Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Semester-V

Subject Code : PC – AUE 501	**Category:** Professional Core Courses
Subject Name : Automotive Engines	**Semester** : Fifth
L-T-P : **3-0-0**	**Credit: 3**
Pre-Requisites: Engineering Thermodynamics	

Objectives:

1. To familiarize with the terminology associated with IC engines.
2. To understand the basics of IC engines.
3. To understand combustion, and various parameters and variables affecting it in various types of IC engines.
4. To learn about various systems used in IC engines and the type of IC engine required for various applications

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Basic air standard cycle Otto, Diesel & dual fuel cycle, comparison between Otto, Diesel and Dual fuel cycles. Basic Concepts-Air standard cycles and fuel-air cycles Assumptions Valve Timing diagram, Actual engine cycle.	3
2	Engine Construction: Construction and working of 4 stroke SI and CI Engine, Comparison between SI and CI engine, SI and CI engine fuel rating, octane number and cetane number, SI and CI Engine fuel properties, Alternative fuels (Alcohol, Biogas, Hydrogen, CNG, LPG).	3
3	SI Engine: Theory of Carburetion, Types of carburettors, Electronic fuel injection system, GDI. Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion. Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion Chambers. Rating of fuels in SI engines and additives.	5
4	CI Engine: Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Types of combustion chambers rating of fuels in CI engines. Additives Comparison of knocking in SI & CI engines, Concepts of Supercharging and Turbo charging.	5

5	Engine systems and components: Ignition system.(battery, magneto & electronic); Lubrication system; Engine starting system; Engine cooling system; Governing system (quality and quantity hit & miss governing); Intake and exhaust systems (two valves & four valves); Drive train (cam shaft, valves etc.).	5
6	Fuels and Emissions: Chemical structure of the Petroleum, Refining process for petroleum, important qualities of the Engine fuels- (SI & CI engines), Diesel, and Gasoline fuels, Indian specifications. Alternate fuels (SI & CI engines)- Liquid fuels, gaseous fuels (LPG, NG, CNG), hydrogen and emulsified fuel. Air pollution due to IC engine, Engine emissions, Hydrocarbon emissions, (HC) & PM & Carbon monoxide emissions (CO), oxides of Nitrogen (NO_x) Euro norms , Bharat stage norms, Introduction to EDC and IDC, Introduction to carbon credit, Emission control methods for SI and CI engines, Electronic control module, Catalytic converters, EGR Concept of hybrid vehicles.	7
7	Cooling and Lubrication system: Need for cooling system. Types of cooling system, Liquid cooled system, Thermosyphon system, Pressure cooling system. Lubrication system, Mist lubrication system, Wet sump and dry sump lubrication. Properties of lubricants. Properties of coolants.	4
8	Performance characteristics & Testing of I.C. Engines: Introduction to Indian. Standards for testing of I.C. Engine, Mean effective pressure, indicated power, brake power, friction power, Methods to determine power and efficiencies Variables affecting performance of engine, characteristic curves, heat balance sheet, Methods of improving engine performance; super & turbocharged engines.	4

Course Outcomes:

Students who have done this course will have a good idea of the basics of IC engines and how different parameters influence the operational characteristics of IC Engines

Learning Resources:

1. Ganesan V., Internal Combustion Engines, Tata McGraw Hill Co., Third Edition, 2007.
2. Babu, A.K., Automotive Engines, Khanna Publishing House, Delhi, 2018.
3. Obert E.F., Internal Combustion Engines and Air Pollution, Harper and Row Publication Inc. New York, 1973.
4. Heisler H., Advanced Engine Technology, Edward Arnold, 1995.
5. Heywood J.B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co., New York, 1989.
6. Heldt P.M., High Speed Combustion Engines, Oxford & IBH publishing Co., India, 1985.

