IV-YEAR

FIRST SEMESTER

Code No.	Course	Credits	Lecture Hrs	Tutorial Hrs	Lab Hrs	Total Contact Hrs/Week	Sessional Marks	Exam Marks	Total Marks
ME 4101	Machine Design	4	3	1	--	4	30	70	100
ME 4102	Heat and Mass Transfer	4	3	1	--	4	30	70	100
ME 4103	Refrigeration & Air-conditioning	4	3	1	--	4	30	70	100
ME 4104	Statistical Quality Control	4	3	1	--	4	30	70	100
ME 4105	Elective-III	4	4	--	--	4	30	70	100
ME 4106	Elective-IV	4	4	--	--	4	30	70	100
ME 4107	Heat and Mass Transfer Lab	2	--	--	3	3	50	50	100
ME 4108	FMM Lab	2	--	--	3	3	50	50	100
ME 4109	CAD/CAM Lab	2	--	--	3	3	50	50	100
	TOTAL	**30**	**20**	**4**	**6**	**30**			

SECOND SEMESTER

Code No.	Course	Credits	Lecture Hrs	Tutorial Hrs	Lab Hrs	Total Contact Hrs/Week	Sessional Marks	Exam Marks	Total Marks
ME 4201	Project	14		---	--	--	50	50	100
ME 4202	MOOCS-III	2	--	--	3	4	50	50	100
ME 4203	MOOCS-IV	2	--	--	3	4	50	50	100
	TOTAL	**15**			**6**	**6**			

IV-YEAR

FIRST SEMESTER

ME 4101 MACHINE DESIGN

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Th+ 1 Tut Ses. : 30 Exam : 70
Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

- The main objectives are:Students will be acquainted with standards like ASTM, ASME etc.,
- Students will understand
- To Design and formulate, to analyze stresses and strains in machine elements like gears, clutches,bearings, etc. under static and dynamic load conditions.
- To Design of Internal combustion engine parts like cylinder, pistons,connecting rod and crankshaft.
- To understand the stresses on miscallenous machine elements like crane hooks ,wrenches ,wire ropes etc.
- Selection and application of composite materials

COURSE OUTCOMES:

- Students are able to -Understand the standadars used for for machine elements,
- -Analyze static laod and dynamic load acting and factor of safety of the machine member like gears, clutches and bearings.
- -Understanding the static and dynamic failure criteria for different materials, in the design and analysis of machine components of internal combustion engine parts
- -Know about various multi-dimensional fatigue failure criteria, fatigue failure and load-life relation
- -Know design and analyze Gears
- Ability to select the material,
- thermo-mechanical condition and configuration of a variety of machine elements under a variety of environmental and service conditions
- .Able to select the bearings and to calculate its life.
- Understanding of wear and fracture mechanics and how they influence engineering design
- Ability to recognize the possibility of buckling failure in machine elements and estimate the critical load.
- Understanding the design and various stress acting on miscellaneous elements like crane hooks, wrenches, wire ropes etc.
- Understanding of the uncertainties inherent in composite material properties and engineering analysis as a real-world engineering application.

SYLLABUS:

Classification of gears.Standard tooth systems. Spur, Helical, Bevel and Worm gears. Terminology of each. Tooth failure. Face width an beam strength. Lewis equation. Design for dynamic and wear loads. Force analysis of Bevel and Worm gears. Thermal design considerations of worm gears.

Engine parts: I.C. engine design. Design of cylinders and heads.Design of pistons.Design of cross-head, connecting rods and crank shafts.

Friction clutches. Torque capacity multi-plate clutches. Design considerations. Energy considerations and Temperature rise friction materials. Centrifugal clutches. Brakes.Energy equations. Band and block brakes. Internal expanding shoe brakes, self locking, brake design.

Sliding contact bearings.Lubrication modes.Temperature effect on viscosity.Journal bearing design.Bearing modulus.McKee equations.Heating of bearings. Collar and thrust bearings. Roller and ball bearings.Static and dynamic load capacity.Equivalent bearing load.Load-life relationships. Load factor. Selection of bearings from manufacturers catalogue.

Design of crane hooks, Wire rope construction and classification. Stresses in wire ropes. Design for service like lifts and winches. Chain drives, Nomenclature: Brief outline and simple applications of composite materials.

Text books:

1. Design of Machine Elements by V.B. Bhandari, TMH publishing Co. Ltd., New Delhi.

References:

1. Machine Design by R.K. Jain, Khanna publications.
2. Mechanical Engineering Design by Joseph E. Shingley.

ME 4102 HEAT AND MASS TRANSFER

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Th+ 1 Tut Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1. To know three modes of heat transfer i.e. in cartesian, cylindrical and spherical coordinates.
2. To acquire knowledge on steady and unsteady conduction on slabs, cylinders and spheres.
3. To understand the heat transfer on plates, internal and external flows of ducts and spheres in forced as well as natural convection.
4. To acquire knowledge on laws of radiation and importance of shape factor.
5. Analyse the types of heat exchangers and its performance.
6. Understand the basic principles of boiling, condensation and diffusion mass transfer.

