Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Curriculum Structure

Semester III (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Basic Science Courses	BS-M 301	Mathematics III (PDE, Probability & Statistics)	3	1	0	4	4
2	Basic Science Courses	BS-BIO 301	Biology	3	0	0	3	3
3	Engineering Science Courses	ES-ECE 301	Basic Electronics Engineering	3	0	0	3	3
4	Engineering Science Courses	ES-AUE 301	Engineering Mechanics	3	1	0	4	4
5	Professional Core Courses	PC-AUE 301	Applied Thermodynamics	3	1	0	4	4
6	Professional Core Courses	PC-AUE 302	Manufacturing Methods	4	0	0	4	4
7	Professional Core Courses	PC-AUE 391	Machine Drawing	0	0	3	3	1.5
			Total	**19**	**3**	**3**	**25**	**23.5**

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Semester IV (Second year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Engineering Science Courses	ES-AUE 401	Materials Engineering	3	0	0	3	3
2	Professional Core Courses	PC-AUE 401	Strength of Materials	3	1	0	4	4
3	Professional Core Courses	PC-AUE 402	Fluid Mechanics & Hydraulic Machines	4	0	0	4	4
4	Professional Core Courses	PC-AUE 403	Theory of Machine	3	1	0	4	4
5	Professional Core Courses	PC-AUE 404	Metrology & Instrumentation	3	0	0	3	3
7	Professional Core Courses	PC-AUE 491	Manufacturing & Testing Lab	0	0	3	3	1.5
8	Mandatory Courses	MC-401	Environmental Science	2	-	-	2	0
			Total	**18**	**2**	**3**	**23**	**19.5**

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Semester V (Third year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Professional Core Courses	PC-AUE 501	Automotive Engines	3	0	0	3	3
2	Professional Core Courses	PC-AUE 502	Automotive Body & Chassis Engineering	3	0	0	3	3
3	Professional Core Courses	PC-AUE 503	Heat Transfer	3	1	0	4	4
4	Professional Core Courses	PC-AUE 504	Design of Machine Element	3	1	0	4	4
5	Humanities and Social Sciences including Management Courses	HSMC (OEL I)-HM-HU 511A-511B	Humanities I	3	0	0	3	3
6	Professional Core Courses	PC-AUE 591	Fluid Mechanics & Heat Transfer Lab	0	0	3	3	1.5
7	Professional Core Courses	PC-AUE 592	Automobile Engineering Lab I (Engine & Chassis Component Lab)	0	0	3	3	1.5
8	Professional Core Courses	PC-AUE 593	Automobile Engineering Lab II (ETPM Lab)	0	0	3	3	1.5
9	Project (Mini Project)	PW-AUE 581	Project - I	0	0	0	(30 hrs total)	1
Total				**15**	**2**	**9**	**26**	**22.5**

HSMC (OEL I)

HM-HU 511A: Values & Ethics

HM-HU 511B: Education Technology & Society

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Semester VI (Third year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Professional Core Courses	PC-AUE 601	Automotive Transmission	3	0	0	3	3
2	Professional Core Courses	PC-AUE 602	Hybrid & Electric Vehicles	3	0	0	3	3
3	Professional Elective Courses	PE-AUE 611A-611B	Elective - I	3	0	0	3	3
4	Humanities and Social Sciences including Management courses	HM-HU 611A-611B	(Humanities-II)	3	0	0	3	3
5	Professional Core Courses	PC-AUE 691	Automobile Engineering Lab III (Automotive Design Lab) (Catia/ Creo etc.)	0	0	3	3	1.5
6	Professional Core Courses	PC-AUE 692	Automobile Engineering Lab IV (Vehicle Maintenance Lab)	0	0	3	3	1.5
9	Mandatory Courses	MC-III	Essence of Indian Traditional Knowledge	1	0	0	1	0
7	Project (Summer Internship)	PW-AUE 681	Project - II	0	0	0	90 hrs	3
			Total	**13**	**0**	**6**	**19**	**18**

PE-AUE 611A: Electronic Vehicle Management System
PE-AUE 611B: Transport Management & Motor Vehicles Act

