration and Noise Engineering	3	0	0	3
PR026	Concepts of Engineering Design	3	0	0	3
PR 027	Engineering Optimization	3	0	0	3
PR 028	Computational Fluid Dynamics	3	0	0	3
PR 029	Experimental Stress Analysis	3	0	0	3
PR 030	Design of Automated Manufacturing System	3	0	0	3
Industrial Engineering Stream					
PR 041	Design and Analysis of Experiments	3	0	0	3
PR 042	Agile Manufacturing	3	0	0	3
PR 043	Integrated Materials Management	3	0	0	3
PR 044	Lean Manufacturing	3	0	0	3
PR 045	Total Quality Management	3	0	0	3
PR 046	Engineering Optimization	3	0	0	3
Global Electives					
PR 081	Operations Management	3	0	0	3
PR 082	Project Management	3	0	0	3
PR 083	Value Engineering	3	0	0	3
PR 084	Artificial Intelligence &Expert systems	3	0	0	3
ME 080	Automobile Engineering	3	0	0	3
HM 080	Corporate Communication	3	0	0	3
MB 080	Financial Management	3	0	0	3

Honors Electives

CODE	COURSE OF STUDY	L	T	P	C
PR 091	Tolerance Technology	3	0	0	3
PR 092	Robotics	3	0	0	3
PR 093	Intelligent Manufacturing Systems	3	0	0	3
PR 094	Total Quality Engineering	3	0	0	3
PR 095	Product Analysis and Cost Optimization	3	0	0	3
PR096	Decision Support Systems	3	0	0	3
PR097	Knowledge Management	3	0	0	3
PR098	Product Life Cycle Management	3	0	0	3
PR099	Technology Management	3	0	0	3
PR100	Multi-Criteria Decision Making Techniques	3	0	0	3

Subjects offered to other Departments
Mechanical Engineering

CODE	COURSE OF STUDY	L	T	P	C
PR 511	Production Technology - I	3	0	0	3
PR 512	Production Technology - II	3	0	0	3
PR 513	Productions Process Lab	0	0	2	1
PR 514	Resource Management Techniques	3	0	0	3

MA 207 MATHEMATICS FOR PRODUCTION ENGINEERS

PREREQUISITE COURSE: Mathematics I and Mathematics II

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To apply various numerical computational techniques to solve various engineering problems
- To apply the basics of Fourier series and partial differential equations to solve thermal, fluid and general engineering problems.

Laplace Transforms of standard functions, derivatives and integrals –Inverse Laplace transform – Convolution theorem- Periodic functions –Application to ordinary differential equations and simultaneous equations with constant coefficients and integral equations.

Fourier Transforms, relationship between Fourier transform and Laplace transform, properties of Fourier transforms, Fourier Cosine and sine transforms- Inverse transforms- Convolution theorem and Parseval‘s identity for Fourier transforms.

Newton‘s forward, backward and divided difference interpolation - Lagrange‘s interpolation - Numerical Differentiation and Integration - Trapezoidal rule – Simpson‘s 1/3 and 3/8 rules - Curve fitting - Method of least squares –Newton-Raphson method for f(x,y)=0 and g(x,y)=0.

Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adam‘s methods.

Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation - Crank - Nicolson method - Solution of one dimensional wave equation.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

1.B. S, Grewal, Engineering Mathematics, Khanna Publishers, 40th edition, 2007

2. Kreyszig E. Advanced Engineering Mathematics, 8th Edition, John Wiley and sons,2008.

3. T. Veerarajan, Volume III, Tata McGraw Hill Edition private Ltd, 2009

REFERENCE BOOKS:

1.Venkataraman, M. K. Engineering Mathematics Volume III, 13th Edition National Publishing Company, 1998.

2. Kandasamy, P., Thilagavathy, K., and Gunavathy, S., Numerical Methods, 3rd edition, S.Chand and Company, 2008.

COURSE OUTCOMES*:*

- Understand the applications of Laplace method, Eulers method, Newton-Raphson method
- Solve linear and non linear equations.
- Apply the studied techniques for optimization
- Solve problems using Fourier series, Laplace and Fourier transforms.
- Formulate and solve partial differential equation
- Apply acquired concepts in like heat conduction, and a prerequisite for post graduate and specialized studies and research

PR 201 CASTING TECHNOLOGY

L	T	P	C
3	0	0	3

PREREQUISITE COURSES: Branch specific course; Introduction to Production Engineering

COURSE OBJECTIVES:

- To perform casting design and able to perform foundry techniques.

Introduction to foundry, advantages and disadvantages. Pattern: Types, pattern making, allowances, materials and color codes. Core: types, core materials, core boxes, core

Sand Molding: Types of sands, sand properties, sand control tests, sand preparation, sand molding techniques, special molding processes.

Casting techniques: Permanent mold, pressure die casting, squeeze casting, centrifugal casting, continuous casting, electroslag casting, fettling, heat treatments for casting, defects and inspections

Casting Design: Gating system, risering system, casting design: Metallurgical consideration, design consideration, economical consideration. Modernization, mechanization of foundries.

Melting: Furnaces - Types and operational features.Application of CAD/CAM in foundry. Casting of complicated shapes: automotive components, casting of light alloys

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS :

1. *Jain, P.L., Principles of Foundry Technology, Tata McGraw Hill Pub., Co. Ltd., 4th Edition, 2008.*

2. *Heine, R.W.,CarlLoper, and Rosenthal, P.C., Principles of Metal Casting, Tata McGraw Hill Pub. Co. Ltd., 2nd Edition,2008.*
3. *NadkarniS.V.,Modern Arc Welding Technology, IBH Publishing, 1st Edition, 2005*

REFERENCES :

1. *Banga, T.R. ,AgarwalRLandManghnani, "Foundry Engineering",4th Edition, Khanna Pub., New Delhi, 2007.*
2. *Srinivasan, N.K., Foundry Technology, Khanna Pub., 3rd Edition, 2009.*

COURSE OUTCOMES:

- Fundamentals in patterns, cores, sand properties and molding, including special techniques and CAD/CAM applications.
- Understand various casting techniques, heat treatments, defects and inspections.
- Design a casting with metallurgical, design and economic consideration.

PR 203 MACHINING TECHNOLOGY

PREREQUISITE COURSE: Basic Engineering

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To perform different machining operations like turning, drilling, milling and finishing.
- To predict tool life and tool failure
- To select suitable cutting fluid for respective materials

Theory of metal cutting: Introduction – Machine tools – Cutting tools – Tool geometry - Orthogonal and oblique cutting – Mechanics of cutting – Types of chips – Cutting speeds and feeds – Tool failure, Tool life – Tool materials – Cutting fluids.

Turning operations: Introduction – Lathe – Types of lathes – Size of a lathe – Work holding devices – Lathe operations – Metal removal rate and machining time calculations.

Drilling and allied operations: Introduction – Drilling machines – Types – Drills – Drilling machine operations – Boring, Reaming and other operations – Boring machine – Types.

Introduction – Milling machine – Types – Milling cutters – Milling process – Milling machine operations.

Finishing processes: Introduction – Abrasive machining – Abrasives – Grinding wheel – Grinding machines – Types – Fine finishing operations.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *NagendraParashar, and Mittal, R.K, Elements of manufacturing processes,Prentice Hall of India Private Limited,1st Edition, 2003.*
2. *HajraChoudhury SK, Bose HK and HajraChoudhury AK, Elements of Workshop Technology, Vol. II, Media promoters and Publishers Pvt. Ltd. 12th Edition, 2007.*

REFERENCES:

1. *Khanna, O.P and Lal, M, A Text book of Production Technology, Vol.II,DhanpatRai Publications (P) ltd.,1st Edition, 2009.*
2. *H.M.T, Production Technology, Tata McGrawHill Publishing Co.Ltd, 1st Edition, 2008.*
3. *ASM Handbook, Machining*

COURSE OUTCOMES:

- Summarize the theory of metal cutting and compute cutting forces involved from Mohr's circle.
- Recognize various parts of lathe, list the accessories and explain various operations performed.
- Explain the construction of drilling, boring, reaming and milling machines and explain operations performed

PR 205 METALLURGY AND MATERIALS ENGINEERING

PREREQUISITE COURSES: Chemistry I and Chemistry II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To test materials through various testing methods to evaluate their properties
- To conduct heat treatment processes for metals

Art and science of metallurgy-structure of metals and alloys-phase and structural constitutions-Equilibrium diagrams

Ferrous metals and alloys-Fe-Fe_3C diagram-Effect of alloying elements in steel, Classification of ferrous alloys and their applications

Heat treatment of steel-CCT diagram-Surface hardening process-Non Ferrous Metals Alloys-composition-properties and applications of copper, nickel, lead, tin, zinc, aluminium, Mg and Ti alloys-Heat treatment of Non Ferrous alloy-Non Metallic Metals and alloys-ceramic material-polymers-composite material – Nano-structured materials

Testing of Materials-Non-Destructive Testing, Tensile testing, compression testing - Hardness Testing

Testing of Materials-Impact testing, Fatigue testing, Creep, other related testing methods characterization of TEM, XRD, SEM

Practice:

Microstructural study of carbon steels, Cast Iron Jominy end quench test – Heat Treatments on steels – Hardening – Annealing – Normalizing – Tempering

Demonstration on SEM/XRD

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOK:

1. Raghavan V, Physical Metallurgy - Principles and Practice, Prentice - Hall of India,2nd Edition, 2007.
2. Avner S.H., Introduction to Physical Metallurgy, Tata McGraw Hill,2nd edition, 2008

REFERENCE BOOKS:

1. Dieter G. E., Mechanical Metallurgy, McGraw Hill Co- Koga, 1stEdition ,2002
2. Suryanarayana AVK, Testing of Metallic Materials,BS Publications,2nd Edition, 2007.

COURSE OUTCOMES:

- Interpret microstructure of engineering materials and explain Equilibrium diagrams.
- Classify ferrous alloys and their applications with respect to foundry and welding processes.
- Understand heat treatment processes for alloys, non alloys & summarize testing methods like TEM, XRD, SEM

CE 282 FLUID MECHANICS AND MACHINERY

L	T	P	C
3	0	0	3

PREREQUISITE COURSES: Engineering mechanics

COURSE OBJECTIVES:

- To measure fluid flows and handle fluid machineries.

Introduction-Units and Dimensions - Fluid properties.Fluid statics : Pressure in a fluid - force on submerged planes - buoyancy - equilibrium of floating bodies

Types of Flow and Measurement-Types of flow - one dimensional continuity, momentum, and Energy equations-Flow measurement - Orificemeter - Venturimeter, Pitot tube, orifices, mouthpieces, notches and weirs

Boundary Layer Theory-Ideal and real fluid flow - boundary layer concepts- flow through pipes - friction factor - flow losses in pipeline

Pump-Centrifugal pump - types - specific speed - Equations for energy transfer - efficiencies. Reciprocating pump - gear pump – screw pump

Turbines - Hydraulic turbines - types - specific speed - pelton - Francis and Kaplan turbines - Calculation of power output efficiencies.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *Kothandaraman, C.P. and Rudramoorthy, R., Basic Fluid Mechanics, New Age International, 1st Edition, 1999.*

REFERENCE BOOKS:

1. *Robert, W. Fox and Allan, T. McDonald. Introduction to Fluid Mechanics, John Willey and Sons (SEA) PTE LTD.5thEdn. 2009.*
2. *Bansal, R.K., Textbook of Fluid Mechanics and Hydraulic Machines,Lakshmi Publications, 9th Edition 2008.*

COURSE OUTCOMES:

- Understand properties of fluids.
- Determine flow through hydraulics machines and pipes

ME 325 THERMAL ENGINEERING

PREREQUISITE COURSES: Physics

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To design I.C.Engines, Compressors and Turbines effectively
- To perform flow analysis in nozzles used in different locations

Laws Of Thermodynamics-Basic concepts - first law of thermodynamics applied to closed and open systems - simple problems.

Second law of thermodynamics - concept of reversible process

Air standard cycles - otto, diesel and dual cycles - I.C. engines, S.I. engines and CI engines

Reciprocating compressor - effect of clearance volume, single and multistage compressor - Volumetric efficiency - calculation of power requirement - gas turbines - open and closed cycle - intercooling, reheating and regenerative cycles Wankel engine-Sonic velocity, mach no. Wave propagation - mach cone, static and stagnation property relations, isotropic flow, use of gas tables, normal shock, flow through converging and diverging nozzle

Properties of steam: P – V, T - S and H - S diagrams- Rankine cycle, modifications to improve thermal efficiency - psychrometrics - various a/c processes - systems - refrigeration - Bell coleman and vapor compression cycles - vapor absorption cycle.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS :

1. Nag,P.K. "Engineering Thermodynamics", 3rd Edition, Tata McGraw Hill, 2005.

2.Kothandaraman, C.P. and Domkundwar, S. "A Course in Thermodynamics and Heat Engines", Part - I, SI units, 3rd Edition, DhanpatRai and Sons, 1993.

REFERENCES :

1. Ganesan, V., "Internal Combustion Engine", Tata McGraw Hill, New Delhi, 2004.

COURSE OUTCOMES :

- Apply thermodynamic laws in engineering applications
- Calculation of power requirements of gas turbines and flow rates through nozzles
- Calculation of thermal efficiencies of steam turbines

PR 207 MECHANICS OF MATERIALS (Theory and Lab)

PREREQUISITE COURSES: Engineering mechanics

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To predict the behavior of structures on loading and implement the concepts in suitable applications.

Simple Stresses and Strains-Types of stresses-types of strain – Composite bar – Temperature stresses – Volumetric Strain.

Stress transformation equations. Principal stress and their planes. Plane of Maximum shear stress – Mohr‘s Circle for stress

Shear force and bending moment Diagrams for different types of beams like cantilever, Simply Supported, overhanging subjected to concentrated load and Uniformly Distributed Load(UDL) – Bending stress , shear stress for different sections

Deflection equation elastic line of a beam – Different methods to find deflection and slope of beams like Macaulay‘s method, Moment area method.

Theory of simple torsion – assumptions – simple torsion formula for circular shafts – hollow shafts – power transmission – strength and stiffness of shafts – Springs -Analysis of Plane Frames – Method of Joints and Method of Sections

EVALUATION PATTERN:
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

THEORY:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examina**tion**
PRACTICE:
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination
TEXT BOOKS:
1.Ramamurtham, S, Narayan .R, "Strength of materials", 16th Edition, DhanpatRai Publishing Co, 2008.
2.Egor P Popov, "Engineering Mechanics of Solids",2nd Edition, Prentice Hall of India., 2008.

REFERENCES :
1.Timoshenko S.P and J.M. Gere “Mechanics of Materials”.2nd Edition, CBS Publishers and Distributors,2002

COURSE OUTCOMES:

- Able to perform simple stress and strain calculations.

- Able to calculate the bending stresses of beams.
- Able to design different types of shafts and springs

PR 211 MANUFACTURING PROCESSES LAB – I

PREREQUISITE COURSES: Branch specific course and Workshop practice

L	T	P	C
0	0	3	2

COURSE OBJECTIVES:

- To perform all lathe operations to produce a component of their need.

EXERCISE-1: Step turning

EXERCISE-2: Taper turning and parting off

EXERCISE-3: Knurling

EXERCISE-4: Thread cutting

EXERCISE-5: Boring

EXERCISE-6: Eccentric turning

EXERCISE-7: Copy turning

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOMES:

- Summarize the machine tool construction.
- Create work pieces by turning, boring using lathe and drilling machine.
- Utilize different machine tool attachments

ME 331FLUID MACHINERY AND THERMAL ENGINEERING LAB

L	T	P	C
0	0	3	2

COURSE OBJECTIVES:

- To perform various test on different hydraulic turbines and pumps.

EXERCISE-1: Francis turbine

EXERCISE-2: Pelton turbine

EXERCISE-3: Submersible pump

EXERCISE-4: Reciprocating pump

EXERCISE-5: 'V' Notch

EXERCISE-6: Centrifugal pump

EXERCISE-7: Venturimeter

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOMES:

- Study the functional aspects of different pneumatic components and its usage in circuits.
- Study the functional aspects of different Hydraulic components and its usage in circuits.
- Design different pneumatic and hydraulic circuits for different application

THERMAL ENGINEERING LABORATORY

COURSE OBJECTIVES:

- To perform tests on different fuels to determine their properties.
- To perform performance tests on gas turbines to collect data for their design and inspection.
- To evaluate IC engines through various tests.