COURSE OUTCOMES:

1. Students will be able to draw line diagrams and solve problems related to composite slabs, cylinders and spheres.
2. They are able to model and make certain assumptions in solving problems and they are able to understand Heisler charts in solving conduction problems.
3. They would understand how to look into Heat transfer data books and graphs.
4. They also understand to write empirical heat flow equations and heat balance equations in forced and natural convection in laminar and turbulent flows by knowing dimensional analysis concepts.
5. They understand the laws of radiation and use relations of shape factor in deriving certain equations for certain geometries.
6. Students are aware of solving problems on different heat exchangers basing on the concepts of three modes of heat transfer.
7. Having been familiar to concepts of boiling, condensation and diffusion mass transfer, students are made aware of certain non dimensional numbers in mass transfer and they are now introduced to two phase flow heat transfer.

SYLLABUS:

Introduction: Basic modes of heat transfer- Rate equations- Generalized heat conduction equation in Cartesian, Cylindrical and Spherical coordinate systems.

Steady state heat conduction solution for plain and composite slabs, cylinders and spheres- Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section- Fin effectiveness and efficiency.

Unsteady steady state heat conduction- Transient heat conduction- Lumped system analysis, and use of Heisler charts.

Convection: Continuity, momentum and energy equations- Dimensional analysis- Boundary layer theory concepts- Free, and Forced convection- Approximate solution of the boundary

layer equations- Laminar and turbulent heat transfer correlation- Momentum equation and velocity profiles in turbulent boundary layers- Application of dimensional analysis to free and forced convection problems- Empirical correlation.

Radiation: Black body radiation- radiation field, Kirchoff's laws- shape factor- Stefan Boltzman equation- Heat radiation through absorbing media- Radiant heat exchange, parallel and perpendicular surfaces- Radiation shields.

Heat Exchangers: Types of heat exchangers- Parallel flow- Counter flow- Cross flow heat exchangers- Overall heat transfer coefficient- LMTD and NTU methods- Fouling in heat exchangers- Heat exchangers with phase change.

Boiling: Different regimes of boiling- Nucleate, Transition and Film boiling. Condensation: Laminar film condensation- Nusselt's theory- Condensation on vertical flat plate and horizontal tubes- Dropwise condensation.

Mass Transfer: Conservation laws and constitutive equations- Isothermal equimass, Equimolal diffusion- Fick's law of diffusion- diffusion of gases, Liquids- Mass transfer coefficient.

Text Books:

1. Heat Transfer, by J.P.Holman, Int. Student edition, McGraw Hill book company.
2. Analysis of Heat transfer, by Eckert and Drake, Int.Student edition, McGraw Hill Kogakusha Ltd.

References:

1. Heat and Mass Transfer by R.K. Rajput, S. Chand & Co.
2. Heat and mass transfer by Sachjdeva.
3. Heat and mass transfer by Kothandaramanna, New Age International

ME 4103 REFRIGERATION & AIR-CONDITIONING

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Th+ 1 Tut Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1. Refrigeration and Air-conditioning course provides knowledge of how thermodynamic principles could be applied to refrigeration and air-conditioning equipment.
2. Students will learn how real systems in commercial, industrial refrigeration and air conditioning are built up.
3. Students will understand the ill effects of global warming and its remedies.

COURSE OUTCOMES:

1. After understanding the principles of refrigeration and air-conditioning the concept of indoor environmental comfort can be understood.
2. Self-attainment and knowledge in home air-conditioning.
3. Understanding the importance of research in designing systems which are global friendly.

SYLLABUS:

Principles of Refrigeration: Refrigeration and II law of thermodynamics- Methods of Refrigeration- Unit of Refrigeration- Applications of Refrigeration. Air cycle Refrigeration: Reversal Carnot cycle- Bell Colman cycle- Selection of Refrigeration systems for air crafts- Boot strap system- Regenerative cycle- Reduced ambient type- Comparisons of different systems.

Vapour Compression Refrigeration: Wet versus Dry compression- Effect of evaporator pressures and temperatures. Simple vapour compression Refrigeration cycle and its analysis. Advantages and disadvantages of vapour compression Refrigeration system over Air compression Refrigeration system- Methods of improving C.O.P.- Multi compression system- Multiple evaporators expansion valves- Flash inter cooler- Defrosting- Hot gas defrosting.