HM-HU 611A: Introduction to Industrial Management
HM-HU 611B: Quantitative Methods for Decision Making

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Semester VII (Fourth year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Professional Core Courses	PC-AUE 701	Vehicle Dynamics	3	0	0	3	3
2	Professional Elective Courses	PE-AUE 711A-711B	Elective – II	3	0	0	3	3
3	Professional Elective Courses	PE-AUE 712A-712B	Elective – III	3	0	0	3	3
4	Open Elective Courses	OE-AUE 711A-711C	Open Elective – I	3	0	0	3	3
5	Humanities and Social Sciences including Management courses	HM-HU 701	Economics for Engineers	2	0	0	2	2
5	Professional Core Courses	PC-AUE 791	Automobile Engineering Lab V (Automotive Electrical & Electronics Lab)	0	0	3	3	1.5
6	Project	PW-AUE 781	Project - III	0	0	6	6	3
			Total	**14**	**0**	**9**	**23**	**18.5**

PE-AUE 711A: Alternate Fuels and Energy Systems
PE-AUE 711B: CAD/CAM and Modern Manufacturing Methods

PE-AUE 712A: Automotive Component & System Design
PE-AUE 712B: Two and Three Wheelers

OE-AUE 711A: Quality Control & Reliability Engineering
OE-AUE 711B: Machine Learning
OE-AUE 711C: Cloud Computing

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Semester VIII (Fourth year)

Sl. No.	Category	Code	Course Title	Hours per week			Total contact hours	Credits
				Lecture	Tutorial	Practical		
1	Professional Elective Courses	PE-AUE 811A-811B	Elective - IV	3	0	0	3	3
2	Professional Elective Courses	PE-AUE 812A-812C	Elective - V	3	0	0	3	3
3	Open Elective Courses	OE-AUE 811A-811C	Open Elective - II	3	0	0	3	3
4	Open Elective Courses	OE-AUE 812A-812C	Open Elective - III	3	0	0	3	3
5	Professional Core Courses	PC-AUE 881	Comprehensive viva voce	0	0	0	0	2
6	Project	PROJ-AUE 882	Project - IV	0	0	12	12	6
			Total	**12**	**0**	**12**	**24**	**20**

PE-AUE 811A: Off Road Vehicles
PE-AUE 811B: Automotive Air Conditioning

PE-AUE 812A: Non-Destructive Testing Methods
PE-AUE 812B: Noise, Vibrations and Harshness
PE-AUE 812C: Finite Element Method & its Applications

OE-AUE 811A: Tribology
OE-AUE 811B: Internet of Things
OE-AUE 811C: Soft Computing

OE-AUE 812A: Computational Fluid Dynamics
OE-AUE 812B: Entrepreneurship Development
OE-AUE 812C: Robotics and Robot Application

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : BS-M301	**Category:** Basic Science course
Subject Name : **Mathematics III(PDE, Probability & Statistics)**	**Semester** : Third
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

1. To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering
2. To provide an overview of probability and statistics to engineers

Course Contents:

Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. (14)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule. (12)

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi-square test for goodness of fit and independence of attributes. (12)

Course Outcomes:

Upon completion of this course, students will be able to solve field problems in engineering involving PDEs. They can also formulate and solve problems involving random variables and apply statistical methods for analysing experimental data.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
3. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
4. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : BS-BIO301	**Category:** Basic Science course
Subject Name : Biology	**Semester** : Third
L-T-P : **3-0-0**	**Credit:3**
Pre-Requisites: No-prerequisite	

Course Contents:

Introduction

Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry. (2)

Classification

Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.

Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M.musculus (3)

Genetics

Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. (4)

Biomolecules

Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. (4)

Enzymes

Purpose: To convey that without catalysis life would not have existed on earth.

Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. (4)

Information Transfer

Purpose: The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure-from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. (4)

Macromolecular analysis

Purpose: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. (5)

Metabolism

Purpose: The fundamental principles of energy transactions are the same in physical and biological world.
Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and
Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge. (4)

Microbiology

Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. (3)

Course Outcomes:

After studying the course, the student will be able to:

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level
8. Apply thermodynamic principles to biological systems.
9. Identify and classify microorganisms.

