With Effect from the Academic Year 2016 - 2017

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV-Year (Production Engineering)

I-Semester

S. No	Syllabus Ref. No	SUBJECT	Instruction Per week				Scheme of Examination			Credits
			L	T	D/P	Lab	Duration in Hrs	Maximum Marks: End Exam	Maximum Marks: Sessional	
THEORY										
1	PE 411	Production Drawing Practice	1	-	3	-	3	75	25	3
2	PE 412	Modern Machining and Forming Methods	4	-	-	-	3	75	25	3
3	ME 412	Metrology and Instrumentation	4	-	-	-	3	75	25	3
4	ME 414	Operations Research	4	-	-	-	3	75	25	3
5		ELECTIVE - II	4	-	-	-	3	75	25	3
PRACTICALS										
1	PE 413	Computer Aided Production Drawing Lab	-	-	-	3	3	50	25	2
2	PE 414	Manufacturing Engineering Lab	-	-	-	3	3	50	25	2
3	ME 416	Metrology & Instrumentation Lab	-	-	-	3	3	50	25	2
4	PE 418	Project Seminar	-	-	3	-	-	-	25	1
		TOTAL	**17**	**-**	**6**	**9**	**-**	**-**	**-**	**22**
ELECTIVE - II										
1	ME 461	Renewable Energy Sources	4	-	-	-	3	75	25	3
2	ME 462	Computational Fluid Dynamics	4	-	-	-	3	75	25	3
3	ME 463	Automobile Engineering	4	-	-	-	3	75	25	3
4	ME 464	Entrepreneurship	4	-	-	-	3	75	25	3
5	PE 461	Robotics	4	-	-	-	3	75	25	3
6	CE 422	Disaster Mitigation and Management	4	-	-	-	3	75	25	3

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PE 411

Production Drawing Practice

Instruction	1 Lecture + 3 Drawing Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The need and the importance of production drawing
2. How to make part drawing from given assembly drawings.
3. Indication of size, form and positional tolerances on the drawing sheets
4. Surface finish and heat treatment process on the drawing sheets.
5. Writing process sheets
6. Notations, symbols and abbreviations on production drawings

Outcomes: On completion of the course the students will develop abilities to

1. Draw part drawings from given assembly drawings of machine parts.
2. Indicate tolerance values on the parts drawn on sheet as per alpha numeric codes for given assembly drawings
3. Indicate form tolerances and position tolerances on the parts drawn on the sheet as per universally accepted norms for a given assembly drawing
4. Indicate values of surface finished and heat treatment process on the parts drawn for a given assembly drawings.
5. Write process sheet for every part that is drawn from given assembly drawings
6. Interpret a production drawing and process sheet.

UNIT-I

Introduction to Production Drawing: Types of Drawings and their uses, Format of drawing sheet, title block - Machine tools elements, methods of indicating notes on drawing

UNIT-II

Limits and Fits: Basic definition of terms, alpha numeric designation of limits/fits, calculation of limits and tolerances - Types of fits, interchangeability and selective assembly - Exercises involving selection/interpretation of fits and calculation of limits.

UNIT-III

Production Drawing: Conventional practices of indicating tolerances on size and geometrical form, Position - Surface finish, surface treatments

UNIT-IV

Part drawings: Part drawings from assembled drawings (10 No's - out of which student should draw a minimum of 8 drawings) – (Specification and indication of the above features on the drawings) - Stuffing box, Screw jack, I.C engine connecting rod, Revolving center, Square tool post, Single tool post, Steam engine cross head, Drill jig (plate type), Non return valve, Blow off cock

UNIT-V

Writing Process sheets, tolerances and surface finish for different components such as Bevel Gear, Flange & Pinion shaft.

Text Books:

1. K.L. Narayana, P. Kannaiah and K. Venkat Reddy, *Production Drawing*, New Age Intl., (P) Ltd., Revised Edition, 1997.
2. P. Narasimha Reddy, T.A. Janardhan Reddy and C. Srinivasa Rao, *Production Drawing Practice*, Hitech Publishers, 2001

Suggested Reading:

1. R.L. Murthy, *Precision Engineering in Manufacturing*, New Age International Private Ltd., 1996
2. R.K. Jain, *Engineering Metrology*, Khanna Publishers, 8th edition, 1985
3. IC Gupta, *Engineering Metrology*, Dhanpat Rai Pub., New Delhi, 1984.
4. Rega Rajendra, *Principles of Engineering Metrology*, Jaico Publishing House, Mumbai, 2008.
5. Doeblin, *Measurement Systems Application and Design*, TMH, 5 th Edn., 2004.

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PE 412

Modern Machining and Forming Methods

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will learn

1. The importance of non-conventional machining processes
2. Various non-conventional machining processes and their process parameters
3. The relative merits, limitations and applications of various non-conventional machining processes
4. The knowledge regarding working media and its functions of non-conventional machining processes
5. The concepts of non-conventional forming processes such as rubber pad forming, hydro forming, stretch forming, etc.,
6. The concepts of HERF and to provide the description of HERF process

Outcomes: At the end of the course, the students are able to

1. Select the non-conventional machining process for a particular application
2. Demonstrate the capability of comparison of various non-conventional machining methods
3. Describe the various non-conventional machining processes
4. Exhibit the proficiency of selecting working media for various non-conventional machining processes
5. Exhibit the basic understanding of non-conventional forming processes
6. Compare various non-conventional forming processes based on their merits, limitations and applicability

UNIT-I

Mechanical Energy Methods:

Ultrasonic Machining (USM): Introduction, Process description, abrasive slurry, Abrasive materials and their characteristics, Functions of liquid medium in slurry, Types of transducers, effect of process parameters, applications and limitations

Abrasive Jet Machining (AJM): Principle of operation, process details, process variables and their effect on MRR and accuracy, equation for MRR, advantages, disadvantages and applications

Water Jet Machining (WJM): Schematic diagram, equipment used, advantages and applications

Abrasive Water Jet Machining (AWJM): Process, advantages, limitations and applications

UNIT-II

Thermal methods: Electro Discharge Machining (EDM): Process description with schematic diagram, process parameters, functions and characteristics of dielectric medium, dielectric fluids, over cut and side taper, flushing, mechanism of metal removal, crater volume, types of power supply circuits, mathematical analysis of metal removal rate (MRR), equations for surface finish, characteristics of spark eroded surfaces, advantages, disadvantages and applications

Wire EDM: Process description and applications

LASER Beam Machining (LBM): Principle of LASER beam production, materials used, process parameters, advantages, limitations and applications,

Plasma Arc Machining (PAM): Introduction, equipment used, process description and parameters, types of plasma arc: transferred arc and non transferred arc and process applications, **Electron Beam Machining (EBM):** Schematic of the process, process parameters, principle of production of electron beam, equipment used, advantages, disadvantages and applications,

UNIT-III

Electro chemical, Chemical and other machining processes: Electro-chemical machining (ECM): Schematic of process parameters, function and characteristics of electrolyte, chemistry of the process, MRR for pure metal and alloys, electrode feed rate (EFR), advantages, limitations and applications

Chemical Machining: Chemical blanking and chemical milling, advantages, limitations and applications

ION Etching: Process description, merits, limitations and applications, hot machining, high speed machining, process parameters, advantages and applications

UNIT-IV

High Energy Rate Forming Processes (HERF): Introduction, applications, advantages, **Explosive Forming:** Principles, explosive materials, Equipment, types of explosive forming, standoff operation and contact operation, the pressure pulse, gas bubble and the process applications

Electro-Hydraulic Forming (EHF): Schematic of process, description and its applications, **Electro-Magnetic Forming (EMF):** Process description, merits, limitations and applications

UNIT-V

Other Forming Processes:

Rubber Pad Forming: Principle of the process, process details and its types, Guerin, wheelon, Mar forming and Hydro forming processes and applications,

Stretch Forming: Introduction, types of stretch forming, stretch draw forming, rotary stretch forming or stretch wrapping, compression forming, radial draw forming.

Tube spinning: introduction, methods of tube spinning, backward spinning, forward spinning, machines and tools used, machine variables, speeds and feeds, effect of tube spinning on work metal properties and applications.

Text Books:

1. P.C. Pandey and H.S. Shah, *Modern Machining Process* Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1980
2. J Paulo Davim, *Modern Machining Technology, A Practical Guide*, 1st Edition, Woodhead Publishing in Mechanical Engineering

Suggested Reading:

1. Hassan Abdel-Gawad El-Hofy, *Advanced Machining Processes, Nontraditional and Hybrid Machining Processes*, McGraw Hill Publishing Co. Ltd.,
2. Davies and Austin, *Developments in High Speed Metal Forming*, The Machinery Publishing Co. Ltd., 1985
3. *Production Technology*, HMT
4. A. Bhattacharya, *New Technology*, The Institution of Engineers (India), 1984

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ME 412

Metrology and Instrumentation

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Student will understand the need for measurement and fundamental concepts of measurement.
2. Student will get familiarize with limits, Fits& tolerances and the instruments used to measure these limits.
3. Student will able to have knowledge of various precision linear and angular measuring instruments.
4. Student will learn the importance of Geometric form and how to measure form errors.
5. Equip the student to have knowledge in the concepts of classification of instrument errors and their characteristics.
6. Student will enable to understand the working principles of various instruments used for the measurement of strain, forces, pressure, and temperature.

Outcomes: At the end of the course, students are able to

1. Learn and understand the need for measurement and fundamental concepts of measurement.
2. Demonstrate sound knowledge in gauges design and gauge selection for inspection.
3. Acquire the knowledge about fundamentals of linear and angular measurements and various instruments used for measuring the different parameters.
4. Demonstrate an ability to select and use the appropriate measuring instruments to measure surface roughness and other geometric form errors.
5. Recognize the concepts of errors, classification and instrument characteristics.
6. Apply the skills in measuring various quantities like strain, force, pressure & temperature.

UNIT-I

Limits, Fits and Tolerances: Types of fits, Selective assembly and interchangeability, Taylor's Principle for plain limit gauges, Use of Plug, Ring and Snap gauges, Introduction to Linear and Angular measurements, Slip gauges and End bars, Gauge material and manufacturing methods, Different types of Micrometers, Height gauges, Tomlinson gauges, Sine bar.

UNIT-II

Comparators: Dial indicator, Sigma Mechanical comparator, Back pressure type Pneumatic comparator. Optical projector and its Principle and Applications, Tool maker's Microscope and its Principle and applications, measurement of straightness and flatness, Auto collimator, Roundness measurement with bench centers and talyround, Coordinate Measuring Machine.

