ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Kahilipara, Guwahati - 19

SYLLABUS

8th Semester, B.Tech

Mechanical Engineering

8th Semester B.Tech (MECHANICAL ENGINEERING)

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	T	P	C
Theory						
1	ME131801	Industrial Engineering	3	0	0	3
2	ME131802	Project and Production Management	3	0	0	3
3	ME1318EXX	Elective I	3	0	0	3
4	ME1318 EXX	Elective II	3	0	0	3
5	**1318EXX	Elective (open)	3	0	0	3
Practical						
6	ME131811	CAD/CAM Lab	0	0	2	1
7	ME131812	Project	0	0	14	7
8	ME131821	Comprehensive Viva	0	0	0	2
		Total	15	0	16	25
Working Hours			31			

SEMESTER-VIII

ME131801	INDUSTRIAL ENGINEERING	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction, Production Planning and Control, Product design, Value analysis and value engineering, Plant location and layout, Equipment selection, Maintenance planning, Job, batch, and flow production methods, Group technology, Work study, Time and motion study, Incentive schemes, Work/job evaluation, Inventory control, Manufacturing planning: MRP,	15 Hours
Module-II	MRP-II, JIT, CIM, Quality control, Statistical process control, Acceptance sampling, Total quality management,	10 Hours
Module-III	Taguchi's Quality engineering. Forecasting, Scheduling and loading, Line balancing, Break-even analysis. Concept of unit worth of resource, sensitivity analysis, Transportation problems, Assignment problems, Network models: CPM and PERT, Queuing theory.	15 Hours
	Total	40Hours

Reference Books

1. O.P. Khanna**,** Industrial Engineering and Management , DhanpatRai
2. S. L. Narasimhan, D. W. McLeavey, and P. J. Billington, Production, Planning and Inventory Control, Prentice Hall, 1997.
3. J. L. Riggs, Production Systems: Planning, Analysis and Control, 3rd Ed., Wiley, 1981.
4. A. Muhlemann, J. Oakland and K. Lockyer, Productions and Operations Management, Macmillan, 1992.
5. H. A. Taha, Operations Research - An Introduction, Prentice Hall of India, 1997.
6. J. K. Sharma, Operations Research, Macmillan, 1997.

ME131802	PROJECT AND PRODUCTION MANAGEMENT	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction : System concept of production; Product life cycle; Types and characteristics of production system; Productivity; Process and product focused organization structures; Management decisions - strategic, tactical and operational	4 Hours
Module-II	Forecasting : Patterns of a time series – trend , cyclical, seasonal and irregular; Forecasting techniques : moving average, simple exponential smoothing, linear regression; Forecasting a time series with trend and seasonal component	6 Hours
Module-III	Materials Management and Inventory Control : Components of materials management; Inventory control : EOQ model, Economic lot size model, Inventory model with planned shortages, Quantity discounts for EOQ model; ABC analysis; Just-in-time inventory management.	6 Hours
Module-IV	Materials Requirement Planning : MRP concept – bill of materials (BOM), master production schedule; MRP calculations.	4 Hours
Module-V	Machine Scheduling : Concept of Single machine scheduling – shortest processing time (SPT) rule to minimize mean flow time, Earliest due date (EDD) rule to minimize maximum lateness, Total tardiness minimizing model; Minimizing makespan with identical parallel machines; Johnson's rule for 2 and 3 machines scheduling.	5 Hours
Module-VI	Project Scheduling : Activity analysis; Network construction; critical path method (CPM); Crashing of project network.	4 Hours
Module-VII	Quality Assurance : Meaning of Quality; Quality assurance system; choice of process and quality; Inspection and control of quality; Maintenance function & quality; Process control charts : x-chart and Rchart, p-chart and c-chart; Acceptance sampling : Operating characteristic (O.C) curve, Single sampling plan, Double sampling plan, Acceptance sampling by variables; concept of Six Sigma.	7 Hours
	Total	36Hours

Reference Books

1. Buffa and Sarin, Modern Production/Operations Management, John Wiley & Sons.
2. R. Panneerselvam, Production and Operations Management, PHI.
3. Russell & Taylor, Operations Management, PHI.
4. Adam and Ebert, Production and Operations Management, PHI.
5. Production & Operations Management by Starr, Cenage Learning India