1. Determinations of flash and fire point-lubricating oil.
2. Valve timing and port timing diagram
3. Performance test for constant speed engine
4. Heat balance test using exhaust gas calorimeter
5. Morse test on multi-cylinder petrol engine
6. Performance curve for air compressors.
7. Determination of COP using Refrigeration Test Rig.

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOMES :

- Conduct of experiments on various thermal systems.
- Support in development of energy field.

MA 208 PROBABILITY AND STATISTICS

PREREQUISITE COURSE: Mathematics-I, Mathematics-II

L	T	P	C
2	1	0	3

COURSE OBJECTIVES:

- To apply probability and statistics tools for quality assurance procedure for their products.

Random variable - Two dimensional random variables – standard probability distributions – Binomial Poisson and normal distributions - moment generating function

Sampling distributions – testing of hypotheses – Large sample tests for mean and proportion – t-test, F-test and Chi-square test – Independence of attributes-Analysis of Variance

Point estimation-Interval estimation –Measures of quality of estimators-Confidence intervals for means and variance -Correlation -rank correlation – multiple and partial correlation – Regression Analysis

Random process – Markov Dependence, Markov Chains, definition, examples – ergodicity- Finite Markov Chain- Various States – Limiting Probability – Application of Markov Chain to Simple Problems.

Time Series Analysis- Introduction- Probability models for Time Series- moving average-method of least squares- auto regressive models-Application to simple problems.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOK :

1. *Gupta, S.C. and Kapoor, V.K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Eleventh Revised Edition,June 2002.*

REFERENCES:

1. Gupta, S.C. ,Fundamentals of Statistics , Himalaya Publishing House , Sixth Revised Edition , April,2004.

2. Medhi,J. , Stochastic Processes , New Age International(P) Ltd., Publishers,2ndEdition,2004

COURSE OUTCOMES:

- Understand the fundamentals and application of statistics to engineering problem
- Use statistical concepts in their research work.
- To form hypothesis and able to test their hypothesis with various statistical tests. Identify the significant factors using ANOVA

PR 204 KINEMATICS AND DYNAMICS OF MACHINES

PREREQUISITE COURSES: Engineering Mechanics

L	T	P	C
2	2	0	4

COURSE OBJECTIVES:

- To design various machines and to perform kinematic and dynamic analysis.

Kinematic pairs, diagram and inversion - Displacement, velocity and acceleration analysis of planarlinkages– static and dynamic analysis of simple mechanisms

Cam profile synthesis - Gears dynamic force analysis

Flywheel – fluctuation of energy and speed, Governors

Inertia forces and their balancing for rotating and reciprocatingmachines.Hydrodynamic and boundary lubrication in journal and thrustbearings.

Longitudinal – Transverse – Torsional vibration – Two degrees of freedom and multi-degree of freedom systems.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

1.Shigley, J.E. and Uicker, J.J.,Theory of Machines and Mechanisms, OxfordUniversity Press, 3rd Edition, 2008.
2.Thomas Bevan, Theory of Machines, CBS Publishers. 3rd edition, 2008.
3. Rattan S.S., Theory of Machines, Tata McGraw Hill Pub Co, 2nd Edition, 2008.

REFERENCES:

1.Rao, J.S., and Dukkipati, R.V.,Mechanism and Machine Theory, Wiley Eastern Ltd., Second Edition 1992.
2. Ghosh A and Mallik A.K., Theory of Mechanisms and Machines, Affiliated EWP Pvt. Ltd, Third Edition,2003.

COURSE OUTCOMES:

- Understand the basic concepts of machines and machinery
- Understand law of gearing
- Understand the laws of dry friction
- Understand all mechanisms of machines.
- Design various mechanisms of machines
- Evaluate various mechanisms of machines

PR206 WELDING TECHNOLOGY

PREREQUISITE COURSES: Metallurgy and Materials Engineering

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To apply the basics of metal joining processes to join different metals.
- To select appropriate technique for joining suitable materials

Classification of welding processes: Arc welding power sources, power source characteristic curves, flux covering, different types of electrodes and their applications, gas welding and cutting, flame characteristics

Gas tungsten arc welding process**,** electrode polarity, shielding gas, use of pulsed arc welding process; gas metal arc welding**,** mode of metal transfers, pulsed MIG welding process. Submerged arc welding, advantages and limitations.

Orbital welding of tubes / pipes; Plasma-arc welding process, transferred and non- transferred arc welding and their applications, plasma cutting, surfacing and applications

Working Principle of resistance welding process-spot, seam, projection, upset and flash butt welding, electro slag and electro gas welding.

Radiant energy welding processes - equipment -electron beam welding (EBW) - laser beam welding (LBW) - applications of EBW and LBW- Friction Steel Welding-Defects in welding.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:
1. *Nadkarni S.V., Modern Arc Welding Technology, IBH Publishing,1st Edition, 2005*
2. Kearns W. H, 'Welding Hand Book (Welding Processes)', Volume II and III, AWS,7th Edition, 1984

REFERENCES:
1. Parmar R. S., Welding Engineering and Technology, Khanna Publishers,1st Edition, 2008.
2.ASMHandbook"Welding"

COURSE OUTCOMES:
- Understand the different types of welding
- Analyze the parameters that influences welding
- Understand the application of various welding processes

PR 208 FORMING TECHNOLOGY

L	T	P	C
3	0	0	3

PREREQUISITE COURSES: Chemistry I, Chemistry II and Metallurgy and Materials Engineering

COURSE OBJECTIVES:
- To apply basic of metal forming processes to shape products to their desired forms without any defects.

Yield criteria for ductile metals - Flow theories – strain hardening - recrystallization

Fundamentals of metal forming- Effect of temperatures, speed and metallurgical microstructure on forming processes - Mechanics of Metal Forming

Forging Processes Forging Equipment, Forging defects - Types of Rolling mill - process variables – defects

Types of extrusion - Process variables - Wire drawing - Drawing and Deep drawing – Sheet metal working

High energy rate forming processes.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. Narayanasamy,R., Metal forming technology,Ahuja Pub,2nd Edition,2000.
2. William FHosford and Robert M Caddell, Metal Forming Mechanics and Metallurgy, Cambridge University Press,Third Edition, 2008

REFERENCES:

1.GeorgeE. Dieter, Mechanical Metallurgy, McGraw Hill book Co.- Koga, 1st edition, 2002
2. ASM Handbook on Forming and Forging, Vol.14, ASM International.,9th Edition, 1998

COURSE OUTCOMES:

- Understand the properties of ductile metals
- Understand the effects of temperature, speed on metal forming process
- Understand the principle, procedure and applications of Bulk Metal Forming and Sheet Metal Forming

PR 210 METROLOGY (Theory & Lab)

PREREQUISTE COURSE: Physics-I

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To apply various measurement techniques to inspect and test products
- To apply statistical tools for quality assurance purpose
- To test and evaluate various components using various measuring instruments

Introduction to Measurement – objectives – classification of methods of measurements - Precision and Accuracy - Standards and their evolution -Types of errors in measurements – Limit gauging

Comparators – types – applications – Linear, angular and form measurements – Surface roughness – methods of surface finish – Direct instrument measurements.

Screw Thread Measurement- Standard thread profiles, Effective diameter, Terminology of gear tooth – Gear measurement – Parkinson gear tester- Alignment testing of machine tools – Coordinate measuring machines – Machine vision – Nano measurements.

Measurement of field quantities like temperature, pressure, velocity by intrusive and non-intrusive techniques under various conditions met with in practice like steady and transient conditions. Measurement of derived quantities like heat flux, volume/mass flow rate, temperature in flowing fluids.Measurement of thermo-physical properties, radiation properties of surfaces, vibration and noise.Measurement of length, measurement of angle. Limits and fits.

LAB EXERCISES

Study and use of Electronic comparator - Profile projector - sine bar - precision measuring instruments - coordinate measuring machine Measurement of Gear tooth thickness - Adjacent base pitch error - surface roughness

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOK:

1. Jain R. K., "Engineering Metrology", Khanna Publications, 2010 2. Douglas C. Montgomery, "Introduction to Statistical Quality Control", Wiley Publications, 2004.

REFERENCES:

1. Gupta. I.C., "Engineering Metrology", DhanpatRai and Sons, 1997.
2. Beckwith G. Thomas , Roy D. Marangoni, John H. Lienhard V, "Mechanical Measurements 6th Edition" Pearson publications, 2006.

COURSE OUTCOMES :

- Describe the fundamental concepts in measurement methods, techniques.
- Apply various instruments for measurements
- Apply quality control tools to achieve defects free quality products
- Take precise measurements using various instruments.
- Develop data for engineering analysis.

EE 244 ELECTRICAL AND CONTROL SYSTEMS (Theory and Lab)

PREREQUISITE COURSES: Physics

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To apply concepts of electrical drives and control systems to various industrial applications.
- To test various electrical and electronic devices like generators, motors,semiconductor diodes, rectifiers and logic gates.

DC machines - Characteristics - Starting and speed control of DC motors. Transformers: (Single phase only)- equivalent circuit and regulation - losses and efficiency - auto transformer.

Alternators - EMF equation - regulation by synchronous impedance method - Synchronous motors - starting and applications.

Three - phase induction motor - Cage and slip ring motors -torque slip characteristics –starting and speed control of induction motors - single phase induction motors and universal motors.

Electric drive for general factory, textile mill - pump, blowers, hoists, traction etc. - group and individual drives - Construction and working of dynamometer type watt meters and induction type energy meters.

Control System – open loop and closed loop systems- transfer function - time response of second order system - frequency response method - polar plot. Concept of stability - application of routh criterion for simple systems.

LAB

EXERCISE-1: No - load speed characteristics of D.C. shunt motor

EXERCISE-2: Load test on D.C.Shunt generator

EXERCISE-3: Equivalent circuit of single - phase transformer

EXERCISE-4: Swinburne's test

EXERCISE-5: Starting of 3-phase induction motors

EXERCISE-6: Semiconductor junction diode V-I characteristics

EXERCISE-7: Semiconductor zener diode V-I characteristics

EXERCISE-8: Inverting and Non-inverting Operational Amplifiers

EXERCISE-9: Uni Junction Transistor (UJT) and Silicon Controlled Rectifier(SCR) characteristics

EXERCISE-10: Logic gates

EVALUATION PATTERN:
Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

THEORY:
Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examina**tion**
PRACTICE:
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOK:

1.Boylestead, Electronics Devices and Integrated Circuits, PHI Publishers, 2008.

REFERENCES:

1.Palani, S. Control Systems ,ShanmugaPriya Publishers, 1995.
2. Theraja, B.L., Electrical Technology, Vol. 1 and 2, S.Chand and Co. Ltd, 23rd and 24th Edition,2009.

COURSE OUTCOMES:

- Understand the concepts of transformer and DC machines
- Understand open and closed system
- Understand the mechanics of fluids, transportation of mass, momentum and energy
- Conduct exercises to learn DC motor
- Conduct experiments for understanding VI characteristics of diodes
- Conduct experiments to learn about Logic Gates

PR 212 MANUFACTURING PROCESSES LAB – II

L	T	P	C
0	0	3	2

PREREQUISITE COURSES: Workshop practice I and Metallurgy and Materials Engineering

COURSE OBJECTIVES:

To perform various operations on special machines like milling machine, drilling machine, grinding machine and slotting machine.

EXERCISE-1: Shaping rectangular block or cube

EXERCISE-2: Slot cutting / Step-cutting / V-block

EXERCISE-3: Milling rectangular block or cube

EXERCISE-4: T - Slot milling

EXERCISE-5: Spur gear cutting

EXERCISE-6: Surface grinding

EXERCISE-7: Single point tool grinding

EXERCISE-8: Spur and Helical gear generation on hobbling machine

EXERCISE-9: Complex shaped component production using EDM.

EXERCISE-10: Drilling

EVALUATION PATTERN:
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOMES:

- Hands on Experience on lathe machine, Milling machine, drilling machine
- Hands on experience on casting methods.
- Hands on experience on welding

PR 214 WELDABILITY AND FORMABILITY TESTING LAB

L	T	P	C
0	0	3	2

PREREQUISITE COURSES: Metallurgy and Materials Engineering

COURSE OBJECTIVES:

To weld materials effectively and evaluate weldment properties

1. Arc butt welding of mild steel
2. Arc lap welding of mild steel
3. Macrostructure and microstructure evaluation of nugget zone
4. Bending testing on welded plates.
5. Hardness test on weldments

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOMES:

- Application of welding knowledge to fabricate sound parts
- Application of testing knowledge to evaluate the quality of weldments.

FORMABILITY TESTING LAB

PREREQUISITE COURSES: Metallurgy and Materials Engineering

COURSE OBJECTIVES:

To test the formability of sheet metals

LAB EXERCISES

1. Tensile testing
2. Three point bend test
3. Deep drawing test

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

COURSE OUTCOME:

- Able to test sheet metals and evaluate their properties

PR 301 DESIGN OF MACHINE ELEMENTS

PREREQUISITES: Engineering Mechanics, Strength of materials

L	T	P	C
2	2	0	4

COURSE OBJECTIVES:

- To understand material properties, design process and various theories of failures
- To design various basic machine components
- To design new components based on design principles

Introduction to the design process,factor influencing machine design, mechanical properties of materials, direct stress, bending stress, torsional stress and variable stress in machine parts, theories of failure, stress concentration factor, factor of safety.

Design of shafts based on bending moment, twisting moment, combined of bending and twisting moments, axial loads in addition to combined torsional and bending loads, rigidity and stiffness. Design of spring.

Belt and chain drives: selection of flat belt, V belt and chain drives. Design of couplings, keys and bearings.

Welded joints: types of joints, welding symbol and weld symbol and their representation, strength of welded joints subjected to various types of load. Riveted joints: types of joints, design of riveted joints for structure.

Design of spur and helical gears. Design of gear box: layout diagram, speed diagram, fixing number of teeth and module of gears.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS:

*1. Bhandari, V.B., "Design of Machine Elements",*Tata McGraw-Hill, 2007.
2. Prabhu, T.J. "Design of Transmission Elements", Mani Offset, Chennai, 2005.

REFERENCES:

1. Shigley, J.E. and Mischke, C.R. "Mechanical Engineering Design" Tata McGraw Hill, 2006.
2. Sharma, C.S. and Purohit, K. "Design of Machine Elements", Eurasia Publishing House (P) Ltd, New Delhi, 2005.

COURSE OUTCOMES:

- Understand the various theories of failures
- Design various machine components
- Design new components based on the design principles

PR 305 TOOLING FOR MANUFACTURING

L	T	P	C
2	2	0	4

PREREQUISITES: Design of Machine Elements, Strength of materials, Engineering Mechanics

COURSE OBJECTIVES: To study the various design considerations for tooling**.**

Design of cutting tools: Tool materials, design of single point cutting tool, form tool, drill, reamer, broach & plain milling cutter.

Theory of metal cutting – design of tool holders for single point tools – Boring bars – selection of tools for machining applications – economics of machining

Design of fixtures: standard work holding devices – principles of location and clamping – clamping methods and elements – quick-acting clamps – design & sketching of milling fixtures

for simple components – Turning, Grinding, Welding fixtures. inspection fixtures and design of gauges

Design of Drill jigs: Drill bushings – types of jigs: Plate, Leaf, Turn over & Box Jigs – design & sketching of drill jigs for machining simple components

Press tools: power presses – die cutting operations – centre of pressure – scrap strip lay out for blanking – press tonnage calculations – Progressive & Compound dies – die design for simple components. Drawing dies – blank development – estimation of drawing force – blank holders & blank holding pressure – design & sketching of drawing dies for simple components – Bending dies & Combination tools.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS :
1. A Bhattacharyya, Metal Cutting Theory and Practice ,Central Book Agency Kolkata.

REFERENCES:
1. ASTME, Fundamentals of Tool Design, Prentice Hall.
2. F W Wilson, Hand Book of Fixture Design, McGraw Hill publications.

COURSE OUTCOMES

- Design single point cutting tool, form tool, drill etc
- Understand how to conduct machining economically
- Design jigs, fixtures and press tools

PR 307 QUALITY, RELIABILITY AND SAFETY ENGINEERING

PREREQUISITES: Basic Engineering

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To identify and analyze failures of components and subcomponents of mechanical and electronic items.
- To distinguish different concepts in maintenance and explore in order to increase service life of the products/machines
- To list various safety measures concerned with environment described for a safety engineer

Introduction to quality assurance and quality control – Statistical concepts in quality – Central limit theorem – Quality control tools

Control charts for variables and attributes– process capability studies – Sampling inspection – Quality System standard

Failure Rate, Mean Time Between Failures (MTBF)-Mean Time To Failure (MTTF), Bathtub distribution, Down time, Repair time, Availability, Series-Parallel Structures, Redundancy, Reliability Allocation, Mechanical Reliability, Failure Mode Analysis.