Learning Resources:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : ES-ECE301	**Category:** Engineering Science Courses
Subject Name : Basic Electronics Engineering	**Semester** : Third
L-T-P : **3-0-0**	**Credit:3**
Pre-Requisites: No-prerequisite	

Objectives:

To provide an overview of electronic device components to Automobile Engineering students

Course Contents:

Semiconductor Devices and Applications: Introduction to P-N junction Diode and V-I characteristics, Half wave and Full-wave rectifiers, capacitor filter. Zener diode and its characteristics, Zener diode as voltage regulator. Regulated power supply IC based on 78XX and 79XX series, Introduction to BJT, its input-output and transfer characteristics, BJT as a single stage CE amplifier, frequency response and bandwidth. (7)

Operational amplifier and its applications: Introduction to operational amplifiers, Op-amp input modes and parameters, Op-amp in open loop configuration, op-amp with negative feedback, study of practical op-amp IC 741, inverting and non-inverting amplifier applications: summing and difference amplifier, unity gain buffer, comparator, integrator and differentiator. (6)

Timing Circuits and Oscillators: RC-timing circuits, IC 555 and its applications as astable and mono-stable multi-vibrators, positive feedback, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator. (6)

Digital Electronics Fundamentals :Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, de- multiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications. (7)

Electronic Communication Systems: The elements of communication system, IEEE frequency spectrum, Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system. (6)

Text /Reference Books:

1. Floyd, "Electronic Devices", Pearson Education 9th edition, 2012.
2. R.P. Jain, "Modern Digital Electronics", Tata Mc Graw Hill, 3rd Edition, 2007.
3. Frenzel, "Communication Electronics: Principles and Applications", Tata Mc Graw Hill, 3rd Edition, 2001.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand the principles of semiconductor devices and their applications.
2. Design an application using Operational amplifier.
3. Understand the working of timing circuits and oscillators.
4. Understand logic gates, flip flop as a building block of digital systems.
5. Learn the basics of Electronic communication system.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : ES-AUE301	**Category:** Engineering Science Courses
Subject Name : Engineering Mechanics	**Semester** : Third
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

The objective of this Course is to provide an introductory treatment of *Engineering Mechanics* to all the students of engineering, with a view to prepare a good foundation for taking up advanced courses in the area in the subsequent semesters. A working knowledge of statics with emphasis on force equilibrium and free body diagrams provides an understanding of the kinds of stress and deformation and how to determine them in a wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

Course Contents:

Module 1*: Introduction to Engineering Mechanics covering,* Force Systems: Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminancy. (3)

Module 2*: Friction covering,* Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;

(4)

Module 3*: Basic Structural Analysis covering,* Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines; (4)

Module 4*: Centroid and Centre of Gravity covering,* Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook. (5)

Module 5*: Virtual Work and Energy Method*- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

(5)

Module 6*: Review of particle dynamics*- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy.Impulse-momentum (linear, angular); Impact (Direct and oblique).

(5)

Module 7:*Introduction to Kinetics of Rigid Bodies covering,* Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation;

(5)

Module 8:*Mechanical Vibrations covering,* Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums; (5)

Tutorials *from the above modules covering*, To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack

Total Hours (36 lectures + 12 tutorials)

Course Outcomes:

At the end of this course students will be able to
1. Use scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Apply basic knowledge of maths and physics to solve real-world problems.
4.Understand measurement error, and propagation of error in processed data.
5. Understand basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).
6. Understand basic dynamics concepts – force, momentum, work and energy.
7. Understand and be able to apply Newton's laws of motion.
8. Understand and be able to apply other basic dynamics concepts - the Work-Energy principle, Impulse-Momentum principle and the coefficient of restitution.
9. Extend all of concepts of linear kinetics to systems in general plane motion (applying Euler's Equation and considering energy of a system in general plane motion, and the work of couples and moments of forces).
10. Learn to solve dynamics problems. Appraise given information and determine which concepts apply, and choose an appropriate solution strategy, and
11. Attain an introduction to basic machine parts such as pulleys and mass-spring systems.

