



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati
Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH
MECHANICAL ENGINEERING
3rd SEMESTER



ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure (From Academic Session 2018-19 onwards)

B.Tech 3rd Semester: Mechanical Engineering

Semester III/B.TECH/ME

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MA181301A	Mathematics III-A (for branches other than CSE and ECE/ETE)	2	1	0	3	30	70
2	EE181302	Electrical Technology	3	0	2	4	30	70
3	ME181303	Basic Thermodynamics	3	0	2	4	30	70
4	ME181304	Theory of Machines	3	0	0	3	30	70
5	ME181305	Machine and Assembly Drawing	2	0	2	3	30	70
6	MC181306	Constitution of India	2	0	0	0 (PP/NP)	-	100
Practical								
1	ME181314	Theory of Machines Lab	0	0	2	1	15	35
2	SI181321	Internship-I (SAI - Social)	0	0	0	1	-	100
TOTAL			15	1	8	19	165	585
Total Contact Hours per week : 24								
Total Credits: 19								

N.B. MC181306 is a Mandatory Audit Course (No Credit). It will be evaluated as PP (Pass) or NP (Not Pass)

Detailed Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
MA181301A	Mathematics III-A (for branches other than CSE and ECE/ETE)	2-1-0	3

MODULE 1: Partial Differential Equation: (15 Hours)

Formation of Partial Differential equations, Linear partial differential equation of first order, Non-linear partial differential equations of first order, Charpit's method, Method of separation of variables, boundary value problem with reference to the one dimensional heat and wave equation.

MODULE 2: Probability Theory: (15 Hours)

Review of basic probability and Bayes' theorem, Probability distribution, Binomial, Poisson and normal distribution, Joint distribution, Test of significance, fitting of straight line by least square method, Elementary concept of Markov Chain.

MODULE 3: Laplace Transform: (10 Hours)

Laplace transform of elementary function, Properties of Laplace transform, inverse Laplace transform, convolution theorem, Solution of ordinary differential equations with the help of Laplace transform.

Textbooks/References:

1. Advanced Engineering Mathematics: Erwin Kreyszig
2. Higher Engineering Mathematics: B V Ramana
3. Theory and problems of Probability: Seymour Lipschutz
4. A text book of engineering Mathematics: N. P. Bali & M. Goel
5. Statistical Methods: An Introductory Text- J. Medhi, New Age International Publishers

Course Code	Course Title	Hours per week L-T-P	Credit C
EE181302	Electrical Technology	3-0-2	4

COURSE OVERVIEW:

The purpose of the course is to teach principles of AC and DC motors and generators, and AC transformers and how they work. Basic concepts of electromagnetic circuits as they relate to voltages, currents, and physical forces induced in conductors are covered, including application to practical problems of machine design. It also includes the study of alternators, synchronous motors, poly phase induction motors and single-phase motors.

Course Objectives

1. Student will be taught the working principle of electric motors/ generators and transformer based upon fundamental theories after getting detailed knowledge of construction, operating principles.
2. Student will be benefited by acquiring knowledge of construction, operating principles of induction motors and can analyze performance parameters of single as well as three phase induction motors.
3. Students will understand the working principle and behavior of synchronous machines along with various area of applications.
4. Students will get the knowledge of power measuring instruments along with their errors.

Motivation:

The objective is to motivate the students in learning electrical machines and strengthening knowledge towards practical work.

Course Outcome (CO):

After the successful completion of the course student should be able to:

CO1: Apply knowledge to relate the constructional details with the performance analysis of DC machine.

CO2: Articulate the concept of 1 phase transformer and complete an analysis.

CO3: Analyze and differentiate the working principle of 3 phase and 1 phase Induction Motor along with various areas of applications.

CO4: Apply knowledge on operation of synchronous machines and analyze variation of excitation with power factor under different loading conditions.

CO5: Analyze the performance of the measuring instruments and identify their errors.

MODULE 1: D C Machines:

- i. Basic Constructional features, E M F equation of D C generator, Elementary Idea of DC machine winding-winding pitch, Lap and Wave windings. Types of generators. Characteristics of DC generator-the OCC and the load characteristics. The shunt generator-condition for voltage builds up. Load characteristics. Losses in a DC generator, Efficiency, Applications, Compound generators
- ii. Working principle of DC motor. Back EMF, Calculation of torque and power. Types of DC motors. Characteristics curves. Losses and Efficiency. Speed equation. Method of speed control. Method of starting. The 3 point, 4-point starter (calculations of the star resistors not required)

MODULE 2: Transformer:

Physical description of transformer. Elementary theory of the ideal transformer, EMF equation, Voltage and current transformation ratio. No load and load phasor diagrams. Transformer reactance and impedances. Equivalent resistance & reactance. Simplified equivalent circuit, open and short ckt tests. Losses and efficiency. Condition for maximum efficiency. All day efficiency. Voltage regulation. The auto transformer, basic working principle.