7. Stockel M.W., Stockel T.S. and Johanson C., Auto Fundamentals, The Goodheart, Wilcox Co. Inc., Illinois, 1996.

Subject Code : PC-AUE 502	**Category :** Professional Core Courses
Subject Name : Automotive Body & Chassis Engineering	**Semester** : Fifth
L-T-P : **3-0-0**	**Credit: 3**
Pre-Requisites: Engineering Mechanics, Theory of Machine	

Objectives:

1. This course imparts knowledge of different body construction and their sub assembly.
2. Identify automotive suspension components, their functions, and maintenance requirements.
3. Understand the differences between the linkage and rack and pinion type steering.
4. Understand the function, construction, and types of frames used on wheeled vehicles.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Types of chassis layout with reference to power plant locations and drive, Vehicle frames. Various types of frames. Constructional details, Materials. Testing of vehicle frames. Unitised frame body construction: Loads acting on vehicle frame, chassis lubrication, and calculation of stresses on sections.	4
2	Front Axle and Steering System: Types of front axles. Construction details. Materials. Front wheel geometry viz. Castor, Camber, King pin inclination, Toe-in Conditions for true rolling motion of wheels during steering. Steering geometry. Ackerman and Davis steering system. Constructional details of steering linkages. Different types of steering gear boxes. Steering linkages and layouts. Power and power assisted steering.	5
3	Drive Line, Final Drive and Differential: Effect of driving thrust and torque reactions. Hotch kiss drive, torque tube drive and radius rods. Propeller shaft. Universal joints. Constant velocity universal joints. Front wheel drive. Different types of final drive. Differential principles. Construction and working of differential Non-slip differential. Differential locks.	3
4	Rear Axles: Construction of rear axles. Types of loads acting on rear axles. Full floating. Three quarter floating and semi floating rear axles. Rear axle housing. Construction of different types of axle housings. Multi-axled vehicles. Construction details of multi drive axle vehicles.	3

5	Suspension System: Need of suspension system- Types of front and rear suspension system- Suspension springs- Constructional details and characteristics of leaf, coil and torsion bar springs- Independent suspension– Pneumatic suspension- constructional details of telescopic shock absorbers. Types, vibrations and riding comfort, role axis of spring suspension.	5
6	Wheel & tyres: Types of wheels, construction, wired wheels, tyres, construction, types, radial, bias & belted bias, comparison, slip angle, under and over steering, tread patterns, tyre re-treading cold and hot, tyre specification tubeless tyre.	4
7	Braking System: Necessity of brake, stopping distance and time. Brake efficiency, weight transfer, brake shoe theory, determination of braking torque, braking systems- mechanical, hydraulic, disc, drum, parking and emergency brakes, power, servo and electrical brakes, details of hydraulic system, mechanical system and components. Types of master cylinders, Anti-lock braking systems.	5
8	Safety Aspect: Different Safety aspect, Driver's safety, passive restraint systems, Use of air bags, side impact analysis. Bumper system. Energy absorbent foams. Mechanisms in vehicle applied to safety.	3
9	Interior Ergonomics: Driver and passenger ergonomics with seating space arrangements for cars. Different types of car seats. Seat comfort, split frame seating, seat adjustment mechanisms. Visibility, methods of improving visibility.	4
10	Body Materials: Different types of ferrous and non-ferrous materials used in vehicle such as cast iron. Steel, Alloy steel, plastic, G.R.P, semi-rigid polyurethane.	2
11	Painting: Corrosion of vehicle body. Anticorrosion method. Paint and painting process.	2

Course Outcomes:

1. Understand the operation of automotive systems and importance of vehicle frame.
2. Apply the knowledge of design consideration for braking system, suspension system and chassis.
3. Understand need of suspension systems and its types. Develop competency in service and repair through testing, adjustment, diagnosis, calibration and validation of a variety of automotive systems.
4. Knowledge of different safety and ergonomic aspect to reduce human injury and increase comfort
5. Understand the fundamentals of various automotive body and their construction details.

Learning Resources:

1. Rjavee J.E., Automotive Technology- A System Approach, 3rd Edition, Thomson Asia Pte Ltd., Singapore, 2004.
2. De A., Automobile Engineering, Galgotia Publishers Pvt. Ltd., 2004.
3. Ramalingam K.K., Scitech Publication (India) Pvt. Ltd., 2nd Edition, 2004.
4. Heitner J., Automotive Mechanics Principle and Practice, 2nd Edition, East West Press, 1999.
5. Powloski J., Vehicle Body Engineering, Business Books Ltd., London, 1989.
6. Babu A.K., Automobile Mechanics, Khanna Publishing House, 2019.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PC-AUE503	**Category :** Professional Core Courses
Subject Name : Heat Transfer	**Semester** : Fifth
L-T-P : 3-1-0	**Credit:4**
Pre-Requisites: Engineering Thermodynamics	