Text /Reference Books:

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE301	**Category:** Professional Core courses
Subject Name : Applied Thermodynamics	**Semester** : Third
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

1. To learn about work and heat interactions, and balance of energy between system and its surroundings.
2. To learn about application of I and II laws of thermodynamics for various energy conversion devices.
3. To learn about gas and vapor cycles and their first law and second law efficiencies.
4. To evaluate the changes in properties of substances in various processes.
5. To understand about the properties of dry and wet air and the principles of psychometry.

Course Contents:

Module 1: Basic Concepts- Basic concepts - concept of continuum, macroscopic approach, Thermodynamic systems - closed, open and isolated. Property, state, path and process, quasistatic process, work, modes of work. Zeroth law of thermodynamics, concept of temperature and heat. Concept of ideal and real gases.

(3)

Module 2: First Law of Thermodynamics- Concepts of Internal Energy, Specific Heat Capacities, Enthalpy. Energy Balance for Closed and Open Systems, Energy Balance for Steady-Flow Systems. Steady-Flow Engineering Devices. Energy Balance for Unsteady- Flow.

(4)

Module 3: Second Law of Thermodynamics- Thermal energy reservoirs, heat engines energy conversion, Kelvin's and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the thermodynamic temperature scale, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – availability, the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, Entropy change of pure substances, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, reversible steady flow work, minimizing the compressor work, isentropic efficiencies of steady-flow devices, and entropy balance. Energy - a measure of work potential, including work potential of energy, reversible work and irreversibility, second-law efficiency, exergy change of a system, energy transfer by heat, work, and mass, the decrease of exergy principle and exergy destruction, energy balance: closed systems and control volumes energy balance.

(10)

Module 4: Properties Of Pure Substance- Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Phase rule, P-V, P-T, T-V, T-S, H-S diagrams, PVT surfaces. Thermodynamic properties of steam. Calculations of work done and heat transfer in non- flow and flow processes. (5)

Module 5: Power Cycles- Vapour and combined power cycles, including the Carnot vapor cycle, Rankine cycle: the ideal cycle for vapor power, the ideal reheat and regenerative and the second-law analysis of vapour power cycles. Gas power cycles, including basic considerations in the analysis of power cycles, the Carnot cycle and its value in engineering, an overview of reciprocating engines, air standard assumptions, gasoline engine Otto cycle, diesel engine cycle, gas-turbine Brayton cycle, and the second-law analysis of gas power cycles.

(8)

Module 6: Ideal and Real Gases and Thermodynamic Relations- Gas mixtures – properties ideal and real gases. Equation of state, Avogadro's Law, Vander Waal's equation of state, Compressibility factor, compressibility

chart. Dalton's law of partial pressure. Exact differentials, T-D relations, Maxwell's relations. Clausius Clapeyron equations, Joule – Thomson coefficient. (4)

Module 7: Psychometry and psychometric charts, property calculations of air vapour mixtures. Psychometric process – Sensible heat exchange processes. Latent heat exchange processes. Adiabatic mixing, evaporative cooling. Use of standard thermodynamic tables, Mollier diagram, Psychometric chart and Refrigerant property tables. Refrigeration cycles, including refrigerators and heat pumps, the ideal reversed Carnot vapour-compression refrigeration cycle, actual vapor compression refrigeration cycles, heat pump systems, gas refrigeration cycles, and absorption refrigeration systems.

(6)

Total Hours (40 lectures + 12 tutorials)

Course Outcomes:

Upon successful completion of the course, student will have

1. Ability to apply mathematics, science, and engineering.
2. Ability to design and conduct experiments, as well as to analyze and interpret data.
3. Ability to identify, formulate, and solve engineering problems.
4. Ability to apply modern engineering tools, techniques and resources to solve complex mechanical engineering activities with an understanding of the limitations.
5. Ability to comprehend the thermodynamics and their corresponding processes that influence the behavior and response of structural components.
6. Ability to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations) and thermodynamics to model, analyze, design, and realize physical systems, components, or processes.

