ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Kahilipara, Guwahati - 19

SYLLABUS

6th Semester, B.Tech

Mechanical Engineering

6th Semester B.Tech (MECHANICAL ENGINEERING)

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	T	P	C
Theory						
1	ME131601	Heat Transfer II	3	2	0	4
2	ME131602	Metrology & Instrumentation	3	2	0	4
3	ME131603	Power Plant Engineering	3	2	0	4
4	ME131604	Machine Design	3	2	0	4
5	ME131605	Machine Tools	3	2	0	4
6	ME131606	Gas Turbine & Jet Propulsion	3	1	0	3
Practical						
7	ME131613	Metrology & Instrumentation Lab	0	0	2	1
8	ME131614	Machine Tools and Machining Lab	0	0	2	1
Total			18	11	4	25
Working Hours			33			

SEMESTER-VI

ME131601	HEAT TRANSFER-II	L = 3 T = 2 P = 0 C = 4
Module-I	RADIATION Basic laws of radiation, radiation in ideal and real surfaces, view factor, radiation shields, electrical analogy using radiosity and irradiation, gaseous emission and absorption.	10 Hours
Module-II	RADIATIVE HEAT EXCHANGE BETWEEN SURFACES Radiation between two black bodies, Radiation shape factor (View factor) and its properties. Shape factors for different geometries, Radiation between two infinite parallel places, Radiation between two infinitely long concentric cylinders, Radiation between grey bodies, Electric network analogy for thermal radiation, Radiation shields, Radiation combined with convection	10 Hours
Module-III	DIFFUSION MASS TRANSFER: Concentrations, Velocities and Fluxes, Fick's law of diffusion, the diffusion co-efficient, Species conservation equation and the boundary equation, Steady state molecular diffusion.	10 Hours
Module-IV	Phase Change Heat Transfer Modes of boiling, Nusselt theory of condensation, correlations in boiling and condensation.	10 Hours
	Total	40Hours

Reference Books

1. Heat Transfer by J P Holman, Souvik Bhattacharyya, Tata Mcgraw Hill
2. Heat and Mass Transfer by Yunus A. Cengel, Tata Mcgraw Hill
3. Heat Transfer by Y V C Rao, University Press
4. Heat and Mass Transfer by P K Nag, Tata McgrawHil

ME131602	METROLOGY AND INSTRUMENTATION	L = 3 T = 2 P = 0 C = 4
Module-I	Introduction: Definition and importance of Metrology Measurement; Methods of measurements – direct, indirect,comparison, substitution, transposition, deflection and null measurement; Errors in measurement – absolute, relative,parallax, alignment, loading, dynamic and calibration error; Units of measurements – SI base and derived units, SI prefixes of units.	5 Hours
Module-II	Linear Metrology: Vernier scale; construction and use of Verniercalliper, Vernier height and depth gauge, micrometer; slip gauge. Angular Metrology: Constructional features and use of protractor, Vernier bevel protractor, angle gauges, sine bar and slip gauges. Measurements of : (i) Level using spirit-level; (ii) Flatness using straight edge, interferrometry (Newton's rings) and surface plate; Parallelism, cylindricity and concentricity using dial indicator.	7 Hours
Module-III	Interchangeability of components; concept of limits, tolerances and fits; Hole basis and shaft basis system of fits; Go and No Go limit gauges; plug, ring, snap, thread, radius and filler gauges.	5 Hours
Module-IV	Definition, use and essential features of Comparators; working principle and application of (i) dial gauge, (ii) Cook optical comparator, (iii) back pressure Bourdon gauge pneumatic comparator, (iv) optical comparator-profile projector.	5 Hours
Module-V	Measuring Instruments: Functional elements of an instrument – sensing, conversion & manipulation, data transmission and presentation element; Characteristics – accuracy, precision, repeatability, sensitivity, reproducibility, linearity, threshold, calibration, response, dynamic or measurement error; Transducers – definition, primary and secondary, active and passive.	5 Hours
Module-VI	Measurement of Surface Finish: Definition; Terminologies – geometrical surface, effective surface, surface roughness, roughness (primary texture), waviness (secondary texture), form, lay, sampling length; Numerical evaluation of surface roughness: peak-to-valley height (Rmax), centre line average (CLA, Ra), average depth (Rm), smoothness value (G); Principle of operation of a Talysurf.	6 Hours
Module-VII	Principle of operation of a few measuring instruments: displacement by LVDT; force by strain – gauge load cell and piezoelectric load cell; pressure by Bourdon – tube gauge; temperature by liquid-in-glass thermometer, thermocouples, optical pyrometer; liquid velocity by pitot tube; water flow by orifice meter	7 Hours
	Total	40Hours

Reference Books

1. E.O. Doebelin and D.N. Manik, Measurement Systems– Application and Design, Tata McGraw Hill.
2. R. Rajendra, Principles of Engineering Metrology, Jaico Pub. House.
3. Beckwith, Lienhard and Marangoni, Mechanical Measurements, Pearson.
4. Bewoor and Kulkarni, Metrology & Measurement, TMH.