ELECTIVE-1

ME1318E01	CONTROL ENGINEERING	L = 3 T = 0 P = 0 C = 3
Module-I	Fluid power; Applications and advantages; Components of a hydraulic and pneumatic system Desired properties of a hydraulic fluid; advantage of mineral oil over water; definition of terms like pressure, head, force, density, specific gravity, kinematic and absolute viscosity, compressibility and incompressibility. Pascal's law; analysis of simple hydraulic jack, Mechanical advantage; continuity equation; hydraulic power of a cylinder.	6 Hours
Module-II	Hydraulic Pumps : positive displacement pumps; constructional features, working principle and volumetric capacity of external gear pump, vane pump, axial piston pump and radial piston pump.	6 Hours
Module-III	Hydraulic Actuators : (i) Constructional features of single acting and double acting hydraulic cylinders; mounting of cylinders, cushioning of cylinder; different application of cylinder through mechanical linkages; force, velocity and power from a cylinder. (ii) Hydraulic motors; torque, power and flow rate in a hydraulic motor	4 Hours
Module-IV	Hydraulic Valves : (i) Direction control valves – operation and graphical symbol of 3 way and 4 way valves; different modes of activation of valves; (ii) Operation and graphical symbols of check valves, pressure relief valve pressure reducing valve, unloading valve and flow control valve.	7 Hours
Module-V	ANSI symbols for different hydraulic components. Analysis of hydraulic circuits for i) single acting cylinder control, ii) double acting cylinder control, iii) regenerative circuit, iv) pump unloading circuit (v) double pump hydraulic system, vi) cylinder synchronization circuit vii) speed control of a hydraulic motor viii) circuit to lift and hold heavy load, ix) automatic sequencing of two cylinders.	7 Hours
Module-VI	Advantages & disadvantages of pneumatic system compared to hydraulic system; constructional details and operation of a reciprocating compressor; working principle and use of filter, pressure regulator, lubricator and silencer; symbols of different pneumatic components; compressed air distribution system in a plant; drawing pneumatic circuits for different operations.	6 Hours
Module-VII	Use of electrical devices for controlling fluid circuits; function of electrical devices like push-button switches, limit switches, pressure switches, solenoids, relays and timers and their symbols; concept of ladder diagram; study of following circuits using electrical control devices : (i) control of a solenoid actuated cylinder using one limit switch; (ii) reciprocation of a cylinder using pressure or limit switches, (iii) two cylinder sequencing circuit using two limit switches.	4 Hours
	Total	40Hours

Reference Books

1. Ilango and Soundararajan, Introduction to Hydraulics and Pneumatics, PHI.
2. A. Esposito, Fluid Power with Applications, Pearson.
3. S.R. Majumdar, Pneumatic Systems: Principles and Maintenance, Tata McGraw Hill.
4. E.C. Fitch Jr., Fluid Power and Control Systems, McGraw Hill Book Co.
5. Banks and Banks, Industrial Hydraulics, Prentice Hall.

ELECTIVE-1

ME1318E02	MECHATRONICS	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction to Mechatronics: Definition, Mechatronics in design and manufacturing, Comparison between Traditional and Mechatronic approach; Concurrent engineering.	3 Hours
Module-II	Review of fundamentals of electronics, Logic gates and their operations, Signal processing devices, Data conversion devices, Input and output devices. Sensors and Transducers, Actuators, Limit switches, Relays.	5 Hours
Module-III	Control Systems: Open loop and closed loop control, block diagrams, transfer functions, Laplace transforms.	3 Hours
Module-IV	Electrical Drives: Stepper motors, servo drives.	4 Hours
Module-V	Mechanical Drives: Different mechanisms, Ball screws, Linear motion bearings, Transfer systems. Pneumatic and Hydraulic Drives: Elements of pneumatic and hydraulic drives, comparison between them. Design of pneumatic and hydraulic circuits, symbolic representations of such circuits indicating different valves, actuators, etc.,	6 Hours
Module-VI	asics of 8085 microprocessor, programmable register architecture, buses, memory mapping, clock pulse and data transfer operations, and simple assembly and mnemonic programming on 8085 microprocessor.	5 Hours
Module-VII	Use of On-Off, PI and PID controllers to control different drives, Programming in PLC controller using Ladder diagram.	4 Hours
Module-VIII	Mathematical modeling of physical systems, such as spring-mass vibration system, linear and rotory motion and its Laplace Transform.	2 Hours
Module-IX	Basics of time domain analysis, Introduction to discrete-time systems and Z-transform.	2 Hours
Module-X	Introduction to Mechatronic systems, such as automatic brake, door closing and opening, robot, CNC machine, AGV, etc	2 Hours
	Total	36Hours