Classification of Refrigerants: Nomenclature- Properties- Secondary refrigerants- Selection of refrigerants- **Condensers-** Air cooled, Water cooled and evaporative type- Evaporators- Once through, flooded, shell and tube Baudelot cooler- **Expansion devices**- Capillary expansion device, Thermostatic expansion device.

Absorption Refrigeration System: Basic absorption system- Aqua ammonia absorption system- Li-Br absorption refrigeration system- Electrolux refrigeration- C.O.P. of absorption refrigeration system- Comparison of vapour compression and vapour absorption system. Steam jet refrigeration system and analysis- Advantages and limitation- Ejector compression system.

Psychrometry: Psychrometric properties and relations- Psy chart- Psy processes- Human comfort and comfort chart- Effective temperature and factors governing effective temperature. **Air conditioning**: Summer, Winter and year round air conditioning- Different types of Air conditioning load - By pass factor, RSHP, GSHF- Fresh air quantity- Cooling coils and Dehumidity- Air washers.

Text Books:

1. Refrigeration and Air conditioning, by C.P.Arora.
2. Refrigeration and Air conditioning, by P.L.Bellany.

References:

1. Refrigeration and Air conditioning, by Jordan R.C. and Priester G.B.
2. Principles of Refrigeration, by Dossat.
3. Refrigeration and Air-conditioning, by W.P.Stoecky.

ME 4104 STATISTICAL QUALITY CONTROL

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Th+ 1 Tut Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

To understand

1. the different concepts of quality and the present philosophy of quality
2. the causes of variation and how they lead to inferior quality
3. use of control charts for both variable type and attribute type of quality characteristics
4. the meaning of statistical six sigma and six sigma procedure
5. the difference between the process control and process capability
6. the need for concurrent engineering
7. the different ways of taking random samples to accept a lot
8. the design of sampling plans for required protection
9. that there exist different types sampling plans to adopt

COURSE OUTCOMES:

1. Understands that quality is caused by variation
2. Understands to recognize and eliminate the causes of variation
3. Designs control charts for both variable and attribute quality characteristics
4. Understands the need of six sigma quality
5. Performs process capability analysis for process with N-type, L-type and S-type of quality characteristics
6. Understands the concept and need for rectifying inspection
7. Develops the ability to design different types of sampling plans
8. Understands the use of standard sampling plans
9. Becomes confident to work in any quality related teams in any type of industry

SYLLABUS:

Introduction to quality, definitions, Taguchi's loss function, examples of off-line and on- line quality control techniques, quality costs, Deming's philosophy, introduction to six sigma concept.

Shewart's normal bowl, control charts for variables, $\bar{X}$, R and sigma control charts, theory of runs, ARL and ATS, Type-I and Type-II errors

Control charts for attributes, p-chart, standardized p –chart, np-chart, c-chart, u-chart, demerit control chart.

Process capability analysis: using frequency distribution and control charts. Process capability ratios, C_p and C_{pk}Process capability ratios for nominal the batter type, smaller the better type and larger the better type product specifications.

Sampling palns: single, double, multiple and sequential sampling plans, rectifying inspection, AOQ, AOQL, and ATI. Use of Dodge Romig Tables, Design of single and sequential sampling plans.

Text Books:

1. Introduction to statistical quality control by E.L. Grant
2. Introduction to statistical quality control by D.C. Montgomery

ME 4105 ELECTIVE-III (A) RENEWABLE ENERGY TECHNOLOGIES

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

- Students should have an exposure to non conventional sources of energy as it is one of the areas of emerging technologies.
- As energy needs of a developing country is on a rise, Students need to explore avenues to meet the rising demand
- Student has to expand his knowledge progressively

COURSE OUTCOMES:

- Students will have a broader outlook about Non conventional energy sources
- Students can design projects for better understanding the feasibility of Non conventional energy sources in India
- Course will be a platform for higher studies in the area of thermal engineering

SYLLABUS:

PRINCIPLES OF SOLAR RADIATION: Role and potential of new and renewable source, The solar energy option, Environmental impact of solar power, Physics of the sun, The solar constant, Extraterrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, Solar radiation data.

SOLAR ENERGY COLLECTION AND ITS APPLICATIONS: Flat plate and concentrating collectors, Classification of concentrating collectors, Orientation and thermal analysis, Advanced collectors. Solar energy storage and applications: Different methods, Sensible, Latent heat and stratified storage, Solar ponds. Solar Applications- Solar heating and cooling technique, Solar distillation and drying, Photovoltaic energy conversion.

