ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH
MECHANICAL ENGINEERING

5th SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure

(From Academic Session 2018-19 onwards)

B.Tech 5th Semester: Mechanical Engineering
Semester V/ B.TECH/ME

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	ME181501	Applied Thermodynamics - I	3	0	2	4	30	70
2	ME181502	Machine Design - I	3	0	2	4	30	70
3	ME181503	Mechanisms and Dynamics of Machines	3	0	2	4	30	70
4	ME181504	Heat Transfer - I	3	0	0	3	30	70
5	ME181505	Engineering Inspection and Metrology	3	0	0	3	30	70
6	HS181506	Engineering Economics	3	0	0	3	30	70
Practical								
1	ME181514	Heat Transfer – I Lab	0	0	2	1	15	35
2	ME181515	Engineering Inspection and Metrology Lab	0	0	2	1	15	35
3	SI181521	Internship-II (SAI-Academia)	0	0	0	1	-	100
TOTAL			18	0	10	**24**	**210**	**590**
Total Contact Hours per week: 28								
Total Credits: 24								

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181501	**Applied Thermodynamics - I**	**3-0-2**	**4**

Course Outcomes (CO): On successful completion of this course the student should be able to:
CO1: Apply the various thermodynamic laws and properties of steam for suitable applications in a steam power plant.
CO2: Analyse the Thermodynamic processes involved in the various components of a steam generating plant.
CO3: Evaluate the performance of steam power cycle and select suitable modified methods to improve the efficiency of power cycle.
CO4: Compare the components of a power plant like boiler, nozzle, turbine and condensers in terms of their advantages and disadvantages for selection in industrial applications.
CO5: Explain the concepts of Availability and Irreversibility under various thermodynamic flow systems.

MODULE 1: Availability
Available and unavailable energy, Available energy referred to a cycle, Availability in non-flow or closed system (Non-cyclic), Availability of steady-flow systems, Helmohltz and Gibb's functions, Irreversibility and loss in availability, Effectiveness.

MODULE 2: Boiler
Classification of boilers, mountings, accessories, evaporation capacity, equivalent evaporation, boiler efficiency, selection of a boiler, boiler feed water treatment and boiler troubles.

MODULE 3: Basic Steam Power Cycles
Carnot and Rankine cycles, Modified Rankine cycle, Regenerative and Reheat cycles.

MODULE 4: Steam Nozzles
Expansion of steam through nozzles, velocity and pressure variation in nozzles, Critical pressure ratio, mass flow rate and maximum mass flow rate, Representation of heat drop in nozzles in Mollier diagram, Nozzle efficiency.

MODULE 5: Steam Turbines
Classification, Flow of steam through impulse and reaction turbines, Velocity diagrams, Reheating, Bleeding, Reheat factor, Compounding and governing of steam turbines, Back pressure turbines, Pass out turbines.

MODULE 6: Steam Condensers
Function of steam condenser, Elements of a condenser plant, vacuum production, Delton's law of partial pressure, Classification of condensers, Sources of air leakage in condensers and their effects, Removal of air from the condesers, Vacuum efficiency and condenser efficiency, Determination of cooling water, Cooling towers and cooling ponds.

Textbooks/ Reference Books:

1. A course in thermodynamics and heat engines by Domkundwar, Kothendaraman, Khajuria and Arora, Dhanpat Rai and Sons.
2. Thermal Engineering by Er. R.K.Rajput, Laxmi Publications.
3. Elements of heat engines by Patel, Karamchandani
4. A text book of thermal engineering by Khurmi, Gupta, K Chand Publications.
5. Applied Thermodynamics by P.K.Nag, Mc Graw Hill Education (India) Pvt Ltd.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181502	Machine Design - I	3-0-2	4

Course Outcomes: On successful completion of the course, the student will be able to:

CO1. Describe the design process, material selection, calculation of stresses and stress concentrations under variable loading. Know different types of Mechanical Failures, different Modes of failure and different theories of failure.