Safety - Importance -Fundamental Concepts and Terms- Workers' Compensation - Product Liability - Hazards and their Control -Walking and Working Surfaces, Electrical Safety -Tools and Machines - Materials Handling.

Fire Protection and Prevention -Explosions and Explosives - Radiation -Biohazards - Personal Protective Equipment - Managing Safety and Health.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams.

TEXT BOOKS:

1. *David J Smith, Butterworth-Heinemann,Reliability Maintainability and Risk; Practical methods for engineers, New Delhi, 2001*
2. *B.S. Dhillon, Maintainability, Maintenance and Reliability for Engineers,CRC Press, 2006*
3. *Roger L. Brauer, Safety and Health for Engineers, John Wiley Sons, 2006*

REFERENCES:

1. *Hoang Pha, Handbook of Reliability engineering, Springer Publication, 2003.*
2. *B.S. Dhillon, Engineering maintenance; a modern approach,CRC Press, 2002*
3. *Butterworth-Heinemann,R. Keith Mobley, Maintenance Fundamentals, II edition, 2004*

COURSE OUTCOMES:

- Identify and analyze the failures of the components and subcomponents of mechanical and electronic items.
- Distinguish different concepts in maintenance and explore in order to increase the service life of the products/machines
- List various safety measures concerning with environments described for a safety engineer

PR 309 UNCONVENTIONAL MACHINING PROCESSES

PREREQUISITES: Machining Technology

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand several non-traditional machining process in micro and precision manufacturing field
- To select suitable machining process for materials considering their merits and demerits

Introduction - Classification - process economy - Mechanical machining - Types - Ultrasonic machining (USM) - Abrasive Jet Machining (AJM) - Abrasive Flow Machining (AFM) - Water Jet Machining (WJM) - Operating principle - Process parameters - Applications - Limitations.

Electro chemical machining - Chemical material removal - Types - Electro chemical machining (ECM) - Electro chemical drilling (ECD) - Electro chemical grinding (ECG) - Electro chemical honing (ECH) - Shaped tube electrolytic machining - Operating principle - Process parameters - Applications - Limitations.

Thermo electrical machining - Types – Electrical discharge machining (EDM) - Electrical discharge wire cutting (EDWC) - Electron beam machining (EBM) - Ion Beam Machining (IBM) - Plasma Arc Machining (PAM) - Operating principle - Process parameters - Applications - Limitations

Laser materials processing - Laser types - Processes - Laser beam machining (LBM) – Laser cutting (LC) – Laser drilling (LD) - Laser marking and engraving (LM) - Laser micromachining (LMM) - Laser engineered net shaping (LENS) - Applications - Limitations.

Special processing technologies - Rapid Prototyping - Methods - Fused Deposition Modeling (FDM) - Laminated Object Manufacturing (LOM) - Selective laser sintering (SLA) - Solid Ground curing (SGC) - 3D printing (3DP) - Processing of integrated circuits - Micro and nano fabrication technologies.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXT BOOKS :

1. *Abdel, H. and El-Hofy, G. "Advanced Machining Processes", McGraw-Hill, USA, 2005.*
2. *Wellar, E.J. "Non-Traditional Machining Processes", Society of Manufacturing Engineers Publications, 2nd Edition, Michigan, 1984.*

REFERENCES :

1. *Steen, W.M. and Watkins, K. "Laser Materials Processing", Springer London Ltd, 2003.*
2. *Groover, M.P. "Fundamentals of modern manufacturing processes - Materials, Processes and Systems", 3rd Edition, John Wiley and Sons Inc., 2007.*

COURSE OUTCOMES :

- Understand the contribution of non-traditional machining process in micro and precision manufacturing field.
- Select suitable machining process for suitable materials
- Summarizes the merits and demerits of the non-traditional manufacturing process

PR 311 PROFESSIONAL ETHICS AND PSYCHOLOGY

PREREQUISITE COURSES: Basic Engineering

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To create awareness on Engineering Ethics and Human Values andMorals

Values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respectfor others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time–Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality.

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

Introduction to Industrial Psychology – Definitions & Scope. Major influences on industrial Psychology- Scientific management and human relations schools Hawthorne Experiments Individual in Workplace

Motivation and Job satisfaction , stress management. Organizational culture, Leadership & group dynamics. Work Environment & Engineering Psychology-fatigue.

Boredom, accidents and safety Job Analysis, Recruitment and Selection – Reliability & Validity of recruitment tests.Performance Management : Training & Development.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOK:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.

REFERENCES:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Thompson Wadsworth, A Division of Thomson Learning Inc., United States, 2000
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

COURSE OUTCOMES:

- Recognize human values, Engineer's responsibility, Employee rights.
- Instill Moral and Social Values and Loyalty.
- Appreciate the rights of others.

PR 313 COMPUTER INTEGRATED MANUFACTURING (Theory & Lab)

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To gain knowledge in Engineering product specification and CAD/CAM integration.
- To impart knowledge in CAD software package for modeling, assembly, FEA of mechanical components and CNC programming for Milling/Turning.

CIM - evaluation, hardware and software of CIM - concurrent engineering – advance modeling techniques.

Numerical Control - Concepts and features– Classification – Input media - Design considerations– Functions of MCU - CNC concepts - Point-to-point and Contouring systems - Interpolators – Feedback devices – DNC - Adaptive Control – ACO and ACC systems.

Part programming - manual part programming – preparatory, miscellaneous functions – computed aided part programming - post processors - APT programming.

Cellular manufacturing - Group Technology – Flexible Manufacturing Systems- Configurations- Workstations - Control systems - Applications and benefits
Materials handling and Storage Systems - types of material handling systems – storage systems- – Automated storage and retrieval systems – Robotics technology - control systems - Programming - Applications– Automated inspection and testing – Coordinate measuring machines.

LAB EXERCISES

Plain turning and facing operations on EMCO turning machine.

2. Step turning operation on LEADWELL machine.
3. External threading operation on LEADWELL and STC 15 machines.
4. Profile milling operation on VMC machine.
5. Rectangular pocketing and drilling operations on EMCO milling machine.
6. Mirroring operation on MTAB milling machine.
7. Inspection on CMM

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice
Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOK:

1. *Paul Ranky, "Computer Integrated Manufacturing", Prentice Hall, 2005.*

REFERENCES:

1.YoramKoren, "Computer Control of Manufacturing Systems", McGraw Hill Book co. New Delhi, 1986.
2.Mikell P Groover,, "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 2007.
3.Donatas T I junclis, Keith E Mekie, "Manufacturing High Technology Hand Book", Marcel Decker.

COURSE OUTCOMES:

- Assembly of mechanical components using CAD software Solid Works/CATIA/Pro-E.
- Finite Element Analysis (FEA) using Pre-processing (solid modeling, meshing, analysis setup)
- and post processing (graphical display and report) with software PATRAN/ NASTRAN/ MARC/
- ABAQUS/ LS-DYNA/ ANSYS/PAM-CRASH (Exercises include Simple Beam, Plane Stress,Strain, axi-symmetric, 3D Solids).
- CNC code generation for CNC Milling.
- CNC code generation for CNC Turning.
- Demonstration of CNC Router Machine/ CNC Lathe/ CNC Milling (Students have to Submit detailed reports on each demonstrations).

PR315 MACHINE DRAWING PRACTICE

PREREQUISITES: Engineering Graphics

L	T	P	C
1	1	2	4

COURSE OBJECTIVES

- To prepare the precise machine drawings for manufacture of components.
- To facilitate better product design.
- To interpret and generate suggestions about drawings.

Conventions, Abbreviations and symbols: Conventional representations of interrupted views, symmetrical objects, intersection curves, square ends and openings, adjacent parts, common machine elements, springs, gear drives – Abbreviations, designation and composition of ferrous materials, nonferrous materials and engineering drawing.

Limits, Fits and Tolerances, tolerance grades, fundamental deviation, indication of tolerances - classification, system, selection and indication of fits, geometrical tolerances, surface texture..

Screw threads and threaded fasteners, types of bolts and nuts, locking pins, screws. Rivet joints, Keys and welded joints.

Assembly Drawing: Cotter and pin joints, couplings, clutches, pulleys and pipe joints.

Assembly Drawing: Bearings, heat engine parts, valves, pumps and machine parts.

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOK:

1.Gopalakrishna, K. R., Machine Drawing, Subhas stores, Bangalore, 16th Edition,2002.

REFERENCES:

1. Varghese, P. L. and John, K.C., Machine Drawing, Jovast Publishers, 1993.
2. BIS, SP: 46 - 1988 - Engineering Drawing Practice for Schools and Colleges, 1992.
3.Faculty of Mechanical Engineering, PSG College of Technology, Design Data Book, M/s.DPV Printers, Coimbatore, 1993.

COURSE OUTCOMES:

- Prepare the precise machine drawings for manufacturing of components.
- Facilitate better product design.
- Interpret and give suggestion about the drawings.

PR 302 OPERATIONS RESEARCH

PREREQUISITES: Applied statistics

L	T	P	C
2	2	0	4

COURSE OBJECTIVES:

- To understand Linear programming, assignment and queuing problems
- To make decisions under uncertainty
- To prepare project network and perform project scheduling

Concept of linear programming model-Development of LP models - Graphical method. Simplex method - Big M method - Two-phase method - Special cases in Linear Programming.Introduction to duality theory.

Introduction-Mathematical model for Transportation problem –balanced and unbalanced transportation problem.Methods to solve transportation problem-finding basic feasible solution-testing solution for optimality - Assignment problem-unbalanced assignment problem-maximisation problem-problem with assignment restrictions.Travelling sales man problem

Introduction-characteristics of queuing problem-terminologies of queuing problem-applications of queuing model -single server model.Simulation-need for simulation-advantages and disadvantages.Random number generation-methods.Applications of simulation-maintenance, queuing and inventory.
Line balancing.

Decision under uncertainty-Laplace criterion, Maximin criterion, Minimax criterion, Savage minimaxregrert criterion, Hurwicz criterion. Decision making under risk-expected value criterion-decision tree, Investment decisions –present worth method, annual equivalent method, rate of return method, Replacement Analysis-types of replacement problem. Replacement of item that fail with respect to time.Replacement of item that fail suddenly-individual replacement and group replacement.

Project network construction – Critical Path Method (CPM) - determination of critical path - Project Evaluation and Review Technique (PERT)-probability of completing a project in a scheduled date - Crashing of project network-cost considerations in project scheduling ,
Production scheduling- single machine scheduling, flow shop scheduling, Johnson's algorithm

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOK:

1.Gupta, P.K. and Hira, D.S, Operations Research, 3rd Edition, S.Chand and Company Ltd., New Delhi, 2008.

REFERENCES:

1. Taha H.A, Operations research,Prentice – Hall of India, New Delhi, 8th Edition, 2006.
2. Panneerselvam, R, Operations Research,Prentice – Hall of India, 2nd Edition, New Delhi, 2006.

COURSE OUTCOMES:

- Summarize different techniques for production planning like queuing uncertainty and mathematical modeling are involved
- Apply optimization in utilization of resources
- Apply resource management techniques to industrial operations

PR 304 WORK DESIGN AND FACILITIES PLANNING

L	T	P	C
3	0	0	3

PREREQUISITE: Reliability, maintenance and safety Engineering

COURSE OBJECTIVE:
To understand method study and work management techniques

Methods study - motion and time study, and productivity - micromotion and macromotion study - Ergonomics.

Work measurement - techniques of work measurement - time study - production study. Facility layout - steps in facility location study - layout types and analysis.

Layout design process - systematic layout planning - analysis - designing the layout - Assignment model

Computerized layout planning - CRAFT, ALDEP and CORELAP

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:
1.Barnes, Motion and time study, John Wiley, New York, 1990.

REFERENCE:
1.ILO, Introduction to work study, ILO,Geneva,1974.

COURSE OUTCOMES:

- Perform ergonomic analysis
- Perform computerized layout planning
- Perform work measurements

PR 306 PRECISION ENGINEERING (Theory&Lab)

L	T	P	C
2	0	2	3

PREREQUISITES: Machining technology

COURSE OBJECTIVES:

To provide and enhance technical knowledge in precision engineering, its components and applications.

Precision machining – Concepts and significance – Classification - Top down – Bottom up approaches– Precision and micromachining - Machining of micro-sized components - Ultra precision machining grinding

Lithography – Photolithography - Electron beam lithography – Ion Beam lithography - Deep UV lithography–MEMS – Principle – Elements – Characteristics – Applications- Design and fabrication approaches.

Micro-manufacturing- Limits of capability of conventional mechanical manufacturing-Micro-machining-concepts-Types–Tools–Electrical Discharge Micro-Machining–Wire cut EDMM–Electro Chemical Micro-Machining-Abrasive Jet Micromachining - Laser based micromachining

Nano surface generation-Concepts and applications-Types- Ductile mode of machining- Diamond turning of parts to nanometer accuracy – ELID grinding – Chemo Mechanical Polishing-Magnetorhelogical finishing.

Precision metrology –In-process measurement of position of processing point - Post process and online measurement of dimensional features -Mechanical measuring systems - Optical measuring systems - Electron beam measuring systems – Scanning Tunneling – Atomic Force Microscope.

Precision Lab exercises

1. Exercise on Micro-turning operation on DT-110 Multi-process micro-machining center.
2. Exercise on Micro-milling operation on DT-110 Multi-process micro-machining center.
3. Exercise on Micro-drilling operation on DT-110 Multi-process micro-machining center.

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOKS:

1. SeropeKalpakjain, "Manufacturing Engg. and Technology", Pearson Education, 2005

2. V.K.Jain, "Introduction to Micromachining", Narosa Publishing House, 2010

REFERENCES :

1. M.J. Madou, "Fundamentals of Micro Fabrication", CRC Press, 2002

2. Mark J. Jackson, "Micro Fabrication and Nano machining", Taylor and Francis, 2006

3. Yi Qin, "Micro-Manufacturing Engineering and Technology", Elsevier Publication,2010

COURSE OUTCOMES:

Understand the concept of precision engineering, its principles and importance as applicable to instruments and machines.

PR 308 COMPUTER AIDED DESIGN AND ENGINEERING (Theory&Lab)

PREREQUISITES: Physics, Applied Electronics

L	T	P	C
2	0	2	3

COURSE OBJECTIVES

- To understand various hardware and software that serve as components of CAD system
- To understand plotting, transformations techniques, geometric modeling
- To understand graphic standards, finite element modeling and DBMS

Fundamentals of computer - configurations - workstations - data communications - input/output devices, display technology, CAD software. Interactive graphics - point plotting techniques. Transformations techniques, Viewing operations : window, viewport and clipping, Visual realism : Hidden line/surface removal, shading and colour models. Computer drafting through high level languages.

Geometric modeling: Wireframe modeling, Surface modeling : Representation of curves and surfaces, design of curves : cubic splines, bezier curves and B-spline, design of surfaces.

Solid modeling: Constructive solid geometry (C-rep) and Boundary representation (B-rep). Graphics standards: GKS, DXF and IGES standards - Parametric design programmes.

Finite element modeling and analysis: types of analysis, degrees of freedom, element and structure-stiffness equation, assembly procedure. Database concepts and data base management systems - SQL.

LAB EXERCISES

- Part modelling using CAD
- Assembly using CAD
- Manufacturing analysis using CAM
- Engineering analysis using CAE

EVALUATION PATTERN

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.

External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOKS:

1. Newman, W.M. andSproull, R.F., Principles of interactive computer graphics,McGraw Hill Pub., II Ed., 1989.

REFERENCES:

1. Anand, V.B., Computer Graphics and Geometric Modeling for Engineers, John Wiley and Sons, Inc., 2000.
2. Zeid,I and Sivasubramanian, R., CAD/CAM, Tata McGraw-Hill, 2007.

COURSE OUTCOMES

- Summarize the concepts and applications of CAD.
- Elaborate fundamental of computers, networks, transformations techniques, geometric modeling solid modeling and finite element modeling
- Distinguish various concepts and techniques used for Product design and to develop product design skills.

PR 310 MECHATRONICS AND INDUSTRIAL AUTOMATION (Theory&Lab)

L	T	P	C
2	0	2	3

PREREQUISITE: Fluid mechanics and Machinery, Engineering mechanics

COURSE OBJECTIVE:

To study hydraulic and pneumatic systems, sensors and their applications

Introduction - overviews, principles and application of hydraulic, pneumatic, electric controls system.