Reference Books

1. N.P. Mahalik, Mechatronics, Tata McGraw Hill Publication
2. W. Bolton, Mechatronics, Pearson Education
3. A. Smaili and F. Arnold, Mechatronics, Oxford University Press, Indian Edition
4. M.D. Singh and J.G. Joshi, Mechatronics, Prentice Hall of India Pvt. Ltd.
5. K.K. AppuuKuttan, Mechatronics, Oxford University Press, New Delhi
6. HMT Ltd., Mechatronics, Tata McGraw Hill Publication

ELECTIVE-1

ME1318E03	FINITE ELEMENT METHOD	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction: Historical background, Relevance of FEM to design problems, Application to the continuum– Discretisation, Matrix approach, Matrix algebra– Gaussian elimination, Governing equations for continuum, Classical Techniques in FEM, Weighted residual method, Ritz method, Galerkin method	8 Hours
Module-II	One dimensional problems: Finite element modeling– Coordinates and shape functions, Potential energy approach– Element matrices and vectors, Assembly for global equations, Boundary conditions, Higher order elements- Shapes functions, Applications to axial loadings of rods– Extension to plane trusses, Bending of beams– Finite element formulation of stiffness matrix and load vectors, Assembly to Global equations, boundary conditions, Solutions and Post processing, Example Problems.	8 Hours
Module-III	Two dimensional problems– scalar variable problems: Finite element modeling– CST element, Element equations, Load vectors and boundary conditions, Assembly, Application to heat transfer, Examples	4 Hours
Module-IV	Two dimensional problems– vector variable problems: Vector Variable problems, Elasticity equations- Plane Stress, Plane Strain and Axisymmetric problems, Formulation, element matrices, Assembly, boundary conditions and solutions Examples.	8 Hours
Module-V	Isoparametric elements for two dimensional problems: Natural coordinates, Iso parametric elements, Four node quadrilateral element, Shape functions, Element stiffness matrix and force vector, Numerical integration, Stiffness integration, Displacement and Stress calculations, Examples.	6 Hours
Module-VI	Computer implementation: Pre-processor, Processor, Post-processor. Discussion about finite element packages.	2 Hours
	Total	36Hours

Reference Books

1. R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, Prentice Hall-India, NewDelhi.
2. T.R. Chandrupatla and A.D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India.
3. C.S. Krishnamoorthy, Finite Element Analysis, TMH.
4. K-J. Bathe, Finite Element Procedures, Prentice Hall.
5. O.C. Zienkiewicz, R.L. Taylor, J.Z. Zhu, The Finite Element Method: Its Basis and Fundamentals, Elsevier.
6. J.N. Reddy, An Introduction to the Finite Element Method, McGraw-Hill.