UNIT-III

Surface Roughness Measurements: Profilometer, Taylor Hobson Talysurf, Application of screw Thread metrology - 2 wire and 3 wire methods, Best wire size, Spur Gear nomenclature, Gear tooth thickness measurement by gear tooth vernier, Parkinson gear tester.
Introduction to Interferometry and its applications, The N.P.L. flatness Interferometer.

UNIT-IV

Elements of instrumentation system: Static and Dynamic characteristics of instruments, Types of errors, Strain measurement, Wire and foil type resistance strain gauges, Rosette Gauges, Bonding procedure, Strain Gauge Factor, Application of strain gauges, Strain gauge load cells, measurement of axial load and torsion by strain gauges, Piezo electric load cell.

UNIT-V

Introduction to Transducers: Displacement and acceleration measurement, L.V.D.T, Pressure measurement by Bourdon pressure gauge, Bulk modulus pressure gauge and Pirani gauge, Temperature measurement by thermo couples, Laws of thermo electricity, Types of materials used in thermocouples, Series and parallel circuits.

Text Books:

1. R.K. Jain, *Engineering Metrology*, Khanna Publications, 1996.
2. Doeblin, *Measurement Systems Application and Design*, TMH, 5th Edn., 2004.
3. Anand Bewoore & Vinay Kulkarni, *Metrology & Management*, McGrawhill Education India, 2014.
4. I B.C. Nakra & K.K. Chaudhary , *Instrumentation Measurement and Analysis* , 3rd Edn., McGrawhill, 2014

Suggested Reading:

1. IC Gupta., *Engineering Metrology*, Dhanpat Rai Pub. New Delhi, 1984.
2. Rega Rajendra, *Principles of Engineering Metrology*, Jaico Publishing House, Mumbai, 2008.

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ME 414

Operations Research
(for Mech, Prod and I.T)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Students will understand the significance of Operations Research concept and techniques
2. Students will come to know the formulation of LPP models
3. Students will understand the Algorithms of Graphical and Simplex Methods
4. Students will understand the Transportation and Assignment techniques
5. Students will come to know the procedure of Project Management along with CPM and PERT techniques
6. Students will understand the concepts of sequencing and queuing theory

Outcomes: At the end of the course, the students were able to

1. Recognize the importance and value of Operations Research and mathematical formulation in solving practical problems in industry;
2. Formulate a managerial decision problem into a mathematical model;
3. Apply Operations Research models to real time industry problems;
4. Build and solve Transportation Models and Assignment Models.
5. Apply project management techniques like CPM and PERT to plan and execute project successfully
6. Apply sequencing and queuing theory concepts in industry applications

UNIT-I

Introduction: Definition and Scope of Operations Research.

Linear Programming: Introduction, Formulation of linear programming problems, graphical method of solving LP problem, simplex method, Degeneracy in Simplex, Duality in Simplex.

UNIT-II

Transportation Models: Finding an initial feasible solution - North West Corner Method, Least Cost Method, Vogel's Approximation Method, Finding the optimal solution, Special cases in Transportation problems - Unbalanced Transportation problem, Degeneracy in Transportation, Profit Maximization in Transportation.

UNIT-III

Assignment Techniques: Introduction, Hungarian technique of Assignment techniques, unbalanced problems, problems with restrictions, Maximization in Assignment problems, Travelling salesman problems

UNIT-IV

Project Management: Definition, Procedure and Objectives of Project Management, Differences between PERT and CPM, Rules for drawing Network diagram, Scheduling the activities, Fulkerson's rule, Earliest and Latest times, Determination of ES and EF times in forward path, LS & LF times in backward path, Determination of critical path, duration of the project, Free float, Independent float and Total float, Crashing of network.

UNIT-V

Sequencing Models: Introduction, General assumptions, processing 'n' jobs through two machines, processing 'n' jobs through three machines.

Queuing Theory: Introduction, Kendal's Notation, single channel - poisson arrivals - exponential service times

Text Books:

1. Hamdy, A. Taha, *Operations Research-An Introduction*, Sixth Edition, Prentice Hall of India Pvt. Ltd., 1997.
2. S.D. Sharma, *Operations Research*, Kedarnath, Ramnath & Co., Meerut,2009
3. V.K. Kapoor, *Operations Research*, S. Chand Publishers, New Delhi, 2004

Suggested Reading:

1. Harvey M. Wagner, *Principles of Operations Research*, Second Edition, Prentice Hall of India Ltd., 1980.
2. R. Paneer Selvam, *Operations Research*, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2008.
3. Nita H. Shah, Ravi M. Gor, Hardik Soni, *Operations Research*, PHI Learning Private Limited, 2013

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PE 413

Computer Aided Production Drawing Lab

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives: Students will learn

1. Construct production drawings to meet final design requirements.
2. Creation drawings for visualization using Modeling Packages Solid works, CATIA
3. The Fits, limits and Tolerances of parts
4. The Conventions like surface finish, roughness, concentricity
5. Preparation of Bill of materials for assembly
6. The process sheet in industrial terminology

Outcomes: At the end of the course, students will be able to

1. Read the working drawing of various components
2. Identify the different parts of the object with dimensional tolerances
3. Create the various part drawings using solid modeling package
4. Use the various functions of modeling soft ware: annotations, sheet making
5. Define the bill of materials with mass properties
6. Understand and read the industrial blueprint readings

Part Drawings:

Prepare the Part Drawings with production drawing details of the following assemblies using modeling softwares, like, solid works/solid edge/CATIA/ProE/Auto CAD-MDT/ Nx

Exercise No: 1	Stuffing box
Exercise No: 2	Screw jack
Exercise No: 3	I.C engine connecting rod
Exercise No: 4	Revolving center
Exercise No: 5	Square tool post
Exercise No: 6	Single tool post
Exercise No: 7	Universal coupling
Exercise No: 8	Flange coupling
Exercise No: 9	Steam Engine Cross Head
Exercise No: 10	Drill Jig (Plate Type)
Exercise No: 11	Non Return Valve
Exercise No: 12	Blow off Cock

Note: Student should prepare a minimum of 10 production drawings

Suggested Reading:

1. K.L. Narayana, P. Kannaiah and K. Venkat Reddy, *Production Drawing*, New Age Intl., (P) Ltd., Revised Edition, 1997.
2. P. Narasimha Reddy, T.A. Janardhan Reddy and C. Srinivasa Rao, *Production Drawing Practice*, Hitech Publishers, 2001

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PE 414

Manufacturing Engineering Lab

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives: Students will learn

1 Various concepts of Manufacturing Processes
2 The process of choosing right manufacturing process and materials
3 The concepts of process sheets
4 Various CAD packages
5 The Bill of Materials and MRP concepts
6 Limits, tolerances and fits in manufacturing

Outcomes: Students able to

1 Apply right manufacturing techniques
2 Choose the right material
3 Operate different machine tools
4 Prepare process sheets and Bill of Material
5 Apply limits, fits and tolerances while manufacturing components
6 Prepare CAD drawings

Part-1: **Manufacturing Mini Product**: Study of all manufacturing facilities available in various manufacturing related laboratories, manufacturing canon.

Part-2: **Manufacturing Major Product:** One/two of the following items have to be manufactured by a group of maximum two members using all the production facilities and processes as far possible and assembly techniques with fits and tolerances using CAD system, various exercises have to be allotted to different groups of students by the lab faculty

1. V block with U clamp
2. Dia test indicator stand
3. Simple Jig
4. Simple fixture
5. Simple die set
6. Simple tail stock mechanism
7. Lathe tool post
8. Milling Machine Arbor
9. Pipe vice
10. Paper Punch (double punch)
11. Hydraulic Cylinder
12. Gear box (Spur, Helical or Worm)

Suggested Reading:

1. P.N. Rao, *Manufacturing Technology – Metal Culling & Machine Tool*, Vol. 2, Tata McGraw Hill Education Pvt. Ltd, 2010.
2. Jain K.C Chitale, A.K., *Production Engineering*, 2nd Edn., PHI, 2014.

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ME 416

Metrology and Instrumentation Lab

Instruction	3 Periods per week
Duration of End Examination	3 Hours
End examination	50 Marks
Sessionals	25 Marks
Credits	2

Objectives:

1. Student will choose the proper measuring instrument for the precise measurement of Length, Height and diameter
2. Student will able to select the proper measuring instrument for the angular measurement.
3. Student will indentify gear & screw thread parameters using optical projector and tool makers microscope.
4. Student will get familiarize with limits & fits, gauge selection and design.
5. Student will enable to understand the working principles in the measurement of Flatness, Roundness and Surface roughness.
6. Student will equip with various aspects regarding displacement.

Outcomes: At the end of the course, the students were able to

1. Identify methods and devices for measurement of length, height and diameter.
2. Acquire the knowledge about angular measurement and various measuring instruments.
3. Recognize & measure the gear and screw thread parameters using profile projector and tool maker microscope.
4. Demonstrate the sound knowledge in gauges selection and design.
5. Acquire adequate knowledge in the measurement of flatness, roundness and surface roughness.
6. Demonstrate the measurement of displacement.

Experiments:

1. Measurement with inside, outside and depth micrometers.
2. Measurement with height gauges, height masters, etc.
3. Measurement of Linear and Angular dimensions with Tool Maker's Microscope – Diameter of a thin wire and single point cutting tool angle.
4. Measurement with Dial Indicator and its calibration.
5. Measurement of angles with Sine bar and Bevel protractor.
6. Measurement of roundness errors with bench centers.
7. Measurement of flatness errors (surface plate) with precision level.
8. Measurement with optical projector.
9. Checking machined components with plug gauges and adjustable snap gauges.
10. Surface roughness measurement by Taylor Hobson -Talysurf.
11. Measurement of Gear tooth thickness.
12. Displacement measurement with LVDT.

Note: Student should complete a minimum of 10 experiments.

Suggested Reading:

1. IC Gupta, *Engineering Metrology*, Dhanpat Rai Pub., New Delhi, 1984.
2. B.C. Nakra & K.K. Chaudhary , *Instrumentation Measurement and Analysis*, , 3rd Edn. McGrawhill, 2014

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PE 415

Project Seminar

Instruction	3	Periods per week
Sessionals	25	Marks
Credits	1	

The objective of the project seminar is to actively involve the student in the initial work required to undertake the final year project. Dealing with a real time problem should be the focus of the under graduate project.

It may comprise of

- Problem definition and specifications.
- A broad understanding of the available techniques to solve a problem of interest.
- Presentation (Oral & written) of the project.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students as project batch(a maximum of 3 in group)
- Allotment of projects and project guides
- Project monitoring at regular intervals.