MODULE 3: Induction motor:

Constructional features of 3-ph induction motor-principle of rotating magnetic field (mathematical treatment not required) Principle of operation of the 3-ph induction motor speed. Rotor emf, current and rotor cu loss, Torque, Starting torque. Maximum torque. Condition for maximum torque. Torque slip curves. Necessity of a starter. Methods of starting of squirrel cage and the slip-ring induction motors.

Introduction to single phase induction motor. Nature of a field and torque produced in single phase induction motors (details of double revolving field not required). Types of motors-split phase, capacitors motors.

MODULE 4: A.C. Synchronous machines:

Principle of operation of alternators. Constructional features of cylindrical generators and salient pole alternator, EMF equation.

Principle of operation of the synchronous motor, Synchronous motor on no load, Synchronous motor on load, Behaviour of the Synchronous motor with change of excitation curves. Starting methods of Synchronous Motor. Application of Synchronous motor.

MODULE 5: Measuring Instruments:

Dynamometer type wattmeter. Induction type wattmeter. Single phase induction type energy meter. Errors and compensations.

Textbooks/References:

1. Theraja: A Text book of Electrical Technology.
2. K. Krishna Reddy: Electrical Machines-I, II, III
3. Electrical Technology: Vaidya, Bhagwat, God bole
4. Kothari D.P., and Nagrath, I.J., 'Electrical Machines', Tata McGraw Hill
5. Electrical Measurements and Measuring Instruments – A.K. Shawney (Dhanpat Rai)
6. Langsdorf: 'Theory of Alternating Current Machines' Tata McGraw Hill
7. Kingsley, Fitzereld: Electric Machinery (McGraw Hill)
8. Ashfaq Husain, Electric Machines, Dhanpat Rai

Suggested Practical:

Course Objectives:

The Electrical Technology Laboratory is designed to provide the students with the practical knowledge of electrical machines specifically keeping in view the following objectives:

- i. to get hands-on experience in performing the basic tests on electrical machines
- ii. to reinforce the theoretical concepts with related practical understanding
- iii. to know about the various precautionary measures necessary in handling electrical machines
- iv. to develop technical report writing skill

Course Outcome (CO):

CO1: Students will be able to apply knowledge on operation of electrical machines (DC motor/generator, transformers) and relate theoretical concepts with experimentation.

CO2: Students will be familiar with the mode of starting, switching-off, and taking pre- cautionary measures while handling electrical machines.

CO3: Students will be able to write effective reports and design documentation after performing an experiment.

LIST OF EXPERIMENTS

1. Open circuit characteristic of a dc generator.
2. Load test on a dc shunt generator.
3. Speed control of dc shunt motor.
4. Open circuit and short circuit test on a single phase transformer
5. Load test on a single phase transformer.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181303	Basic Thermodynamics	3-0-2	4

Objective:

- To impart knowledge on the laws of thermodynamics and their application along with the knowledge of various cycles.
- To give an idea on the mechanism behind the working of different cycles and to develop the ability to analyze and solve problems related with thermodynamics
- To provide the exposure to fuel and combustion to solve a wide variety of engineering problem.

Motivation:

The knowledge of Basic Thermodynamics has wide application in mechanical engineering. All natural processes are governed by the principles of thermodynamics. Automotive engines, Turbines, Compressors, Pumps, Fossil and Nuclear Power Plants, Propulsion systems for the Aircrafts, Separation and Liquefaction Plant, Refrigeration, Air-conditioning and Heating Devices are some of the engineering devices which are typically designed based on the principles of thermodynamics.

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

CO1: Illustrate the basic concepts of thermodynamics and its approaches for conversion of heat and work.

CO2: Apply the laws of thermodynamics in steady flow processes in devices, namely nozzles and diffusers, turbines and compressors, throttle device, water turbine, heat exchangers, for energy conversion and employ the concept of irreversibility.

CO3: Relate through diagrams properties of steam for suitable application in the field of energy conversion

CO4: Illustrate graphically and analytically the working of air standard cycles applied in internal combustion engines, namely, Otto cycle, diesel cycle, dual cycle.

CO5: Examine the various properties of fuel through various experiments to determine their suitability for combustion applications.