CO2. Design and Analyze bolted joints, standardization, Design different types of riveted joints for various Engineering applications like structural joints, boiler joints etc, Design various types of Welded Joints

CO3. Design solid and hollow shafts for different design considerations, Design of Cotter and Knuckle joints for Alternating/Tensile loads

CO4. Differentiate between rigid and flexible couplings, Design Rigid Couplings and checks against failure,

CO5. Design Belt Drive, Rope Drive and Chain Drive, Applications of these drives in Industry

MODULE 1:
Introduction, General considerations and procedure for designing, types of Loads, Designed stress and factor of safety, stress concentration, selection of materials, codes for design-BIS codes, Modes of Failure, Failure theories, Fits and Tolerance.

MODULE 2: Joints
a) Detachable joints: Design of threaded fasteners, thread forms and threaded fastener types and materials, bold tightening and initial tension, Power screws.
b) Permanent Joints: Design of Riveted joints and welded joints – eccentric loading.

MODULE 3: Shafting
Design of shaft subjected to bending, torsion, axial and combined loading
Keys, Cotter and Knuckle joint

MODULE 4: Coupling
Rigid and Flexible coupling.

MODULE 5: Power Transmission Elements:
Belt and Chain Drives, design of Flat and V-belts.

Textbooks/ Reference Books:

1. Machine Design by Black and Adams (TMH)
2. Design of machine elements by M F Spott
3. Design of machine elements by B V Bhandari (TMH)
4. Machine Design by Hall
5. Machine Design by Khurmi and Gupta
6. Machine Design by Bahl and Goel
7. 7. Machine Design by Shigley

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181503	**Mechanisms and Dynamics of Machines**	**3-0-2**	**4**

Course Outcomes (COs) are:

CO1: To illustrate Kinematic analysis of plane motion graphically and analytically and to draw velocity and acceleration diagram; to understand the concept of Coriolis acceleration used in solving problems in kinematics.

CO2: To synthesize mechanisms to generate the desired motions by combination of different machine elements using analytical and graphical approaches.

CO3: To understand different types of mechanisms used in engineering applications and their working principles.

CO4: To estimate gyroscopic action in certain machine elements using principle of gyroscope and their practical applications.

CO5: To analyze balancing of rotating and reciprocating masses, single and multi-cylinder engines, importance of firing order and study of balancing instruments

MODULE 1: Kinematic Analysis of Plane Motion

Velocity diagram, Acceleration diagram, Coriolis component of acceleration, Analytical method of kinematic analysis.

MODULE 2: Kinematic Synthesis of Linkages

Introduction, number synthesis, basic features, analytical methods, graphical methods.

MODULE 3: Mechanisms

Mechanism, Mobility, Inversion, Test for 4 bar mechanism by Grashoff's law, Straight line mechanism, Oscillatory mechanism, Quick return mechanism, Steering mechanism, Spatial mechanism – Hook's joints.

MODULE 4: Gyroscopic Action in Machines

Gyroscopic action and force, method of analysis, Gyroscopic action in certain machine elements, use of gyroscopic principles in instruments.

MODULE 5: Balancing

Balancing of rotating masses, two plane balancing, balancing of reciprocating masses, Graphical solution, balancing of single cylinder and multi-cylinder engines, firing order, Balancing of rotors, Field balancing, Balancing instruments.

Textbooks/ Reference Books:

1. Theory of Machines: Kinematics and Dynamics by Sadhu Singh, Pearson
2. Theory of Machines by V P Singh, Dhanpat Rai & Co
3. Theory of Machine By Rattan, Tata McGraw Hill

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181504	**Heat Transfer - I**	**3-0-0**	**3**

Course Outcomes: At the completion of the course the student will be able:
CO1: Classify the various modes of heat transfer processes and discuss their applications.
CO2: Define various terms related to heat and mass transfer specifically Diffusion.
CO3: Discuss the mechanisms of heat transfer under steady and transient conditions and describe various examples.
CO4: Choose suitable methodology for solving wide variety of practical heat transfer problems involving Conduction and Radiation heat transfer.
CO5: Design various heat transfer systems such as Fins, Radiation shields and define related parameters.