Each project group/batch is required to

1. Submit a one page synopsis of the seminar to be delivered for display on notice board.
2. Give a 30-40 minutes presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

Three (3) teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance on all the three items stated above.

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ME 461

Renewable Energy Sources (Elective – II)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will learn the

1. Need and importance of non-conventional energy resources
2. Extent of solar energy which can be utilized as energy resource
3. Concept of wind energy and its merits and demerits
4. Operating principles of ocean and geothermal energy
5. Advantages and disadvantages of bio-energy over conventional energy
6. Merits and demerits of tidal energy, wave energy and OTEC

Outcomes: At the end of the course, the students are able to

1. Understand the depletion and of environmental impact conventional sources of energy and will suggest suitable and alternative renewable energies in place of fossil energies
2. Know the absorption, conversion and utilization of solar energy
3. Understand the problems associated with utilizing the wind energy
4. Describe the physics of geothermal resources and describe how biomass is currently used as a source of energy
5. Explain the physical principles of wave energy, the generation of tides and how to harness their power
6. Understand the environmental impact of OTEC plants

Unit-I

Statistics on conventional energy sources and supply in developing countries, Definition-Concepts of RES, Limitations of RES, Classification of NCES-Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources.

Unit-II

Solar Energy- Solar Radiation – Energy available from Sun, Solar Thermal Collectors – Flat Plate and Concentrating Collectors –Solar Applications, Solar engines-Stirling, Brayton engines, fundamentals of photo Voltaic Conversion – p-n junction – PV solar cells and its materials-solar satellite system

Unit-III

Wind energy- merits and demerits-Wind power plant-site selection-classification of wind power plants-Windmill rotors- Horizontal axis and vertical axis rotors-.working principle-New developments.

Unit-IV

Geothermal energy- Layers in earth-Definition and classification of resources.

Biomass energy-Biomass- Source, Composition, Conversion technologies – Direct combustion-Pyrolysis–Gasification, Biomass gasifier –float and fixed dome types

Unit V

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation-single basin and double basin tidal plants-progressive wave.

OTEC power plants- Open and closed OTEC Cycles- Environmental impacts of OTEC.

Text Books:

1. S. Hasan Saeed and D.K. Sharma, *Non Conventional Energy Resources*, S.K. Kataria & Sons, New Delhi, 2014
2. Dr. R.K. Singal, *Non Conventional Energy Resources*, S.K. Kataria & Sons, New Delhi, 2005
3. G.D. Rai, *Non Conventional Energy Sources*, Khanna Publishers, New Delhi, 2011

Suggested Reading:

1. Mittal K M, *Non-Conventional Energy Systems*,Wheeler Publishing Co. Ltd, New Delhi, 2003.
2. Ramesh R & Kumar K U, *Renewable Energy Technologies*, Narosa Publishing House, New Delhi, 2004
3. Shali Habibulla, *Non-Conventional Energy Sources*, State Institute of Vocational Education, Hyderabad, 2005
4. Ashok V Desai, *Non-Conventional Energy*, Wiley Eastern Ltd, New Delhi, 2003
5. R.K. Hegde, *Power Plant Engineering*, Pearson Education India, 2015

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ME 462

Computational Fluid Dynamics (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Understanding of governing equations of fluid flow.
2. Student understand finite difference and finite volume methods to solve fluid flow equations.
3. Issues that arise in the solution of such equations.
4. Various methods to overcome those issues and modern trends in CFD.
5. Get exposure to grid generation.
6. Various boundary conditions and their implementation.

Outcomes: At the end of the course, the students were able to

1. Classify basic equations of fluid flow
2. Choose appropriate boundary conditions
3. Choose proper numerical technique to solve equations.
4. Critically analyze different mathematical models and computational methods for flow simulations
5. Interpret computational results.
6. Acquire the required knowledge to take advanced courses in CFD.

UNIT-I

Basic Equations: Continuity, momentum and energy equations, navier-stokes equations, Heat transfer conduction equations for steady and unsteady flows, steady convection-diffusion equation.

UNIT-II

Models: Reynolds and Favre averaged N-S equations, Mixing length model, k-epsilon turbulence model

Classifications of partial differential equations: Elliptic, parabolic and hyperbolic equations, Initial and boundary value problems

UNIT-III

Finite Difference Method: Forward, backward and central difference

Parabolic partial differential equations: Euler, implicit and crank Nicholson methods, ADI models, Errors, consistency, stability analysis, Vonnumen analysis, Convergence criteria.

UNIT-IV

Elliptic partial differential equations - Jacobi, Gauss seidel methods, Viscous incompressible flow, Stream-function-vorticity method

Introduction to grid generation- types of grids O, H, C

UNIT – V

Finite Volume Method: Finite volume formulation for diffusion equation, convection diffusion equation, Solution algorithm for pressure velocity coupling in steady flows, staggered grid, SIMPLE algorithm.

Text Books:

1. J.D. Anderson, Jr., *Computational Fluid Dynamics: The Basic with Applications* McGraw Hill, Inc., 2012
2. H. Versteeg and W. Malalasekra, *An Introduction to Computational Fluid Dynamics*: The Finite Volume Method, Pearson,2nd edn. 2011

Suggested Reading:

1. John F. Wendt (Editor), *Computational Fluid Dynamics - An Introduction*, Springer – Verlag, Berlin, 1992
2. Charles Hirsch, *Numerical Computation of Internal and External Flows*, Vols. I and II. John Wiley & Sons, New York, 1988.
3. K. Muralidhar and T. Sundarajan.. *Computational Fluid Flow and Heat Transfer*, Narosa Publishing House. 2008
4. C.J.Date , *Introduction to CFD*, Dorling Kindersley Pvt Ltd, 2007

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ME 463

Automobile Engineering (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: The student will learn

1. The anatomy of the automobile in general
2. The location and importance of each part
3. The functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels
4. Suspension, frame, springs and other connections
5. ignition, controls, electrical systems and ventilation
6. Emissions, pollution regulations, EURO and BHARATH stages

Outcomes: At the end of the course, the student will be able to

1. Identify the different parts of the automobile
2. Explain the working of various parts like engine, transmission, clutch, brakes
3. Describe how the steering and the suspension systems operate.
4. Understand the environmental implications of automobile emissions
5. Develop a strong base for understanding future developments in the automobile industry

Unit I

Types of automobiles: Normal, Hybrid and Hydrogen Fuel vehicles. Engine location and its components, chassis layout; crank shaft proportion, firing order, piston and piston rings, cylinder liners, valves and operation mechanism, inlet and exhaust manifolds, carburetion and fuel injection system, Mechanical Fuel Injection system & Electronic Fuel Injection System.

Unit II

Lubricating Systems: Wet sump, dry sump and petroil systems - Cooling systems: Water pumps, radiators, thermostat control anti freezing compounds - Types of Ignition Systems, Modern Ignition systems, Types of Batteries and charging systems, starting motors, lighting and electrical accessories, automobile air-conditioning.

Unit III

Steering systems: Linkage arrangements and its components modified Ackerman linkage, wheel alignment, caster and camber. Rack and pinion assembly, recent trends, Wheel and tyres: Tyre construction, specification. Tyre wear and causes, wheel balancing, Types q/' Suspension system, Independent suspension, coil and leaf springs, torsion bar, shock absorbers.

Unit IV

Power Train: Clutches, gear and gearbox manual, semi-automatic and automatic gearboxes. Torque converter, propeller shaft, universal coupling differential, four-wheel drive system

Brakes Systems: Description and operation of hydraulic brake, leading and trailing shoe layout, disc brakes, master cylinder and hand brake linkage, Recent Trends.

Unit V

Maintenance: Pollution control, trouble shooting and servicing procedure overhauling, engine tune up, tools and equipment for repair and overhaul testing equipment, pollution control technologies used for petrol and diesel engines. Types and study of catalytic converters, Euro norms 2 & 3 and Bharat Norms – Recent Trends.

Text Books:

1. *Crouse & Anglin, Automotive Mechanics,* TataMcGraw Hill. Publishing Co. Ltd., New Delhi, Tenth Edition – 2004
2. Kirpal singh., *Automobile Engineering Vol. I & II* Standard Publishers, Delhi.

Suggested Reading:

1. Joseph Heitner, *Automotive Mechanics,* Affiliated East West Pvt. Ltd.
2. C.P Nakra, *Basic Automobile Engineering*, Dhanpat Rai Publishing Co(P) Ltd., New Delhi, 2003.
3. G.B.S. Narang, *Automobile Engineering*, Khanna Publishers, New Delhi, 2014
4. R.K. Rajput, *A Textbook of Automobile Engineering*, Laxmi Publications, New Delhi, 2012

With Effect from the Academic Year 2016 - 2017

ME 464

Entrepreneurship (Elective – II)
(for Mech, Prod, Civil, EEE, ECE, I.T, Chemical, BioTech and CSE)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The essence of Entrepreneurship
2. The environment of industry and related opportunities and challenges
3. Concept a procedure of idea generation
4. Elements of business plan and its procedure
5. Project management and its techniques
6. Behavioral issues and Time management

Outcomes: After completing this course, students will be able to:

1. Apply the entrepreneurial process
2. Analyze the feasibility of a new business plan and preparation of Business plan
3. Evaluate entrepreneurial tendency and attitude
4. Brainstorm ideas for new and innovative products or services
5. Use project management techniques like PERT and CPM
6. Analyze behavioural aspects and use time management matrix

UNIT-I

Indian Industrial Environment: Competence, Opportunities and Challenges, Entrepreneurship and Economic growth, Small Scale Industry in India, Objectives, Linkage among small, medium and heavy industries, Types of enterprises, Corporate Social Responsibility.

UNIT-II

Identification and characteristics of entrepreneurs: First generation entrepreneurs, environmental influence and women entrepreneurs, Conception and evaluation of ideas and their sources, Selection of Technology, Collaborative interaction for Technology development.

UNIT-III

Business plan: Introduction, Elements of Business Plan and its salient features, Technical Analysis, Profitability and Financial Analysis, Marketing Analysis, Feasibility studies, Executive Summary.