Text Books:

1. Nag. P.K., "Engineering Thermodynamics", Tata McGraw-Hill, New Delhi.
2. Cengel, Thermodynamics – An Engineering Approach, Tata McGraw Hill, New Delhi.
3. Sonntag, R. E., Borgnakke, C., & Wylen, G. J. V. Fundamentals of thermodynamics: Wiley.
4. Moran, M. J., Shapiro, H. N., Boettner, D. D., & Bailey, M. Fundamentals of Engineering Thermodynamics: John Wiley & Sons.
5. Jones, J. B., & Dugan, R. E. Engineering thermodynamics: Prentice Hall.
6. Potter, M. C., & Somerton, C. W. Schaum's Outline of Thermodynamics for Engineers, McGraw-Hill.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE302	**Category:** Professional Core courses
Subject Name : Manufacturing Methods	**Semester** : Third
L-T-P : **4-0-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Contents:

Conventional Manufacturing Processes:

Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. (5)

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming(forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending).

(4)

Tool geometry and single point cutting tools, orthogonal and oblique cutting, rake, cutting tool signature; Chip shape and chip formation, chip tool interface, chip flow, built up edge, machined surface. Forces during turning, Merchant's circle diagram for cutting forces, force systems at chip tool interface and shear plane, velocity relationships and problems. Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining. (10)

Joining/fastening processes: Physics of welding, types of welding, brazing and soldering; Solid and liquid state joining processes. (7)

Unconventional Machining Processes:

Abrasive Jet Machining, Ultrasonic Machining, principles and process parameters, Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM).

(5)

Course Outcomes:

Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products

Text Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5^{th} Edition)-Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley Publication.
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing, Wiley Publication.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE391	**Category:** Professional Core courses
Subject Name : Machine Drawing	**Semester** : Fourth
L-T-P : **0-0-3**	**Credit:1.5**
Pre-Requisites: No prerequisite	

Schematic product symbols for standard components in mechanical, electrical and electronic systems, welding symbols and pipe joints; Orthographic projections of machine elements, different sectional views- full, auxiliary sections; Isometric projection of components; Assembly and detailed drawings of a mechanical assembly, such as a plummer block, tool head of a shaping machine, tailstock of a lathe, simple gear box, flange coupling, welded bracket joined by stud bolt on to a structure, welded pipe joints indicating work parts before welding, etc.

Practicing AutoCAD or similar graphics softwares and making orthographic and isometric projections of different components.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Second Year Fourth Semester

Subject Code : ES-AUE401	**Category:** Engineering Science Courses
Subject Name : Materials Engineering	**Semester** : Fourth
L-T-P : **3-0-0**	**Credit:3**
Pre-Requisites: No prerequisite	

Objectives:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity and failure criteria.
2. To provide a detailed interpretation of equilibrium phase diagrams.
3. Learning about different phases and heat treatment methods to tailor the properties of Fe-C alloys.

Course Contents:

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics. Imperfection in solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. (6)

Mechanical Property measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery; Hardness: Rockwell, Brinell and Vickers and their relation to strength. (6)

Mechanisms of Plastic and Elastic deformations, Slip and Twinning, Recover Recrystallization and Grain growth- Strengthening Mechanism- Strain hardening, Precipitation hardening, Refinement of Grain, solid solution strengthening, Types of Fracture-, Ductile and Brittle fracture- Griffith's theory, Creep - Mechanisms of Creep- Creep resistant materials, Fatigue Failure- SN curve- Factors affecting fatigue life, prevention of fatigue failure. (9)

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron. (6)

Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. (6)

Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons.
Advance materials for automotive components: Characteristics, advantage/ disadvantages, and applications. Ceramic Materials: What is ceramics; common ceramic materials and their characteristics; How ceramics are made—sintering and vitrification process; Ceramic structures; Properties and applications. Composite materials: What is composites; Polymers matrix and their applications; Metal matrix and ceramic matrix composites and their applications; How composites are made. (5)

Criteria for selecting materials for automotive components viz. Cylinder Block, Cylinder Head, Piston, Piston Ring, Gudgeon pin, Connecting Rod, Crank Shaft, Cam Shaft, Cam, Engine Valve, Gear, Crown wheel and pinion, Clutch plate, Axle shaft, Chassis, spring, body panel, Brake lining etc. (2)

Course Outcomes:

1. Student will be able to identify crystal structures for various materials and understand the defects in such structures.
2. Understand how to tailor material properties of ferrous and non-ferrous alloys.
3. How to quantify mechanical integrity and failure in materials.