Objectives:

1. Develop an understanding of Heat Transfer in Automobile Engineering.
2. Learn to use modes of heat transfer and to solve problems of engineering application.
3. Practice in the analytical formulation of heat transfer problems.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Modes of heat transfer.	1
2	Conduction: Fourier law of heat conduction for isotropic material. Thermal conductivity. Derivation of the energy equation in three dimensions including transient effect. Non dimensional - thermal diffusivity and Fourier number. One dimensional solution with and without heat generation in slab, cylinder and sphere. Analogy with electrical circuits. Critical thickness of insulation.	10
3	Fins: Heat flow through rectangular fin, Heat dissipation from an infinitely long fin, fin insulated at tip and fin losing heat at the tip, efficiency and effectiveness of fin, Biot number, estimation of error in temperature measurement in a thermometer well.	5
4	Conduction-Unsteady state: Lumped parameter approach and physical significance of time constant, Biot number, Validity of lumped parameter approach. Introduction to Heissler Chart.	3
5	Radiation: Concept of radiation, absorptivity, reflectivity & transmissivity, black, white and grey surfaces, emissive power & emissivity. Intensity of radiation & solid angle, Laws of radiation –Planck's Law, Stefan–Boltzman Law, Wein's displacement Law, Kirchhoff's Law, Lambert's cosine law. Radiation exchange between black bodies and concept of shape factor. Radiation exchange between non black Bodies, heat exchange between two grey surfaces, electrical analogy, radiation shield.	7
6	Convection: Introduction, Newton's law of cooling and significance of the heat transfer coefficient. Momentum and energy equations in	5

	two dimensions, importance of non-dimensional quantities and their physical significance. Order of magnitude analysis for flow over a flat plate. Velocity and thermal boundary layer thickness by integral method. Analogies between momentum, heat and mass transfer.	
7	Heat exchangers: Types, Heat exchanger analysis, LMTD for parallel & counter flow heat exchanger, overall heat transfer coefficient, fouling, correction factor for multi-pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger.	5

Course Outcomes:

1. Ability to identify and formulate the heat conduction problems in rectangular, cylindrical & spherical co-ordinate system, using a mathematical model representing the physical system.
2. Ability to understand and analyze the time dependent (transient) heat conduction.
3. Ability to apply the principles of convective heat transfer to compute heat transfer co-efficient in forced convection, natural convection for internal flows & external flows.
4. Ability to understand the constructional features & working principles of heat exchangers which include the LMTD & NTU approach.
5. Ability to apply the radiation heat transfer problems between black & non-black bodies.

Learning Resources:

1. Ozisik M.N., Heat Transfer- A Basic Approach, McGraw Hill.
2. Holman J.P., Heat Transfer, 8th Ed., McGraw Hill.
3. Rajput R.K., Heat and Mass Transfer, S. Chand, 2010.
4. Sachdeva R.C., Fundamental of Engineering Heat and Mass Transfer, New Age Science, 2010.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PC-AUE 504	**Category** : Professional Core Courses
Subject Name : Design of Machine Element	**Semester** : Fifth
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites: Engineering Mechanics and Strength of Materials	

Objectives:

1. A strong background in mechanics of materials based failure criteria underpinning the safety-critical design of machine components.
2. An understanding of the origins, nature and applicability of empirical design principles, based on safety considerations.
3. An overview of codes, standards and design guidelines for different elements.
4. An appreciation of parameter optimization and design iteration.
5. An appreciation of the relationships between component level design and overall machine system design and performance.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Design considerations- limits, fits and standardization, Review of failure theories for static and dynamic loading (including fatigue failure).	4
2	Design of shafts under static and fatigue loadings.	5
3	Analysis and design of sliding and rolling contact bearings.	4
4	Design of transmission elements: spur, helical, bevel and worm gears; belt and chain drives.	6
5	Design of springs: helical compression, tension, torsional and leaf springs	5
6	Design of joints: threaded fasteners, pre-loaded bolts and welded joints	6
7	Analysis and applications of power screws and couplings	5
8	Analysis of clutches and brakes	5

Course Outcomes:

Upon completion of this course, students will get an overview of the design methodologies employed for the design of various machine components.