UNIT-IV

Project Management: During construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management, Assessment of tax burden

UNIT-V

Behavioral aspects of entrepreneurs: Personality, determinants, attributes and models, Leadership concepts and models, Values and attitudes, Motivation aspects, Change behavior

Time Management: Approaches of time management, their strengths and weaknesses. Time management matrix and the urgency addiction

Text Books:

1. Vasant Desai, *Dynamics of Entrepreneurial Development and Management*, Himalaya Publishing House, 1997.
2. Prasanna Chandra, *Project-Planning, Analysis, Selection, Implementation and Review*, Tata Mcgraw-Hill Publishing Company Ltd. 1995.
3. S.S. Khanka, *Entrepreneurial Development*, S. Chand & Co. Pvt. Ltd., New Delhi

Suggested Reading:

1. Robert D. Hisrich, Michael P. Peters, *Entrepreneurship*, Tata Me Graw Hill Publishing Company Ltd., 5lh Ed., 2005
2. Stephen R. Covey and A. Roger Merrill, *First Things First*, Simon and Schuster Publication, 1994.
3. Sudha G.S., *Organizational Behavior*, National Publishing House, 1996.

With Effect from the Academic Year 2016 - 2017

PE 461

Robotics (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Students will understand

1. The configuration, work envelop and motion controls and applications
2. Familiarities with the kinematics of robots.
3. Robot end effectors and their design.
4. Familiarities with the dynamics of robots.
5. Robot Programming methods & Languages of robot.
6. Various Sensors and drives and their applications in robots

Outcomes: At the end of the course, the students will be

1. Equipped with robot anatomy, work volume and robot applications
2. Familiarized with the kinematic motions of robot
3. Having good knowledge about robot end effectors and their design concepts
4. Familiarized with the robot dynamics
5. Equipped with the Programming methods & drives used in robots
6. Equipped with the principles of various Sensors and their applications in robots.

Unit I

Robots: History and evolution of robots, Laws of Robotics, basic configuration, degree of freedom, work envelope, motion control methods, Application in industry, material handling, loading & unloading, processing, welding & painting applications, assembly and inspection, Robot specification requirements

Unit II

Rotation matrix: Homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles, RPY represnsation, Direct and inverse kinematics for industrial robots for position and orientation, Redundancy

Unit III

Manipulator Jacobian: Joint, End effector velocity, direct and inverse velocity nalysis, Trajectory Planning, interpolation, cubic polynomial, linear segments with with parabolic blending, static force and moment transformation, solvability, stiffness, singularities

Unit IV

Robot dynamics: Lagrangian formulation, link inertia tensor and manipulator inertia tensor, Newton-Euler formulation for RR & RP manipulators, Control: Individual joint, computed torque

Unit V

End effectors: position and velocity measurement, Sensors: Proximity and range, tactile, force and torque, Drives for Robots: Electrical, Hydraulic and Pneumatic, Robot vision: Introduction to technique, image acquisition and processing, introduction to robot programming languages

Text Books:

1. Spong and Vidyasagar, *Robot Dynamics and Control*, John Wile and Sons, 1990
2. R.K. Mittal, I.J. Nagrath, *Robotics and control*, Tata Mcgraw-Hill Publishing Company Ltd. 2003
3. Groover, *Industrial Robotics*, Mcgraw-Hill Publishing Company Ltd. 2003

Suggested Reading:

1. Asada and Siotine, *Robot analysis and Intelligence*, Wiley Interscience, 1986
2. K.S. Fu Gon ZalezRC., lEEc.S.G., *Robotics, Control Sensing Vision and Intelligence*, McGraw Hill, Int. Ed., 1987
3. Richard S. Paul, *Robot Manipulators: Mathematics, Programming, and Control*, MIT Press (MA)

With Effect from the Academic Year 2016 - 2017

CE 461

Disaster Mitigation and Management (Elective – II)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Course Objectives: Students will understand

1. The basic knowledge of hazards, disasters, risks and vulnerabilities including natural, climatic and human induced factors and associated impacts.
2. The nature, mechanism causes, consequences and mitigation measures of the various natural disasters including hydro metrological and geological based disasters.
3. Risks, vulnerabilities and human errors associated with human induced disasters including chemical, biological and nuclear warfare agents.
4. The knowledge of various chronological phases in the disaster management cycle.
5. The disaster management framework and legislations in the context of national and global conventions.
6. The applications of geospatial technologies like remote sensing and geographical information systems in disaster management.

Course Outcomes:

1. Ability to analyse and critically examine existing programs in disaster management regarding vulnerability, risk and capacity at local level
2. Ability to choose the appropriate activities and tools and set up priorities to build a coherent and adapted disaster management plan.
3. Ability to understand various mechanisms and consequences of natural and human induced disasters for the participatory role of engineers in disaster management.
4. Develop an awareness of the chronological phases of disaster preparedness, response and relief operations for formulating effective disaster management plans
5. Ability to understand various participatory approaches/strategies and their application in disaster management
6. Ability to understand the concepts of remote sensing and geographical information systems for their effective application in disaster management.

UNIT-I:

Introduction to Natural, human induced and human made disasters – Meaning, nature, types and effects; International decade of natural disaster reduction (IDNDR); International strategy of natural disaster reduction (ISDR)

UNIT-II:

Natural Disasters– Hydro meteorological disasters: Causes, impacts, Early warning systems, structural and non-structural measures for floods, drought and cyclones; Tropical cyclones: Overview, cyclogenesis, drought monitoring and management.; Geographical based disasters: Earthquakes and Tsunami- Overview, causes, impacts, zoning, structural and non-structural mitigation measures; Tsunami generation; Landslides and avalanches: Overview, causes, impacts, zoning and mitigation measures. Case studies related to various hydro meteorological and geographical based disasters.

UNIT III:

Human induced hazards: Risks and control measures in a chemical industry**,** Causes, impacts and mitigation measures for chemical accidents, chemical disaster management, current status and perspectives; Case studies related to various chemical industrial hazards eg: Bhopal gas tragedy; Management of chemical terrorism disasters and biological disasters; Radiological Emergencies and case studies; Case studies related to major power break downs, fire accidents and traffic accidents .

UNIT IV:

Use of remote sensing and GIS in disaster mitigation and management; Scope of application of ICST (Information, communication and space technologies in disaster management, Critical applications& Infrastructure; Potential application of Remote sensing and GIS in disaster management and in various disastrous conditions like earthquakes, drought, Floods, landslides etc.

UNIT V:

Concept of Disaster Management: Introduction to disaster management, Relationship between Risk, vulnerability and a disaster, Disaster management cycle, Principles of disaster mitigation: Hazard identification and vulnerability analysis, Early warning systems and forecasting; Infrastructure and development in disaster management; Disaster management in India: National disaster management framework at central, state, district and local levels. Community based disaster management.

Text Books :

1. Rajib, S and Krishna Murthy, R.R, *Disaster Management Global Challenges and Local Solutions*, Universities Press Hyderabad, 2012
2. *Notes / Reading material published by National Disaster Management Institute*, Ministry of Home Affairs, Govt. of India.

Suggested Reading:

1. Navele, P & Raja, C.K., *Earth and Atmospheric Disasters Management, Natural and Manmade*. B.S. Publications, Hyderabad, 2009
2. Fearn-Banks, K, *Crises computations approach: A case book approach*. Route ledge Publishers, Special Indian Education, New York & London, 2011
3. Battacharya, T., *Disaster Science and Management*. Tata McGraw Hill Company, New Delhi., 2012

With Effect from the Academic Year 2016 - 2017

Chaitanya Bharathi Institute of Technology (Autonomous)
Department of Mechanical Engineering

SCHEME OF INSTRUCTION & EXAMINATION

B.E. IV-Year (Production Engineering)

II-Semester

S. No	Syllabus Ref. No	SUBJECT	Instruction Per week				Scheme of Examination			Credits
								Maximum Marks		
			L	T	D/P	Lab	Duration in Hrs	End Exam	Sessional	
THEORY										
1	ME 421	Production and Operations Management	4	-	-	-	3	75	25	3
2	PE 421	Tool Engineering	4	-	-	-	3	75	25	3
3		ELECTIVE - III	4	-	-	-	3	75	25	3
4		ELECTIVE - IV	4	-	-	-	3	75	25	3
PRACTICALS										
1	PE 422	Seminar	-	-	3	-	-	-	25	1
2	PE 901	Project	-	-	6	-	-	100	50	9
		TOTAL	**16**	**-**	**9**	**-**	**-**	**-**	**-**	**22**
ELECTIVE - III										
1	ME 471	Power Plant Engineering	4	-	-	-	3	75	25	3
2	ME 472	Intellectual Property Rights	4	-	-	-	3	75	25	3
3	ME 473	Mechatronics	4	-	-	-	3	75	25	3
4	ME 474	Mechanics of Composite Materials	4	-	-	-	3	75	25	3
5	ME 475	Supply Chain Management	4	-	-	-	3	75	25	3
6	PE 471	Manufacturing Systems and Simulation	4	-	-	-	3	75	25	3
ELECTIVE - IV										
1	PE 481	Micro Manufacturing	4	-	-	-	3	75	25	3
2	PE 482	Non - Destructive Testing and Evaluation	4	-	-	-	3	75	25	3
3	PE 483	Product Design and Process Planning	4	-	-	-	3	75	25	3
4	PE 484	Nano Materials and Technology	4	-	-	-	3	75	25	3
5	PE 485	Total Quality Management	4	-	-	-	3	75	25	3
6	CSE 481	Information Security	4	-	-	-	3	75	25	3
Service Course [B.E.]										
1	PE 484	Nano Materials and Technology (Chem)	4	-	-	-	3	75	25	3

With Effect from the Academic Year 2016 - 2017

ME 421

Production and Operations Management

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives:

1. Understand plant layout design to facilitate material flow and processing of a product in the most efficient manner
2. Understand work study methods to improve the performance of workers
3. Gain some ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making on operations management and strategy.
4. Understand how Materials Requirement Planning and MRPII systems are used in managing operations
5. Recognize the importance of Inventory control to ensure their availability with minimum capital lock up.
6. Evaluate the quality processes in manufacturing and service sector to improve the operational performance

Outcomes: At the end of the course, the student will be able to

1. Identify and evaluate the processes, tools and principles of production and operations management to better understand the logistics and supply chain operations
2. Demonstrate the ability to apply mathematical forecasting techniques
3. Identify future challenges and directions that relate to production and operations management to effectively and efficiently respond to market changes
4. Apply the tasks, tools and underlying principles of operations management in the manufacturing an d service sectors to improve organizational performance
5. Explain and evaluate the quality process in manufacturing and service sector to improve the operational performance

UNIT-I

Production & Operations Management: Introduction: Types of Production Systems, job shop, batch, flow shop

Plant location and layout: Factors affecting plant location, plant layout objectives, types of layouts, merits and demerits.