Text Books:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, "Material Science and Engineering', Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, "Engineering Materials and Metallurgy", Pearson, 2011.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE401	**Category:** Professional Core courses
Subject Name : Strength of Materials	**Semester** : Fourth
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

1. To understand the nature of stresses developed in simple geometries such as bars, cantilevers, beams, shafts, cylinders and spheres for various types of simple loads.
2. To calculate the elastic deformation occurring in various simple geometries for different types of loading.

Course Contents:

Deformation in solids - Hooke's law, stress and strain- tension, compression and shear stresses – elastic constants and their relations- volumetric, linear and shear strains - principal stresses and principal planes - Mohr's circle. (10)

Beams and types of transverse loading on beams- shear force and bend moment diagrams - Types of beam supports, simply supported and over-hanging beams, cantilevers. Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution, point and distributed loads. (8)

Deflection of a beam using double integration method, computation of slopes and deflection in beams, Maxwell's reciprocal theorems.
Buckling of columns, Euler's theory, critical loads for different types of constraints. (10)

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs. (8)

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure. (8)

Course Outcomes:

1. After completing this course, the students should be able to recognise various types loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components.
2. The students will be able to evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.

Text Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.
4. Debabrata Nag and Abhijit Chanda, Fundamentals of Strength of Materials, Wiley India.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE402	**Category:** Professional Core courses
Subject Name : Fluid Mechanics & Hydraulic Machines	**Semester** : Fourth
L-T-P : **4-0-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

1. To learn about the application of mass and momentum conservation laws for fluid flows.
2. To understand the importance of dimensional analysis.
3. To obtain the velocity and pressure variations in various types of simple flows.
4. To analyze the flow in water pumps and turbines.

Course Contents:

Definition of fluid, Newton's law of viscosity, Units and dimensions - Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications. (9)

Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli- concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram. (9)

Need for dimensional analysis–methods of dimension analysis–Similitude–types of similitude. Dimensionless parameters–application of dimensionless parameters–Model analysis. (6)

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps - Reciprocating pump – working principle. (8)

Impact of Jet, Classification of water turbines, heads and efficiencies, velocity triangles - Axial, radial and mixed flow turbines - Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube - Specific speed, unit quantities, performance curves for turbines – governing of turbines. (8)

Course Outcomes:

1. Upon completion of this course, students will be able to mathematically analyze simple flow situations.
2. They will be able to evaluate the performance of pumps and turbines.

Text Books:

1. Fluid Mechanics and Machinery, R.K.Bansal, Laxmi Publication.
2. Introduction to Fluid Mechanics & Fluid Machines, Som and Biswas, TMH.
3. A Textbook on Fluid Mechanics and Machines, S.Pati, McGrawHill.
4. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
5. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE403	**Category:** Professional Core courses
Subject Name : Theory of Machine	**Semester** : Fourth
L-T-P : **3-1-0**	**Credit:4**
Pre-Requisites: No-prerequisite	

Objectives:

1. To understand the kinematics and rigid- body dynamics of kinematically driven machine components.
2. To understand the motion of linked mechanisms in terms of the displacement, velocity and acceleration at any point in a rigid link.
3. To be able to design some linkage mechanisms and cam systems to generate specified output motion.
4. To understand the kinematics of gear trains.

Contents:

Classification of mechanisms-Basic kinematic concepts and definitions-Degree of freedom, mobility - Grashof's law, Gruebler's criterion for plane mechanism, Kinematic inversions of four bar chain and slider crank chains-Limit positions - Mechanical advantage-Transmission angle-Description of some common mechanisms-Quick return mechanism, straight line generators (pantograph) -Universal Joint-Rocker mechanisms. (8)

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations kinematic analysis of simple mechanisms - slider crank mechanism dynamics-Coincident points - Coriolis component of acceleration-introduction to linkage synthesis- three position graphical synthesis for motion and path generation. (8)

Classification of cams and followers-Terminology and definitions-Displacement diagrams – Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions specified contour cams-circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller, flat face and knife edge followers. (8)

Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/ undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics. (8)

Belt-drive – introduction; Law of belting, Length of flat belt for open and cross belt connections; Stepped pulley for open flat belt; Tension in flat belt and V-belts; Power transmitted in belt drive. (8)

Course Outcomes:

1. After completing this course, the students can design various types of linkage mechanisms for obtaining specific motion and analyse them for optimal functioning.