MODULE 1: Introduction: Concept of Modes of Heat Transfer

Conduction Heat Transfer: General 3-D differential equation for heat conduction, Boundary conditions and their types.

MODULE 2: One Dimensional Steady State Heat Conduction

System with or without heat generation: slab, cylinder, sphere, Concept of thermal resistance and electrical analogy, Variable thermal resistance and electrical analogy, Composite systems: slab, co-axial cylinder, concentric sphere, Critical radius of insulation, Fins.

One Dimensional Unsteady State Heat Conduction: Lumped system analysis, Response time of a temperature measuring instrument, Mixed boundary condition.

MODULE 3: Radiation Heat Transfer

Nature of thermal radiation, emissive power, Absorption, Reflection and Transmission, Concept of a black body, Intensity of radiation, Laws of black body radiation, Radiation to and from real surfaces.

MODULE 4: 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.

MODULE 5: 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.

Textbooks/ Reference Books:

1. A basic approach to heat transfer – by M N Ožišik, McGow Hills.
2. Fundamentals for heat transfer – by Sachdeva, Wiley Eastern.
3. Heat transfer, by P.S. Ghoshdastidar, Oxford University Press

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181505	**Engineering Inspection and Metrology**	**3-0-0**	**3**

Course Outcomes (CO): At the completion of the course the student will be able:
CO1: To apply proper instruments for dimensional measurements according to level of precision.
CO2: To apply necessary standards for obtaining desired fit and design appropriate limit gauges.
CO3: To develop analytical and experimental techniques for precise measurement of thread and gear parameters.
CO4: To design appropriate control charts for statistical process control.
CO5: To estimate texture of machined surface by stylus equipment and optical interferometry.

MODULE 1: Introductory Concept
(a) Meaning of engineering metrology. Precision, Accuracy, Sources of errors in measurement.
(b) Meaning of engineering inspection, types of inspection, merit/demerit of 100% inspection.
(c) Sampling inspection – Representative sample.
Standards of measurement and sub-division of standards.

MODULE 2: Statistical Process Control
(a) Dimensional variations during manufacture, Chance causes and Assignable causes.
(b) Control chart and its significance in statistical process control, Meaning of process under statistical control. Examples of control charts.
(c) Computer implementation of control charts.

MODULE 3: Tolerance, Limits of Size and Fits
(a) Concept of tolerance, allowance and clearance
(b) Natural tolerance limits, Process capability and Specification limits.
(c) Hole and shaft basis systems of specifying limits of size and tolerances.
(d) Indian Standard for fits and tolerances.
(e) Limit gauges – Meaning of gauge, Taylor's principle of limit gauging, Design of hole/ring gauge and plug gauge and their use, Type I and Type II statistical errors.
(f) Interchangeability – its importance in production, techniques of achieving interchangeability during manufacture of industrial products.
Comparators – Features of comparators, classification of comparators, different comparators and their uses in mass production.

MODULE 4: Tool Room Measuring Instruments
Vernier Calliper, Micrometer screw gauge, Height gauge, Depth gauge, V blocks, Straight edges, Radius gauge, Feeler gauge, Wire gauge, Thread pitch gauge, Bevel protractor, Combination set, Bore gauge, Sine bar and slip gauges, Dial indicator with magnetic base, Surface plate, Profile projector (PP), Tool maker's microscope (TMM), Diameter measuring machine (DMM) and Coordinate measuring machine (CMM): Types of CMM, Role of CMM, and applications of CMM.

MODULE 5: Measurement of Screw Threads

(a) Parameters for measurement of screw threads.
(b) Measurement of various parameters of screw thread such as diameter, thread angle, effective diameter and pitch.
(c) Use of screw thread micrometer and Thread pitch gauge
(d) One wire, Two wire and Three wire methods.
(e) Use of TMM, PP, DMM in thread measurement.