Work Study: Introduction to method study and work measurement, standard time calculations, methods of rating, work sampling, wages and incentives, types of incentive plans.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models, market survey, Delphi, quantitative models, moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, least square method, simple regression, multiple regression.

Forecast Errors: Mean Absolute Deviation (MAD), Mean Square Error (MSE), Mean Forecast Error (MFE), Mean Absolute Percentage Error (MAPE)

UNIT-III

Aggregate planning and master scheduling: Introduction, objectives of aggregate planning, cost in aggregate planning, strategies in aggregate planning, master production scheduling

Materials Requirement Planning (MRP): Importance of MRP, MRP system inputs and outputs, MRP calculations, bill of materials.

UNIT-IV

Inventory Control: Importance of inventory control, types of inventory models, inventory costs deterministic inventory models, basic EOQ model, production model without shortages, purchase model with instantaneous replenishment and with shortages, production model with shortages, inventory model with price breaks, fixed order quality system, periodic review system and inventory model with probabilistic demand.

UNIT-V

Quality Control: Introduction, history and early contributions by quality gurus, quality tools, process capability, quality control by control charts, control charts for variables and attributes, sampling plans, operating characteristic curves, introduction to total quality management

Text Books:

1. Stevenson, *Production operation Management*, Mc-Graw Hill International
2. Joseph Monks, *Operations Management*, TMH Publishers, New Delhi, 2004.
3. Buffa Elwood S, *Modern Production /Operations Management* , John Wiley Publishers, Singapore, 2002

Suggested Reading:

1. Everrete E. Adama & Ronald J. Ebert, *Production & Operations Management*, Prentice Hall of India, 5th Edition, 2005
2. Panneer Selvam R, *Production and Operations Management*, Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2006.
3. S.D. Sharma, *Operations Research*, Kedarnath, Ramnath & Co., Meerut,2009
4. S.N. Chary, *Production and Operations Management*, Tata McGraw Hill, 3rd Edition, 2006.

With Effect from the Academic Year 2016 - 2017

PE 421

Tool Engineering

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Students will understand

1. The fundamentals of Tool Design that apply to different areas of manufacturing.
2. How to design simple tools independently as required by the industry
3. Various tool materials available including new materials like plastics
4. Significant technological advancement in this field
5. The fundamental concepts of Jigs and fixtures along with design principles
6. Common tools used in manufacturing practices

Outcomes: At the end of the course, the students will be able to

1. Understand the definition of tool design, its importance and application in various fields.
2. Suggest appropriate tool geometry, tool material, locating and clamping methods and manufacturing process for various tools.
3. Design simple tools independently
4. Design jigs and fixtures based on requirements.
5. Understand importance of plastics as tooling material
6. Design the tools for various operations like blanking, piercing, drawing, broaching, milling etc.

Unit-I

Introduction to Tool Engineering: Role and importance of tool engineering in industries, tool engineering functions, duties of a tool engineer.

Tools : Types, classification, features and applications**,** Properties of Cutting tool materials, types of cutting tool material -- Major constituents , relative characteristics and their applications, ISO classification and coding of carbide tools, coated tools, modern cutting tool materials and their applications, cutting tools for machining composites. Introduction to plastics, their properties and commonly used plastics as tooling materials and their applications.

Unit-II

Design of tools: Design of single point cutting tools, Design of flat and circular form tools, Design elements of a milling cutter, types of milling cutters, forces and power estimation, grinding of milling cutters, Design of milling cutters.

Introduction to broaching operation: Types of broaches - pull, push broach, geometry of broach, and design of broaching tool and manufacturing of broaches.

Unit-III

Twist drill geometry: Design and manufacturing of twist drill, effect of variation of angles on torque and thrust forces and sharpening of twist drills.

Reamers: Types of reamers, geometry of a reamer, reaming allowance, tolerance disposition, design and manufacture of reamers

Taps and Dies: Types, geometry, calculation of tapping drill diameters, design and manufacturing of taps and dies.

Unit-IV

Introduction to press tools and various sheet metal forming operations: Design of die set for blanking and piercing operations, design of bending dies, design of die set for deep drawing operation, design of die set for forging operation, design of dies for metal spinning operation.

Unit-V

Jigs & Fixtures: Design principles and construction features, locating methods associated with flat, cylindrical, internal and external surfaces, type of locating pins, requirements and choice of locating systems, redundant location, fool proofing, setting blocks, types of clamping devices and their basic elements, quick action clamps and nuts, equalizing and multiple clamping pneumatics, hydraulic, magnetic, electrical and vacuum clamping, types of drill jigs and their classification, drilling bushings, indexing jigs, design of fixtures for turning, grinding, welding and milling, economic analysis of jigs and fixtures.

Text Books:

1. Cyril Donaldson, George H LeCain, V C Goold and Joyjeet Ghose, *Tool Design*, 4th edition, Tata Me Graw Hill Education Private Limited, New Delhi, 2012
2. David Spitler, Jeff Lantrip, John Nee and David A Smith, *Fundamentals of Tool Design*, 5th edition, Society of Manufacturing Engineers, 2003

Suggested Reading:

1. P.C Sharma, *A Textbook of Machine Tools and Tool Design*, S.Chand (G/L) & Company Ltd, 2005
2. AmitabhaBattacharya and Inyong Ham, *Design of Cutting Tools Use of Metal Cutting Theory*, ASTME Pub., Michigan, USA
3. Surender Keshav & Umesh Chandra, *Production Engineering Design (Tool Design)*, Satya Prakashan, New Delhi-1994.
4. P.C Sharma, *Production Engineering*, New Age India Pub.,

With Effect from the Academic Year 2016 - 2017

PE 422

Seminar

Instruction	3 Periods per week
Sessionals	25 Marks
Credits	1

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of state of the art topics in a broad area of his /her specialization.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to following aspects of seminar presentations.

- Literature survey
- Consolidation of available information
- Power point Preparation
- Technical writing

Each student is required to:

1. Submit a one page synopsis of the seminar talk for display on the notice board.

2. Give twenty(20) minutes presentation through OHP/ PPT/ Slide Projector followed by Ten(10) minutes discussion

3. Submit a report on the seminar topic with list of references and hard copy of the slides.

Seminars are to be scheduled from 3rd week to the last week of the semester and any change in schedule should be discouraged.

For the award of sessional marks students are judged by three (3) faculty members and are based on oral and written presentations as well as their involvement in the discussions during the oral presentation.

Note: Topic of the seminar should be from any peer reviewed recent journal publications.

With Effect from the Academic Year 2016 - 17

PE 901

Project

Instruction	6 Periods per week
Duration of End Examination	Viva Voce
End Examination	100 Marks
Sessionals	50 Marks
Credits	9

Dealing with a real time problem should be the focus of under graduate project.

All projects will be monitored at least four times in the II-semester through individual presentations (Project batch wise).

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the marks, awarded by a project monitoring committee of faculty members as well as the marks given by the guide.

Common norms are established for final documentation of the project report, the students are directed to download from the website regarding the guidelines for preparing the project report and the project report format.

The project report shall be evaluated for 100 Marks by the External Examiner.

If the project work found inadequate in the end examination, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

Break up for 100 Marks in the end examination:

1. Power point presentation 30 Marks
2. Thesis/Report preparation 20 Marks
3. Viva-voce 30 Marks

With Effect from the Academic Year 2016 - 2017

ME 471

Power Plant Engineering (Elective – III)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will learn

1. Different types of power plants and their site selection criteria
2. Operation of thermal power plant
3. About hydraulic power plant, dams and spillways
4. Different types of nuclear power plants including Pressurized water reactor, Boiling water reactor, Liquid metal fast breeder reactor and Gas cooled reactor
5. The power plant economics
6. The environmental and safety aspects of power plant operation.

Outcomes: At the end of the course, the student will be able to

1. Select the suitability of site for a power plant.
2. Propose ash handling, coal handling method in a thermal power plant
3. Understand the flow-sheet of hydro-power plant
4. Explain working principle of different types of nuclear power plant.
5. Know the various factors of plant load and economy
6. Indicate safety aspects of power plants

Unit - I

Introduction: Power plant, classification of power plants, conventional and non-conventional power plants

Steam power plant: Plant Layout, types of coals, coal handling equipment, Ash handling systems

UNIT II

Steam power plant: Combustion Process - Overfeed and Underfeed stokers-traveling grate stokers, spreader stokers, retort stokers- Pulverized fuel burning system-cyclone furnace-Fluidized bed combustion (FBC).

UNIT III

Hydro electric power plant: Hydrological cycle, flow measurement, Hydrographs - drainage area characteristics, Types of hydroelectric power plants- storage and pondage - classification of dams and spill ways.

UNIT - IV

Nuclear power plant: Nuclear fuel - breeding and fertile materials - types of reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Gas cooled Reactor-Radioactive waste disposal.

UNIT - V

Power plant economics and environmental considerations:

Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor - related exercises-Fixed cost and variable cost-methods to find depreciation cost, Effluents from power plants and Impact on environment – pollutants - Pollution control.

Text Books:

1. R.K. Rajput, *A Text Book of Power Plant Engineering* 4th edition, Laxmi Publications (P) Ltd., New Delhi, 2015
2. P.K. Nag, *Power Plant Engineering* 4th edition, McGraHill Education(India) Private Limited, New Delhi, 2014
3. S.C. Arora and S. Domukundwar, *A Course in Power Plant Engineering*, Dhanpat Rai & Sons, New Delhi, 2005

Suggested Reading:

1. R. Yadav, *Fundamentals of Power Plant Engineering*, Central Publishing House, Allahabad, 2012
2. R.K. Hegde, *Power Plant Engineering*, Pearson Education India, 2015
3. P.C. Sharma, *A Text Book of Power Plant Engineering*, S.K. Kataria & sons, New Delhi, 2016

With Effect from the Academic Year 2016 - 2017

ME 472

Intellectual Property Rights (Elective – III)

(for Mech, Prod, Civil, ECE, EEE, CSE, IT)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will learn

1. Fundamental aspects of IP
2. Aspects of IPR acts.
3. Awareness of multi disciplinary audience
4. Awareness for innovation and its importance
5. The changes in IPR culture
6. About techno-business aspects of IPR

Outcomes: At the end of the course, a student

1. Will respect intellectual property of others
2. Learn the art of understanding IPR
3. Develop the capability of searching the stage of innovations.
4. Capable of filing a patent document independently.
5. Completely understand the techno-legal business angle of IP. .
6. Capable of converting creativity into IP and effectively protect it.