Text Books:

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. Cleghorn W.L., Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE404	**Category:** Professional Core courses
Subject Name : Metrology & Instrumentation	**Semester** : Fourth
L-T-P : **3-0-0**	**Credit:3**
Pre-Requisites: No-prerequisite	

Objectives:

1. To understand the working of linear and angular measuring instruments.
2. To familiarize with the working of optical measuring instruments and fundamentals of limits and limit gauges.
3. To give basic idea about various methods for measurement of screw thread and surface finish parameters.
4. To give an exposure to advanced measuring devices and machine tool metrology.
5. To provide students an overview of mechanical measurement systems and principle of instruments for motion and dimension measurement.
6. To provide basic idea about working principle and applications of devices for measurement of force and torque; strain and stress and temperature.

Course Contents:

Module 1: Concept of measurement:-Introduction to Metrology; Need for high precision measurements; Terminologies in Measurement- Precision, accuracy, sensitivity, calibration, resolution. Errors in Measurement, types of errors, Abbe's Principle. Basic standards of length- Line standard, End standards, Wavelength standard; Various Shop floor standards. Linear Measurement – Slip gauges, wringing, grades; Surface plate; Dial indicators; Height gauges and Vernier calliper; screw gauge. Comparators- mechanical, electrical, optical and pneumatic. Angular Measurement – Bevel protractor; Sine Bar, principle and use of sine bar, sine centre; Angle gauges. Sprit level; Angle Dekkor; Clinometers.

(8)

Module 2: Limits and Limit gauges – Making to suit, selective assembly, systems of limits and fits; Types of fits; Hole basis system and Shaft basis system. Tolerance, allowance and deviation (as per BIS). Limit Gauges – GO and NO GO gauges; types of limit gauges. Gauge design - Taylor's principle of gauging; Gauge tolerance, disposition of gauge tolerance, wear allowance. Optical Measuring Instruments: - Benefits of light waves as standards; Monochromatic light; Principle of Interference. Interference band, optical flat, surface measurement. Interferometers – NPL, Pitter-NPL, auto collimator. (8)

Module 3: Screw thread measurement – Screw thread terminology; Measurement of major diameter; root diameter; pitch; effective diameter with two wire method and three wire method. Measurement of flank angle and form by profile projector and microscope. Measurement of surface texture – roughness and waviness; Analysis of surface traces, peak to valley height, R.M.S. value, Centre Line Average and Ra value, Rt, Rz etc. Methods of measuring surface roughness – Stylus probe, Tomlinson surface meter, Talysurf; surface roughness measurement – assessment length, roughness width cut-off, sampling length and evaluation length.

(8)

Module 4: Introduction to Digital Measurement – significance of Digital measurement; methods; Classification. Stages in generalized measuring system – Sensor-Transducer stage, Signal-Conditioning stage, Readout-Recording stage; Types of input quantities; Active and Passive transducers. Performance characteristic of measuring devices. Drift, Resolution, Threshold, Hysteresis, Static calibration. Dynamic characteristics-different order systems and their response-, Measuring lag, Fidelity, Dynamic error; Transducers – Working, Classification of transducers. Motion and Dimension measurement – LVDT – Principle, applications, advantages and limitations. (8)

Module 5: Strain and Stress Measurement - Electrical resistance strain gauge - Principle, operation. Measurement of Force and Torque – Strain-Gauge Load Cells, Hydraulic and Pneumatic load cells – force

measurement using piezoelectric quartz crystal. Torque Measurement – Dynamometers – Mechanical, Hydraulic and Electrical. Vibration measurement – Vibrometers and Accelerometers. Temperature Measurement – Use of Thermal Expansion – Liquid-in-glass thermometers, Bimetallic strip thermometer, Pressure thermometers. Thermocouples – Resistance Temperature Detectors (RTD); Thermistors; Pyrometers. (8)

Course Outcomes:

Upon successful completion of the course, student will have

1. Understand the working of linear and angular measuring instruments.
2. Know the fundamentals of limits and limit gauges, various methods for measurement of screw thread and surface roughness parameters and the working of optical measuring instruments.
3. Acquire an overview of mechanical measurement systems and principle of instruments for motion and dimension measurement.
4. Get basic idea about working principle and applications of devices for measurement of force and torque; strain and stress and temperature.