Hydraulic system, hydraulic components - pressure-flow-direction controls valves –proportional , servo, cartridge(logic) valves- accumulator, accessories. Hydraulic components symbols- Design and application of hydraulic circuits of machine tool, press, Mobile hydraulic.

Pneumatic system, pneumatic components - pressure-flow-direction controls valves - pneumatic components symbols- Design and application of pneumatic circuits of machine tool.

Semi automats-automats-transfer lines - automatic assembly - transfer devices and feeders-classifications and applications-job orienting and picking devices- setting of automats and transfer lines.

Introduction to mechatronics, mechatronics system, Microprocessors and their applications, Sensors and Principles, PLC system, examples of mechatronics systems.

LAB EXERCISES

1. Design, simulate and testing of Pneumatic and Electro Pneumatic circuits for engineering applications using actuators and control valves (pressure, flow and direction).
2. Design, simulate and testing of Hydraulic and Electro Hydraulic circuits for engineering applications using actuators and control valves (pressure, flow and direction).
3. Design, simulate and testing of PLC circuits for engineering applications using sensors.
4. Using MAT Lab/ SCI lab -Study on Robot programming and operation with vision systems

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.

External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.

External Evaluation:End semester Practical examination

TEXTBOOKS:

1. Michael J. Pinches and John G. Ashby, Power Hydraulics, Prentice Hall, 1989.
2. DudleytA.Pease and John, J. Pippenger, Basic Fluid Power, Prentice Hall, 1983.

REFERENCES:

1. Doeblin, E.O. Measurement Systems, McGraw Hill, 1995.
2. Mechatronics 3/e,W, Bolton (Addison Wesley, ISBN 981-235-874-9.
3. Geoffrey Boothroyd, Assembly Automation and Product Design,Hardcover , 1992.
4. Rexroth- hydraulic training manual.

COURSE OUTCOMES:

- Understand hydraulic devices and their applications.
- Analyze the integrated product design
- Generate electro-hydraulic, electro-pneumatic solutions

PR 312 PRODUCTION DRAWING AND COST ESTIMATION

PREREQUISITES: Machine Drawing, Design of machine elements

L	T	P	C
1	0	2	2

COURSE OBJECTIVES

- To understand the fundamentals of manufacturing drawings
- To develop process sheets and production drawing for various assemblies
- To perform cost and time estimation

Review ofCurrentinternational standards (ISO) and Indian Standards (IS) - Geometric Dimensioning and Tolerancing - Centrality Analysis - Compound Assembly.

Process Sheet - Fundamentals - Contents - Preparation of process sheet for various components.

Manufacturing Drawings : Surface texture indication on drawing - welds symbolic representation of drawings. Given a sub-assembly/assembly to prepare manufacturing drawings of components, Sample exercises on CAD- preparation of manufacturing Drawings.

Re-dimensioning and Tolerance Charting :Introduction to re-dimensioning to suit manufacturing requirements-manufacturing datum-functional datum. Introduction to tolerance charting

Cost Estimation :Preparation of Process chart for a given component-estimation of setting time and machining time-estimation of material cost, labour cost and overhead cost based on supplied data - Kaizen costing - Activity Based costing - Life cycle costing.

EVALUATION PATTERN:

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOK:

1.IS :10714,10715,10716,10717,11669,10719,813,919,2709,8000 pt 1 to 10721,11158 and AWS/ISO

REFERENCES:

1.Siddeshwar and Kanniah ,"Machine Drawing", Tata McGraw Hill 2001
2.Gopalakrishna, K.R., "Machine Drawing" 16th Edition, Subhas Stores, 2002.
3. Wade, O. "Tolerance Control in design and manufacturing", Industrial Press, 1972

COURSE OUTCOMES:

- Interpretation of contents of production drawing
- Development of process sheet and manufacturing drawings
- Systematic estimation of cost and time

PR 401 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITES: Operations Research, Quality, Reliability & Safety Engineering

COURSE OBJECTIVES

To provide an insight on the fundamentals of supply chain strategy, logistics, sourcing and outsourcing supply chain networks, tools and techniques.

Evolution of supply chain-essentials of SCM-structure of supply chain, examples-process views-decision phases, issues - aligning supply chain with business strategy –supply chain decision variables, performance measures-new challenges - reverse logistics.

Supply chain configuration design - factors involved - sourcing, models for strategic alliances – supplier selection, outsourcing and procurement process – facility location and capacity allocation - modeling approaches LP, MILP - network design in uncertain environment – evaluation using simulation models.

Demand forecasting-collaborative forecasting models-bullwhip effect-information sharing - aggregate planning in supply chain- strategies-multi echelon inventory planning-models-discounting- risk pooling- centralized versus decentralized systems.

Roles of transportation- tradeoffs in transportation design-modes of transportation and their design - vehicle routing and scheduling - models - packaging-pricing and revenue management.

Role of IT in supply chain -IT infrastructure-CRM-SRM-e-business-RFID-supply chain collaboration-Decision Support System (DSS) for supply chain- selection of DSS for supply chain.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Supply Chain Management: Strategy, Planning and Operations-Sunil Chopra, Peter Meindl, Prentice Hall India , 3rd ed., 2007.

REFERENCES:

1.Designing and Managing the Supply Chain: Concepts, Strategies, and Cases-David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Tata McGraw Hill, 3rd ed, 2007.

2.Modeling the supply chain, J. Shapiro, Thomson, 2nd ed., 2002

COURSE OUTCOMES:

- Define structure of supply chain
- Design supply chain configuration
- Analyze the role of Transportation in SCM

PR 403 ANALYSIS OF PRODUCTION SYSTEMS AND IELAB

L	T	P	C
2	0	2	3

PREREQUISITES:Operations research

COURSE OBJECTIVES:

To understand production function, Design of Product, Planning functions, Material Planning and Layout and Scheduling

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

Production Planning: Forecasting techniques – causal and time series models, moving average, exponential smoothing, trend and seasonality

Capacity and aggregate production planning; master production scheduling; MRP and MRP-II

Scheduling and priority dispatching

Inventory – functions, costs, classifications, deterministic and probabilistic inventory models, quantity discount; perpetual and periodic inventory control systems.

IE LAB EXERCISES

The objective of this lab is to have practical exposure on operations management and also to study on the ergonomic aspects of human evaluation.

Part-A Operations Management

1. Forecasting Models
2. Inventory Models
3. Scheduling Case studies
4. Material Requirements Planning
5. Project management

Part-B Ergonomics Study

1. Performance rating using stop watch
2. Peg board experiment
3. Time study trainer

4. Fitness study using treadmill
5. Fitness study using ergo cycle

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXT BOOKS:

1. *Buffa, E.S., "Modern Production/Operations Management", 8th edition, John Wiley sons, 2003.*
2. Elsayed A Elsayed, Thomas O. Boucher, "Analysis and control of Production System", Prentice Hall, 2002.

REFERENCES:

1. Samuel Eilon, "Elements of Production Planning and control", Universal Book Corp., 1999.
2. Krajervaki and Ritzman, "Operations management", Prentice Hall, 2009
3. Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition, 2002.
4. Monks J.G. Operations Management, McGraw Hill, 2004

COURSE OUTCOMES:

- Effective Forecasting of Production functions
- Enhanced Planning of Product Design and Service Operations
- Facility Plnning and Project Management

PR 405 MANUFACTURING SYSTEM SIMULATION (Theory & Lab)

L	T	P	C
3	0	2	4

PREREQUISITES: Applied statistics, Resource Management Techniques

COURSE OBJECTIVES:

- To study various simulation software
- To simulate various production system model

Introduction to Simulation - Components of a system, Types of models, Monte Carlo Simulation, Steps in simulation, applications -Discrete Event Simulation – components of DES -Time advance mechanism.

Introduction – probability mass function, probability density function, Statistical models –Discrete distributions – Bernoulli, Binomial, Poisson, Geometric- Continuous distributions –Normal, Uniform, Exponential Gamma, Triangular Empirical Distributions

Properties of random numbers- Random number generation techniques – midsquare, mid product Constant multiplier, linear, additive congruential. Test for random numbers- uniformity, independence- Kolmogorov simronov test, chi squareRuns test, Gap test, poker test, autocorrelation test Random variate generation-Inverse transform Acceptance rejection, convolution method

Input Analysis Methods-Examples-Verification of simulation models- Validation of simulation models-Measure of performance and their estimation- Output Analysis Methods-Transient and steady state behavior – Evaluation of alternate system design – Simulation Based Optimization (SBO).

Simulation packages spreadsheet, witness, Arena etc., Simulation of queuing models, inventory models, Material handling, assembly systems, logistics and supply chains –Tutorial.

LAB EXERCISES

ARENA

Exercise 1: Simulation of Single Server Queuing System.

Exercise 2: Simulation of manufacturing shop

SIMQUICK

Exercise 3: Simulation of supply chain Inventory System

Exercise 4: Simulation of Multiple Servers Queuing System

Exercise 5: Simulation of batch shop manufacturing process

WITNESS

Exercise 6: Simulation of multi machine assignment system

Exercise 7: Simulation of Manufacturing and material handling systems

Exercise 8: Simulation of supply chain inventory system

GPSS

Exercise 9: Simulation of Job shop System

Exercise 10: Simulation of queuing System

Demo on

QUEST, UGRIP, Systat, GAMS

EVALUATION PATTERN

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOK:

- *1. Banks, Carson, Nelson and Nicol, Discrete-Event System Simulation,Prentice Hall of India Fourth Edition, 2005.*

REFERENCES:

- *1. A. M. Law and W. D. Kelton, Simulation, Modeling and Analysis, McGraw-Hill ,Third Edition,2000.*
- *2. Geoffrey Gordon, System simulation,Prentice Hall of India, second edition.*

COURSE OUTCOMES:

- Understand the basics of Discrete event system simulation
- Apply several tests
- Acquire knowledge about the design/evaluation of different manufacturing systems using simulation modeling.
- Model and simulate using ARENA,SIMQUICK,WITNESS, Flexsim
- Familiarize QUEST, UGRIP, Systat
- Simulate job shop system and queuing system

PR 407 SUSTAINABLE MANUFACTURING (Theory & Lab)

L	T	P	C
2	0	2	3

PREREQUISITES: Fundamentals of Manufacturing

COURSE OBJECTIVES

- To understand the importance of sustainable manufacturing
- To study various tools/techniques of sustainable manufacturing
- To perform Life Cycle Assessment and assess environmental impacts of manufacturing processes
- To develop eco friendly products/processes

Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Relation between lean and sustainable manufacturing.

Tools and Techniques – Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, Design for Disassembly, Design for recycling, Eco friendly product design methods.

Environmental Impact Assessment Methods –CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters.

Sustainability Assessment – Concept Models and Various Approaches, Product Sustainability and Risk/Benefit assessment– Corporate Social Responsibility.

Sustainable characteristics of manufacturing processes - Energy efficiency analysis of manufacturing processes - Software packages for sustainability analysis and LCA - Scope of sustainable manufacturing centres.

Laboratory Exercises :

Sustainability Analysis, Life Cycle Assessment, Design for Environment, Sustainable product design

Software packages used: Sustainability Xpress, GaBi, Simpro.

EVALUATION PATTERN:

Theory content is evaluated for 70 % and Practical input is evaluated for 30 %

Theory

Internal Evaluation: Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks.
External Evaluation: 50 marks end semester exams and End semester Practical examination

Practice

Internal Evaluation:Continuous internal evaluation during performing exercises.
External Evaluation:End semester Practical examination

TEXTBOOKS:

1. G. Atkinson, S. Dietz, E. Neumayer, "Handbook of Sustainable Manufacturing". Edward Elgar Publishing Limited, 2007.
2. D. Rodick, Industrial Development for the 21st Century: Sustainable Development Perspectives, UN New York, 2007.

REFERENCES :

1. P. Lawn, Sustainable Development Indicators in Ecological Economics, Edward Elgar Publishing Limited.
2. S. Asefa, The Economics of Sustainable Development, W.E. Upjohn Institute for Employment Research, 2005.

COURSE OUTCOMES:

- Recognize the need for sustainable manufacturing
- State-of-art tools and techniques of sustainable manufacturing
- Design Eco friendly processes/products

PR 411COLLOQUIUM

L	T	P	C
0	0	2	1

PREREQUISITE: All subjects from manufacturing and industrial streams.

COURSE OBJECTIVES:

To gain knowledge from academic institution by doing mini project, attending inplant training, Internship.

Preparing and making presentations – preparing slides, time management and communication aspects.

Making presentation on experience gathered during 50 working day practical training in the area of Manufacturing Engineering /Industrial Engineering.

Preparation of report, making a presentation with audience response sheet and a critique on writing style, completeness and editorial get-up.

EVALUATION PATTERN:

Presentation by students on gained knowledge

COURSE OUTCOMES:

- Develop presentation & reporting skills.
- Improve the soft skills like time management, communication
- Understand contemporary industrial practices

PR447 COMPREHENSIVE TRAINING

L	T	P	C
0	2	0	2

COURSE OBJECTIVES:

To review the engineering concepts and advancements in manufacturing and industrial engineering

GATE (Production & Industrial Engineering) syllabus

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-25 marks; Cycle test-2-25 marks

External Evaluation:Final Exam: 25 Marks and Viva Voce - 25 marks

COURSE OUTCOMES:

Comprehensive understanding of manufacturing and industrial engineering

PR402 ENTREPRENEURSHIP DEVELOPMENT

PREREQUISITES: Professional ethics and psychology

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To introduce the basic concepts, project identification, marketing, and accounting

Concept Of Entrepreneurship-Definition and concept of enterprising - profile of an entrepreneur - need scope and characteristics of entrepreneurs

Project Identification-Methodology of project identification - short listing and zeroing on product/service - problems in project evaluation

Marketing-Market share - distribution - sale strategies - certification agencies - term finance - source and management working capital

Assistance To Entrepreneur-Small industries development in India and its concept - ancillary industries - starting a small scale industry

Accounting Principles-Accounting principles - conventions and concepts - balance sheet - profit and loss account - accounting rate of return, payback period, SSI duty practice.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOK:

1. UdaiPareek and T.V.VenkateswaraRao, Developing Entrepreneurship - A Hand book Learning systems, N.D., 1978.

REFERENCES:

1.EDI-1 Faculty and Experts, A Handbook for new entrepreneur, Entrepreneurship Development Institute of India, 1986.

COURSE OUTCOMES:

- Point out the scope of an entrepreneur
- Indentify Project & market scenario
- Indentifykey areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc

MANUFACTURING ENGINEERING STREAM

PR 001 MATERIAL HANDLING & STORAGE

COURSE OBJECTIVES

L	T	P	C
3	0	0	3

- To understand about material handling systems
- To understand material storage methods
- To understand automation in material transfer

Introduction to material handling- Principle of material handling equipment-layout and aerial handling systems- Types of material handling systems.

Fixed Path Equipment- flexible-path equipment - Conveyers-automated guided vehicles (AGV) - Applications of AGVS

Production line equipments-pick and place robots-transfer devices-feeder lines, robotic devices

Conveyors-storage equipments-Automated ware houses- types of storage systems- small containers - unit load containers - rack and shelving

Automated storage and retrieval systems-methods of protecting materials for packages - auxiliary equipments -automated identifications systems

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Groover, M.P. "Automation ,Production systems and computer integrated manufacturing" Part V , P HAllInc.New Delhi, 2007

REFERENCE BOOKS:

1. Apple, J.M. "Materials handling systems design", The Ronald Press Co.N.Y. 2001

COURSE OUTCOMES

- Classify various material handling and and storage systems
- Identify various fixed path equipment
- Summarize various packaging techniques

PR 002 MANUFACTURING OF COMPOSITE MATERIALS

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

- To understand the properties of composite materials
- To classify the composites based on properties
- To design metal matrix composite

FRP composites – Fiber types, fiber forms and properties, matrices type and properties, lamina, laminate, orthotrophy, anisotrophy, composites
Macro and micro-mechanical analysis and properties, Failure theories – Tsai – Hill, Tsai-Wu

Primary and secondary manufacturing of composites – Lay-up, Autoclave Molding filament Winding, Pultrusion, Compression Molding, RTM, RIM, SRIM, machining, drilling and routing

Metal matrix composites – Manufacturing route Design, Structural and testing, application

Ceramic matrix composites – Manufacturing routes and application

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Mein Schwartz., "Composite Materials Handbook", McGraw Hill, 1992*
2. *AutarK.Kaw, "Mechanics of Composite Materials", CRC Press, 2005.*

REFERENCE BOOKS:

1. *"ASM Hand book on Composites", Volume 21, 2001*

COURSE OUTCOMES

- Define fundamentals of composite material strength and its mechanicalbehavior
- Classification of composites –matrix composites, metal matrix composites, Ceramic matrix composites reinforcement – particle reinforced composites, fiber reinforced composites
- Analysis of fiber reinforced Laminate design for differentcombinations of plies with different orientations of the fiber.