WIND ENERGY AND BIO-MASS: Sources and potentials, Horizontal and vertical axis windmills, Performance characteristics, Betz criteria, Bio- mass: Principles of Bio-Conversion, Anaerobic/aerobic Digestion, Types of Bio-gas digesters, Gas yield, Combustion characteristics of bio-gas, Utilization for cooking, I.C.Engine operation and economic aspects.

GEOTHERMAL ENERGY AND OCEAN ENERGY: Resources, Types of wells, Methods of harnessing the energy, Potential in India, Ocean Energy: OTEC, Principles of utilization, Setting of OTEC plants, Thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, Mini-hydel power plants, and their economics.

DIRECT ENERGY CONVERSION : Need for Direct Energy Conversion, Carnot cycle, Limitations, Principles of DEC, Thermo-electric generators, Seebeck, Peltier and Joule Thomson effects, Figure of merit, Materials, Applications, MHD generators, Principles, Dissociation and Ionization, Hall effect, Magnetic flux, MHD accelerator, MHD, Engine, Power generation systems, Electron gas dynamic conversion, Economic aspects. Fuel cells, Principles, Faraday's law's, Thermodynamic aspects, Selection of fuels and operating conditions.

Text Books:

1. Renewable Energy Resources by Tiwari and Ghosal, Narosa Publications..
2. Non-ConventionalEnergy Sources by G.D. Rai

References:

1. Renewable Energy Sources by Twidell& Weir
2. Solar Energy bySukhatme
3. Solar Power Engineering by B.S Magal, Frank Kreith and J.F Kreith.
4. Principles of Solar Energy by Frank Krieth and John F Kreider.
5. Non-Conventional Energy by Ashok V Desai, Wiley Eastern Publications.
6. Non-Conventional Energy Systems by K Mittal , Wheeler.
7. Renewable Energy Technologies by Ramesh and Kumar, Narosa Publications

ME 4105 ELECTIVE-III (B) TOTAL QUALITY MANAGEMENT

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1. To understand the concept and philosophy of TQM.

2. To get acquainted with the tools of quality control.

3. To understand the quality function - Quality function deployment, Designing for quality, Manufacturing for quality.

4. To learn the importance and use of quality systems - ISO standards.

5. To understand the process of implementing the quality tools like KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods and the difficulties in implementing them.

COURSE OUTCOMES:

1. Students will have knowledge of quality and the contributions of quality gurus' like Deming, Crossby and Miller.

2. Can apply the quality and management tools and methodologies for solving the problems.

3. Will be able to apply and use functions like quality function deployment, standardization, designing and manufacturing for quality.

4. Get acquainted with ISO series and the process of implementing it.

5. Will be able to apply quality tools like KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods.

SYLLABUS:

Concepts of TQM: Philosophy of TQM, Customer focus, Organization, Top management commitment, Team work, Quality philosophies of Deming, Crossby and Muller.

TQM process: QC tools, Problem solving methodologies, New management tools, Work habits, Quality circles, Bench marking, Strategic quality planning.

TQM systems: Quality policy deployment, Quality function deployment, Standardization, Designing for quality, Manufacturing for quality.

Quality system: Need for ISO 9000 system, Advantages, Clauses of ISO 9000, Implementation of ISO 9000, Quality costs, Quality auditing, Case studies.

Implementation of TQM: Steps, KAIZEN, 5S, JIT, POKAYOKE, Taguchi methods, Case studies.

References:

1. Total Quality Management by Rose, J.E., Kogan Page Ltd., 1993.
2. The Essence of Total Quality Management by John Bank, PHI, 1993.
3. Beyond Total Quality Management by Greg Bounds, Lyle Yorks et al, McGraw Hill, 1994.
4. The Asian Productivity Organization by Takashi Osada, 1991.

5.KAIZEN by Masaki Imami, McGraw Hill, 1986.

ME 4105 ELECTIVE-III (C) OPTIMIZATION DESIGN

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES: To introduce

1. The need and origin of the optimization methods in engineering.
2. The idea of the various applications of optimization methods used in engineering
3. The classical and various advanced optimization techniques used in engineering.

COURSE OUTCOMES: The student will be able to understand:

(1) The terminology in optimization
(2) Formulation of mathematical optimization models based on physical engineering problems
(3) Various solution techniques based on classification of optimization problems
(4) Applications to a wide range of engineering problems in design, manufacturing, production and management.

SYLLABUS:

Introduction to Optimization: Engineering applications of optimization- Statement of an optimization problem- Classification of optimization problem- Optimization techniques.

Classical Optimization Techniques: Single variable optimization- Multivariable optimization with equality constraints- Multivariable optimization with inequality constraints.

Nonlinear Programming: One-Dimensional Minimization: Unimodal function- Elimination methods- Unrestricted search- Exhaustive search- Dichotomous search- Fibonacci method- Golden section method- Interpolation

methods- Quadratic interpolation method- Cubic interpolation method- direct root method.