Text Books:

1. Anand K Bewoor, Vinay A Kulkarni, Metrology & Measurement, McGraw-Hill, 2009
2. Ernest O. Doebelin, Dhanesh N. Manik, Measurement Systems Application and Design, McGraw-Hill, 2004
3. Galyer J.F.W., Schotbolt C.R., Metrology for Engineers, ELBS,1990
4. Thomas G. Beckwith, John H. L., Roy D. M., Mechanical Measurements, 6/E, Pearson Prentice Hall, 2007

R.K. Rajput, Mechanical Measurements & Instrumentation, S.K.Kataria & Sons.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : PC-AUE491	**Category:** Professional Core courses
Subject Name : Manufacturing and Testing Lab	**Semester** : fourth
L-T-P : **0-0-3**	**Credit:1.5**
Pre-Requisites: No prerequisite	

List of Experiments:

About 12 experiments will be carried out as listed below.

1. Impact tests: Charpy or Izod tests; Hardness test, Test for drawability of sheet metals through cupping test;
2. Fatigue test of a typical sample.
3. Sample preparation and etching of ferrous and non-ferrous metals and alloys for metallographic observation;
4. Experiments on heat treatment of carbon steels under different rates of cooling including quenching, and testing for the change in hardness, and observing its microstructural changes for standard specimen through metallographic studies.
5. Determining spring stiffness under tension and compressive loads; Strain gauge based strain/ deflection/ force measurement of a cantilever beam;
6. Tension Test and Compression Test of ductile and brittle materials: stress-strain diagram, determination of yield strength, ultimate strength, modulus of elasticity, percentage elongation and percentage reduction in areas, observation of fractured surfaces; Bend and rebend test of flat test pieces, determination of bending stresses;
7. Torsion Test; Experiments on friction: determination of coefficient of friction;
8. Sand preparation and testing: specimen preparation for testing permeability, clay content, grain fineness number, moisture content, green compression strength, green shear strength, splitting strength, hardness, etc.;
9. Casting of metals after preparation of a suitable type moulds; Experiments on properties of post casting, fettling, cleaning, deburring, and polishing operations;
10. Same experiment for another type of moulds.
11. Practicing smithy or forging of carbon steels and testing for its property changes;
12. Laboratory experiments in Fabrication processes to observe effects of varying process parameters in GMAW
13. Testing for Joint defects in GMAW with visual inspection and DP test.
14. Surface roughness measurement.
15. Measurement of threads, gears.

Course Outcomes:

Students will be able to

1. List the characteristics of material.
2. Interpret different engineering material properties.
3. Identify different destructive and nondestructive testing.
4. Translate suitable testing for proper application.
5. Compute stress, strains and deformation of engineering materials.

6. Demonstrate to find out hardness of engineering materials.
7. Attain basic knowledge on pattern making.
8. Construct moulds.
9. Examine properties of mould material in casting.
10. Determine and explain the various measurement systems, surface metrology, gears measurement.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Automobile Engineering

(Applicable from the academic session 2018-2019)

Subject Code : MC-401	**Category:** Mandatory courses
Subject Name : Environmental Science	**Semester** : Third
L-T-P : **2-0-0**	**Credit: 0**
Pre-Requisites: No-prerequisite	

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

I. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
II. Slogan making event
III. Poster making event
IV. Cycle rally
V. Lectures from experts

(b) Actual Activities:

I. Plantation
II. Gifting a tree to see its full growth
III. Cleanliness drive
IV. Drive for segregation of waste
V. To live some big environmentalist for a week or so to understand his work
VI. To work in kitchen garden for mess
VII. To know about the different varieties of plants
VIII. Shutting down the fans and ACs of the campus for an hour or so