PR 003 MACHINE TOOL TECHNOLOGY

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

- To understand different types of machine tools
- To analyse the source of vibration in machine structure
- To apply automation in machine control

Classification of machine tools - features construction and operation of basic machine tools - different types and mechanics of transmission of machine tool motion - kinematic structure of machine tools

Mechanical drives for rotational movement - stepped and step less O/P -mechanical drives for reciprocation

Strength and rigidity of machine tool structures - design of lathe beds - design of drill columns - analysis of spindle bearings hydrodynamic bearings - stack slip motion - hydrostatic bearings-

Vibration of machine - sources of vibration

Semi automation - automatic machines with mechanic controls.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. Sen, G.C. and Bhattacharya, A., "Principles of machine tools", New Central Book Agency, Calcutta, 2006.

REFERENCE BOOKS:

1. Mehta, N.K., "Machine tool design", Tata McGraw Hill Co., N.Delhi , 2008.

COURSE OUTCOMES:

- Classify different types of machine tools
- Analyse vibration of machine structures
- Design lathe beds,drill columns

PR 004 INDUSTRIAL ROBOTICS

COURSE OBJECTIVES

L	T	P	C
3	0	0	3

- **To** understand the components of robot
- To understand the drives and programs used to actuate the robot
- To utilize robot technology in various applications

Fundamentals of Robotics: Definition - robot classification - robot arm geometry - power sources, application areas - control techniques - path control - robot controller operation - open loop and closed loop systems.

End of arm tooling and sensors: characteristics - classification - special purpose tools - Typical designs, compliance in Wrists. End Effectors: types, mechanical and other types of griper - types of sensors and applications.
Robot Programming And Languages: Language classification - program commands, arm motion, task point diagram - on line/off line programming, sample programs, program analysis - AI and experts systems.
Robot Applications: Robot applications in manufacturing - material transfer and machine loading / unloading - Processing operations like welding and painting - Assembly operations - Inspection Automation. Robot cell layouts - multiple robots and machine interference.

Recent developments: Recent developments in advanced Robotics –Modular concept - Special applications of robotics - micro robotics, Bio robotics - technologies and applications.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. Keramas,J.G. " Robot Technology Fundamentals", Delmer Publisher, 2002
2. Jain, K.C, and Aggarwal, L.N., "Robotics Principles and Practice", Khanna Publishers, 2001

REFERENCE BOOKS:

1. Groover, M.P., "Industrial Robotics", McGraw Hill International Editions, 2008.
2. Deb, S.R., "Robotics Technology and Flexible automation", Tata McGraw Hill Pub., New Delhi, 1994.

COURSE OUTCOMES

- Explain the basic concepts, parts of robots and types of robots
- Identify the various drive systems for robot, sensors andtheir applications in robots, programming of robots
- Discuss about the various applications of robots, justification, implementation and safety of robot

PR 005 PLANT ENGINEERING

COURSE OBJECTIVES

L	T	P	C
3	0	0	3

- To exemplify different types of plants and its functions
- To analyse the principles used in plants maintenance
- To understand the safety methods in plants

Organization of the plant engineering function-Classification of maintenance work- Electric power supply system's-Electric generators and turbines-compressors, ventilation and air-conditioning Producer Gas Plants-operation and safety aspects in P.G. Compressor and Oxygen plants Material handling system-AS and RS (Automatic Storage and Retrieval System)-AGV and robotics- piping system design and components-Pollution control and plant safety

Noise and vibration control - safety in plant operations, fire and electrical protection and prevention security equipment

Lubrication and corrosion- Synthetic and solid lubricants -lubrication systems - causes and control deterioration - paints and protective coatings.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. Rosaler, R.C. "Standard HandBook of Plant Engineering", 3rd Edition, McGraw Hill, 2002.

REFERENCE BOOK:

1. Lindley and Higgins, "Maintenance Engineers Hand Book", 7th Edition, McGraw Hill Professional, 2008.

COURSE OUTCOMES

- Understand the different type of plant and material handling system AS and RS (Automatic Storage and Retrieval System)-AGV and robotics
- Define the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- Know about safety in plant operation, fire and electrical protection and prevention security equipment

PR 006 NON-DESTRUCTIVE TESTING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To study and understand various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

OVERVIEW OF NDT: NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

SURFACE NDE METHODS: Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers,advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

THERMOGRAPHY AND EDDY CURRENT TESTING: Thermography- Principles, Contact and non contact inspection methods, Techniques for applyingliquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods,

applications.Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION: Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications

RADIOGRAPHY: Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess,density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographicequivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.*
2. *Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010*

REFERENCES:

1. *ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.*
2. *Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005*
3. *Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.*
4. *ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing,*

COURSE OUTCOMES:

- Upon completion of this course, the students can able to use the various Non Destructive Testing and Testing methods understand for defects and characterization of industrial components

PR 007MICRO FABRICATION PROCESSES

COURSE OBJECTIVE:

L	T	P	C
3	0	0	3

To perform various micro fabrication processes to achieve very concise tolerances in micron level materials removal applications.

ofmicromanufacturing and fabrication- Classification- Substrates- Processes- Dimensions- Devices- Traditional vs advanced processes- Microforming- Micromolding- Microcasting- Microjoining- Clean rooms- Applications.

Laser microprocessing- laser classification- interaction effects- parameters- mechanism- laser ablation- Laser assisted chemical etching-Techniques- Direct writing- Mask projection- Interference- Mirco-cutting, welding, drilling- Marking and engraving.

Semiconductor manufacturing - processes- Integrated circuit Manufacturing - Pattern transfer - E beam and X ray lithography - Etching - Doping - Diffusion and ion implantation - PVD- CVD- Process integration - CMOS - BiCMOS - Process monitoring.

Solar cell materials and processing- Crystalline Si Cell- Amorphous Si Cell - Thin Film Cell Technologies- Space and Concentrator Cells- Organic and Dye Sensitized Cells- Recent advancement.

Self assembly - Basics - Cheerios effect - Static, dynamic, template driven self assembly - assembly via capillary forces - structured surface - assembly by folding - magnetically and mechanically driven dynamic systems - self propelled systems.

REFERENCES:

1. V. K. Jain, "Micromanufacturing Processes", CRC Press, 2013.

2. Sami Franssila, "Introduction to Microfabrication", 2nd Edition, Wiley, 2010.

3. Narendra B. Dahotre, Sandip P. Harimkar, "Laser fabrication and machining of Materials", Springer, 2008.

4. Gary S. May, "Fundamentals of Semiconductor manufacturing", Wiley, 2006

5. AugustinMcEvoy, L. Castaner, Tom Markvart, "Solar Cells: Materials, Manufacture and Operation", 2nd Edition, Elsevier, 2013.

6. John. A. Pelesko "Self assembly: the science of things that put themselves together", Chapman & Hall/CRC, 2007

COURSE OUTCOMES:

- Students can perform various micro fabrication techniques to achieve micron level materials removal

PR 008 SURFACE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To apply various surface protection techniques to protect metallic materials from degradation and wear

Introduction- Significance of surface engineering- Solid surface- Surface energy-Superficial layer-Physico-chemical parameters- Properties of the superficial layer-Surface coating- Classification.
Physical vapor deposition (PVD): Ion plating- Sputter deposition- Reactive deposition- Magnetron sputtering- Chemical vapor deposition (CVD)- Ion implantation- Electron beam technology-Applications.
Thermal Spraying Techniques- Flame Spraying, Atmospheric Plasma Spraying (APS), Vacuum Plasma Spraying (VPS), Detonation-Gun Spraying (D-GUN), High-Velocity Oxy-Fuel (HVOF) Spraying-Applications.
Laser surface engineering- Laser transformation hardening - Laser remelting- Laser alloying-Laser cladding- Laser ablation- Pulsed laser deposition- Laser doping - Laser crystallization- Laser surface texturing- Laser shock peening.
Methods of characterization-Microstructure- Mechanical: Adhesion-Hardness-Residual stress-Friction-Wear- Physical: Porosity-Density- Electrical: Conductivity- Magnetic- Chemical.

REFERENCES:

1.*TadeuszBurakowski, TadeuszWierzchon, "Surface Engineering of Metals-Principles, equipment and technologies", CRC Press, 1999.*

2. Lech Pawlowski, "The Science and Engineering of Thermal Spray Coatings", 2nd Edition, John Wiley & Sons, 2008.

3. William M. Steen, JyotirmoyMazumder, "Laser Material Processing", 4th Edition, Springer Verlag, 2010.

COURSE OUTCOMES:

- Perform different surface protection techniques like PVD, thermal spray techniques and laser surface modification techniques for the protection of metallic surfaces

PR 009 PROCESSING OF POLYMERIC COMPOSITES

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To enable students to understand the methods of preparation, properties and applications of thermoplastic materials covering commodity, engineering and high performance plastics.

Methods of manufacturing - Properties and applications of polyethylene - LDPE -LLDPE- HDPE, HMWHDPE- UHMWHDPE - Crosslinked polyethylene- Chlorinated polyethylene - Polypropylene - Homopolymers - Copolymers.

Methods of manufacturing - Properties and applications of poly(vinyl chloride)- Poly (vinylidene chloride)- Poly(vinyl alcohol) - Poly(vinyl acetate)- Chlorinated poly(vinyl chloride)- Plastisols, Poly vinylpyrrolidiene,Polystyrene, HIPS, EPS, SAN, EVA, EPDM, ABS.

Methods of manufacturing - properties and applications of Acrylates - Poly (methyl methacrylate)- Polyacrylonitrile. Aliphatic polyamides –Aromatic polyamides- Polyethylene terephthalate - Polybutylene terephthalate - Polyacetals and copolymers -Polycarbonates- Thermoplastic polyurethane (TPU)

Methods of manufacturing- Properties and applications of Fluoro polymers - Polytetrafluoroethylene, Polychlorofluoroethylene, Thermoplastic polyurethanes, Biodegradable polymers - poly ξ–caprolactone and copolymers - polylactic acid-Bacterial polyhydroxy alkonates.

Preparation, properties and applications of High performance Thermoplastic materials PPS, PO, Polysulphone, Polyether Sulphone, PEEK, Polyimide. Biopolymer-cotton wool, collagen, hyaluroran.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

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TEXT BOOKS:

1. *J.A.Brydson, "Plastics Materials", Butterworth- Heinemann - Oxford, 6th Ed., 1995.*
2. Feldman.D and Barbalata.A, "Synthetic Polymers", Chapman Hall, 1996.

REFERENCES:

1. *OlagokeOlabisi, "Hand Book of Thermoplastics", Marcel Decker, inc., 1997*
2. K.J. Saunders, "Organic Polymer chemistry", Chapman & Hall, NY, 1988.
3. Irvin.I. Rubin, "Hand Book of Plastic Materials and Technology", Wiley Interscience, NY, 1990.
4. Charles Gebelein, Biotechnological Polymers: Medical, pharmaceutical and industrial applications, CRC press,1993

COURSE OUTCOMES:

- Familiarize in manufacturing process of plastic
- Acquire skills in selecting polymeric materials for specific applications
- Demonstrate basic knowledge of degradable plastics

DESIGN STREAM

PR 021RAPID PROTOTYPING, TOOLING AND MANUFACTURE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand need of rapid prototyping process
- To understand about different Rapid prototyping process
- To understand tools used in Rapid prototyping techniques

Introduction- Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, Classification of RP systems.

Principle, process parameters, process details and applications of various RP processes - Stereo lithography systems, Selective Laser Sintering, Fused Deposition Modeling, Laminated Object Manufacturing, Solid Ground Curing, Laser Engineered Net Shaping, 3D Printing.

Rapid Tooling: Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, Direct rapid tooling - direct AIM, copper polyamide, sand casting tooling, laminate tooling, soft tooling Vs hard tooling.

Rapid Manufacturing Process Optimization- Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.

Allied Processes: Vacuum casting, surface digitizing, surface generation from point cloud, surface modification, data transfer to solid models.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.*
2. *Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME, 1996.*

REFERENCE BOOKS:

1. Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.

COURSE OUTCOMES

- Understand the principle, parameters and applications of R P processes
- Recognize various types of rapid tooling
- Identify different allied processes

PR 022 FINITE ELEMENT METHODS

COURSE OBJECTIVES

L	T	P	C
3	0	0	3

- To apply partial differential equations in element analysis
- To evaluate the element shape using FEM
- To apply numerical methods in element analysis

Introduction-Different approaches in Finite Element Method - Steps involved in FEM--Types Of Elements Used

Interpolation Polynomials - Linear elements Shape function - Finite Element Formulation Of Field Problems

Classification of partial differential equations - Finite Element Formulation Of Solid Mechanics Problems

Axial force member - element matrices for axial force members - Truss element analysis of pinned truss - Two dimensional elasticity problems-Numerical Methods In FEM

Evaluation of shape functions - Solution of finite element equations - Cholesky decomposition, Skyline storage - Computer implementation.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOK:

1. *Larry J Segerlind ," Applied Finite Element Analysis", John Wiley, 1984*

REFERENCE BOOKS:

1. *K.J.Bathe, "Finite Element Procedures", Prentice Hall, 1994.*
2. *Huebner and E.A.Thornton, "The Finite Element Method for Engineers", John Wiley,2008*

COURSE OUTCOMES

- Obtain expertise in formulating finite element models for structurals thermal and vibrational problems.
- Obtain ability to solve FE models using numerical solutions.

PR 023 PRODUCT DEVELOPMENT STRATEGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To understand the complexities in product development
- To gain knowledge on tools/techniques of product development
- To recognize the need for design to suit environment

Product development versus design, types of design and redesign, modern product development process, reverse engineering and redesigning product development process, examples of product development process, scoping product development – S-curve, new product development.

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality.

Tear Down and Experimentation- Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

Generating Concepts- Information gathering, brain ball, C-sketch/6-3-5 method, morphological analysis, concept selection, technical feasibility, ranking, measurement theory, DFMA, design for robustness

Design for the Environment: DFE methods, life cycle assessment, weighted sum assessment method, techniques to reduce environmental impact – disassembly, recyclability, remanufacturing regulations and standards, analytical and numerical model solutions.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Kevin Otto and Kristin Wood, "Product Design – Techniques in Reverse Engineering and New Product Development", Pearson Education, 2004.*
2. *Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", McGraw Hill, 1994.*

COURSE OUTCOMES

- Explain modern product development process
- Design for the Environment through DFE method life cycle assessment
- Gather customer needs

PR 024 DESIGN FOR MANUFACTURE AND ASSEMBLY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To identify opportunities for design.
- To address technical considerations of design and manufacturing.
- To utilize DFM and Concurrent Engineering Principles on a "real life" project.

Engineering design – Kinds of design – Design process steps – Factors influencing design – Concurrent Engineering – Material selection process – Evaluation methods for material selection

Process capability analysis – Cumulative effect of tolerances – Centrality analysis – Compound assembly – Selective and Interchangeable assembly – Grouped Datum systems

Design for castings – Design for weldments – Design for forgings – Design for sheet metal formed parts – Design for powder metallurgy parts – Design for plastic parts

Design for machining – Design for economy – Design for clampability – Design for ease of assembly – Design for disassembly

Advances in DFMA- Design for robustness – Axiomatic design – Design for environment – DFA index – Poka Yoke – Lean principles – Six sigma concepts – Computer aided DFA using software.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS

1. Dieter, G.E., Engineering Design: A Materials and processing Approach, McGraw Hill Co. Ltd, 2000.

2. Boothroyd, G., Assembly, Automation and product design, CRC press, 2005.

REFERENCES

1. Eggert, R.J., Engineering Design, Pearson Education, Inc. New Jersey, 2005.
2. KalandarSaheb, S.D and Prabhakar, O., Engineering Design for Manufacture, ISPE 1999.
3Boothroyd, DFMA.

COURSE OUTCOMES

- Identify opportunities for design.
- Address technical considerations of design and manufacturing.
- Utilize DFM and Concurrent Engineering Principles on a "real life" project.