Nonlinear Programming: Unconstrained Optimization Techniques: Direct search methods- Random search methods- Univariate method- Pattern search method- Rosenbrock's method of rotating coordinates- The simplex method- Descent methods- Gradient of function- Steepest descent method- Conjugate gradient method (Fletcher-Reeves method)- Quasi-Newton methods- Variable metric method (Davidon- Fletcher-Powell method).

Nonlinear Programming: Constrained Optimization Techniques: Characteristics of a constrained problem- Direct method- The complex method- Cutting plane method- Methods of feasible directions- Indirect methods- Transformation techniques- Basic approach in the penalty function method- Interior penalty function method- Convex programming problem- Exterior penalty function method.

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency

conditions.Solution of a constrained geometric programming problem (G.P.P). Complimentary geometric programming(C.G.P)

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimisation, computational procedure in dynamic programming calculus method and tabular methods.Linear programming as a case of D.P., Continuous D.P.

Integer programming(I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem.Integer non linear programming.

Text Book:

1. Optimization Theory and Applications, by S.S.Rao, Wiley Eastern Limited, New Delhi.

References:

1. Optimization of Design of Machine Elements, by R.C.Johnson.
2. Computer Aided Analysis and Design of Machine Elements, by RaoV.Dukkipati, M.AnandaRao and R.B.Bhat.
3. Engineering optimization methods and applications, by G.V.Reklaits, A.Ravindarn and K.M.Ragsdell, by Publications John Wiley and Sons.

ME 4105 ELECTIVE-III (D) TOOL DESIGN

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1). To make the student to be familiar with jigs and fixtures

2). To make the student how to lacate and clamp the devices in industries for manufacturing, inspection and assembly processes.

3). To make the student proficient with the press working tools, terminology and various types of dies.

4). To provide full information regarding cutting tools used on NC machine tool and holding methods

5). Tomould the students in the field of designing of limit gauges.

COURSE OUTCOMES:

1) The students will be in a position to know about jigs and fixtures in detail.
2) The students can work with jigs and fixtures.
3) They will be effecitively work in mass production type industries.
4) The students will be in a position to work with press and press tools
5) They can design tooling for production on NC machines
6) They can effectively work with gauges and also in guage design.

SYLLABUS:

Locating and Clamping Devices: Principles of Jigs and Fixtures design-Locating principles-Locating elements-Standard parts-Clamping devices-Mechanical actuation-Pneumatic & hydraulic actuation-Analysis of clamping forces-Tolerance and error analysis.

Jigs & Fixtures: Drill bushes-Different types of Jigs-Plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs- Automatic drill jigs-Rack & Pinion Operated, Air operated Jigs Components.

General principles of lathe, milling and broaching fixtures-Grinding, Drilling and shaping fixtures, Assembly, Inspection and Welding fixtures-Modular fixtures.Design and development of Jigs and fixtures for simple components.

Press Tools: Press working terminology-Presses and Press accessories-Computation of capacities and tonnage requirements-Design and development of various types of cutting, forming and drawing dies.

Tool Design for Numerically Controlled Machine Tools: Fixture Design for Numerically Controlled Machine Tools, Cutting Tools for Numerical Control, Tool-holding Methods for Numerical Control

Design of Limit Gauges: Elements, types and application of limit gauges, Gauge materials, their selection, Taylor's principles of gauge design, Types and methods to provide gauge tolerances. Design steps and design of plug & ring / snap gauge for given dimension and application.

Text Books:

1. Donaldson. C, Tool Design, Tata McGraw-Hill, 1986
2. "ASTME Handbook of Fixture Design ".Prentice Hall of India Pvt. Ltd.
3. Basu, Mukherjee, Mishra, Fundamentals of Tool Engg. Design, Oxford & IBH Publishing, N. Delhi

References:

1. A. K. Goroshkin, " Jigs and Fixtures Handbook ", Mir Publishers, Moscow, 1983.
2. "Die Design Handbook ", IvanaSuchy, McGraw Hill Book Co., 2005.
3. Production technology, HMT,Tata McGraw Hill.
4. P. Eugene Ostergaard, "Basic Die Making" - McGraw Hill Book, 1963.
5. Principle of Machine Tool. Sen& Bhattacharya,New Central Book Agencies, 1975.
6. Production tooling equipments,S. N. Parsons,Macmillan, 1966.

ME 4106 ELECTIVE-IV (A) INSTRUMENTATION AND CONTROL SYSTEMS

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

Instrumentations: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain. pressure, flow, temperature and vibration.

Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement.

Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.