UNIT-I

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development, IPR abroad, Some important examples of IPR. Importance of WTO, TRIPS agreement, International Conventions and PCT

Patents: Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document, How to protect your inventions. Granting of patent, Rights of a patent, how extensive is patent protection. Why protect inventions by patents. Searching a patent, Drafting of a patent, Filing of a patent, the different layers of the international patent system, (national, regional and international options), compulsory licensing and licensers of right & revocation, Utility models, Differences between a utility model and a patent. Trade secrets and know-how agreements

UNIT-II

Industrial Designs: What is an industrial design. How can industrial designs be protected? What kind of protection is provided by industrial designs? How long does the protection last? Why protect industrial designs?

UNIT-III

Trademarks: What is a trademark, Rights of trademark? What kind of signs can be used as trademarks. Types of trademark, function does a trademark perform, How is a trademark protected? How is a trademark registered. How long is a registered trademark protected for? How extensive is trademark protection. What are well-known marks and how are they protected? Domain name and how does it relate to trademarks? Trademark infringement and passing off.

UNIT-IV

Copyright: What is copyright. What is covered by copyright. How long does copyright last? Why protect copyright? Related Rights: what are related rights. Distinction between related rights and copyright. Rights covered by copyright? Copy rights in computer programming.

UNIT-V

Enforcement of Intellectual Property Rights: Infringement of intellectual property rights Enforcement Measures Emerging issues in Intellectual property protection. Case studies of patents and IP Protection.

Unfair Competition: What is unfair competition. Relationship between unfair competition and intellectual property laws.

Text Books:

1. Ajit Parulekar and Sarita D' Souza, *Indian Patents Law – Legal & Business Implications*; Macmillan India ltd , 2006
2. B. L.Wadehra; *Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications*; Universal law Publishing Pvt. Ltd., India 2000
3. P. Narayanan*; Law of Copyright and Industrial Designs*; Eastern law House, Delhi 2010

Suggested Reading:

1. Cronish W.R1 *Intellectual Property; Patents, copyright, Trad and Allied rights*, Sweet & Maxwell, 1993.
2. P. Narayanan, *Intellectual Property Law*, Eastern Law Edn., 1997.
3. Robin Jacob and Daniel Alexander, *A Guide Book to Intellectual Property Patents, Trademarks, Copy rights and designs*, Sweet, Maxwell 4th Edition.

With Effect from the Academic Year 2016 - 2017

ME 473

Mechatronics (ELECTIVE - III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. How to identify, formulate, and solve engineering problems
2. The design a system, component, or process to meet desired needs within realistic constraints
3. The how to use the techniques, skills, and modern engineering tools necessary for engineering practice
4. The use of drive mechanisms and fluid power systems
5. The use of industrial electronic devices
6. The demonstrate the design of modern CNC machines, and Mechatronics elements

Outcomes: At the end of the course, the students will be able to

1. Model and analyze electrical and mechanical systems and their interconnection
2. Integrate mechanical, electronics, control and computer engineering in the design of mechatronics systems
3. Do the complete design, building, interfacing and actuation of a mechatronics system for a set of specifications
4. Be proficient in the use of fluid power systems in various mechatronics applications
5. Demonstrate the use of industrial electronic devices
6. Demonstrate the design of modern CNC machines, and mechatronics elements

UNIT-I

Introduction to mechanization & automation: Need of interface of electrical & electronic devices with mechanical elements, the concept of Mechatronics, Flow chart of Mechatronics system, elements of Mechatronics system, drive mechanisms, actuators, feedback devices and control system, application in industries and systems development

UNIT-II

Drive mechanisms: Feeding and indexing, orientation, escapement and sorting devices, conveyor systems

Introduction to electrical actuators: A.C. servomotors, D.C. servomotors, stepper motors

UNIT-III

Introduction to fluid power systems: Industrial Pneumatics and hydraulics, merits of fluid power, pneumatic & hydraulic elements symbols, study of hydraulic control valves, pumps & accessories, hydraulic circuits & mechanical servo control circuits, Electro-hydraulic and Hydro-pneumatic circuits

UNIT-IV

Introduction to industrial electronic devices: Diodes, Transistors, Silicon Controlled Rectifiers (SCR), Integrated Circuits (IC), Digital Circuits, Measurement systems & Data acquisition systems: sensors, digital to analog and analog-to-digital conversion, signal processing using operational amplifiers, introduction to micro processor & micro controller, Temperature measurement interface and LVDT interface, Systems response

UNIT-V

Design of modern CNC machines and Mechatronics elements: machine structures, guide ways, spindles, tool monitoring systems, adaptive control systems, Flexible manufacturing systems, Multipurpose control machines, PLC programming

Text Books:

1. William Bolton, *Mechatronics*: *Electronic control systems in mechanical and electrical engineering*, 6th edition, Pearson Education
2. HMT Ltd, *Mechatronics*, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998

Suggested Reading:

1. Michaels Histand & David G, Alciatore, *Introduction to Mechatronics and Measurement Systems*, Tata McGraw-Hill International Edition
2. Devdas Shetty, Richard A. Kolk, *Mechatronics System Design*, Cengage Learning
3. S.R. Majumdar, *Oil Hydraulic Systems – Principles & Maintenance*, McGraw-Hill Publishing Company Limited, New Delhi
4. Godfrey Onwubolu, *Mechatronics: Principles and Applications*, Butterworth-Heinemann

ME 474

Mechanics of Composite Materials (ELECTIVE - III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand the

1. Properties of fiber and matrix materials used in commercial composites, as well as some common manufacturing techniques.
2. How to predict the elastic properties of long fiber composites based on the constituent properties. An ability to rotate stress, strain and stiffness tensors using ideas from matrix algebra.
3. Linear elasticity with emphasis on the difference between isotropic and anisotropic material behavior. An ability to analyze a laminated plate in bending using classical lamination theory.
4. How to predict the failure strength of a laminated composite plate. A knowledge of issues in fracture of composites.
5. Exposure to recent developments in composites, including metal and ceramic matrix composites.
6. How to use the ideas developed in the analysis of composites towards using in industrial application.

Outcomes: At the end of the course, a student should be able to

1. Understand the various fabrication methods of composite materials.
2. Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
3. Determine stresses and strains in composites.
4. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level.
5. Understand the failure of composites including fracture.
6. Understand the theory of plate and shell; understand the bending analysis of composite beams.

Unit-I

Introduction: Fibers, matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composites and carbon composites.

Unit-II

Micromechanics of lamina and mechanical properties: Prediction of elastic constants, micromechanical approach, Halpin-Tsai equations, thermal properties, hygro properties, mechanics of load transfer from matrix to fibre.

Unit-III

Macro-mechanics of lamina: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter-laminar stresses and edge effects, simplified composite beam solutions, bending of laminated beams.

Unit-IV

Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: single and multiple fractures, de-bonding, fibre pullout and de-lamination.

Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria, designing with composite materials

Unit-V

Manufacturing processes: Hand lay-up, prepregs, bag molding, autoclave processing, RTM, pultrusion, filament winding, gel time test for resins, curing cycle,

Measurement of basic composite properties: Fiber and matrix tests, tensile test, compressive test, in-plane shear test, inter-laminar shear test, flexure test.

Text Books:

1. Jones, R.M., *Mechanics of Composite Materials*, Mc Graw Hill Co., 1967
2. B.D. Agarwal et.al, *Analysis and performance of fiber composites*, 3rd edition, Wiley sons., 2013
3. P.K. Mallick, *Fiber Reinforced Composites Materials*, Manufacturing, and Design, Taylor & Francis, Third Edition 2007 ,

Suggested Reading:

1. Ever J Barbero, *Introduction to composite materials design*, Taylor &Francis, 1999.
2. Hyer, M.W., *Stress Analysis of Fibre Reinforced Composite Materials*, McGraw Hill Co., 1998.
3. Carl. T. Herakovich, *Mechanics of Fibrous Composites*, John Wiley Sons Inc., 1998.

With Effect from the Academic Year 2016 - 2017

ME 475

Supply Chain Management (Elective – III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The significance of supply chain management in engineering.
2. The awareness about transportation and warehouse management systems.
3. The designing supply chain networks.
4. The concept of demand and supply and integrating it with supply chain management.
5. The acquainted with planning and managing inventories.
6. The pricing and revenue management

Outcomes: At the end of the course, the student is able to

1. Apply supply chain management concepts in engineering applications
2. Plan an effective transportation and warehouse management systems
3. Design an effective supply chain networks
4. Integrate and optimize demand and supply gaps
5. Apply inventory management techniques
6. Understand and design a pricing and revenue management systems

UNIT-I

Concept of SCM, Concept of Logistics Management, Supply Chain, Types of supply chain, functions in SCM, Transportation Management, Warehousing Management, Warehouse management systems.

UNIT-II

Designing the supply chain Network, Designing the distribution network, Network Design, Network Design in an uncertain environment.

UNIT-III

Planning and Demand:Planning demand & supply in a supply chain, demand forecasting, aggregate planning, planning supply & demand.

UNIT-IV

Planning & managing inventories in a supply chain, managing economies of scale, cycle inventory, and managing uncertainty safety inventory optimal level of product availability

UNIT-V

Sourcing, Transporting & Pricing Products, sourcing decisions, transportation, pricing & revenue management. Coordination & technology in the supply chains, coordination in supply chain, information technology and supply chain.