Learning Resources:

1. Shigley J.E. and Mischke C.R., Mechanical Engineering Design, 5th Edition, McGraw-Hill International, 1989.
2. Deutschman D., Michels W.J. and Wilson C.E., Machine Design Theory and Practice, Macmillan, 1992.
3. Juvinal R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
4. Spottes M.F., Design of Machine Elements, Prentice-Hall India, 1994.
5. Norton R.L., Mechanical Design – An Integrated Approach, Prentice Hall, 1998.
6. Sadhu Singh, Machine Design, Khanna Book Publishing House, 2016.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : HM-HU 511A	**Category :** Humanities and Social Sciences including Management Courses
Subject Name : Values & Ethics	**Semester** : Fifth
L-T-P : 3-0-0	**Credit : 3**
Pre-Requisites: Nil	

Objectives:

The course aims to teach students the principles of values and ethics for their personal, academic and professional needs.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Definition and classification of values: Extrinsic values, Universal and Situational values, Physical, Environmental, Sensuous, Economic, Social, Aesthetic, Moral and Religious values.	~~8~~
2	Concepts related to values: Purusartha, Virtue, Right, duty, justice, Equality, Love and Good.	6
3	Egoism, Altruism and universalism. The Ideal of Sarvodaya and Vasudhaiva Kutumbakam.	7
4	The Problem of Sustenance of value in the process of Social, Political and Technological changes.	8
5	The Problem of hierarchy of values and their choice, The views of Pt. Madan Mohan Malviya and Mahatma Gandhi.	7

Course Outcomes:

A student will learn the principles of value system, about the sustenance of value in the process of social, political and technological system.

Learning Resources:

1. Kapoor, P., Professional Ethics and Human Values, Khanna Publishing House, 2019.
2. Little W., An Introduction of Ethics, Allied Publisher, Indian Reprint, 1955.
3. William K.F., Ethics, Prentice Hall of India, 1988.
4. Pradhan A. and Vichara M., B.H.U., Varanasi.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : HM-HU 511B	**Category:** Humanities and Social Sciences including Management Courses
Subject Name : Education, Technology & Society	**Semester** : Fifth
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites: Nil	

Objectives:

The goal of the proposed course is to enable students:

1. To explore the various ways in which technology has and may in future affect not only the mode of delivery of education but also the very nature of education.
2. To understand the requirement of education
   a) for becoming an effective member of the society
   b) to fulfill the potential of a learner to the fullest without too much thought of an individual's responsibility towards the contemporary society.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Necessity of education for human life, Impact of education on society.	6
2	Nature and scope of education (Gurukul to ICT driven), Emotional intelligence Domains of learning, Approaches to learning, Learning outcomes.	8
3	Role of education in technology advancement.	7
4	Technology and society; management of technology; technology transfer	8
5	Ethical and value implications of education and technology on individual and society.	7

Course Outcome:

On successful completion of this course, the students will be able to integrate their technical education for betterment of society as well motivates them to lead a good human life.

Learning Resources:

1. Russel B., Education and Social Order.
2. Bower and Hilgard, Theories of Learning.
3. Harrington J.L., Technology and Society.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PC-AUE591	**Category:** Professional Core Courses
Subject Name : Fluid Mechanics & Heat Transfer Lab	**Semester** : Fifth
L-T-P : 0-0-3	**Credit: 1.5**
Pre-Requisites: Engineering Thermodynamics, Fluid Mechanics and Fluid Machines	

Objectives:

1. To understand the principles and performance characteristics of flow and thermal devices
2. To know about the measurement of the fluid and thermal properties.

Contents (12 experiments/ studies/ problems are to perform from the list given below or relevant others):

1. Measurement of co-efficient of discharge of given orifice and venturi meters.
2. Determination of the co-efficient of friction factor for flow through pipes.
3. Determination of the performance characteristics of a centrifugal pump.
4. Determination of the performance characteristics of Pelton Wheel.
5. Determine the flow rate and velocity profile in a duct using pitot tube.
6. Determination of thermal conductivity of a metal rod and/or insulating powder materials.
7. Heat transfer through forced convection.
8. Heat transfer through natural convection from a vertical surface.
9. Determination of the convective heat transfer coefficient for flow over a heated plate
10. Measurement of emissivity in a test surface.
11. Experiment with a parallel flow and a counter flow heat exchanger.
12. Determination of the performance characteristics of a vapour compression system
13. Heat transfer through a pin fin.