ME131603	POWER PLANT ENGINEERING	L = 3 T = 2 P = 0 C = 4
Module-I	Power plant cycles, reheat, regenerative and binary vapor and co-generation cycles	4 Hours
Module-II	Boilers: Definition, classification, fire tube and water tube boilers, mountings and accessories. Draft in boilers, performance of boiler - boilers efficiency, equivalent evaporation, Losses in boilers. Coal and combustion: Properties of coal, ultimate analysis and proximate analysis, combination calculation.	6 Hours
Module-III	Fuel bed firing, PF firing and Fluidized bed boilers. Introduction to boiling and circulation in boilers. Power station boilers - Benson, Lamont. Supercritical boiler.	5 Hours
Module-IV	Boilers accessories: Super heater, economizer and air-pre heater. Handling of coal and ash	5 Hours
Module-V	Steam turbine- i) parts and classification, ii) nozzles types, flow through nozzles and nozzle efficiency Impulse turbine - velocity diagram, work done and blade efficiency. Pressure compounding and velocity compounding of steam turbine Impulse reaction turbine - Velocity diagram, degree of reaction and Parsons turbine. Governing in Steam turbine. Condensers – Basic ideas.	16 Hours
Module-VI	Power plant economics: load curve and various factors, cost of power generation. Introduction to Hydel, Nuclear and Renewable power plants.	4 Hours
	Total	40Hours

Reference Books

1. P.K. Nag, “Power plant Engineering,” Tata McGraw - Hill.
2. Arora and Domkundwar, “A course in Power plant Engineering” DhanpatRai& Sons.
3. M.M.EI- Wakil, “Power plant technology,” Tata McGraw - Hill

ME131604	MACHINE DESIGN	L = 3 T = 2 P = 0 C = 4
Module-I	Objective and scope of Mechanical Engineering Design; Design considerations; Review and selection of materials and manufacturing processes; codes and standards;	4 Hours
Module-II	Modes of failure; Design/allowable stress; Factor of safety (FoS); Theories of failure – maximum normal stress theory, maximum shear stress theory, Distortion energy theory. Choice of Failure criteria; Design for stability : buckling analysis – Johnson and Euler columns.	6 Hours
Module-III	Fatigue in metals; S-N curve; Endurance limit and fatigue strength; Stress concentration factors – effect of discontinuity, fillets and notches; Effect of size, surface finish, stress concentration and degree of reliability on endurance limit; Design for finite and infinite life; Goodman, modified Goodman and Soderberg diagrams with respect to fatigue failure under variable stresses; Cumulative fatigue damage – Miner's equation.	10 Hours
Module-IV	Design of (i) Cotter joint; (ii) Knuckle joint	6 Hours
Module-VI	Design of : Shaft coupling-rigid, pin-bush and geared flexible type, alignment of coupling; (iii) Belt drives-geometrical relations, derivation of torque and power transmission by flat and V-belt drives, selection of belt from manufacturers' catalogues, pulley	8 Hours
Module-VII	Design of: Transmission screw, Screw jack	6 Hours
	Total	40Hours

Reference Books

1. V.B.Bhandari, " Design of Machine Elements ", Tata McGraw Hill
2. R.L. Norton, Machine Design, Pearson
3. U.C. jindal Machine Design, Pearson
4. J. Keith Nisbett, Richard G. Budynas , Shigley's Mechanical Engineering Design, Tata McGraw Hill

