ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Kahilipara, Guwahati - 19

SYLLABUS

7th Semester, B.Tech

Mechanical Engineering

7th Semester B.Tech (MECHANICAL ENGINEERING)

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	T	P	C
Theory						
1	ME131701	Refrigeration & Air Conditioning	3	1	0	3
2	ME131702	Integrated Design and Manufacturing	3	1	0	3
3	ME131703	Optimization Technique	3	1	0	3
4	ME131704	Turbo Machinery	3	2	0	4
5	ME1317EXX	Elective 1	3	0	0	3
6	HS1317EXX	Elective 2	3	0	0	3
Practical						
7	ME131711	Refrigeration & Air Conditioning Lab	0	0	2	1
9	ME131715	Project	0	0	8	4
10	ME131721	Seminar on Summer Training	0	0	0	1
Total			18	5	10	25
Working Hours			33			

SEMESTER-VII

ME 131701	REFRIGERATION AND AIR-CONDITIONING	L = 3 T = 1 P = 0 C = 3
Module-I	Introduction: Concepts of Refrigeration and Air-conditioning. Unit of refrigeration, Refrigerants– Desirable Properties, Nomenclature	2 Hours
Module-II	Simple Vapour Compression Refrigeration System(Simple VCRS): Vapour compression cycle on ph and T-s diagrams. Cycles with subcooling and superheating, their effects; Effect of changes in evaporator pressure and condenser pressure on the performance of a simple VCRS; dry compression and wet compression of refrigerant; actual Vapour Compression Cycle	6 Hours
Module-III	Air Refrigeration System (ARS): Bell-Coleman refrigerator. COP determination, actual air-refrigeration cycle.	3 Hours
Module-IV	Vapour Absorption Refrigeration System (VARS): Advantages of VARS over VCRS. Working principle of simple VARS, practical VARS. Limitations of VARS, maximum COP of a VARS, Lithiumbromide-water System; Aqua-ammonia systems.	4 Hours
Module-V	Equipment and Control: Major Refrigeration Equipment - Compressors: Types; reciprocating, rotary & centrifugal, volumetric efficiency, Condensers: types used in refrigeration systems; Evaporators: expansion devices: capillary tubes and thermostatic expansion valves.	6 Hours
Module-VI	Ventilation – Definition & Requirement, Natural & Mechanical Ventilation, Ventilation Load Calculation	3 Hours
Module-VII	Basic definitions and principles related to Psychrometry ; Psychrometric Charts & Their Uses; Heating, Cooling, Heating & Humidification & Cooling & Dehumidification processes. Adiabatic Saturation, Cooling Coils, By-pass Factor. Sensible Heat Factors. Heat Load estimation: Simple cases of Cooling and Dehumidification.	10 Hours
Module-VIII	Duct Sizing & Design.	2 Hours
	Total	36Hours

Reference Books

1. Stocker & Jones, Refrigeration and Air Conditioning, McGraw Hill.
2. C.P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill
3. P.L. Ballaney, Refrigeration and Air Conditioning, Khanna Publishers
4. R.C.Arora, Refrigeration and Air Conditioning, Tata McGraw Hill.

ME 131702	INTEGRATED DESIGN AND MANUFACTURING	L = 3 T = 1 P = 0 C = 3
Module-I	Role of manufacturing process in product design, classification of processes; Casting process, pattern and mould, melting and pouring, solidification and cooling, removal and finishing, sand casting, comparisons of casting processes	10 Hours
Module-II	Metal forming, cold and hot working, rolling, forging, extrusion, drawing, deep drawing, punching and blanking, comparison of forming process.; Machining process, metal cutting, grinding and finishing operations, comparison.	10 Hours
Module-III	Unconventional machining, ultrasonic, electrochemical, laser beam, electro discharge machining, comparison, numerical examples.; Selection of manufacturing processes, manufacturing cost, production volume, manufacturing characteristics, material properties, shapes, sizes, dimensional accuracy and surface finish.	10 Hours
Module-IV	Product development, from concept to product designing for function, production, handling, use and maintenance; Design for manufacturability, designing for economical production, design considerations in sand casting, forging, machining, grinding and welding. Integrated manufacturing.	10 Hours
	Total	40Hours

Reference Books

1. G K Lal& Vijay Gupta, Fundamentals of design & manufacturing, Narosa Publishers
2. Ulrich &Epinger, Product design & development, TMH Publishers
3. Ghosh& Malik, Manufacturing Science, New Age Publishers.