Course Outcomes:

The students who have undergone the course will be able to measure various properties of thermal and fluids and also characterize the performance of fluid/ thermal machinery.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PC-AUE592	**Category:** Professional Core courses
Subject Name : Automobile Engineering Lab I (Engine & Chassis Component Lab)	**Semester** : Fifth
L-T-P : **0-0-3**	**Credit: 1.5**
Pre-Requisites: Engineering Thermodynamics and Engineering Mechanics	

Objectives:

To train the Students to know the details of different automobile components, dismantling, assembling, inspect, measures and testing them.

Contents (12 experiments/ studies/ problems are to perform from the list given below or relevant others):

1. Dismantling, measurement, inspection and assembling of different modern engine [like Multipoint fuel injection (MPFI) and Common rail injection (CRI) engines and Digital twin spark ignition (DTSI) etc.] engine for passenger car, commercial vehicle and two wheeler engines.
2. Study of fuel supply system (SI and CI) and structure and testing of common rail high pressure injectors.
3. Dismantling, assembling and testing of different types of Fuel injection Pumps such as distributor type, high pressure pump.
4. Electronic ignition and battery ignition system with accessories.
5. Study of cooling, lubrication.
6. Study and testing of automotive air conditioning system.
7. Dismantling and assembling of different types of clutch.
8. Dismantling and assembling of different types of Gear.
9. Dismantling and assembling of different Steering system and study of driver seat.
10. Study of Frames used for Heavy commercial vehicle (HCV), Car, Two & Three Wheelers and Dismantling and assembling of Suspension system.
11. Dismantling and assembling of Braking system, Brake adjustment and brake bleeding.
12. Dismantling and assembling of Wheels and Tyres.
13. Dismantling and assembling of Propeller Shaft, Universal Joints and Differential.

Course Outcomes:

1. Ability to dismantle, assemble, inspect, measure and testing the automobile engine components.

2. This Laboratory course is intended to give the students, experimental knowledge about various automotive chassis components.

Subject Code : PC-AUE593	**Category:** Professional Core courses
Subject Name : Automobile Engineering Lab II (ETPM Lab)	**Semester** : Fifth
L-T-P : 0-0-3	**Credit: 1.5**
Pre-Requisites: Engineering Thermodynamics and Fluid Mechanics	

Objectives:

To introduce the learners with the need for automotive engine testing methods and their importance.

Contents (12 experiments/ studies/ problems are to perform from the list given below or relevant others):

1. Valve Timing Diagram for Four Stroke Engine
2. Valve Timing Diagram for Two Stroke Engine
3. Studying the components and working principle of an MPFI engine
4. Performance test and energy balance on MPFI engine at different load conditions.
5. Performance test and energy balance on 2-Stroke Petrol engine at different load conditions.
6. Performance test and energy balance on 2-Stroke Diesel Engine at different load conditions.
7. Performance test and energy balance on 4-Stroke Petrol engine at different load conditions.
8. Performance test and energy balance on 4-Stroke Diesel Engine at different load conditions.
9. Morse test on petrol engine.
10. Determination of flash and fire point of fuels and lubricating oil.
11. Determination of calorific value of different types of fuel by Bomb calorimeter.
12. Measurement of pollutants emitted from the vehicle by gas analyzer/ Orsat apparatus/ smoke meter.

Course Outcomes:

1. By the use of this Laboratory course students can gain the experimental knowledge on the performance and testing of engines.
2. At the end of the course students can able to test the fuel and oil properties.
3. Gain the knowledge on emission test of the IC engines.
4. Ability to control the emission and use of different equipments to conduct performance test.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PW-AUE581	**Category:** Mini Project
Subject Name : Project-I	**Semester** : Fifth
L-T-P : **0-0-0**	**Credit: 1**
Pre-Requisites: Nil	

Objectives:

This course is aimed at providing more weightage on project work. The project work could be done in the form of a summer project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.