PR 025 VIBRATION AND NOISE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of thecomponents

BASICS OF VIBRATION: Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

BASICS OF NOISE: Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise,measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

AUTOMOTIVE NOISE SOURCES: Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise,assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

CONTROL TECHNIQUES: Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, applicationdynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

SOURCE OF NOISE AND CONTROL: Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis,palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *SingiresuS.Rao, "Mechanical Vibrations", 5th Edition, Pearson Education, 2010*

REFERENCES:

1. *Benson H. Tongue, "Principles of Vibrations", 2nd Edition, Oxford University, 2007*
2. *David Bies and Colin Hansen, "Engineering Noise Control – Theory and Practice",4th*
3. *Edition, E and FN Spon, Taylore&Francise e-Library, 2009*
4. *William T. Thomson, Marie Dillon Dahleh, ChandramouliPadmanabhan, "Theory of*
5. *Vibration with Application", 5th Edition Pearson Education, 2011*
6. *Grover. G.T., "Mechanical Vibrations", Nem Chand and Bros., 1996*

COURSE OUTCOMES:

- Understanding causes, source and types of vibrations in machineries
- Gaining knowledge in sources and measurement standard of noise
- Ability to design and develop vibrations and noise control systems.

PR 026 CONCEPTS OF ENGINEERING DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study about fundamental design standards and needs
- To learn about human and product factors involved in design concepts and rapid prototyping methods

DESIGN FUNDAMENTALS: Importance of design- The design process-Considerations of Good Design –Morphology of Design –Organization for design– Computer Aided Engineering – Designing to codes and standards – Concurrent Engineering – Product and processcycles – Technological Forecasting – Market Identification – Competition Bench marking.

CUSTOMER ORIENTED DESIGN & SOCIETAL CONSIDERATIONS: Identification of customer needs- customer requirements- Quality Function Deployment- Product Design Specifications- Human Factors in Design – Ergonomics and Aesthetics.Societal consideration - Contracts – Product liability – Protecting intellectual property – Legal and ethical domains – Codes of ethics – Ethical conflicts – Environment responsible design-future trends in interaction of engineering with society.

DESIGN METHODS: Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving(TRIZ)– Conceptual decomposition-Generating design concepts-Axiomatic Design – Evaluation methods-Embodiment Design-Product Architecture Configuration Design-

Parametric Design. Role of models in design-Mathematical Modeling – Simulation – Geometric Modeling –Rapid prototyping- Finite Element Analysis– Optimization – Search Methods.
MATERIAL SELECTION PROCESSING AND DESIGN: Material Selection Process – Economics – Cost Vs Performance – Weighted property Index – Value Analysis – Role of Processing in Design – Classification of Manufacturing Process – Design for Manufacture – Design for Assembly –Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue, Fracture and Failure.

PROBABILITY CONCEPTS IN DESIGN FOR RELIABILITY: Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design for Reliability – Reliability centered Maintenance-Robust design – FMEA.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOK:

1. Dieter, George E., "Engineering Design - A Materials and Processing Approach", McGraw Hill, International Editions, Singapore, 2000.

REFERENCES:

1. Suh, N.P., "The principles of Design", Oxford University Press, NY.1990.
Karl T. Ulrich and Steven D. Eppinger "Product Design and Development"
McGraw Hill Edition 2000

COURSE OUTCOMES:

- Demonstration of fundamental design standards and customer needs
- Understand human and product factors involved in design concepts
- Application of engineering design concepts

PR 027 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To perform different optimization techniques to solve various engineering problems

Introduction: Introduction to engineering optimization - General principles –Classification - Problem formulation & their classifications – Classical optimization techniques – Single variable and multivariable optimization-Single and Multi objectives-Pareto Optimal solutions.

Unconstrained Optimization Techniques: Techniques of unconstrained optimization – Golden section, Random, Pattern and Gradient search methods – Interpolation methods.

Constrained Optimization Techniques: Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions.

Unconventional Optimization Techniques: Genetic Algorithms, Particle Swarm Optimization, Simulated Annealing and Ant Colony algorithm.

Applications: Structural applications – Design of simple truss members - Design applications – production planning, controlling and scheduling – Facility layout applications, etc.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

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TEXT BOOKS:

1. *S.S. Rao, "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2009.*
2. *Kalyanamoy Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice Hall of India Pvt. Ltd., 2006.*

REFERENCES:

1. *C. Johnson Ray, "Optimum Design of Mechanical Elements", Wiley, John & Sons, Digitized 2007.*
2. *D.E.Goldberg, "Genetic Algorithms in Search, Optimization and Machine", Barnen, AddisonWesley, New York, 1989.*
3. *C.S.Rao, "Optimization Techniques", DhanpatRai& Sons, New Delhi*

COURSE OUTCOMES:

- Able to perform classical optimization techniques
- Able to perform constrained and unconstrained optimization techniques
- Able to perform optimization techniques for design of simple truss members, production planning and scheduling

PR 028 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce governing equations of viscous fluid flows
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer
- To enable students to understand the various discretization methods, solution procedures and turbulence modeling.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

GOVERNING EQUATIONS AND BOUNDARY CONDITIONS: Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity,Momentum and Energy equations – Chemical species transport – Physical boundary conditions Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION: Derivation of finite difference equations – Simple Methods – General Methods for first and secondorder accuracy – Finite volume formulation for steady state One, Two and Three – dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

FINITE VOLUME METHOD FOR CONVECTION DIFFUSION: Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

FLOW FIELD ANALYSIS: Finite volume methods -Representation of the pressure gradient term and continuity equation –Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correctionequation, SIMPLE algorithm and its variants – PISO Algorithms.

TURBULENCE MODELS AND MESH GENERATION: Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds
number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition, 2007.*
2. *Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.*

REFERENCES:

1. *Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation,2004.*
2. *Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.*
3. *Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005*
4. *Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.*
5. *ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.*
6. *Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.*

COURSE OUTCOMES:

- Perform numerical modeling and its role in the field of fluid flow and heat transfer
- Use various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

PR 029 EXPERIMENTAL STRESS ANALYSIS

PREREQUISITES

- Strength of Materials.

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand the basic aspects of experimental stress analysis that includes exhaustive treatment of the most versatile techniques like photo elasticity and strain gauges and also a brief introduction to the emerging techniques like digital image correlation.

Overview of Experimental Stress Analysis- Optical Methods Work as Optical Computers- Stress, Strain and Displacement Fields- Physical Principle of Strain Gauges, Photo elasticity and Moiré- Introduction to Moiré, Brittle Coatings and Holography- Hologram Interferometry, Speckle Methods- Introduction to Shearography, TSA, DIC and Caustics- Fringe Patterns – Richness of Qualitative Information

Multi-Scale Analysis in Experimental Mechanics- Selection of an Experimental Technique- Introduction to Transmission Photo elasticity- Ordinary and Extraordinary Rays- Light Ellipse, Passage of Light Through a Crystal Plate- Retardation Plates, Stress-optic Law- Plane Polariscope- Jones Calculus

Circular Polariscope-Determination of Photoelastic Parameters at an Arbitrary Point-Tardy's Method of Compensation-Calibration of Photo elastic Materials-Fringe Thinning Methodologies
Photoelasticity Ordering Fringe in Miscellaneous-Topics in Transmission Photoelasticity -Three Dimensional Photoelasticity

Overview of Digital Photo elasticity-Introduction to Photoelastic Coatings-Correction Factors for Photoelastic Coatings-Coating Materials, Selection of Coating Thickness, Industrial Application of Photoelastic Coatings-Calibration of Photoelastic Coatings, Introduction to Brittle Coatings-Analysis of Brittle Coatings -Introduction to Strain Gauges-Strain Sensitivity of a Strain Gauge, Bridge Sensitivity, Rosettes

Strain Gauge Alloys, Carriers and Adhesives-Performance of Strain Gauge System-Strain Gauge Selection-Bonding of a Strain Gauge-Soldering, Accounting for Transverse Sensitivity Effects-Correction Factors for Special Applications-Special Gauges

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

REFERENCE BOOKS:

1. *K. Ramesh, e-Book on Experimental Stress Analysis, IIT Madras, 2009. URL: http://apm.iitm.ac.in/smlab/kramesh/book_5.htm*
2. *K. Ramesh, Digital Photoelasticity â€“ Advanced Techniques and Applications, Springer, 2000.*
3. *W.N. Sharpe (Ed.), Springer Handbook of Experimental Solid Mechanics, Springer, 2008.*
4. *J.W. Dally and W.F. Riley, Experimental Stress Analysis, McGraw-Hill, 1991.*

COURSE OUTCOMES:

- Understand stress strain analysis with its relation
- Recognise materials structure and testing methods

PR 030 DESIGN OF AUTOMATED MANUFACTURING SYSTEM

L	T	P	C
3	0	0	3

CORSE OBJECTIVES:

To understand pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.

FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION : Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

TRANSFER LINES AND AUTOMATED ASSEMBLY: General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines.AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.

PNEUMATIC CONTROL: Components, constructional details, filter, lubricator, regulator, constructional features, types of cylinders, control valves for direction, pressure and flow, air motors, air hydraulic equipments. PNEUMATIC CONTROL SYSTEM DESIGN: General approach to control system design, symbols and drawings, schematic layout, travel step diagram, circuit, control modes, program control, sequence control, cascade method, Karnaugh-Veitch mapping.

PROGRAMMABLE AUTOMATION: Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems. DESIGN FOR HIGH SPEED AUTOMATIC ASSEMBLY: Introduction, Design of parts for high speed feeding and orienting, high speed automatic insertion. Analysis of an assembly. General rules for product design for automation. DESIGN OF MECHATRONIC SYSTEMS: Stages in design, traditional and mechatronic design, possible design solutions. Case studies-pick and place robot, engine management system.

ELEMENTS OF HYDRAULIC SYSTEMS: Pumps and motors- types, characteristics. Cylinders, types, typical construction details.Valves for control of direction, flow and pressure, types, typical construction details. HYDRAULIC SYSTEM DESIGN: Power pack–elements, design. Pipes- material, pipe fittings.seals and packing. maintenance of hydraulic systems. Selection criteria for cylinders, valves, pipes. Heat generation in hydraulic system ADVANCED TOPICS IN HYDRAULICS AND PNEUMATICS**:** Electro pneumatics, ladder diagram. Servo and Proportional valves - types, operation, application.Hydro-Mechanical servo systems. PLC-construction, types, operation, programming

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. *Mikell P Groover, "Automation Production Systems and Computer- Integrated Manufacturing" Pearson Education, New Delhi, 2001.*
2. *Bolton W, "Mechatronics", Pearson Education, 1999.*

REFERENCES:

1. *Mikell P Groover, "Industrial Robots – Technology Programmes and Applications" , McGraw Hill , New York, USA. 2000.*
2. *Steve F Krar, "Computer Numerical Control Simplified", Industrial Press, 2001.*
3. *JoffreyBoothroyd, Peter Dewhurst and Winston A. Knight, "Product Design for manufacture and Assembly", CRC Press, 2011*

COURSE OUTCOMES:

- Knowledge of industrial automation by transfer lines and automated assembly lines.
- Understanding of automated controls using pneumatic and hydraulic systems
- Ability to understand electronic control systems in metal machining and other manufacturing processes.

INDUSTRIAL ENGINEERING STREAM

PR 041 DESIGN AND ANALYSIS OF EXPERIMENTS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide an introduction to fundamental concepts of statistical Process control
- To enhance student understanding of the complexities of Statistical Analysis and control chart interpretation

Introduction- Planning of experiments – Steps – Need - Terminology: Factors, levels, variables, experimental error, replication, Randomization, Blocking, Confounding.

Single Factor Experiments- ANOVA rationale - Sum of squares – Completely randomized design, Randomized block design, effect of coding, Comparison of treatment means – Newman Kuel's test, Duncan's Multiple Range test, Latin Square Design, Graeco-Latin Square Design, Balanced incomplete design.

Factorial Experiments-Main and interaction effects –Two and three Factor full factorial Designs, 2^k deigns with Two and Three factors-Unreplicated design- Yate's Algorithm

Special Experimental Designs: Blocking in factorial design, Confounding of 2^k design, nested design-Response Surface Methods.

Taguchi Techniques- Fundamentals of Taguchi methods, Quality Loss function, orthogonal designs, application to Process and Parameter design.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1. Montgomery, D.C. "Design and Analysis of Experiments", John Wiley and Sons, 5th Edition,2002.

REFERENCE BOOKS:

1. Hicks,C.R. "Fundamental concepts in the Design of Experiments", Holt, Rinehort and Winston, 2000.
2. Bagchi, T.P. "Taguchi Methods explained", PHI, 2002.
3. Ross, P.J. "Taguchi Techniques for quality Engineering", Prentice Hall, 2000.

COURSE OUTCOMES:

- Create steps, need and terminology for experiments
- Know about factorial experiments and special experimental techniques
- Apply Taguchi techniques for various design problems

PR 042AGILE MANUFACTURING

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

To enable manufacturing enterprises to be competitive by dynamically reconfiguring software, equipment and organization structures.

Types of Production- The Agile Production Paradigm- History of Agile Manufacturing- Agile Manufacturing Vs Mass Manufacturing, Agile Manufacturing Vs Mass Customization- Agile Manufacturing Research Centers.

Agile Practices- Agile practice for product development - Manufacturing agile practices - understanding the value of investing in people, Concept models of Agile Manufacturing- Infusing managerial principles for enabling agility.

Implementing technology to enhance agility- Implementing new technology – reasons – guidelines preparation for technology implementation - A checklist, technology applications that enhance agility - agile technology make-or-buy decisions.

Performance Measurement and Costing: Measurement of agility – methods – Scoring and Fuzzy approaches – Costing for Agile Manufacturing practices – Activity Based Costing.

Creating the learning factory: Imperative for success, factory becoming a learning factory, building a road map for becoming a learning factory - core capabilities, guiding vision, leadership that fits, ownership and commitment, pushing the envelope, prototypes, integration, learning challenges for learning manufacturing business.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Gunasekaran A, "Agile Manufacturing, 21st Strategy Competitiveness Strategy", Elsevier Publications, 2001.*
2. *Montgomery J C and Levine L O, "The Transition to Agile Manufacturing – Staying Flexible for Competitive Advantage", ASQC Quality Press, Wisconsin, 1995.*

REFRENCE BOOKS:

3. *Goldman S L, Nagal R N and Preiss K, "Agile Competitors and Virtual Organizations", Van Nostrand Reinhold, 1995.*
4. *Brian H Maskell, "Software and the Agile Manufacturer, Computer Systems and World Class Manufacturing, Productivity Press, 1993*

COURSE OUTCOMES

- Understanding recent trends in manufacturing
- Customization of product for manufacturing
- Implementation of new technology

PR 043 INTEGRATED MATERIALS MANAGEMENT

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

To study the fundamentals of Integrated MaterialsManagement,Inventory Management, Material Handling and to ensure that continuity of supply of materials to the users is maintained by avoiding out of stock situation.

Introduction to Integrated Materials Management – need, scope, functions and objectives of Materials Management. Purchasing function – purchase budget and materials budget – Source selection and development -Negotiations in purchasing - public buying - JIT concept

Inventory Management- Functions – Associated Costs – Classification – ABC – VED – FSN analysis - Basic EOQ model. Inventory control systems – Periodic Review – P system and Continuous review systems – Q systems – Lead-time analysis – Reorder point level Calculations.

MRP – Introduction – Terminology – Types of demand input to the MRP – Working Principle of MRP – Output of MRP – advantages and disadvantages. Stores Management: Stores function – types of stores – storage procedures- stock verification and stock accounting – stores records

Material Handling: layout, selection of equipment, principles of materials handling – Packaging, types of material handling equipment

Introduction to Supply Chain Management – Understanding the supply chain – Supply chain performance – Supply chain Drivers and Obstacles – Supplier selection and Supplier evaluation

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. Gopalakrisnan, P. "Purchasing and Materials Management", McMillan Company, 2006
2. Telsang, M."Industrial Engineering and Production Management", S.Chand and Company, 2006

REFERENCE BOOKS:

1. Chary, S.N."Production and Operations Management", Tata McGraw Hill, 2006
2. Chopra, S. "Supply chain management", Prentice Hall,2008

COURSE OUTCOMES:

- Understand various concepts and functions of material management
- Classification of inventory management
- Summarize Material handling and Logistic

PR 044 LEAN MANUFACTURING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To introduce the fundamentals of Lean Manufacturing and Components for Lean including: Waste identification and elimination (value stream analysis), 5S, JIT, Kaizen and Poke Yoke.