ME131703	OPTIMIZATION TECHNIQUES	L = 3 T =1 P = 0 C = 3
Module-I	Formulation of Optimization Problems. Mathematical foundations and basic definitions: concepts from linear algebra, geometry, and multivariable calculus.	8 Hours
Module-II	Linear optimization: formulation and geometrical ideas of linear programming problems, simplex method, revised simplex method, duality, sensitivity analysis, transportation and assignment problems. Nonlinear optimization: basic theory, method of Lagrange multipliers, Karush-Kuhn-Tucker theory, convex optimization.	12 Hours
Module-III	Unconstrained optimization of one Variable; Unconstrained optimization of Many Variables; Constrained Optimization of Many Variables.	8 Hours
Module-IV	Numerical optimization techniques: line search methods, gradient methods, Newton's method, conjugate direction methods, quasi-Newton methods, projected gradient methods, penalty methods.	12 Hours
	Total	40Hours

Reference Books

1. S.S. Rattan, Theory of Machines, Tata McGraw Hill
2. J.S. Rao, The Theory of Machines Through Solved Problems, New Age Int. Pub
3. W.T. Thomson, Theory of vibration with Applications, McGraw Hill.
4. Uicker, Pennock&Shigley, Theory of Machines and Mechanisms, Oxford University Press.
5. Ghosh& A.K. Mallik, Theory of Mechanisms and Machines, Affiliated East-West Publication.
6. Rao&Dukkipati, Mechanism and Machine Theory, New Age Int. Pub.

ME131704	TURBO-MACHINARY	L = 3 T = 2 P = 0 C = 4
Module-I	Introduction: Classification: Incompressible and compressible flow machines; Radial, axial and mixed flow machines; Turbines vs pumps, fans and compressors. Applications: Water supply, ventilation, power generation, propulsion.	4 Hours
Module-II	Incompressible- Flow Machines: Hydraulic Turbines: Headrace, penstock, nozzle, runner, draft tube and tail race; Gross head and net head; Velocity diagrams for impulse and reaction turbines; Discharge, head, power and efficiencies. Pumps: Reservoir, foot valve, suction line, pump, delivery line and overhead tank; Static head and losses; Velocity diagrams; Discharge, head, power and efficiencies.	8 Hours
Module-III	Compressible-Flow Machines: Static and stagnation states; Isentropic and adiabatic expansion and compression processes; Nozzle, diffuser and rows of stationary and moving blades; Efficiencies.	8 Hours
Module-IV	Dimensional Analysis: Similarity laws, Volume-flow, mass-flow head and power coefficients, pressure ratio, enthalpy ratio, Reynolds number, Mach number; Specific speed and machine selection.	4 Hours
Module-V	Testing and Performance Analysis: Measurement devices; affinity laws and unit quantities. Set up and operating characteristics of pumps, turbines; fans and turbo-compressors.	8 Hours
Module-VI	Cavitation– cause of cavitation and definition of Thoma's cavitation parameter, surge and choking.	4 Hours
	Total	36Hours

Reference Books

1. S.M. Yahya, Turbine, Compressors and Fans.
2. J. Lal, Hydraulic Machines.
3. S.K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics & Fluid Machines, TMH.
4. M.M. Das, Fluid Mechanics & Turbo Machines, PHI, 2010.
5. R.K. Bansal, Fluid Mechanics & Machinery, Luxmi Publications.
6. C. Ratnam, A.V. Kothapalli, Fluid Mechanics & Machinery, I.K. International Publishing House Ltd, 2010.
7. C.S.P. Ojha, R. Berndtsson, P.N. Chandramouli, Fluid Mechanics & Machinery, Oxford University Press.
8. Gupta, Fluid Mechanics and Hydraulic Machines, Pearson Publication.
9. A.T. Sayers, Hydraulic and Compressible Flow Turbomachines.
10. R.K. Bansal, Fluid Mechanics and Hydraulic Machines.
11. G. Gopalakrishnan, A Treatise on Turbo Machines, Scitech Publication.
12. Karassic, Kulzsch, Fraser and Messina, Pump Handbook.
13. Cherkassky, Pumps, Fans and Compressors, MIR Publication, Moscow