MODULE 6: Measurement of Gears

(a) Profile of gear tooth and Involute function.
(b) Spur gear measurements by functional and analytical tests. Parkson gear tester.
(c) Measurement of tooth thickness – chordal thickness method, constant chord method, base tangent method.
(d) Check for pitch circle diameter and tooth spacing.

MODULE 7: Surface Texture

(a) Meaning of surface texture, Elements of surface texture.
(b) Meaning of roughness and Waviness.
(c) Roughness width cut-off (Sampling length) and its significance
(d) Representation of surface roughness.
(e) Procedure of estimation of surface roughness.
(f) Measurement of surface roughness by stylus equipment.

MODULE 8: Interferometry

(a) Condition for constructive and destructive interference of monochromatic light waves.
(b) Sources of monochromatic light for lab use.
(c) Use of optical flat.
(d) Principle of Gauge length interferometer and Laser interferometer.

MODULE 9: Alignment Testing

(a) Optical methods for alignment testing
(b) Laser alignment testing.
(c) Alignment tests on machine tools

Textbooks:

1. Metrology and Measurement, Anand Bewoor, Vinay A. Kulkarni, TMH
2. Engineering metrology – M Mahajan
3. Engineering Metrology – R K Jain
4. Dimensional metrology – M K Khare and S Vajpayee, OXFORD-IBH Publishers

Reference Books:

1. Handbook of industrial metrology – ASTME publication
2. Engineering Metrology – K J Hume, Published by Macdonald & Co.(1968)
3. Practical Engineering Metrology – K W B Sharp, Sir Isaac Pitman & Sons
4. Engineering Precision measurements – A W Judge, Chapman and Hall publishing (1957)
5. Dimensional Metrology – L Miller,Edward Arnold publishing Co
6. Precision Measurements – Jack Johnson – Pitman publishing Co.

Course Code	Course Title	Hours per week L-T-P	Credit C
HS181506	**Engineering Economics**	**3-0-0**	**3**

Course Outcomes (COs):

The students will be able to

1. Acquire knowledge about economics its nature, scope and importance.
2. Understand the economic laws, principles, and theories and their relevance in present day situation.
3. Develop the ability of critical thinking to meet the challenges at the national and global problems.
4. Apply knowledge in finding out socio-economic problems and appropriate measures to deal with them.
5. Equip students with vital knowledge to run government and non-government institutions and bodies.
6. Assemble knowledge which is vital for industry and research and evolve proper policy for economic development.

MODULE 1: Introduction to Economics (3 Lectures)
Meaning and Definition of Economics, Nature and Scope of Economics, Concept of Micro and Macro Economics.

MODULE 2: Utility Analysis (3 Lectures)
Meaning of Utility, Utility Function, Consumers Equilibrium, Concept of Indifference Curve, properties of Indifference Curve, Equilibrium under Indifference Curve.

MODULE 3: Demand and Supply Analysis (4 Lectures)
Law of Demand, Demand Function, Elasticity of Demand, Types of Elasticity of Demand, Measurement of Elasticity of Demand, Demand Forecasting, , Law of Supply, Supply Function.

MODULE 4: Revenue, Production & Cost Analysis (4 Lectures)
Average, Marginal and Total Revenue, Revenue Function, Average, Marginal and Total Cost, Cost Function, Short and Long Run Cost Curves. Break Even Point, Managerial Uses of Cost Function, Cobb Douglas Production Function.

MODULE 5 : Market Structure (4 Lectures)
Concept of Market, Price-Output Determination under Perfect Competition, Monopoly Market and Monopolistic Competition.

MODULE 6 : Money, Banking and National Income (8 Lectures)
Definition of Money, Function of Money, Index Numbers, Construction of Index Numbers, value of Money, Causes of Inflation, Functions of Commercial and central bank, Central bank and its monetary policy, Money Market and Capital Market, Functions of Stock exchange, Concept of National Income, Measurement of National Income, Concept of Investment.