ELECTIVE-1

ME1318E04	ADVANCE MANUFACTURING TECHNOLOGY	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction to and scope of the subject of Advanced Manufacturing Technology	1 Hours
Module-II	Manufacturing Systems and Automation : Job shop, Flowlines, Transfer lines, Project shop, Continuous processes, Cellular manufacturing system, Flexible Manufacturing System: Automation: (i) degree of automation and their justified application in different levels of production (ii) benefits and draw backs of employing automation (iii) examples of conventional non-automatic, semi-automatic and automatic machine tools (iv) extent of automation in transfer machines Integrated Manufacturing Production System: Steps involved in implementation, forming the linked-cell factory.	6 Hours
Module-III	CNC machine tools and systems (i) types of automation ; fixed (or hard), programmable and flexible (ii) need and advantages of flexible automation (iii) basic principles of NC system Components and their functions in NC machines (i) Control ; MCU, DPU and CLU (ii) feed drives ; special motors and screw-nut system (iii) advantages of CNC over NC machines Basic systems of NC and CNC machines (i) coordinate system (ii) control – open loop and closed loop (iii) dimensioning – absolute and incremental CNC machine tools ; (i) structure and working principle (ii) examples and use of CNC machines (iii) machining centre (MC) – characteristics and applications. Control of tool – work travel ; (i) point – to – point and contouring (ii) interpolation – linear and circular Part programming for NC, CNC and MC systems Manual part programming (i) definition and codes used (ii) sequential steps (iii) examples ; part programming for machining in CNC lathes, drilling machines and milling. Computer aided part programming (i) definition and advantages (ii) programming languages (iii) statements in APT (iv) examples of CA part programming in APT	8 Hours
Module-IV	An overview of Non Traditional Manufacturing - Advantages over traditional, classification, characteristics of all processes: Abrasive Jet Machining (AJM) Working principle with help of layout, Applications, Effect of pressure, strand-off distance, grain size, abrasive flow rate on material removal rate (mrr) Mechanism of material removal. Advantages and limitations. Water Jet Machining: Introduction, Machining System, Basic principle, Process parameters, Applications,	8 Hours

	Advantages and Disadvantages. Ultrasonic Machining (USM) Schematic Diagram of USM- Working principle, Functions of each equipment used in the set up, Material removal process. Influence of Process parameters on (i) machining rate (ii) Surface finish and accuracy and repeatability, Applications. Plasma Arc Machining Basic principle, applications	
Module-V	Chemical Machining- Introduction, Blanking, Chemical Machining to multiple depths, Design factors, advantages and disadvantages. Electro-Chemical Machining- Process principle, Equipment, Applications. Electron Beam Machining Set up, Basic Principle, Applications. Electrical Discharge Machining (EDM) Diesinking- Basic principle, Schematic diagram of EDM setup, Dielectric fluid, Electrode materials. System for maintaining the spark gap constant, Effect of cutting parameterspulse- on-time, pulse off time, peak current setting, no load voltage, servo reference voltage, Applications. Wire-cut EDM: Schematic diagram, working principle Dielectric fluid, use. Advantages & Disadvantages of EDM, Applications.	7 Hours
Module-VI	Laser Beam Machining (LBM) Characteristics of Laser light, Basic mechanism of Ruby laser, Energy level diagram of Ruby laser. Carbon Dioxide laser, Energy level diagram. Commercial lasers available for machining, welding Heat treating, cladding. Hybrid Machining-Introduction, Methodology for Hybrid Machining thermal interaction, chemical and electrochemical interaction, mechanical interaction, Electromechanical Discharge Machining (ECDM/ECAM), Electrical Discharge Machining with Ultrasonic Assistance (EDMUS).	6 Hours
	Total	36Hours
Reference Books 1.		

ELECTIVE-2

ME1318E05	TRIBOLOGY	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction: History, Industrial Importance. Engineering Surfaces: Properties and Measurement: Measurement Methods, Surface Profilometry, Statistical Description of Roughness.	4 Hours
Module-II	Surface Contact: Hertz contact theory, Greenwood-Williamson model, Elastic-plastic contact Adhesion: Basic Models, Factors influencing Adhesion.	4 Hours
Module-III	Friction: Measurement Methods, Origin of Friction, Friction Theories – adhesion and ploughing, Mechanisms, Friction of Metals, Non-metallic Materials	6 Hours
Module-IV	Wear: Types: Adhesive, Abrasive, Corrosive, Fatigue, Minor Forms: Fretting, Erosion, Percussion, Delamination Theory, Wear Debris Analysis, Wear Testing Methods, Wear of Metals, Ceramics, Polymers.	6 Hours
Module-V	Surface Engineering: Surface Treatments: Microstructural and Thermochemical Treatments, Surface Coatings: Hard Facing, Vapour Deposition Processes: PVD, CVD, PECVD etc.	4 Hours
Module-VI	Lubrication: Basic Equations for Fluid Film Lubrication. Hydrodynamic lubrication -Thrust and Journal bearings, Squeeze Film Bearings, Hydrostatic lubrication, Gas-Lubrication. Lubrication of rolling element bearings. Boundary lubrication – metal working lubrication, solid film lubrication. Hygiene of lubricants	10 Hours
Module-VII	Nanotribology: Measurement Tools: Surface Force Apparatus, Scanning Tunnelling Microscope, Atomic / Friction Force Microscope.	2 Hours
	Total	36Hours