ELECTIVE-1

ME1317E01	WATER RESOURCE ENGINEERING	L = 3 T = 0 P = 0 C = 3
Module-I	Fluid Mechanics: Review of fluid statics. Review of fluid dynamics; dimensional analysis.	4 Hours
Module-II	Closed Conduit Flow Closed conduit flow Design of water distribution systems, pipe network analysis: Hardy Cross Method Design of Network Reservoir pipeline	9 Hours
Module-III	Open Channel Flow Continuity, momentum equations Chezy, Mannings and energy equations Water surface profiles	9 Hours
Module-IV	Surface Water Hydrology Rainfall depth, duration, distribution, determination of average rainfall depth by Arithmatic Mean Method, Thiessen Polygon Method and Isohyetal Method Rainfall/ runoff equations. Rainfall/ runoff models, unit hydrograph, hydrologic routing models	10 Hours
Module-V	Groundwater Hydrology Porosity and water content, Equations of ground water flow (unconfined aquifers/ confined aquifers/ unsaturated flow), Estimation of aquifer parameters using graphical and analytical approach	4 Hours
	Total	36Hours

Reference Books

1. S.K. Garg, Hydrology and Water Resources Engineering, Khanna Pub.
2. R.A. Wurbs and W.P. James, Water Resources Engineering, PHI Learning Pvt. Ltd., New Delhi.
3. K. Subramanya, Engineering Hydrology, Tata McGraw-Hill.

ELECTIVE-1

ME1317E02	AUTOMOBILE ENGINEERING	L = 3 T = 0 P = 0 C =3
Module-I	Introduction**:** History & Development of Automobile. various sub system of Automobile.	1 Hours
Module-II	Prime Mover**:** Engine for Two –Wheeler & Three- Wheeler vehicles, Engine for passenger cars, commercial and other vehicle, Fuel system for carburetted engine, MPFI engine and Diesel engine, Lubrication and cooling system.	6 Hours
Module-III	Auto Electrical**:** Electric Motor as prime mover, Battery, generator, Ignition system, Starting system, lighting &signalling	6 Hours
Module-IV	Steering System**:** Devis steering & Ackerman steering system. Rack & pinion, cam & lever, worm & sector system.	4 Hours
Module-V	Transmission System**:** Flywheel & clutch. Gearbox sliding and constant mesh type, Automoatic Transmission, Universal joint, Propeller shaft	6Hours
Module-VI	Differential & Axle**:** Construction & function of differential, Different types of front & rear axles.	3 Hours
Module-VII	Suspension System**:** Conventional and independent suspension system, application.	3 Hours
Module-VIII	Brake System**:** Disc & drum brake, Hydraulic brake, Parking brake. Stopping distance.	3 Hours
Module-IX	Power Requirement**:** Various resistances such as air resistance, gradient resistance, rolling resistance. Tractive effort. Torque- Speed curve. Horse power calculation.	4 Hours
	Total	36Hours

Reference Books

1. Motor Vehicle by Newton, Steed and Garrette 2nd ed, Butter worth.
2. Automobile Mechanics by N.K.Giri, 7th ed, Khanna Publishers.
3. Automobile Engineering by Amitosh De, Revised edition 2010, Galgotia Publication Pvt. Ltd.
4. Automobile Mechanics by Heitner Joseph, East West Press

ELECTIVE-1

ME1317E03	ADVANCE WELDING TECHNOLOGY	L = 3 T = 0 P = 0 C = 3
Module-I	Review of welding processes, joint design.	3 Hours
Module-II	Process descriptions of and parametric influences on fusion welding; arc welding- SMAW, stud arc welding, GMAW, GTAW and FCAW, solid state welding processes- pressure welding, friction welding, diffusion welding; resistance welding processes.	6 Hours
Module-III	Arc welding- different types of equipment, power sources, arc characteristics, electrode selection.	5 Hours
Module-IV	Critical and precision welding processes like: PAW, LBW, EBW, USW, friction stir welding, under-water welding. Welding of plastics, ceramics and composites.	6 Hours
Module-V	Welding metallurgy, HAZ, effects of different process parameters on the characteristics of weldment. Welding fixtures, welding automation and robotic applications	6 Hours
Module-VI	Weldability of plain carbon steels, stainless steel, cast iron, aluminium and its alloys.	4 Hours
Module-VII	Welding defects- types, causes, inspection and remedial measures; testing of welded joints by visual inspection, dye-penetration (DP) test, ultrasonics and radiography. Safe Practices in Welding.	6 Hours
	Total	36Hours