MODULE 1: System and Continuum:

Intensive and Extensive properties – Thermodynamic state, pressure, energy, work and heat – process and cycle – Macroscopic and Microscopic points of view – Kinetic theory of gases

MODULE 2: Laws of thermodynamics:

Zeroth law – Concept of equilibrium– Principles of therm. Fixed points. First law of thermodynamics and its application to open and closed systems Concept of internal energy – Steady flow energy equation – Processes of closed systems. Second law of thermodynamics – Various statements – Carnot cycle – Irreversible and Reversible processes – Thermodynamic efficiency and temperature scales – Concept of entropy – Entropy changes in various processes.

MODULE 3: Properties of steam:

Latent heat – Saturation pressure and temperature – Dryness fraction – Degree of superheat – Total heat; Rankine cycles (use of steam tables, Mollier chart and other property diagrams).

MODULE 4: Air standard cycles:

Otto, Diesel and dual cycles. Principles of working of two and four stroke SI and CI engines – Representations of processes on T-s and p-v diagrams and comparisons of efficiencies.

MODULE 5: Fuels and Combustions:

Classification of fuels; HCV, LCV, Bomb Calorimeter, Boy's gas calorimeter; Combustion of fuels; Minimum air required (by weight and by volume); Conversion of volumetric analysis into weight analysis and vice versa; excess air and Orsat apparatus.

Textbooks/References:

1. Engineering thermodynamics by P K Nag
2. Fundamentals of Thermodynamics by Cengel and Boles

Practical:**Objective:**

- i. To impart knowledge on the basic thermodynamic properties.
- ii. To give the idea of different types of boilers and its mounting and accessories.
- iii. To give the idea of practical knowledge of two stroke and four stroke engines and their thermodynamic cycles.

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

CO1: Understand the basic concept of thermodynamic properties such as temperature and pressure

CO2: Understand the basic differences of different types of boilers, from the study of cut models, such as vertical tube boiler, Cochran boiler together with their mountings.

CO3: Understand the working principles of Internal Combustion Engines, from the study of cut models, such as 2 stroke and 4 stroke petrol engine, 4 stroke diesel engine

LIST OF EXPERIMENTS

1. To study thermodynamic properties such as temperature and pressure in different condition with thermometer and pressure gauge.
2. To study the mountings and accessories of boilers like vertical tube boiler and Cochran boiler with the help of cut models.
3. To study the working principle of Internal Combustion Engines such as 2 stroke and 4 stroke Petrol Engine and 4 stroke Diesel Engine with the cut models.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181304	Theory of Machines	3-0-0	3

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

CO1: Analyze the kinematic analysis of a given mechanism.

CO2: Analyze the motion and dynamic forces acting on mechanical motion transmitting element composed of gears, belts, cams

CO3: Apply the concept of mechanical control mechanism to reduce fluctuation of speed and energy.

CO4: Apply the fundamental principles of friction for effective transmission of power and intermittent control of speed.

CO5: Apply the concept of theory of machine in mechanical engineering system for appropriate transmission power and motion.

MODULE 1: SIMPLE MECHANISMS

Link, Pair, chain, mechanism and inversions. Simple mechanism, Slider crank, four bar, straight line steering. Simple velocity and acceleration diagrams,

MODULE 2: GOVERNOR

Watt and Porter governors. Spring controlled centrifugal governor – Hartnell, Hartung, Wilson – Hartnell, Inertia governors. Stability, Effects of friction, Isochronism, Hunting, effort and power.

MODULE 3: CAM

Introduction, classification of cams and followers, Displacement diagram, graphical layout of cam profiles

MODULE 4: FRICTION AND FRICTION DRIVES

Types of friction, Uniform Pressure and Uniform Wear, Friction Clutches, Rolling Friction, Flat Belt, V Belt and Rope Drives, Velocity Ratio in Belt Drives, Law of Belting, Ratio of Friction Tensions in Belts, Power Transmitted by Belts and Ropes, Maximum Power Transmission by Belt, Types of Brakes, Block and Shoe Brake, Band Brake, Internal Expanding Shoe Brake, dynamometer

MODULE 5: TM DIAGRAM AND FLYWHEEL

Fluctuations of energy, Co-efficient of fluctuation of energy and speed, function of flywheel.

MODULE 6: GEAR AND GEAR TRAIN Nomenclature, types – simple, compound, epicyclic gear train including reverted gear train. Simple description of automobile gear train.

Textbooks/References:

1. Ratan, S.S., Theory of Machines, Tata McGraw Hill Publishing company Ltd., 2nd Edition, 2005.
2. Singh Sadhu, Theory of Machine, Pearson Education
3. Singh V.P., Theory of Machines

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181305	Machine and Assembly Drawing	2-0-2	3

Objective:

- To impart knowledge on various basic mechanical parts and its construction.
- To give an idea on functioning of the parts
- To proffer knowledge on assembling of the parts of engine and valves

Motivation:

This is a very basic subject which will improve the visualization skill for evolving mechanical parts. It will also provide the knowledge on how the various mechanical parts are to be built by assembling some small elementary parts. Knowledge of the subject will also furnish the better understanding of machine design, workshop theory, theory of machine and IC engine to the students.