Reference Books

1. P. Sahoo, Engineering Tribology, Prentice Hall-India, New Delhi, 2009.
2. B. Bhushan, Introduction to Tribology, Wiley, 2002.
3. G W Stachowiak and A W Batchelor, Engineering Tribology, Butterworth-Heinemann, 2005.
4. S.K. Basu, S.N. Sengupta, B.B. Ahuja, Fundamentals of Tribology, Prentice Hall-India, 2005.
5. B C Majumdar, Introduction to Tribology of Bearings, S Chand & Co, 2012.

ELECTIVE-2

ME1318E06	COMPUTATIONAL METHODS IN ENGINEERING	L = 3 T = 0 P = 0 C = 3
Module-I	Approximations: Accuracy and precision, round off and truncation errors, error propagation.	4 Hours
Module-II	Algebraic equations: Formulation and solution of linear algebraic equations, Gauss elimination, LU decomposition, iteration methods – convergence, Eigen values and eigenvectors.	4 Hours
Module-III	Interpolation methods: Newton's divided difference, interpolation polynomials, Lagrange interpolation polynomials	6 Hours
Module-IV	Differentiation and Integration: High accuracy integration formula, extrapolation, derivatives of unequally spaced data, Gauss quadrature and integration.	6 Hours
Module-V	Transform techniques: Continuous Fourier series, frequency and time domains, Laplace transform, Fourier integral and transform, Discrete Fourier Transform, fast Fourier Transform.	6 Hours
Module-VI	Differential Equations: Initial and boundary value problems, eigen value problems, solutions to elliptical and parabolic equations, partial differential equations.	6 Hours
Module-VII	Regression methods: Linear and non-linear regression, multiple linear regression, general linear test squares. Statistical methods: Statistical representation of data, modeling and analysis of data, ANOVA, test of hypotheses.	4 Hours
	Total	36Hours

Reference Books

1. S K Gupta, Numerical Methods for Engineers, New Age International, 2005.
2. S C Chapra and R P Canale, Numerical Methods for Engineers, McGraw Hill, 1989.
3. R J Schilling and S L Harris, Applied Numerical Methods for Engineering using Matlab and C, Brooks/Cole Pub.,2000.

ELECTIVE-2

ME1318E07	INDUSTRIAL INSTRUMENTATION	L = 3 T = 0 P = 0 C = 3
Module-I	DISPLACEMENT - LVDT, capacitive type transducers- Theory, applications. ACCELEROMETER AND VIBROMETER – seismic instrument for acceleration measurement, velocity measurement, piezoelectric accelerometer, strain gauge accelerometer theory and applications.	4 Hours
Module-II	PRESSURE Absolute, gauge and vacuum pressures. Elastic transducers: Elastic diaphragm, Corrugated diaphragm, capsule type - relative merits and demerits, pressure ranges. Bourdon type pressure gauge- Theory, construction, installation, Pressure range, materials Electrical Pressure gauges: Strain gauges, Strain gauge half bridge and full bridge configurations, load cells Vacuum gauges: Mcleod gauge, thermal conductivity gauge, Calibration of pressure gauges. Dead-weight tester.	7 Hours
Module-III	TEMPERATURE Non- Electrical gauges: Liquid in glass thermometer, pressure thermometer. Electrical gauges- resistance temperature detector- 2, 3 and 4-wire configurations thermocouples and thermopiles, CJC, Compensating wires, thermistor- theory, applications, relative merits and demerits, operating range. Non contact type temperature gauges - total radiation pyrometer, optical pyrometer, temperature measuring problem in flowing fluid. Thermo well.	6 Hours
Module-IV	FLOW: Variable head type flow meters: orifice plate, Venturi tube, Flow nozzle-Theory, construction, installation, tapping, selection methods. Variable Area flow meter: Theory ,construction and installation Positive displacement type flow meters: Nutating disc, reciprocating piston, oval gear and helix type-Theory, construction and installation Open channel flow measurements: Different shapes of weirs and corresponding flow relations. Electrical type flow meters: Theory, installation details of electromagnetic flow meter, ultrasonic flow meterGuide lines for selection of flow meters , Calibration of flow meters	8 Hours
Module-V	LEVEL :Non-Electrical gauges: Sight glass type, Float type, displacer type, Air purge system-Theory, arrangements, relative merits and demerits Electrical level gauge: Resistive and capacitive types- Theory, arrangement, limitations Nuclear radiation type, ultrasonic type	6 Hours