Objectives of lean manufacturing-key principles and implications of lean manufacturing-traditional Vs lean manufacturing. Value creation and waste elimination- main kinds of waste- pull production-different models of pull production-continuous flow-continuous improvement/Kaizen-worker involvement -cellular layout- administrative lean.

Standard work -communication of standard work to employees -standard work and flexibility -visual controls-quality at the source- 5S principles -preventative maintenance-total quality management-total productive maintenance -changeover/setup time -batch size reduction -production leveling.

Value Stream Mapping-The as-is diagram-the future state map-application to the factory simulation scenario-line balancing -Poke Yoke – overall equipment effectiveness. One Piece Flow-Process razing techniques – cells for assembly line – case studies

Introduction - elements of JIT - uniform production rate - pull versus push method- Kanban system - small lot size - quick, inexpensive set-up - continuous improvement. Optimised production technology.

Team establishment, transformation process, Project Management, Lean implementation, Reconciling lean with other systems- lean six sigma-lean and ERP-lean with ISO 9001:2000.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Askin R G and Goldberg J B, "Design and Analysis of Lean Production Systems", John Wiley and Sons Inc., 2003.*
2. *Hobbs, D.P. "Lean Manufacturing implementation", Narosa Publisher, 2004.*

REFERENCE BOOKS:

1. Micheal Wader, "Lean Tools: A Pocket Guide to Implementing Lean Practices", Productivity and Quality Publishing Pvt Ltd, 2002.
2. Michael L George, David T Rowlands, Bill Kastle, "What is Lean Six Sigma", McGraw Hill, New York, 2004.
3. *Kenichi Sekine, "One-Piece Flow", Productivity Press, Portland, Oregon, 1992.*
4. Alan Robinson "Continuous Improvement in Operations", Productivity Press, Portland, Oregon, 1991.
5. Poke - Yoke, "Improving Product Quality by Preventing Defects", Productivity Press, 1992.

COURSE OUTCOMES:

- Indentify the waste and how to eliminate those waste
- know the recent trends of manufacturing like just in time (JIT) and Pull Push system
- Implementation of some modern tool like 5S, Poke-Yoke and Kaizen in an organization

PR 045 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To facilitate understanding of Quality Management principles and tools.

Understanding quality, quality, competitiveness and customers, building quality chains, managing quality, quality in all functions, models and frame works for total quality management, Early TQM frameworks – quality award models – the four Ps and three Cs of TQM - a new model for TQM.

The TQM approach – commitment and policy – creating or changing the culture – effective leadership – excellence in leadership.

Design, innovation and improvement – the design process – quality function deployment (QFD) – the house of quality – specifications and standards - design in the service sectors – failure mode effect and criticality analysis (FMECA) – The links between good design and managing the business.

Human Resource Management - Introduction – strategic alignment of HRM policies – effective communication – employee empowerment and involvement – training and development – teams and team work – review, continuous improvement and conclusions – organizing people for quality – quality circles or kaizen teams.

Quality and Environmental Management Systems:Benefits of ISO registration - ISO 9000 series of standards ISO 9001 requirements – implementation – documentation – writing the documents – internal audits – registration - ISO 14000 series standards – concepts of ISO 14001 – requirements of ISO 14001 – benefits of EMS – integrating ISO 14000 with ISO 9000 – relationship between health and safety.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

REFERENCE BOOKS:

1. *Oakland J S, "Total Quality Management - Text with Cases", Butterworth – Heinemann – An Imprint of Elseiver, First Indian Print, 2005.*
2. *Besterfield D H et al, "Total Quality Management", Pearson Education Private Limited, 2004.*

COURSE OUTCOMES:

- Apply TQM principle for continuous process improvement
- Lead teams for quality production
- Utilization of modern tool like QFD, FMECA to design and manage the business.

PR 046 ENGINEERING OPTIMIZATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:
To perform different optimization techniques to solve various engineering problems need optimum values for effective usage.

Introduction: Introduction to engineering optimization - General principles –Classification - Problem formulation & their classifications – Classical optimization techniques – Single variable and multivariable optimization-Single and Multi objectives-Pareto Optimal solutions.

Unconstrained Optimization Techniques: Techniques of unconstrained optimization – Golden section, Random, Pattern and Gradient search methods – Interpolation methods.

Constrained Optimization Techniques: Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions.

Unconventional Optimization Techniques: Genetic Algorithms, Particle Swarm Optimization, Simulated Annealing and Ant Colony algorithm.

Applications: Structural applications – Design of simple truss members - Design applications – production planning, controlling and scheduling – Facility layout applications, etc.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

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TEXT BOOKS:

1. *S.S. Rao, "Engineering Optimization – Theory & Practice", New Age International (P) Limited, New Delhi, 2009.*
2. *Kalyanamoy Deb, "Optimization for Engineering Design Algorithms and Examples", Prentice Hall of India Pvt. Ltd.,2006.*

REFERENCES:

1. *C. Johnson Ray, "Optimum Design of Mechanical Elements", Wiley, John & Sons, Digitized 2007.*
2. *C.S.Rao, "Optimization Techniques", DhanpatRai& Sons, New Delhi*

COURSE OUTCOMES:

- Perform classical optimization techniques.
- Perform constrained and unconstrained optimization techniques.
- Perform optimization techniques for design of simple truss members, production planning and scheduling.

GLOBAL ELECTIVES

PR 081 OPERATIONS MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To understand various components and functions of operation management such as Aggregate Planning,process planning, production scheduling, Assembly Line Balancing.

Overview of Production System, Objectives of Operation Management, Scope of Operations Management, Operations Management Frame work, Relationship of operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Production Design Process and Process choices

Measures of capacity, Factors affecting capacity, Capacity planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement planning- Business process outsourcing

Aggregate Planning strategies and methods-Pure and mixed strategies-Transportation method-LPP method

Master Production Schedule, MRP-Lot sizing methods - Wagner and whitens algorithm, MRP II, CRP

Assembly Line Balancing – algorithms, Group technology – Production Flow analysis – Rank order clustering, Business Process Reengineering-JIT

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Analysis and control of Production System by Elsayed A Elsayed, Thomas O. Boucher, Prentice Hall publications, 1993
2.Buffa, E.S., "Modern Production/Operations Management", 7th edition, John Wiley sons,2007.

REFERENCE BOOKS:

1. Krajewski and Ritzman, "Operations management", Addison Wesley Pub. Co, 2007
2.Norman Gaither, Greg Frazier, Operations Management, Thomson Learning, 9th Edition,2002.
3.Monks J.G. Operations Management, McGraw Hill, 2004

COURSE OUTCOMES

- Perform production management tasks.
- Describe the various components and functions of production planning and control such as capacity planning, aggregate planning, process planning, productionscheduling, line balancing.
- Know the recent trends like manufacturing requirement Planning (MRP II) and Master production schedule (MPS)

PR 082 PROJECT MANAGEMENT

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

To understand the concepts of project definition, life cycle, Market and demand analysis, Financial analysis and systems approach and to handle the complex tasks of time estimation and project scheduling, including PERT and CPM

Introduction - Project Management: An Overview – Types, Characteristics of Projects – Project life cycle. Identification of investment opportunities - Screening and Selection, Project Appraisal

Market and demand analysis- market survey-demand forecasting methods-Technical analysis – manufacturing process, materials-product mix, plant location-project charts and layouts.

Financial analysis – cash flows for project appraisal- Investment evaluation using capital budgeting techniques - net present value, profitability index internal rate of return, pay back period, accounting rate of return

Mathematical Techniques for project evaluation – Linear programming, goal programming, Network technique for Project Management – CPM, PERT, Multiple projects and constraints, scheduling.

Organization systems for project implementation- Work Breakdown-coordination and control-Project Management Soft wares

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Prasanna Chandra, "Projects – Planning, Analysis, Financing, Implementation and Review", Tata McGraw Hill,4th Ed, 1997

REFERENCE BOOKS:

1.Mike Field and Laurie Keller, "Project Management", Thompson Business press, 2002
2.Gido and Clements, "Successful project management", Thompson south-western, 2nd edition 2003
3.John M Nicholas, "Project Management for business and technology", Pearson Education Asia, 2nd edition, 2001
4.Bhavesh M Patel, "Project Management – Strategic Financial planning, Evaluation and control", Vikas publishing house, 2000
5.S.Choudry "Project Management", ", Tata McGraw Hill,27th edition, 2006

COURSE OUTCOMES:

- Understand the Method for Project Identification &appriasial
- Develop & Analyze quantitative models for Project selection & Scheduling.

PR 083 VALUE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To give a brief account of value analysis and engineering tool for productivity improvement and removing unnecessary cost through case studies

An Overview Of Value Engineering-Concepts and approaches of value analysis and engineering - importance of value, Function - identity, clarify – analysis

Evaluation of VE-Evaluation of function, Problem setting system, problem solving system, setting and solving management - decision - type and services problem, evaluation of value

Results accelerators, Basic steps in using the systems

Understanding the decision environment, Effect of value analysis on other work in the business-Life Cycle Cost (LCC), Case studies

VE Level Of Effort-VE Team, coordinator, designer, different services, definitions, construction management contracts, value engineering case studies, Effective organization for value work, function analysis system techniques- FAST diagram, Case studies.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Parker, D.E., "Value Engineering Theory", Sundaram publishers, 1990.

REFERENCE BOOKS:

1. Khanna, O.P., "Industrial Engineering and Management", DhanpatRai and Sons, 1999.

COURSE OUTCOMES:

- Understand the concept and approaches of value analysis and engineering
- Justify the value of money and value of product
- Implementation of Value Engineering in any type of organization

PR 084 ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

- To study the concepts of Artificial Intelligence
- To understand the methods of solving problems using Artificial Intelligence
- To learn about the components of decision support system and expert systems.

Aspects of intelligence and AI - heuristic search - logic programming and reasoning - automatic programming-scope of AI-in manufacturing - components of intelligent manufacturing-

Requirements of AI languages - Languages Lisp and Prolog - simple programs

Knowledge engineering- protocol analysis - fuzzy logic - Semantic networks, Learning systems - inference engine

Vision programmes - factory vision systems - machine learning

Features of Experts systems - applications in manufacturing planning and control.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1.Simons, G.L., "Introducing Artificial Intelligence", NCC Publications, 1984

REFERENCE BOOKS:
1.Maus, R and Keyes J Handbook of Expert Systems in manufacturing McGraw Hill, 1991
2. Ernest R Tello, "Mastering AI tools and techniques"

COURSE OUTCOMES:

- Describe the basic concepts, Operations and Principles of Artificial Intelligence
- Recognize the basic concepts, Operations and Principles of Fuzzy Logic
- Employ the concept of AI & fuzzy logic in Manufacturing Environments

ME 080AUTOMOBILE ENGINEERING

COURSE OBJECTIVES:

L	T	P	C
3	0	0	3

To study about various components of vehicles and its functions for different types of vehicles and maintenance

Engine And Fuel System-Introduction : General classification of vehicles- major parts-Petrol and Diesel Engines - their working- Cooling, lubrication and electrical system-Types of cooling - Transmission Systems
Need for clutch - Type of clutches - Mechanical details
Brakes, Wheels And Suspension System-Principle of braking, Mechanical brake system, Hydraulic and pneumatic brakes - drum and disc brakes - power assisted brakes. Wheels - tyres wheel alignment, tyre specification - tyre wear and maintenance
Suspension system : Purpose and characteristics- rigid axle suspension system, and torsion bar – Steering-Principle of Steering , Ackerman principle of correct steering , center point steering , steering geometry
Maintenance, Servicing and tuning up on engine, Faultfinding and remedy.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:
1.Narang, G.B.S., "Automobile Engineering", Khanna Publishers, 1991.

REFERENCE BOOKS:
1.JosephHeitner., "Automotive Mechanics", 2nd Edition, East West press. 2004.
2.Kirpal Singh, "Automobile Engineering", Vol I and Vol II, Standard Publishers,Delhi, 1998.

COURSE OUTCOMES

- Classification of vehicles- petrol and diesel engines and their working principle
- Describe various component of automobile like clutch, brakes wheels and suspension system
- Recognize the basic concepts of mechanisms and machinery

HM080 CORPORATECOMMUNICATION

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To learn about culture, communication, speech mechanics, listening, reading, writing and marketing of corporate with its barriers and strategies

Corporate culture and communication - Process of communication – Networks and channels of communication – Barriers to communication – Strategies to overcome them - Use of technology in successful communication – Role of psychology in communication- Internal and External Communication.

Speech mechanics – Mental process of speaking – Extempore speech practice –Body Language – Group discussion practice – Group dynamics – Seminar skills and interview strategies – Presentation skills – Use of Power point-- Techniques to make people listen.

Importance of listening in the corporate world -Listening for information and content – Kinds of listening – Factors affecting this – Methods to overcome them – Retention of facts, data and figures- Role of Speaker in listening.

Reader-writer relationship - Varieties of styles and registers- Mechanics of technical writing – Reports of different kinds – Oral and written reports – Executive summary and abstract –Memos and IOMs-- Use of charts, graphs etc.

Circulars and notices – Proposals , Agenda and Minutes – Marketing language – Corporate Branding - 'You' tone - Captions and Eye catchers - Interoffice memos Communication in a crisis.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXT BOOKS:

1 .Basic Business Communicaion – Raymond V. Lesikar and Marie E. Flatley - Tata McGraw-Hill,2005
2. Business Communication Strategies – M. Monippally Tata McGraw-Hill.,2001

REFERENCE BOOKS*:*

1. A Guide to Scientific Writing – David Lindsay– Macmillan,1995.
2. Business Listening Tasks - Patrick Hanks and Jim Corbett (CUP),1986.
3. New International Business English – Leo Jones and Richard Alexander, Cambridge University Press.(CUP),1996.
4.Social Psychology – James A. Wiggins, Beverly B. Wiggins and James Vander Zanden McGraw Hill,1987.
4. *What do you say after you say Hello – Dr. Eric Berne – Corgi books.*

COURSE OUTCOMES:

- Appropriate decision for business improvement through group discussion
- Improve business electively by having good communication with internal and external customers

MB 080FINANCIAL MANAGEMENT

COURSE OBJECTIVES

L	T	P	C
3	0	0	3

- To understand the types of investment in finance
- To evaluate the asset of a management
- To understand about the management and investments

Financial management – Nature, Scope, Objectives, Decisions
Management of current asset
Short and intermediate financing
Capital investment and evaluation
Long term financing

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

TEXTBOOKS:

1. *Prasanna Chandra, K., "Fundamendals of Financial Management" Tata McGraw Hill Publishing Company,1993.*

REFERENCE BOOKS:

1. Van Horne, J.C., Fundamental of financial management, P.Hall.p.Ltd.,1977

COURSE OUTCOMES

- Start and manage new business
- Evaluate and monitor short term and long term investments
- Evaluate and monitor current asset

HONORS ELECTIVES

PR 091 TOLERANCE TECHNOLOGY

(Use of approved design data book is permitted in the examination)

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Machine Drawing practice

COURSE OBJECTIVE:

- To recognize the importance of tolerances
- To perform tolerance analysis

Introduction to Geometric Dimensioning and Tolerancing,Scope, Definitions, and General Dimensioning, General Tolerancing and Related Principles,Symbology , Datum Referencing, Tolerances of Location, Tolerances of Form, Profile, Orientation, and Runout

Properties of the surface , Principles for tolerancing , Principles for geometrical tolerancing.

Profile tolerancing, Tolerancing of cones, Positional tolerancing, Projected tolerance zone, Substitute elements, Maximum material requirement, Envelope requirement, Least material requirement

Tolerancing of flexible parts, Tolerance chains (accumulation of tolerances), Statistical tolerancing.

General geometrical tolerances, Tolerancing principles, Tolerancing of edges, ISO Geometrical Product Specifications (GPS).

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Gene R. Cogorno "Geometric Dimensioning and Tolerancing for Mechanical Design", McGraw-Hill,2006*
2. *Georg Henzold "Geometrical Dimensioning and Tolerancing for Design, Manufacturing and Inspection-A Handbook for Geometrical Product Specification using ISO and ASME Standards", Elsevier, Second edition*

3. *Bryan R. Fischer "Mechanical Tolerance Stackup and Analysis" Advanced Dimensional Management, Sherwood, Oregon, U.S.A., Marcel Dekker,Inc.*
4. *ASME "Dimensioning and Tolerancing", Y14.5M-1994 [REVISION OF ANSI Y14.5M-1982 (RI98811)]*

COURSE OUTCOMES:

- Interpretation of tolerances
- Perform tolerance analysis

PR 092 ROBOTICS

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Computer Integrated Manufacturing

COURSE OBJECTIVE:

- To understand the fundamentals of robotics
- To perform robot programming

Fundamentals of robotics – wrists design - end effectors – actuators - modular robots.
Robot and its peripherals - sensors, machine vision - image processing & analysis - application of artificial intelligence, voice communication - robot control units - motion controls.