MODULE 7: Introduction to Environmental Economics (5 Lectures)
Concept of Environmental Economics, Cost -Benefit Analysis, Social Cost, Externalities, Concept of Pareto Equilibrium, Externality, Market Failure.

MODULE 8: Public Finance (3 Lectures)
Introduction to Public Finance, Concept of Budget, Types of Budget, Budget Receipts, Concept of Goods and services Tax (GST).

Textbooks/Reference Books:

1. Managerial Economics by V. Agarwal: Pearson Pvt. Limited, New Delhi.
2. Engineering Economics by Dr. A. Ahmed & G. Begum: Chandra prakash, Guwahati
3. Principles of Engineering Economics with Application by Dr. Z. A. Khan, A. N. Siddiquee, B. Kumar, M. H. Abidi: Cambridge University Press.
4. Public Finance and Public Policy by Dr. R. K Choudhury: Kalayani publishers .
5. Quantitative Methods for Economics by R. Veerachamy: New Age International Publication Ltd.
6. Micro and Macro Economics by Dr. M. L. Seth: Educational Publishers , Agra -3
7. A Koutsoyiannis: Modern Microeconomics
8. Environmental Economics by R. N. Bhattacharya: Oxford Publication.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181514	**Heat Transfer – I Lab**	**0-0-2**	**1**

Course Outcomes: After successful completion of the course, the student will be able to:

CO1: Estimate physical properties like thermal conductivity of different liquids and solids and compare its variation.

CO2: Demonstrate the pin-fin apparatus, draw the temperature curve and predict its efficiency and deduce the practical applications of a fin.

CO3: Conduct experimental research in radiation heat transfer and determine various related parameters specifically Stefan-Boltzmann constant and Emissivity of solid surface.

List of Experiments

Experiments on Conduction

1. Determination of thermal conductivity of guarded hot plate
2. Determination of thermal conductivity of liquid
3. Determination of thermal conductivity of insulating powder
4. Study of temperature distribution in a pin-fin
5. Experimentation with unsteady heat transfer apparatus

Experiments on Radiation

1. Determination of stefan boltzmann constant
2. Determination of emissivity of the test plate surface at various temperatures

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181515	**Engineering Inspection and Metrology Lab**	**0-0-2**	**1**

Course Outcomes (CO): At the completion of the course the student will be able:

CO1: To apply proper instruments for dimensional measurement according to level of precision.

CO2: To utilize setting gauge for calibration of instrument during precision measurement.

CO3: To apply necessary tolerances on limit gauges for quality control.

CO4: To compare results of theoretical analysis with practical measurement in threads and gears.

CO5: To estimate precisely surface roughness of machined surface texture

LIST OF EXPERIMENTS

(*to select experiments from the list and add similar experiments to address the COs*)

1. To use vernier caliper and standard setting gauge for precision measurement.
2. To use micrometer screw gauge to measure major diameter and minor diameter of thread
3. To measure the height of an object by using height gauge
4. To measure the depth of a hollow cylinder by using depth gauge
5. To measure the internal diameter of a hollow cylinder by using bore gauge
6. To use feeler gauge to set clearance between mating parts
7. To use radius gauge to check the radius of a fillet
8. To use plug gauge/ring gauge/snap gauge as GO/NOGO gauge
9. To use dial indicator as comparator
10. To use thread pitch gauge to estimate the pitch of screw thread
11. To use screw thread micrometer to estimate effective diameter of screw thread
12. To use standard wire method to estimate effective diameter of screw thread
13. To use profile projector in measuring linear and angular dimensions of engineering components
14. To use Tool Maker's Microscope for linear and angular measurements
15. To use bevel protractor for angular measurement
16. To use gear tooth vernier caliper in the measurement of spur gear parameters
17. To estimate roughness of a machined surface by surface roughness testing instrument.

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