Reference Books

1. M. Bhattacharyya, Weldment Design, The Association of Engineers, India Publication, Kolkata.
2. J.C. Lippold and D.J. Kotecki, Welding Metallurgy and Weldability of Stainless Steels, Wiley-India (P) Ltd., New Delhi.
3. Udin, Funk and Wulf, Welding for Engineers, John Wiley and Sons.
4. J.L. Morris, Welding Process and Procedures.
5. S.V. Nadkarni, Modern Arc Welding Technology, Oxford & IBH Publishing Co. Pvt. Ltd./ Advani-Oerlikon Ltd.
6. O.P. Khanna, A Text Book of Welding Technology, DhanpatRai& Sons.
7. R.S. Parmar, Welding Engineering and Technology, Khanna Publishers.

ELECTIVE-1

ME1317E04	COMPUTATIONAL FLUID DYNAMICS	L = 3 T = 0 P = 0 C = 3
Module-I	The Basic Equations of Fluid Dynamics: General form of a Conservation law: equation of mass conservation, conservation law of momentum, conservation equation of energy	3 Hours
Module-II	The dynamic levels of approximation: The Navier-Stokes(NS) equation: The Reynold's averaged NS equation, The thin layer NS approximation, The parabolaised NS approximation, The boundary layer approximation The distributed loss model, The inviscid flow model, Euler equations, steady inviscid rotational flow, The potential flow model, small disturbance approximation of the potential equation, Linearised potential flow, singularity methods, mathematical nature of flow equations..	6 Hours
Module-III	Basic discretization techniques: (a)The finite difference method, (b)The finite volume method and conservative discretization.	3 Hours
Module-IV	Analysis and application of Numerical schemes: Consistency, stability, convergence, Fourier and Von Neumann stability analysis, modified equation, application of finite difference methods, to wave, heat. Laplace and Burger's equation.	6 Hours
Module-V	Integration methods for systems of ODE: Linear multi step methods, predictor-corrector schemes, ADI methods, The Runge-Kutta schemes.	6 Hours
Module-VI	Numerical solution of Euler Equations: Mathematical formulation of the system of Euler equations, space-centered schemes, upwind shemes for the Euler's equation-Steger and warming flux vector splitting, Van Leer's flux splitting.	6 Hours
Module-VII	HEAT TRANSFER Basics of finite difference and finite element methods: Numerical methods for conduction heat transfer, Numerical methods for convection heat transfer, Numerical methods for radiative heat transfer.	6 Hours
	Total	36Hours

Reference Books:

1. Computational Fluid Mechanics and Heat Transfer—Hemisphere-Anderson, Tannehill, Pletcher.
2. Computational Heat Transfer-Hemisphere and Springer-Verlag-Jaluria and Torrance.
3. Computational techniques for Fluid Dynamics-Verlag-Fletcher and Springer.
4. Numerical Computation of Internal and External flows-John-Wiley-Charlse and Hirch.

ELECTIVE-2 (OPEN)

NOTE: SUBJECTS WILL BE OFFRED DEPENDING ON THE AVAILABILITY OF THE RESOURCES IN THE DEPARTMENT AND THE DEMAND OF THE SUBJECT. HOWEVER, THE CREDIT FOR ELECTIVE 2 WILL BE L-3,T-0,P-0,C-3, WHICH IS MANDATORY.

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

ME131711	**REFRIGERATION & AIR CONDITIONING LAB**	L = 0 T = 0 P = 2 C = 1
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
ME131715	**PROJECT**	L = 0 T = 0 P = 8 C = 4
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		
ME131721	**SEMINAR ON SUMMER TRAINING**	L = 0 T = 0 P = 0 C = 1
PRACTICAL SYLLABUS WILL BE UPLOADED BY THE UNIVERSITY FROM TIME TO TIME		