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

CO1: Illustrate and draw the profiles of thread and locking devices such as nuts and bolts

CO2: Sketch various joints-key and cotter joints, riveted joints, welded joints, coupling, pipe joints as well as machine elements.

CO3: Assemble basic engine parts and components such as piston, staffing box, cross head, connecting rod, eccentric

CO4: Assemble elementary mechanical parts to construct valve like feed check valve, stop valve, blow off cock, non-return valve.

CO5: Develop solid models of various machine elements in CAD.

MODULE 1: Screw Fasteners:

Introduction, Screw Thread Nomenclature, Forms of Thread, Thread Profiles- V-Thread, Buttress Thread, British Standard with worth (B.S.W) Thread, Square Thread ACME Thread, Worm Thread, Thread designation, Multistart Thread, left hand thread, right hand thread, Locking devices for nuts, Different types of bolts and nuts.

MODULE 2: Key Cotter and Pin Joints:

Introduction, Saddle Key, Sunk Key, Cotter Joint with Sleeve, Cotter Joint with Socket and Spigot Ends, Cotter Joint with a Gib, Pin Joints-Knuckle joints.

MODULE 3: Riveted and Welded Joints:

Introduction, Rivets and Riveting, Rivet heads, Definitions-Pitch, Margin, Chain Riveting, Zig-Zag Riveting, welded joints and Symbols, Dimensioning of welds, Edge preparation of Welds.

MODULE 4: Coupling and pipe joints:

Introduction, Rigid Coupling-Flanged Coupling, Sleeve or Muff Coupling, Flexible Coupling – Bushed pin type Flanged Coupling, Pipe Joints- Flanged join, Hydraulic Joints.

MODULE 5: Assembly Drawings:

- a) Engine Parts: Stuffing Box, Crosshead, Connecting Rod, Eccentric, Piston
- b) Valves: Stop Valve, Feed Check Valve, blow off Cock, Non Return Valve

MODULE 6: Computer Aided Drafting:

2D Drawing, Solid Modeling

Textbooks/References:

1. Machine Design by N.D Bhatt
2. Machine Design by K.L. Narayan

Course Code	Course Title	Hours per week L-T-P	Credit C
MC181306	Constitution of India	2-0-0	0

Course Objectives: Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

MODULE 1: History of Making of the Indian Constitution:

- a) History
- b) Drafting Committee, (Composition & Working)

MODULE 2: Philosophy of the Indian Constitution:

- a) Preamble
- b) Salient Features

MODULE 3: Contours of Constitutional Rights & Duties:

- a) Fundamental Rights
- b) Right to Equality
- c) Right to Freedom
- d) Right against Exploitation
- e) Right to Freedom of Religion
- f) Cultural and Educational Rights
- g) Right to Constitutional Remedies □ Directive Principles of State Policy □ Fundamental Duties.

MODULE 4: Organs of Governance:

- a) Parliament
- b) Composition
- c) Qualifications and Disqualifications

- d) Powers and Functions
- e) Executive
- f) President
- g) Governor
- h) Council of Ministers
- i) Judiciary, Appointment and Transfer of Judges, Qualifications
- j) Powers and Functions

MODULE 5: Local Administration:

- a) District's Administration head: Role and Importance,
- b) Municipalities: Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation.
- c) Pachayati raj: Introduction, PRI: Zila Pachayat.
- d) Elected officials and their roles, CEO Zila Pachayat: Position and role.
- e) Block level: Organizational Hierarchy (Different departments),
- f) Village level: Role of Elected and Appointed officials,
- g) Importance of grass root democracy

MODULE 6: Election Commission:

- a) Election Commission: Role and Functioning.
- b) Chief Election Commissioner and Election Commissioners.
- c) State Election Commission: Role and Functioning.
- d) Institute and Bodies for the welfare of SC/ST/OBC and women.

Textbooks/References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181314	Theory of Machines Lab	0-0-2	1

Course Outcomes (CO): At the completion of the lab, the student will be able to

CO1: Compare analytical results with observed results and infer the cause of variation.

CO2: Determine the stability characteristics of governor for appropriate selection in future engineering applications

CO3: Apply the concept of dynamometer for power measurement.

CO4: Identify appropriate cam for engineering applications.

LIST OF EXPERIMENTS

1. Study of slider crank mechanism
2. Study of gear trains
3. Analysis of porter governor
4. To determine the co-efficient of friction between belt & pulley
5. Power measurement using the principle of dynamometer
6. Cam analysis