Text Books:

1. N. J. Kumar & Mukesh Bhatia, *Supply Chain Management***,** Neha publishers & Distributors,2010
2. Michael H. Hugos, *Essentials of Supply Chain Management*, 3rd edition, John Wiley & Sons, Inc, Hoboken, New Jersy,2011
3. Sunil Chopra & Peter Meindl, *Supply Chain Management* – Strategy, Planning and Operation, Pearson Education, Inc., Upper Saddle River, New Jersey, 2003

Suggested Reading:

1. Martin Christopher, *Logistics & Supply Chain Management*, 5th edition, Financial Times Series,2010
2. Dobler Donald. W, David.N.Burt, *Purchasing & supply Management Text & Cases*. McGraw-Hill, 1996
3. Chitale A.K. Gupta R.C, *Materials Management-Text and Cases*, Prentice-Hall Of India Pvt. Limited, 2007

With Effect from the Academic Year 2016 - 2017

PE 471

Manufacturing Systems and Simulation (Elective – III)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The systems, subsystems for manufacturing techniques
2. The information technologies relevant to manufacturing systems
3. The discrete and continuous systems
4. The system simulation and associated concepts
5. The queuing theory concepts applied to system simulation
6. The awareness about programming with GPSS and SIMSCRIPT

Outcomes:

1. Student is able to have overall view of various manufacturing processes
2. Capable of applying information systems and automation to manufacturing
3. Ability to build various models suitable for appropriate manufacturing facility
4. Able to understand and conceptualize systems simulations
5. Ability to simulate discrete and continuous systems
6. Capable of programming with GPSS and SIMSCRIPT

UNIT-I

Manufacturing Systems: Definition of systems, basic concepts and problems concerning systems, systems design, decision making procedures, Structural, transformational and procedural aspects of manufacturing, modes of production, process systems for manufacturing, logistic systems, material flow & technological information flow, management & information systems for manufacturing, managerial information flow in manufacturing systems

UNIT-II

Information Systems: Fundamentals of information technology, information systems, information networking, parts oriented production information systems and computerized production scheduling, online production control systems, Computer based production management systems, Automation systems for manufacturing, Industrial automation, Kinds of automation, principles of CIM, effectiveness of CIM, factory automation, automatic machine tools for mass production, NC machine tools, computer controlled manufacturing systems, FMS, automated assembly, automatic material handling, automatic inspection & testing, computer integrated automation systems- unmanned factory

UNIT-III

System Models: Concepts, continuous and discrete systems, systems modeling, type of models, subsystems, corporate model and system study

System simulation: Techniques, comparison of simulation and analytical methods, types of simulation, distributed log model, cobweb models

UNIT-IV

Continuous system Simulation: Numerical solution of differential equation, analog computers, hybrid computers, continuous system simulation languages CSMP, system dynamic growth models, logistic curves

Discrete systems simulation: Events generation of arrival patterns, simulation programming tasks, analysis of simulation output

Queuing theory: Arrival pattern distribution, service times, queuing disciplines and measure of queues

UNIT-V

GPSS and SIMSCRIPT: General description of GPSS and SIMSCRIPT, programming in GPSS simulation programming techniques: Data structures, implementation of activities, event and queues, event scanning, simulation algorithms in GPSS and SIMSCRIPT

Text Books:

1. Geofery Gordan, *Systems Simulation,* Prentice Hall, 1980
2. Allan Carrie, *Simulation of Manufacturing Systems*, John Wiley & Sons Ltd,1998

Suggested Reading:

1. Adelaide Marzano, *Manufacturing system simulation*, VDM Verlag
2. Davi Bedworth & James Bailey, *Integrated Production Control system Management, analysis & design*, 2nd edition, John Wiley & Sons Ltd.,2010
3. Ronald Zskin & Charles Standridge, *Modeling and Analysis of Manufacturing Systems*, John Wiley & Sons Ltd.,2011
4. Deo. N., '*ystem simulation with Digital Computers,* Prentice Hall, 1980

PE 481

Micro Manufacturing (ELECTIVE - IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand

1. The importance of micromachining, Nano polishing, Micro forming and Micro welding.
2. Micromachining processes
3. The Nano polishing methods
4. The micro forming processes
5. The concepts of micro welding to the students
6. The recent trends and applications of micro manufacturing

Outcomes: At the end of the course, the students are able to

1. Suggest suitable micromachining process to a particular application.
2. Select the process parameters of particular micro machining process
3. Describe the various micro, machining, welding and forming processes
4. Compare various micro machining / forming/ welding processes based on relative merits and demerits.
5. Demonstrate the understanding of various nano machining operations.
6. Exhibit the knowledge regarding the recent trends in micro-manufacturing processes

UNIT I

Micro Machining I: Introduction, scaling laws, mechanical micro machining, ultra sonic micro machining, abrasive jet micro machining, water jet micro machining, abrasive water jet micro machining, micro turning, chemical and electro chemical micro machining, electric discharge micro machining, electro discharge grinding.

UNIT II

Micro Machining II: Beam energy based micro machining, electron beam micro machining, laser beam micro machining, ion beam micro machining, plasma beam micro machining, hybrid micro machining, electro chemical spark micro machining, electrolytic in process dressing.

UNIT III

Nano Polishing: Abrasive flow finishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing, magnetic float polishing, elastic emission machining, chemo-mechanical polishing

UNIT IV

Micro Forming and Welding: Micro extrusion, micro and nano structured surface development by nano plastic forming and roller imprinting, micro bending with laser, laser micro welding, electron beam for micro welding.

UNIT V

Recent Trends and Applications: Metrology for micro machined components, ductile regime machining, AE based tool wear compensation, machining of micro gear, micro nozzle, micro pins and applications.

Text Books:

1. Jain V. K., *Micro Manufacturing Processes*, CRC Press, Taylor & Francis Group, 2012
2. Janocha H., *Actuators – Basics and applications*, Springer publishers, 2012
3. Jain V.K., Introduction to Micro machining, Narosa Publishing House, 2011

Suggested Reading:

1. Bharat Bhushan, *Handbook of nanotechnology*, springer, Germany, 2010.
2. Bandyopadhyay. A.K., *Nano Materials*, New age international publishers, New Delhi, 2008, ISBN:8122422578.
3. Jain V.K., *Advanced Machining Processes*, Allied Publishers, Delhi, 2002
4. Mcgeoug.J.A., *Micromachining of Engineering Materials*, CRC press 2001, ISBN-10:0824706447.

PE 482

Non - Destructive Testing and Evaluation (ELECTIVE - IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student has to understand the

1. Need, basic concepts and technologies of Non Destructive Testing (NDT)
2. Security precautions from Radiography, protection from radiation and measurement of radiation received by personnel.
3. Technology of acoustic emission (AE), the associated instrumentation and applications
4. Technologies like neutron radiography; laser induced ultrasonics, surface analysis and thermography
5. Merits and demerits of the different NDT Technologies
6. Latest research and developments in NDT

Outcomes: At the end of the course, the students will be able to demonstrate

1. the knowledge of different NDT techniques.
2. clear understanding of liquid penetrant inspection and magnetic particle inspection.
3. view and interpret radiographs, utilize the various principles of radiography for different components of different shapes.
4. the knowledge of acoustic emission for NDT and the instrumentation used for NDT.
5. the ability to analyze and prepare a technical report.
6. the knowledge of latest research, developments and trends in NDT.

UNIT-I

Liquid penetrate inspection: Principles of penetrate inspection, characteristics of a penetrate, water washable system, post emulsification system , solvent removable system, surface preparation and cleaning, penetrate application, development, advantages limitations, and applications.

Magnetic particle instruction: Principle, magnetization methods, continuous and residual methods, sensitivities, demagnetization, magnetic particles, applications advantages and limitations.

UNIT-II

Eddy current testing: Principle, lift-off factor, and edge effect, skin effect, inspection frequency, coil arrangements, inspection probes, types of circuit, reference pieces, phase analysis, display methods and applications.

UNIT-III

Ultrasonic testing: Generation of ultra sound, characteristics of an ultrasonic beam, sound waves at interfaces, sound attenuation, display systems, probe construction, type of display, inspection techniques, identification of defects, Immersion testing , sensitivity and calibration. Reference standards. Surface condition, Applications.

UNIT-IV

Radiography: Principle and uses of radiography, limitation principle, radiation sources, production of X-Rays, x-ray spectra, attenuation of radiation, radiographic equivalence, shadow formation enlargement and distortion, radio graphic film and paper, Xeroradiography, fluoroscopy, exposure factors, radiographic screens, identification markers and image quality indicators, inspection of simple shapes, inspection of complex shapes, viewing and interpretation of radiographs, radiation hazard, protection against radiation, measurement of radiation received by personnel.

UNIT-V

Acoustic Emission: Physical Principles, Sources of emission, instrumentation and applications, Other NDT Techniques: Neuron radiography, Laser induced ultrasonics, surface analysis, and thermography.

Text Books:

1. Barry Hull & Vernon John, *Non Destructive Testing*, 1988.
2. H J Frissell (Editorial Coordinator), Non-*Destructive Evaluation and quality control*, ASM handbook-International Publication USA, 1989..
3. Dove and Adams, *Experimental Stress analysis and Motion Measurement*, Prentice Hall of India, Delhi

Suggested Reading:

1. *Non-Destructive Examination and Quality Control*, ASM International, Vol.17, 9th edition (1989)
2. J. Prasad and C. G. K. Nair, *Non-Destructive Test and Evaluation of Materials*, Tata McGraw-Hill Education, 2nd edition (2011).
3. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical *Non Destructive Testing*, Alpha Science International Limited, 3 rd edition (2002).
4. T. Rangachari, J. Prasad and B.N.S. Murthy, *Treatise on non-destructive testing and evaluation*, Navbharath Enterprises, Vol.3, (1983

PE 483

Product Design and Process Planning (ELECTIVE – IV)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will understand

1. The Product Design and Process Functions
2. The essence of innovation in product development
3. The Human Machine Interactions (ergonomics)
4. The various Intellectual Property Rights
5. The interaction between Design, Manufacturing, Quality and Marketing
6. The awareness about overall view of Process Planning

Outcomes: At the end of the course, the student is able to

1. Have overall view of Product Design and Process Planning
2. Apply creativity techniques in Product Development
3. Applying ergonomically enabled concepts in developing a new product
4. Have awareness and apply Intellectual Property Rights
5. Integrate various stages of developing a new product
6. Develop and execute an effective Process Plan

UNIT-I

Product Design and Process Design functions: selection of right product, systematic procedure of product innovation, factors contributing to successful technological innovation, need for creativity and innovation, techniques of innovation like brain storming and Delphi techniques

UNIT-II

Product Selection and Evaluation: Function of design, design with Human Machine Interaction (HMI) and collection of ideas and purpose of project, selection criteria, screening ideas for new products using evaluation techniques, principles of ergonomics.

UNIT-III

New Product Planning: Interaction between the functions of design, manufacture, quality, testing and marketing, design and material selection, steps for introducing new products after evaluation.

UNIT-IV

New Product Development: Research and new product development, patents, definitions, patent search, patent laws, international code for patents, Intellectual Property Rights (IPR).

UNIT-V

Process Selection and Planning: Process selection, process planning, process sheets, selection of manufacturing process, estimation of machining time in various cutting operations, estimation of costs for manufacture, value engineering in product design, group technology, concepts of concurrent engineering.