Introduction: Control systems, Feedback and its effects. Transfer Function, Block Diagram and Signal Flow Graph: Impulse response and Transfer functions of linear systems, Block diagrams.

Mathematical Modeling of Physical Systems: Equations of electrical networks, Modeling of mechanical system elements, Equations of mechanical systems. State-variable Analysis of Linear Dynamic Systems: Matrix representation of state equations, State transition matrix, State transition equation, relationship between state equations and high-order differential equations, relationship between state equations and transfer functions, Characteristic equation, eigen values and eigen vectors.

Time-Domain Analysis of Control Systems: Typical test signals for the time response of control systems, Time- domain performance of control systems- The steady- state error, Time-domain performance of control systems- Stability of control systems- stability, Characteristic equation and the state transition matrix, Methods of determining stability of linear control systems, Routh- Hurwitz criterion.

Frequency-domain Analysis of Control Systems: Introduction, Nyquist stability criterion, Application of the Nyquist criterion, Stability of multi loop systems, Stability of linear control systems with time delays.

Text Books:

1. Automatic Control Systems, by Benjamin C. Kuo.
2. Mechanical Measurements, by R.S.Sirohi, H.G. Radha Krishna, Wiley Eastern, New Delhi.

References:

1. Experimental Methods for Engineers, by J.P.Holman, McGraw-Hill.
2. Instrumentation for Engineering Measurements, by R.H. Cerni and L.E.Foster, J.Wiley& Sons, New York.

3. Mechanical and Industrial Measurement, by R.K.Jain, Khanna publishers, Delhi.
4. Control Systems Engineering by Nagrath/Gopal ,New age international.

ME 4106 ELECTIVE-IV (B) SUPPLY CHAIN MANAGEMENT

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1. Supply Chain Management involves the flows of materials and information among all of the firms that contribute
2. Value to a product, from the source of raw materials to end customers. We will integrate issues from finance (investments in productive assets), marketing (channels of distribution), logistics, and operations management to
3. Develop a broad understanding of a supply chain. By taking a strategic perspective, we will focus on relatively
4. long term decisions involving the investment in productive resources, configuration of processes, product
5. Designs and development of partnerships with suppliers and channels of distribution.
6. Although the development of analytical tools is not the primary objective of the course, students should be
7. Comfortable with quantitative analysis. By the end of the course, you should have enhanced your ability to use
8. Analytical tools and conceptual frameworks to make decisions in supply chain contexts as well as a better
9. Understanding of the major strategic issues and trade-offs that arise in supply chain management

COURSE OUTCOMES:

1. Provide students with the requisite knowledge and skills to design and manage Supply chain. Analyse and improve the supply chain performance.
2. Align appropriate supply chain strategies with product characteristics.
3. To engage students in case studies based on real world logistics and supply chain decisions.
4. Acquaint the student with various Supply Chain Strategies; the differences between efficient and responsive supply chains and the correct strategies to use based on product type and location in the product life cycle.
5. Causes of Bullwhip Effect by playing a version of the well known "Beer Game" simulation.
6. The student will be able to explore three fundamental design concepts: component commonality, modularity vs. integral design, and universality, and a cost/benefit framework

7. Learn process improvements such as postponement, mass customization, re sequencing production operations, and shifting the push-pull point; these design changes can significantly improve the performance of your supply chain.
8. Understand the importance of technology in supply chain optimization

SYLLABUS:

Role of supply chain management in Economy and Organization- Introduction to SCM, Evolution, Key concepts, Decisions and Importance of SCM.

Supply chain strategy and Performance Measures- Competetive supply chain strategies, CRM strategy, Supplier relationship strategy- Performance Measures (Financial, Productivity, Quality and cycle time).

Supply chain drives- Introduction, Facilities, Inventory, Transportation and Information.

Supply chain design- Network design and operation models.

Sourcing and Transportation- Role of sourcing, Supplier selection and contracts, Procurement process, Role of Transportation, Design options for transportation network.

Planning and Managing Inventories-Introduction, cycle/safety/seasonal stock, Inventory for short life cycle products, Multi echelon inventory.

Information Technology in SCM- Role of IT, E-business and future trends.

Supply chain innovations- Introduction, Supply chain integration, Restructuring, Agile supply chains.

References:

1. Supply chain management text and cases: Janat Shah, Pearson Education, 2009.
2. Supply chain management strategy, planning and operation, Sunil Chopra, Peter Meindl, PHI.
3. Supply chain management: Chopra, Pearson Education, 2009.
4. Business logistics/ Supply chain management, 5/e: Ballou, Pearson Education.