	Differential pressure type level measurement: open and closed tanks Boiler drum level measurement.	
Module-VI	DATA Acquisition, Transmission and Recording: Cable transmission of analog voltage and current signals; cable transmission of digital data; Analog voltmeters and potentiometers; digital voltmeters and multimeters; Electromechanical XT and XY recorders; Analog Cathode-ray oscilloscope.	5 Hours
	Total	36Hours

Reference Books

1. R K Jain, “Mechanical and Industrial Measurements”, Khanna Publishers Co Ltd., New Delhi.
2. S.K.Singh, “Industrial instrumentation”, TMH
3. RK Rajput, “Mechanical Measurements and Instrumentation”, SK Kataria and Sons, New Delhi.
4. Donald P. Eckman, " Industrial Instrumentation”, Wiley
5. E O Doeblin, Measurement Systems- Application and Design, McGraw Hill
6. T G Beckwith and N L Buck, “Mechanical Measurements”, Addition Wesley Publishing Company Limited.
7. J P Holman, “Experimental Methods for Engineers”, McGraw Hill
8. Alan S Morris, “Measurement and Instrumentation Principles”, Butterworth

ELECTIVE-2

ME1318E08	INDUSTRIAL ROBOTICS	L = 3 T = 0 P = 0 C = 3
Module-I	Introduction: Brief history of robotics; definition of robot; Main components of robot: manipulator, sensors, controller, power conversion unit; Robot geometry: types of joints, workspace, number of degrees of freedom; Common configurations used in arms: rectangular, cylindrical, spherical, joined; Classification of robot according to coordinate system: cartesian, cylindrical, polar, articulated or jointed; Classification of robots according to control method: non-servo, servo; Robot specifications: payload, accuracy, repeatability resolution, maximum tip speed, reach stroke:	4 Hours
Module-II	Robot End Effector ,End effector: definition, gripper, tools; Gripper : main parts, source of power; Types of grippers: mechanical grippers, vacuum cups, magnetic grippers, adhesive grippers, Hooks, scoops, ladles, universal gripper; Robot Tools: Spot welding gun, pneumatic impact wrench, pneumatic nut runner, inert gas welding torch, heating torch, grinder, spray painting gun.	4 Hours
Module-III	Robot Actuators: Definition; Characteristics: power to weight ratio, stiffness, compliance, reduction gears; Conventional actuators: hydraulic actuator, pneumatic actuator, electric motor, direct drive motor, stepper motor, servo motor; Special actuators: magnetostrictive, shape memory alloy, elastomer**.**	4 Hours
Module-IV	Robot Sensors: Definition; of Sensor and transducer; Calibration; Basic categories of measuring devices: analog, discrete; Main types of sensors: position, velocity, acceleration, force and pressure, torque, slip and tactile, proximity. Definition of digital image, generation of digital image; Robot Vision System: definition, use, functions, components, classification; vision cameras; Techniques of image processing and analysis: Image data reduction, segmentation, feature extraction, object recognition; Application of robot vision system.	9 Hours
Module-V	Robot Kinematics: Definition of Robot kinematics, Tool frame and base frame. Word –coordinate system, Direct kinematics, Inverse kinematics, Describing position and orientation of an object in space, Homogenous transformation, Translational transformations, Rotational transformations, Denavit- Hartenberg representation.	7 Hours
Module-VI	Robot Programming Definition of robot programming; Different methods of robot programming: teach-pendant programming, key board programming; Programming languages: VAL II, AML/2, ARM BASIC	4 Hours
Module-VII	Industrial Applications of Robots Welding, Spray painting, Grinding;Material Transfer: machine loading and unloading, Processing operation; Assembly operation; Inspection. Special applications: underwater prospecting and repairs, Mining, Space Exploration, Surgery.	4 Hours
	Total	36Hours
Reference Books 1. Klafter, Richard D. Chmielewski, Thomas A. and Negin, Michael (2001) - Robotic		