ME131605	MACHINE TOOLS	L = 3 T = 2 P = 0 C = 4
Module-I	Introduction: Machining: Basic principle, purpose, definition and requirements	1 Hours
Module-II	Geometry of cutting tools: Geometry of single point turning(shaping, planning and boring) tools in ASA, ORS and NRS Systems. Conversion of tool angles from one system to another by graphical and vector methods. Geometry of drills and milling cutters---1	4 Hours
Module-III	Mechanism of machining: Chip formation mechanism, yielding and brittle fracture, chip reduction coefficient, cutting ratio,shear angle and cutting strain. Built-up edge formation, cause, type and effects, orthogonal cutting and oblique cutting. Machining chips: types and conditions, chip formation in drilling and milling.	3 Hours
Module-IV	Mechanics of machining: Purposes of determination of cutting forces and basic two approaches, cutting force components in ORS and Merchant's circle diagram. Determination of cutting forces, analytical methods, measurement. Dynamometers, construction and working principles of strain gauge type and piezoelectric crystal type turning drilling, milling and grinding dynamometers	3 Hours
Module-V	Cutting temperature: Heat generators and cutting zone temperature, sources, courses and effects on job and cutting tools, role of variation of the machining parameters on cutting temperature. Determination of cutting temperature by analytical and experimental methods. Control of cutting temperature and application of cutting fluids(purpose, essential properties, selection and methods of application)	3 Hours
Module-VI	Cutting tools-failure, life and materials: Methods of failure of cutting tools mechanisms, geometry and assessment of tool wear. Tool life, definition, assessment and measurement, Taylor's tool life equation and it's use. Cutting tool materials, essential properties, characteristics and applications of HSS, carbide(uncoated/coated), ceramic, diamond and CBN tools	3 Hours
Module-VII	Broaching and grinding: Modes and mechanisms of chip formation, selection and application. Grinding forces, surface roughness and wheel life.	2 Hours
Module-VIII	Machinability and machining economics: Machinability(and grindability), definition, assessment, improvement and evaluation of optimum cutting velocity and tool life.	2 Hours
Module-IX	Machine tools – Introduction : Purpose of use , definition and general features of machine tools. Generatrix and Directrix and tool – work motions in different operations of conventional machine tools	2 Hours
Module-X	General constructions function of machine tools : Major components and their functions in lathes ; shaping , planning and slotting machines ; drilling machines and melting machines. Machining operations and application of the common machine tools and their way of specification.	2 Hours
Module-XI	Automation and classification : Purposes, degree, type and economy of machine tool automation ; broad classification of machine tools.	3 Hours
Module-XII	Kinematic structure of machine tools : Kinematic structure of centre lathe ,shaping, planning and slotting machine. Kinematic structure of drilling (column /radial) and milling machines, capstan lathe, turret lathes. Kinematic structure of single spindle automatic lathe, by hydraulically driven machine tools , hobbling machine and gear shaping machine.	3 Hours
Module-XIII	Control of speed and feed machine tools : Need of wide ranges of	3 Hours

	speeds and feeds , and machine tool drive. Design of speed, gear box, speed layout, gear layout, ray diagrams , gears and spindle. Control (selection and change) of feed in centre lathes and by hydraulically driven machine tools	
Module-XIV	Machining time : Estimation of time required for various operations like turning , drilling , shaping , milling and gear teeth generation.	2 Hours
Module-XV	Computer numerical controlled machine tools : NC and CNC system ; purpose, principle , advantages , limitations and application in machine tools. Basic features and characteristics of CNC , lathes , milling machines etc, machining centres and FMS with reference to construction, advantages and application.	4 Hours
	Total	40Hours

Reference Books

1. A.B. Chattopadhyay, Machining and Machine Tools, Wiley *India (P) Ltd., New Delhi.*
2. A. Bhattacharyya, Metal Cutting Theory and Practice, New Central Book Agency (P) Ltd., Kolkata.
3. G. Kuppuswamy, Principles of Metal Cutting, University Press, Hyderabad.
4. Stephenson &Agapion, Metal Cutting Theory and Practice, Taylor and Francis, NY.
5. M.C. Shaw, Metal Cutting Principles and Practices, Oxford University Press.
6. G.C. Sen and A. Bhattacharyya, Principles of Machine Tools, New Central Book Agency

ME131606	GAS TURBINES AND JET PROPULSION	L = 3 T = 1 P = 0 C = 3
Module-I	Thermodynamic cycle analysis of gas turbines; open and closed cycles	6 Hours
Module-II	Centrifugal and axial flow compressors, blowers and fans. Theory and design of impellers and blading. Axial flow turbines; blade diagrams and design of blading, performance characteristics. Matching of turbines and compressors.	8 Hours
Module-III	Combustion chamber design, types of combustion chambers and their comparative merits and demerits. Design considerations. Processes within combustion chamber. Various losses occurring in the combustion chamber. Ignition problems. Pollution emission.	8 Hours
Module-IV	Classification of various air-breathing jet propulsive devices, Thrust equation and definition of various efficiencies. Performances of Turbo-prop, turbojet, turbofan engines. Thrust Augmentation	6 Hours
Module-V	Gas Turbine engine used for aircraft propulsion, Design of intakes and nozzle. Performance of Ram jet and pulse jet engines.	8 Hours
	Total	36Hours

Reference Books

1. Gas Turbines by V Ganeshan, Tata McGraw Hill
2. Elements of Gas Turbine Propulsion by James Mattingly, Tata McGraw Hill (2005)
3. Gas Turbine Theory by Cohen & Rogers.

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

ME131613	**METROLOGY & INSTRUMENTATION LAB**	L = 0 T = 0 P = 2 C = 1
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
ME131614	**MACHINE TOOLS AND MACHINING LAB**	L = 0 T = 0 P = 2 C = 1
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		