ME 4106 ELECTIVE-IV (C) POWER PLANT ENGINEERING

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

COURSE OBJECTIVES:

1. Students will learn the applications of basic thermodynamic cycles in power plant engineering
2. Student, will be exposed to different types of conventional, non-conventional, renewable and non- renewable energy power plants
3. Students will also be exposed to economics involved in power plant engineering

COURSE OUTCOMES:

1. Students will understand the working of different types of power plants and this exposure can help them during industrial visits to any power plant
2. Theoretical exposure and industrial visits can help the students to take up projects in power plant engineering
3. Theoretical and industrial exposure can aid them in fetching job opportunities in power plants

SYLLABUS:

Introduction : Definition – Objectives of production Planning and Control – Functions of production planning and control – Types of production – Organization of production planning and control department.

Forecasting : Importance – Types of forecasting– Forecasting techniques – qualitative methods and quantitative methods.

Inventory management : Functions of inventories – relevant inventory costs – EOQ model

– Inventory control systems – ABC analysis – VED analysis

Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

Aggregate planning,: Chase planning, Expediting, controlling aspects.

Routing : Definition – Routing procedure –Route sheets — Factors affecting routing, procedure – Difference with loading

Scheduling: Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

Dispatching : Activities of dispatcher – Dispatching procedure – follow up – priority rules for dispatching jobs.

Applications of computer in production planning and control.

Text Books :

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa&RakeshSarin

References :

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
4. Production Control A Quantitative Approach / John E. Biegel.
5. Operations Management / Joseph Monks.

ME 4106 ELECTIVE-IV (D) CONDITION MONITORING

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 4 Th Ses. : 30 Exam : 70

Examination (Theory): 3hrs. Credits : 4

Introduction: Failures – System, Types of failures, Causes of failures, Maintenance Schemes – objectives – types and economic benefits, break down, preventive, predictive and Reliability monitoring.

Vibration Monitoring: Basic vibration theory, vibration measurement and analysis, machine vibration; Rotational machine faults and vibration characteristics. Applications of vibration monitoring to rotating machines. Vibration monitoring in practice - overall vibration monitoring and experience based spectrum analysis to detect machine condition and faults in bearings and gears. Current diagnostic techniques/tools commercially available, Commonly witnessed machinery faults diagnosed by vibration analysis.

Thermal Monitoring: Introduction to thermal monitoring; thermal monitoring techniques, application of thermal monitoring to manufacturing processes. Thermal imaging camera, and its application as a condition monitoring tool.

Lubricant analysis/monitoring: Introduction to tribology - lubricant types and their properties. Introduction to wear debris monitoring; collecting and quantifying wear debris; wear debris and oil analysis in practice.,SOAP, Ferrography and other spectrometric analysis techniques for wear rate evaluation and interpretation.

Sensors for condition monitoring: Accelerometers, strain gauges, eddy current probes and LVDT for measurement of displacement, velocity and acceleration. Lock in amplifier for signal conditioning. Thermocouples, thermistors, resistance thermometers and junction semiconductor devices for temperature measurement.Radiation pyrometers for temperature measurement, Thermal imaging devices.

Data acquisition and Analysis for condition monitoring: Fourier analysis and FFT, Sampling, Shannon's theorem, Analogue to digital conversion. Static characteristics of signals including mean, standard deviation, skewness and kurtosis, probability density function, power spectral density and autocorrelation.

Electrical Condition Monitoring: Overview of electrical plant and how the interaction of inherent stresses causes degradation of plant Components and affects equipment operation; Electrical contact methods for assessing electrical plant condition; Acoustic measurement of electrical plant condition; RF/UHF assessment of electrical plant condition; Chemical methods of assessing electrical plant condition

References

1. Rao J. S., Vibration Condition Monitoring, Narosa Publishing House, 2/e 2000.
2. Isermann R., Fault Diagnosis Application, Springer-Verlag Berlin, 2011.
3. Allan Davis, Hand book of Condition Monitoring, Chapman and Hall, 2000.
4. Choudary K K., Instrumentation, Measurement and Analysis, Tata McGraw Hill.
5. Collacott, R. A., Mechanical Faults Diagnosis, Chapman and Hall, London, 1990
6. Collacot R.A.- Mechanical fault diagnosis and condition monitoring
7. Hunt, T.M., (1993), Handbook of wear debris analysis and particle detection in liquids, Elsevier applied science, London and New York
8. Rao, B. (1996), Handbook of condition monitoring, Elsevier advanced technology, Oxford.
9. A Davis – Handbook of condition monitoring.
10. P Girdhar – Machinery vibration analysis and predictive maintenance
11. R G Eisenmann et-al – Machinery malfunction diagnosis and correction
12. John S Mitchell – Machinery analysis and monitoring
13. Mechanical Vibrations Practice with Basic Theory by V. Ramamurti, Narosa Publishing House.
14. Machinery Condition Monitoring: Principles and Practices *by* A. R. Mohanty (ISBN: 9781466593046, CRC Press, 2014)
15. NPTEL II Video Lectures: Machinery Condition Monitoring and Signal Processing *by* A R MOHANTY (NPTEL, 2013)