Engineering:An Integrated Approach, Prentice-Hall of India Pvt. Limited.
2. Mikell P. Groover, Mitchell.Weiss, Roger N. Nagel, Nicholas G. Odrey, Industrial Robotics: Technology, Programming and Applications, McGraw-Hill International Edition
3. S.R. Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill Publication.
4. S.K. Saha, Introduction to Robotics, The McGraw-Hill Publication
5. Niku, Saeed B., Introduction to Robotics Analysis, Systems, Applications, Prentice Hall of India Private Limited, New Delhi
6. Koren, Yoram, Robotics for Engineers, McGraw-Hill Book Company, Singapore
7. Hegde, Ganesh S., A Textbook on Industrial Robotics, Laxmi Publications (P) Ltd

ELECTIVE-2

ME1318E09	RENEWABLE ENERGY SYSTEM	L = 3 T = 0 P = 0 C = 3
Module-I	Principles of Renewable Energy: i) The history of energy scene ii) The energy future: energy and sustainable Development and role of renewable energy iii) Scientific Principles of renewable energy.	4 Hours
Module-II	Review of principles of thermodynamics, fluid dynamics and heat transfer.	1 Hours
Module-III	Solar radiation: i) Sun-Earth geometry ii) Extraterrestrial Solar Radiation iv) Measurement and estimation of solar radiation. Solar Water Heating: i) Flat Plate Collectors: Heat Transfer analysis, Testing ii) Evacuated Tube Collectors Other Solar Thermal Applications: i) Air heaters ii) Water Desalination iii) Space Cooling iv) Solar Concentrators v) Solar ponds. Photovoltaic Generation: i) Photon absorption at Silicon p-n junction ii) Solar Cell iii) Application and Systems	16 Hours
Module-IV	Wind Power: i) Turbine types & terms ii) Mechanical & Electrical Power from Wind Turbines	3 Hours
Module-V	Biomass & Biofuels: i) Use of Biomass ii) Classification & Use of Biofuels.	3 Hours
Module-VI	Wave Power & tidal Power: Basic Concepts.	3 Hours
Module-VII	Ocean Thermal Energy Conversion	2 Hours
Module-VIII	. Geothermal Energy	2 Hours
Module-IX	. Energy Storage.	2 Hours
	Total	36Hours

Reference Books

1. Renewable Energy – G. Boyle, 2nd edition, OUP,2010.
2. Renewable Energy Resources- Twidell, J & Weir, T, 2nd edition, Taylor & Francis, 2006.
3. Non Conventional Energy Resources- B.H. Khan, T M H, 2010.
4. Non Conventional Energy Sources- G.D. Rai, Khanna Publishers.

ELECTIVE-3(OPEN)

ME1318E10	ENERGY CONSERVATION & MANAGEMENT	L = 3 T = 0 P = 0 C = 3
Module-I	The Energy Resources; Finite & Renewable	3 Hours
Module-II	The Need for Energy Conservation- estimation of Finite fuel resource; Hubbert's model for oil reserve.	3 Hours
Module-III	Total Energy Concept- CHP Cycles & their applications.	6 Hours
Module-IV	Waste Heat Recovery; Waste Heat Exchangers; Commercial Waste Heat Recovery Devices- Recuperators, Regenerative Heat Exchangers, Heat Pipes.	8 Hours
Module-V	Industrial Energy Conservation- Industrial Insulations; Case Studies for HVAC, Air Compressor, Mechanical Handling & Other Systems.	8 Hours
Module-VI	Energy Audit; Basic Steps; Graphical representation; Case Studies.	4 Hours
Module-VII	The Economics of Energy Saving Schemes; Costs; investment analysis.	4 Hours
	Total	36Hours