Robot kinematics - homogeneous transformations - forward & inverse kinematics - problems of dynamics - differential relationships - motion trajectories - dynamics of a robot control of single & multiple link robot - static force analysis.

Robot Programming - different languages - expert systems.

Robot applications in manufacturing - material transfer & machine loading/unloading - processing operations – inspection - automation - robot cell design – control – recent developments and special applications-Micro & Bio robotics.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Richard D Klafter, Thomas A Chmielewski& Michael Negin, "Robotic Engineering – An Integrated Approach", Prentice Hall, 1994.*
2. *Deb, S.R., "Robotic Technology and Flexible Automation", Tata McGraw Hill, 1994.*

COURSE OUTCOMES:

- Demonstration of knowledge in robotic engineering
- Develop programming for robot applications

PR 093 INTELLIGENT MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Mechatronics and Industrial automation

COURSE OBJECTIVE:

- To understand the basic concepts of intelligent manufacturing
- To develop knowledge based systems for various applications

Basic concepts of Artificial intelligence and expert systems - System Components - System architecture and Data flow – System Operations

Knowledge based systems - knowledge representation – knowledge acquisition and optimization - Knowledge based approaches to design mechanical parts and mechansims and design for automated assembly

Knowledge based system for material selection – Intelligent process planning system.

Intelligent system for equipment selection - Intelligent system for project management & factory monitoring. Scheduling in manufacturing – scheduling the shop floor – Diagnosis & trouble shooting

The role of Artificial Intelligence in the factory of the future – Intelligent systems.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Andrew Kussiak,, "Intelligent Manufacturing Systems", Prentice Hall , 1990.*
2. *Simons, G.L, "Introducing Artificial Intelligence", NCC Pub, 1990.*

COURSE OUTCOMES:

- Development of knowledge based systems
- Application of Artificial Intelligence for future automated factories

PR094TOTAL QUALITY ENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Quality, Reliability and Safety Engineering

COURSE OBJECTIVES:

- To study the quality control tools and ISO Standards
- To understand TQM applications in service sector

Principles of TQM – Quality Gurus and their contributions – Old and New Quality Control tools – Quality Function Deployment – Failure Modes and Effect Analysis – Vendor relations –vendor qualification process – vendor quality surveys – Vendor quality improvement – vendor quality rating and evaluation - ISO 9000 standards – ISO 14000 standards – Quality Costing – Quality Audit – Product and Process audit – Six Sigma – Benchmarking - TQM in Service Sector– Application case studies on TQM.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Dale H.Besterfield, "Total Quality Management", Pearson Education Asia, (Indian reprint 2002)*
2. *Rose, J.E. Total Quality Management, Kogan Page Ltd. 1993.*
3. *John Bank, The essence of total quality management, PHI 1993.*
4. *Greg Bounds, Lyle Yorks et al, Beyond Total Quality Management, McGraw Hill,1994.*

COURSE OUTCOMES:

- Apply TQM principle for continuous process improvement
- Lead teams for quality production
- Utilization of modern tool like QFD, FMECA to design and manage the business

PR 095 PRODUCT ANALYSIS AND COST OPTIMIZATION

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Production drawing and cost estimation

COURSE OBJECTIVES:

- To perform value engineering projects
- To perform cost accounting

New product strategy, market definition - idea generation - design process - forecasting sales potential - product engineering, manufacturing planning - selection of economical process - standardization - simplification – specialization - break even analysis.

Value engineering – evaluation of function determining function - classifying function - evaluation of costs - evaluation of worth - determining worth - evaluation of value - value engineering.

Job plan information phase - speculation phase - analysis phase - development phase - presentation phase - implementation phase - follow up phase - fast diagramming - cost models - life cycle costs.

Cost accounting - cost estimation

Cost calculations for machined components, welding, casting and forging components - calculation of selling price - activity based cost analysis.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *SamualEilon, "Elements of Production Planning and Control",Universal Book Co, 1984*
2. *Narang, C.B.S and Kumar V, "Production and Costing", Khannapublishers ,1983.*

COURSE OUTCOMES:

- Execute value engineering projects
- Cost computation for various fabricated products

PR096DECISION SUPPORT SYSTEMS

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Work Design and Facilities planning

COURSE OBJECTIVE:

- To introduce decision support systems and show their relationship to other computer- based information systems,
- To demonstrate DSS development approaches, and to utilize DSS capacities to support different types of decisions

DSS components- Data warehousing, access, analysis, mining and visualization-modeling and analysis-DSS development -Group support systems- enterprise DSS- supply chain and DSS-knowledge management methods, technologies and tools-Artificial intelligence and expert systems- Representation in logic and schemas, semantic networks, production rules and frames, inference techniques – DSS applications.

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Efraim Turban and Jay E Aronson, Decision Support and Intelligent Systems, Pearson education Asia, Seventh edition, 2005.*
2. *Elain Rich and Kevin Knight, Artificial intelligence, TMH, 2006.*
3. *Vicki L. Sauter, Decision Support Systems for Business Intelligence John Wiley & Sons. Turban, Decision Support And Business Intelligence Systems, 8/E, Pearson Education India, 2011.*
4. *FradaBurnstein, Clyde W. Holsapple., Handbook on Decision Support Systems Springer, 2008.*

COURSE OUTCOMES:

- Recognize the importance of decisions in the work and anduse DSS Software Tools.
- Evaluation of the Success/Failure of Decision Support Systems
- Discuss the advantages/disadvantages of different Types of decision support systems and analyze practical cases from the life for different problems (technical , management)

PR097KNOWLEDGE MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Work Design and Facilities planning

COURSE OBJECTIVE:

To understand the fundamental concepts in the study of knowledge and its creation, acquisition, representation, dissemination, use and re-use, and management.

Knowledge society- Drivers of knowledge management-Intellectual capital- KM and learning organizations-Strategic alignment- Evaluation and strategic alignment-Infrastructural development and deployment- Role of CKO-Analyzing business environment-knowledge audit and analysis – designing KM team, system–Technology components- Intranet and Groupware solutions- tools for collaborative intelligence- Social networking-package choices- knowledge security-Integrating with web -based and internal operational & support systems- change management- reward systems- continuous improvement – Intellectual Property Rights.

EVALUATION PATTERN
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Guus Schreiber, Hans Akkermans, AnjoAnjewierden, Robert de Hoog, Nigel Shadbolt, Walter Van de Velde and Bob Wielinga, "Knowledge Engineering and Management", Universities Press, 2004.*
2. *Elias M.Awad& Hassan M. Ghaziri, "Knowledge Management", Pearson Education, 2004.*

COURSE OUTCOMES:

- Appreciate the role and use of knowledge in organizations and institutions, and the typical obstacles that Knowledge Management aims to overcome.
- Understand the core concepts, methods, techniques, and tools for computer support of knowledge management.
- Understand how to apply and integrate appropriate components and functions of various knowledge management systems.

PR098 PRODUCT LIFE CYCLE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To understand product life cycle management strategies
- To recognize PLM integration with other functions

New Product Development, Introduction to PLM, Product Data Management (PDM), Views of PLM, PLM Strategies and its Development, Product Design Modeling and simulation in product design.Integration of PLM with other applications, Technology, Forecasting, Virtual product development tools, Product structures

EVALUATION PATTERN:

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *AnttiSaaksvuori, AnselmiImmonen, " Product Lifecycle Management", Springer, 2005*
2. *John Stark, " Product lifecycle management: 21st century paradigm for product realization", Springer 2006*
3. *Michael Grieves, "Product lifecycle management: Driving the next generation of lean thinking", McGraw-Hill, 2006*

COURSE OUTCOMES:

- Understand PLM applications
- Developproduct data managementtools

PR099 TECHNOLOGY MANAGEMENT

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Operations Research

COURSE OBJECTIVE:

- To understand technology development process
- To recognize technology management issues in the context of advanced manufacturing systems

Definition-scope-components -Issues in managing new technology, Life cycle approach to technology management-Approaches to forecasting, Technology performance parameters. Use of Experts in technology forecasting, planning technological process, Morphological analysis of a

Technology system-Techno-Economic feasibility study, Application of multi-criteria decision making techniques in technologies evaluation and selection-AHP, fuzzy AHP-Modes of global technology transfer-Technology–Human Interface-Organization structures and Technology Implementation issues in new technology – Technology Management issues in the context of lean, agile and sustainable systems – Intellectual Property Rights.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES:

1. *Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997*
2. *Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995*
3. *James A.Senn, Information technology in Business, Prentice Hall, 1995*
4. *Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995*

COURSE OUTCOMES:

- Develop an awareness of the range, scope, and complexity of technological innovation, and the issues related to managing technological change.
- Understand different approaches to manage innovation, with multi-criteria decision making techniques
- Clearly identify drivers and barriers to technological innovation within an organization.

PR100MULTI-CRITERIA DECISION MAKING TECHNIQUES

L	T	P	C
3	0	0	3

PREREQUISITE COURSE: Operations Research

COURSE OBJECTIVE:

- To recognize the need for Multi-criteria decision making
- To understand various MCDM methods

Multi-Criteria Decision Making – An Overview – Classification of MCDM methods – Simple Additive Weighting method – Weighted Product method - Network based MCDM methods – Analytic Hierarchy Process – Revised Analytic Hierarchy Process – Analytic Network Process - Outranking MCDM methods – PROMETHEE , ELECTRE , TOPSIS - Compromise Ranking method - VIKOR, ORESTE – DEMATEL - Fuzzy based MCDM methods – Hybrid MCDM methods – Group Decision Making- Graph Theory and Matrix approach – Goal Programming – Balanced Scorecard Approach - MCDM application areas – Case studies on application of MCDM techniques.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES

1. *Belton, V., Stewart, T.J. Multiple Criteria Decision Analysis: An Integrated Approach, Kluwer Academic Publishers, Dordrecht, 2003.*
2. *Triantaphyllou, E., Multi-Criteria Decision Making Methods: A Comparative Study, Springer, 2010.*
3. *Pedrycz, W., Ekel, P., Parreiras, R., 2011. Fuzzy Multi Criteria Decision-Making: Models, Methods and Applications, John Wiley & Sons, 2011.*
4. *Kahraman, C., Fuzzy Multi-criteria Decision Making: Theory and Applications with Recent Developments, Springer, 2008.*

COURSE OUTCOMES:

- Understanding of various MCDM methods
- Apply MCDM methods for real time applications

SUBJECTS OFFERED TO OTHER DEPARTMENTS

PR511 PRODUCTION TECHNOLOGY I

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

To learn about different types manufacturing and joining methods

Moulding sands - Types and properties. Patterns - Types of patterns. Selection of patterns. Pattern allowances. Classifications of castings according to mould materials and moulding methods.Special casting techniques.Fettling and finishing of castings.Defects in castings.

Classification of welding process : Principle of gas welding. Arc welding.Resistance welding.Solid state welding.Thermochemical welding.Radiant energy welding. Brazing and soldering. Thermal cutting of metals or alloys.

Forging : Classification of forging processes. Forging processes. Forging defects and inspection.Rolling : Classification of rolling processes. Rolling mill.Rolling of bars and shapes.Extrusion : Classification of extrusion processes. Extrusion equipments.Examples.

Drawing : Drawing of rods, wires and tubes. Sheet metal forming methods : Shearing, Blanking, Bending, Stretch forming, Deep forming. Spinning : Spinning processes.

High Velocity Forming : Explosive forming , Electro hydraulic forming. Magnetic pulse forming.Pneumatic.Mechanical high velocity forming. Plastics working : Types of plastics. Plastic moulding processes.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCES :

1. Jain R.K., *Production Technology*, Khanna Publishers, 2001
2. HajraChoudhry, Elements of Workshop Technology, Vol II*DhanpatRai& Sons, 1992.*
3. HMT Production Technology*, Tata McGraw-Hills Publishing Co. Limited, 1994.*

COURSE OUTCOMES:

- Understand different types of casting processes, moulding machines and foundry components
- Ability to learn different welding methods and their defects

PR 512 PRODUCTION TECHNOLOGY – II

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To learn about different types of machines, working principles and mechanism
- To study about NC and CNC machines and its programs

Lathes. Capstan and ferret lathe. Drilling and boring machine. Classification.Principles of working components. Work holding and tool holding devices.

Shaper, planner and slottermachines.Classification.Principles of working components. Work holding & tool holding devices.

Milling.Hobbing.Broaching.Grindingmachines.Classification.Principles of working components. Work holding & tool holding devices.

NC & CNC machine tools and manual part programming.Machiningcentre.Turning centre.NC part programming.

Computer aided part programming. APP : Post processors. APT programming.Motionstatements.Additional APT statements.

EVALUATION PATTERN:
Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks
External Evaluation:50 marks end semester exams

REFERENCE BOOKS:

1. *Khanna,O.P., and Lal,M., " A Text Book of Production Technology"2006 , Vol II , DhanpatRai& Sons.*
2. *YoramKoren, " Computer Control of Manufactuting Systems " , McGraw Hill.*
3. *Choudhry, S.K.H., "S.K.H.,Elements of Work Shop Technology, VoL II", MPP. 1.*
4. *HMT , "Production Technology" , Tata McGraw Hill ,*
5. *Kundra, T.K., Rao., P.N., and Tiwari,NLK.,, "Numerical Control and Computer Aided Manufacturing", Tata McGraw Hill.*

COURSE OUTCOMES

- Understand different type of machine like Lathes, Drilling machine, Boring machine, shaper, planner and slotter machine and their work holding and tool holding device
- Fundamentals and application of CNC machine, constructional features, working and programming CNC machines with programming methods with or without the multiple tools for straight line machining and complex machining.
- Understand Computer aided part programming

PR 513 PRODUCTION PROCESSES LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- To measure various forces during machining, hands-on operation with welding; bead profile measurement and testing of sand for casting are involved
- To measure cutting forces in turning, drilling and milling using strain gauge are involved
- To measure temperature distribution in the rake surface of the single point cutting tool using thermocouple is studied

EXERCISE.1 Measurement of cutting forces in turning using strain gauge

EXERCISE.2 Measurement of cutting forces in drilling using strain gauge

EXERCISE.3 Measurement of cutting forces in milling using strain gauge

EXERCISE.4 Measurement of temperature distribution in the rake surface of the single point cutting tool using thermocouple

EXERCISE.5 Measurement of specific cutting energy in orthogonal cutting operation

EXERCISE.6 TIG welding of butt joints

EXERCISE.7 Bead profile measurement in TIG welding

EXERCISE.8 Sand testing – Permeability, Moisture content, Shear strength

Internal Evaluation: Continuous internal evaluation during performing exercises.

External Evaluation:End semester Practical examination

COURSE OUTCOMES

- Measurement of various forces during machining, hands-on operation with welding; bead profile measurement and testing of sand for casting are involved
- Measurement of cutting forces in turning, drilling and milling using strain gauge are involved
- Measurement of temperature distribution in the rake surface of the single point cutting tool using thermocouple is studied

PR 514RESOURCE MANAGEMENT TECHNIQUES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To study about different types of production techniques and optimization process in industrial operations

Linear programming, graphical method - simplex method - big M method - Two-phase method - introduction to duality theory

Transportation & assignment models -Mathematical model for Transportation problem – balanced and unbalanced problem –Assignment problem.

Queuing theory & sequencing - applications of queuing model -single and multi server model.

Decision theory and replacement analysis.

Project scheduling -project network - determination of critical path, project duration and slack time calculation - Cost considerations in project scheduling.

EVALUATION PATTERN

Internal Evaluation:Cycle test-1-20 marks; Cycle test-2-20 marks; Assignment-10 marks

External Evaluation:50 marks end semester exams

REFERENCE BOOKS:

1. *Gupta and Hira, Problems on operations research, S.Chand&Co.Ltd., New Delhi, 1991.*
2. *Taha H.A., Operations research, Prentice – Hall of India, New Delhi,2001.*
3. *Panneerselvam, R, Operations Research, Prentice – Hall of India, New Delhi, 2002*

COURSE OUTCOMES

- Summarize different techniques for production planning like queuing uncertainty and mathematical modeling are involved
- Apply optimization in utilization of resources.
- Apply resource management techniques to industrial operations.