Text Books:

1. Niebel BW & Draper AB, *Production Design & Process Engg*, McGraw Hill, Kogakusha, 1974
2. K. G. Swift & J. D. Booker, *Process Selection*: From Design to Manufacture", Butterworth-Heinemann Ltd; 2nd Revised edition, 2003
3. Bhaskaran Gopalakrishnan, *Product Design and Process Planning in CE (Design & Manufacturing*", Chapman and Hall publishers, 1994

Suggested Reading:

1. Harry Nystrom, *Creativity and Innovation*, John Wiley & Sons,
2. Brain Twiss, *Managing Technological Innovation*, Pittrnan Publications, 1992
3. Harry, B.Waton, *New Product Planning*, Prentice Hall Inc., 1992
4. Chitale, A. K. & Gupta RC., *Product Design & Manufacturing*, PHI, 1997

PE 484

Nano Materials and Technology (Elective – IV)
(for Mech, Prod and Chemical)

Instruction	4	Periods per week
Duration of End Examination	3	Hours
End examination	75	Marks
Sessionals	25	Marks
Credits	3	

Objectives: Student will learn the

1. Nanotechnology approach and challenges
2. Materials of nanotechnology
3. Nano structures
4. Nano fabrication
5. Special nano materials
6. Bio materials

Outcomes: At the end of the course

1. Understand the developments and challenges in nano technology
2. Understand synthesis and properties of nanostructured materials
3. Analyze magnetic and electronic properties of nano materials
4. Analyze nano fabrication methods and their applications
5. Understand the characterization of nano and bio materials and their use
6. Analyze the synthesis and characterization of nano wires and tubes

Unit I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance of Nanotechnology, Bottom-up and Top-down approaches, challenges in nanotechnology, proximal probe technologies

Unit II

Materials of Nanotechnology: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, GaAs& InP (HI-V) group materials, Nanotribology and materials, characterization using Scanning Probe Microscope, AFM, FFM

Unit III

Nano Structures: Zero dimensional Nanostructure (Nano particles), synthesis procedure, characterization techniques, properties and applications of Nano particles
One dimensional Nanostructures (Nano Wires, Nano Tubes), various Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires, Types of Nano Tubes, Synthesis procedure, characterization properties and applications of Nano Tubes

Unit IV

Nano Fabrication: Introduction, Basic fabrication techniques (Lithography, thin film deposition, and doping), MEMS fabrication techniques, Nano fabrication techniques (E-beam Nano-imprint fabrication, Epitaxy and strain engineering, Scanned probe techniques)

Unit V

Special Nano Materials: Nano Composites: Introduction, Synthesis procedures, various systems (metal-polymer, metal-ceramics and Polymer-ceramics), Characterization procedures, applications,

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, principles involved, applications

Text Books:

1. A.K. Banopadyay, *Nano Materials*, New Age Publications
2. T. Pradeep, *Textbook of Nanoscience and Nanotechnology*, McGraw Hill Education (India) Private Limited, New Delhi
3. Dieter Vollath, *Nanomaterials: An Introduction to Synthesis, Properties and Applications*, Wiley, 2013

Suggested Reading:

1. Carl C. Koch, *Nano Materials Synthesis, Properties and Applications*, Jaico Publishing House
2. Willia Tllsey Atkinson, *Nano Technology*, Jaico Publishing House
3. George W. Hanson, *Fundamentals of Nanoelectronics*, Pearson Education, 2009
4. T. Pradeep, *Nano: Essentials-understanding Nano Science and Technology*, TMH, 2007
5. Sabu Thomas, Nandakumar Kalarikkal, A. Manuel Stephan, B. Raneesh, *Advanced Nano-materials*: Synthesis, Properties, and Applications, Apple Academic Press

With Effect from the Academic Year 2016 - 2017

PE 485

Total Quality Management (Elective – IV)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand

1. The essence of total quality management in design and manufacturing a product
2. The various principles and concepts of total quality management
3. The functional requirement of quality
4. The various technical tools of quality like control charts and ANOVA etc
5. The quality information system
6. The awareness about measuring and satisfying customer needs

Outcomes: At the end of the course, the student is able to

1. Apply TQM techniques in engineering applications
2. Use various theories and principles related to TQM
3. Using functional requirements of quality
4. Use statistical techniques in TQM
5. Have awareness and use quality information system and innovative systems
6. Deal with customer grievances and satisfying the customers

UNIT-I

Strategic Quality Management: Quality policies, quality goals, obstacle to achieving successful strategic quality management, Organization for quality role of {Top, middle, work force team (Quality Circles)}, Developing a quality work culture, Maslow need theory, Herzberg two factor theory, Theory X, Y & Z methods to create and maintain awareness of quality, provide evidence of management leadership, types of self development and empowerment programmes, methods of participations means of inspiring action, recognition and rewards, Supplier quality rating plans (lot plot plan, OC curve, parent analysis), assignment of supplier capability, methods of evaluating supplier products, contract management (Joint economic plan, joint technological forecasting

UNIT-II

Design for quality: Basic functional requirements of quality, design for (reliability, safety, cost and product performance), concurrent engineering (DFMA) value engineering, support for quality improvement processes (block diagram, brain storming, cause effect analysis, pareto analysis), quality function deployment, reliability analysis, failure rate, failure pattern of complex products (bath tub curve), weibull distribution relationship between part and the system, exponential reliability, availability, FMEA (Fracture Mode and Effect Analysis), Design for experiments: Factorial experiments, construction fractional designs

UNIT-III

Technical tools for Quality: Analysis of variance (ANOVA), 4 factor ANOVA experiment, 2 levels, analysis of means, Techniques for online quality: data collection plan, variable and attribute charts, interpreting the control charts, Techniques for offline quality control: background to Taguchi method (quality loss and loss function, controllable factor, and non controllable factors in parameter performance, tolerance design

Taguchi analysis techniques: net variation and contribution ratio, estimation of process performance, accumulating analysis, performance measures, Taguchi tolerance design and tolerance (re) design

UNIT-IV

Quality Information System: Scope of Quality Information System, differences between QIS and MIS, creating new software (steps, types, defects) reports on quality (operational and executive reports), features of QIS software, software for inspection

Inspection System: Operational sorting and correlation sorting, AQL, LTPD, AOQL, Nondestructive test, Audit systems: (quality improvement planning and implementation, describing quality function, process control system, control of measurement system, material identification and control, drawing and specification control, process corrective action), the concept of POKAYOKE

UNIT-V

Measure of customer needs: The need to measure customer satisfaction, importance of proper packaging, customer processing and installation of product, dealing with customer complaints, using weibull analysis, field feedback, parameter to measure customer (dis)satisfaction, problems with the customer satisfaction system

Beyond TOM: Difficulties in implementing TOM system, rating your quality system, JIT system, the people side of TOM system, system integration, Kansei engineering and flexibility in manufacturing

Text Books:

1. L. Suganthi, Aanand A. Samuel, *Total Quality Management*, PHI Learning Pvt. Ltd., 2004
2. H.G. Menon, *TQM in view Production Manufacturing*, McGraw Hill Publishers

Suggested Reading:

1. Joel E. Ross & Susan Perry, *Total Quality Management*: *Text, Cases, and Readings*, 3rd edition, CRC Press, 1999
2. John S Oakland, *Total Quality Management*: *The route to improving performance*, A Butterworth-Heinemann Title, 2nd edition, 1994
3. Jankiraman, *Total Quality Management*: *Text and Cases*, PHI Learning Private Limited-New Delhi; 1 edition (2006)

With Effect from the Academic Year 2016 - 2017

CSE 481

Information Security (Elective – IV)

Instruction	4 Periods per week
Duration of End Examination	3 Hours
End examination	75 Marks
Sessionals	25 Marks
Credits	3

Objectives: Student will understand the

1. Information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
2. Several ethical issues in information system
3. Principal concepts, major issues, technologies, and basic approaches in information security.
4. Prevalent network and distributed system attacks, defenses against them, and forensics to investigate the aftermath.
5. Cryptography, how it has evolved, and some key encryption techniques used today.
6. Security policies (such as authentication, integrity and confidentiality), as well as protocols to implement such policies in the form of message exchanges.

Outcomes: At the end of the course, the students are able to understand the

1. Basic concepts and goals of Information security such as Confidentiality, Integrity, Authentication, Non-Repudiation, Authorization, and Availability and their relevance in various Contexts.
2. Classical cryptosystems and techniques used to break them.
3. Ideas of public key cryptosystems and digital signature schemes
4. Different network issues as well as database security issues and the solutions for them through firewall, intrusion detection system
5. Critical evaluation of a range of access control and authentication mechanisms
6. Legal privacy and ethical issues in computer security

Unit I

Introduction: History, critical characteristics of information, NSTISSC SECURITY MODEL, Components of an information system, securing the components, balancing security and access, The SDLC, The Security SDLC

Need for security: Business needs, Threats, Attacks-secure software development

Unit II

Legal, Ethical and Professional Issues: Law and Ethics information security, relevant U.S. laws, international laws and legal bodies, Ethics and information security

Risk Management: Overview, Risk Identification, risk assessment, Risk Control Strategies, selecting a risk control strategy, Quantitative versus qualitative risk control practices, Risk Management discuss points, recommended risk control practices

Unit III

Planning for security: Security policy, standards and practices, security blue print, security education, continuity strategies, Security technology

Firewalls and VONs: Physical design, firewalls, protecting remote connections

Unit IV

Security Technology: Intrusion detection, access control and other security tools, Intrusion detection and prevention systems, scanning and analysis tools, access control devices

Cryptography: Foundations of cryptology, cipher methods, crypryptographic algorithms, cryptographic tools, protocols for secure communications, attacks on cryptosystems

Unit V

Implementing Information Security: Information security project management, technical topics of implementation, Non-technical aspects of implementation, security certification and accreditation,

Security and personnel: Positioning and staffing security function, Employment policies and practices, internal control strategies

Information Security Maintenance: Security management models, the maintenance model, digital forensics

Text Books:

1. Michael E. Whitman and Hebert J. Mattord, *Principles of Information Security*, 4th edition, Ed. Cengage Learning, 2011
2. Thomas R. Peltier, Justing Peltier, John Blackley, *Information Security Fundamentals*, Auerbacj Publications, 2010

Suggested Reading:

1. Detmar W Straub, Seymor Goodman, Richard L Baskerville, *Information Security Policy Processes and Practices*, PHI, 2008
2. Marks Merkow and Jim Breithaupt, *Information Security, Principle and Practices'*, Pearson Education, 2007
3. Mark Rhodes-Ousley, *Information Security, The Complete Reference* McGraw-Hill Education, New York, 2013
4. Alberts, Christopher and Dorofee, Audrey, *Managing Information Security Risks*: *The OCTAVE Approach* Addision-Wesley Publications, 2003