Reference Books

1. Energy Management- Murphy WR, G Mckay- Butterworth Heinmann, 2007
2. Energy Mangement, Audit & Conservation-De Barun, Vrinda Publications, Delhi, 2007
3. Eastop& Croft- Energy Efficiency, Longman, 1990
4. Turner- Energy management Handbook, 2nd Ed., Fairmont Press, 1993

ELECTIVE-3(OPEN)

ME1318E11	QUALITY & RELIABILITY ENGINEERING	L = 3 T = 0 P = 0 C = 3
Module-I	Management of Product Quality Evolution of Quality Control; Changing Quality Concepts; Modern Concept of Total Quality Management; Contribution of Quality masters (Deming, Juran, Crosby, Ishikawa, Taguchi);	3 Hours
Module-II	Creating Quality by Design Assessment of Customer's needs; Formulation of Design Specifications; Standardization; Costs of Quality; Quality Circles; 5-S concept;	4 Hours
Module-III	Total Quality Management Concept of Total Quality, Difference between "Quality" Management and "Total Quality" Management, total quality maintenance, total quality in service sector; Role of Customer and People in Total Quality Management; Steps for Quality Improvement, Kaizen; Organizing for effective Quality Management;	4 Hours
Module-IV	Process Control Control Charts; Statistical Quality Control Tools; Statistical Process Control and Process Capability, Zero defect programme; Six – Sigma approach;	4 Hours
Module-V	Quality Management Systems ISO 9000 Series of Standard; ISO 14000 Series of Standards	4 Hours
Module-VI	Strategic tools and Techniques for TQM Need for Tools and Techniques in TQM; Commonly used Tools for TQM; Approaches and Deployment of Tools for Quality Planning – Quality Function Deployment (QFD), concurrent engineering; Tools for continuous Improvement – Deming's Plan – Do – Check – Act (PDCA) cycle, Poka – Yoke (Mistake – Proofing), Taguchi's Quality Loss Function	5 Hours
Module-VII	Reliability Concept and definition of reliability; Reliability Parameters: Reliability as a function of time, failure rate as a function of time, constant failure rate, mean time to failure (MTTF), MTTF as a function of failure rate, mean time between failure (MTBF), mean down time (MDT), maintainability & availability, increasing failure rate, bath-tub curve; Brief discussion on hazard models: constant hazard model, linearly increasing hazard model, nonlinear hazard model and weilbull distribution, Advantages of weibull distribution; System reliability models: series system, parallel system, series-parallel system.	7 Hours
Module-VIII	Risk Assessment & Reliability in Design Causes of failures, Failure modes & Effects Analysis (FMEA), faulty tree analysis (FTA); Tribological failure and monitoring techniques; Design based on reliability, redundancy in design.	5 Hours
	Total	36Hours

Reference Books

1. H. Lal, Total Quality Management – A Practical Approach — New Age International (P) Ltd. Publishers
2. S. K. Mondal –Total Quality Management Principles and Practice –Vikas Publishing House Pvt. Ltd.
3. A. V. Feigenbum– Total Quality Control, Mcgraw-Hill Book Company
4. Juran's Quality Control Handbook –McGraw Hill Book Company
5. AmitavaMitra, Fundamentals of quality Control and Improvement — PHI
6. Grant and Leavenworth-Statistical Quality Control, 7th Edition, Tata Mcgraw Hill
7. E. Balaguruswamy , Reliability Engineering – TMH
8. Bhadury and Basu- Terotechnology: Reliability Engineering and Maintenance Management, Asian Books Pvt. Ltd.
9. Paul Kales- Reliability of Technology, Engineering and Management- PHI

PRACTICAL AND PROJECT SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME, WHICH IS MANDATORY.

ME131811	**CAD/CAM LAB**	L = 0 T = 0 P = 2 C = 1
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
ME131812	**PROJECT**	L = 0 T = 0 P = 14 C = 7
ME131821	**COMPREHENSIVE VIVA**	L = 0 T = 0 P = 0 C = 2