ME 4107 HEAT AND MASS TRANSFER LAB

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 2

COURSE OBJECTIVES:

- Students have to be exposed to practical applications of various modes of heat transfer
- Studentshave to learn how to use measuring instruments related to heat transfer studies
- Students have to be exposed to latest equipment's related to heat transfer studies
- Students have to learn various experimental/analytical methods of evaluating parameters related to heat transfer studies

COURSE OUTCOMES:

- Students will learn applications of heat transfer in real time applications
- Students will have hands on experience of handling various equipment's used in heat transfer studies
- This exposure will help students to undertake projects related to heat transfer studies

LIST OF EXPERIMENTS:

1. Study of conduction phenomena in the composite slab system.
2. Determination of emmissivity, time constant, FouriesBiot module and study of variation of temperature with respect to time on a circular disc.
3. Study of heat transfer by forced convection through a horizontal test section.
4. Study of heat transfer by forced convection through a vertical test section.
5. Determination of free convective heat transfer coefficient from a horizontal cylinder in air.
6. Determination of thermal conductivity of brass employing it as a fin.
7. Tests on natural convection and pool boiling.
8. Study of forced convection with turbulence promoters.
9. Study of condensation on fin.
10. Tests on film condensation.
11. Determination of COP of a vapour compression refrigeration system.
12. Study of vapour compression air conditioning system.

ME 4108 FMM LAB

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Pr. Ses. : 50 Exam : 50

Examination (Practical): 3hrs. Credits: 2

List of Experiments:

1. Calibration of flow meters,
    a. Venturi meter
    b. Orifice meter
    c. Nozzle meter
2. Determination of coefficient of discharge for
    a. small orifice
    b. cylindrical mouth piece
3. Finding coefficient of discharge for
    a. rectangular notch
    b. triangular notch
    c. trapezoidal notch
4. To draw the performance characteristics of C.F. pump.
5. To find the specific speed of
    a. Pelton turbine
    b. Francis turbine
6. To draw the characteristic curves for reciprocating pump.
7. To draw the pressure distribution and finding coefficient of drag for
    a. a bluff body
    b. an Aero foil
8. To draw the characteristic curves for the hydraulic ram.

ME 4109 CAD/CAM LAB

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : 3 Lab Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 2

COMPUTER AIDED DESIGN LAB

COURSE OBJECTIVES:

1. Introduction to AUTOCAD package in design and drafting of the different parts by using computer aided modelling.
2. Develop the design skills of the students to practice the different 2D/3D engineering drawings.
3. Application of CAD packages to solving the simple problems in modeling and analysis.
4. Motivation of the students towards the good position in automated and software industries as a design engineer.

COURSE OUTCOMES:

1. Students will be able to know to produce the industrial drawings by using CAD/CAM software's.
2. After successful completion of this laboratory student can do the job in CAD/CAM industry as a design engineer.

CAD experiments:

1. Initiating the graphics package; Setting the paper size, space; setting the limits, units; use of snap and grid commands.
2. Drawing of primitives (line, arc, circle, ellipse, triangle etc.)
3. 3D GEOMETRIC MODELING:Creation of 3D Models,Wire Frame, Surface, Solid modeli ng Techniques Using CAD Packages – CSG, B-Rep Approaches in Solid Modeling Feature Based Modeling Technique – Assembly – Detailing Exposure to Industrial Components – Application of GD&T
4. Drawing a flange.
5. Drawing a Bushing assembly.
6. Dimensioning the drawing and adding text.
7. Setting the layers and application of the layers.
8. Isometric and orthographic projections.
9. Viewing in Three dimensions.
10. Removal of hidden lines - Shading and rendering.

CAM experiments:

1. Preparation of manual part programming for CNC turning/Milling.
2. Part programming preparation through AutoCAD.
3. APT part programming for 2D - contour.
4. Machining of one job on CNC machine tool.
5. Robot programming through Teaching Box method.
6. Robot programming through computer.

SECOND SEMESTER

ME 4201 PROJECT

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : ---- Ses. : 50 Exam : 50

Examination (Theory): ---- Credits : 14

ME 4202 MOOCS-III

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : ---- Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 2

ME 4203 MOOCS-IV

(Effective from the batch admitted during 2015-2016- CBCS)

Periods/week : ---- Ses. : 50 Exam : 50

Examination (Theory): 3hrs. Credits : 2