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-VIII

Subject Code : PE – AUE 811A	**Category :** Professional Elective Courses
Subject Name : Off Road Vehicles	**Semester** : Eighth
L-T-P : 3-0-0	**Credit : 3**
Pre-Requisites : Nil	

Objectives:

1. To understand the various off road vehicle and their systems and features.
2. Design and Develop the hydraulic and pneumatic circuits for various off road vehicles

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Classification of off-road vehicles and their applications.	2
2	Shovels: types of shovel. Construction details of diesel, electric and hydraulic shovel. Operating principles and operating cycle. Production capacity and cost of production.	5
3	Draglines: Types of Dragline. Construction and Operating cycle, Production capacity and cost of production.	5
4	Dumpers: Types of Dumpers. Construction and Operating cycle, Carrying capacity, matching with Shovel capacity and cost of production.	5
5	Dozer and Grader: Different types of Dozer, construction and operation, dozer capacity, grader and its construction, application of dozer and grader.	5
6	Tractor and Tractor Units: Tractors in Earth Moving, Application of Tractors, Rating of Tractors, Wheel and Crawler Tractor, Recent Trend in Tractor Design, Power shift Transmission and Final drive in Caterpillar Tractor, Control Mechanism of a Caterpillar.	8
7	Fork Lift Truck and Road Roller: Types, layout and lifting mechanism of Fork Lift Truck, construction and working Principle of Fork Lift truck, Types, layout, operation & maintenance of Road Roller.	6

Course Outcome:

1. Understand the types, special features, design methodology, working principle, application of various off–road vehicles.
2. Identify various systems & subsystems of earth moving machines & agricultural machines.
3. Design and develop the hydraulic and pneumatic circuits for various off road vehicles
4. Carry out preventive maintenance of earth moving machines & agricultural machines

Learning Resources:

1. Abrosimov K., Branberg A. and Katayer K., Road Making Machinery, MIR Publishers, Moscow, 1971.
2. De, A., Latest Development of Heavy Earth Moving Machinery, Annapurna Publishers, Dhanbad, 1995.
3. Nichols H.L.Jr., Moving the Earth, Galgotia Publishing House, New Delhi, 1962.
4. Rudnev V.K., Digging of Soils by Earthmover with Power Parts, Oxanian Press Pvt. Ltd., New Delhi, 1985.

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : PE – AUE 811B	**Category :** Professional Elective Courses
Subject Name : Automotive Air Conditioning	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit: 3**
Pre-Requisites : Engineering Thermodynamics	

Objectives:

1. To identify various components of vehicle air conditioning and heating system.
2. To operate manually and automatic air conditioning and heating system.
3. To apply various concepts related to air conditioning and heating system.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction of Air-conditioning System: Simple vapour compression refrigeration system (V.C.R.S), Driers, Lubricants, Refrigeration components and controls: components, condenser, evaporators, valves electrical circuits and devices, etc.	8
2	Refrigerants: Refrigerants and their properties.	4
3	Psychometrics: Human comfort, Psychometric properties and processes, sensible and latent heat loads, characterization and SHF load for ventilation and filtration, concepts of SHF and ESHF and ADP, concepts of human comfort and effective temperature.	8
4	Air-conditioning equipment: Components and controls, Installation of Air conditioning system in vehicle.	6
5	Load estimation: Heat transfer from exterior wall, passenger, Equipment and infiltrated air. Heater system for winter conditioning, Requirement of air and air distribution systems, duct design, duct systems.	8
6	Maintenance and repair: Air-conditioning system.	2

Course Outcome:

1. A student will be able to identify various components of Vehicle Air conditioning and heating system
2. Operate manually and automatic Air conditioning and heating system
3. Apply various concepts related to Air conditioning and heating system
4. Diagnose various faults in air conditioning system by using suitable tools and instruments
5. Follow safety rules while servicing of Air conditioning and heating system

Learning Resources:

1. Stoecker W.F. and Jones J.W., Refrigeration & Air-conditioning, McGraw Hill Publishing Company Limited, 1982.
2. Lung P., Automotive Air Conditioning, C.B.S. Publisher & Distributor, New Delhi.
3. Giri N.K., Automotive Technology, Khanna Publishers, 2004.
4. De A., Automobile Engineering, Galgotia Publishing House, 2004.
5. Babu A.K., Automobile Mechanics, Khanna Publishing House, 2019.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PE – AUE 812A	**Category :** Professional Elective Courses
Subject Name : Non-Destructive Testing Methods	**Semester** : Eighth
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites : Nil	

Objectives:

1. To predict material properties without destroying the materials
2. To list out the defect less material for proper design
3. Analyze structural analysis

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Visual/Optical Examination: Principal, Procedure, Instrument, Applications.	2
2	Principle, Procedure and Applications of Liquid Penetrating technique, Magnetic Particle Testing, Eddy Current Testing, Ultrasonic Testing, Radiography, Thermography and Accoustic emission testing.	20
3	Comparison and Selection of NDT Methods: Inspection of Raw materials, Inspection of Secondary Processing, In-service Damage Inspection.	5
4	Common Application of NDT: a) Characterization of materials, b) Defect analysis, c) Case study. Codes Standards, Specifications and Procedures.	5

Course Outcome:

1. A student will be able to define the principles and concepts of nondestructive testing.
2. Understand the difference between destructive and non destructive testing.
3. Analyze structural analysis.

Learning Resources:

1. Mcgomnagle W.J., Non-Destructive Testing, McGraw Hill.
2. Raj B., Jayakumar T. and Thavasimuthu M., Practical Non-Destructive Testing, Narosa Publishing House, 2009.
3. ASM Metals Handbook, Non-Destructive Evaluation and Quality Control, American Society of Metals, Metals Park, Ohio, USA.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PE – AUE 812B	**Category :** Professional Elective Courses
Subject Name : Noise, Vibrations and Harshness	**Semester** : Eighth
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites: Nil	

Objectives:

1. To study basic concepts of noise, vibration and harshness and their effects.
2. To study various methods of Vibration control.
3. To study and analyze sounds and detection of noise from automobiles.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Basics of Vibrations: Basic Concepts, Mathematical Models, System characteristics and response, Single and Multi DOF systems.	6
2	Vibration control: Isolators, Tuned absorbers, Untuned viscous dampers, Applications: single cylinder engines, multi cylinder engine, Simple rubber engine mounts, Hydro elastic mounts, Semi active mounts and active mounts, Mass elastic models and measurements, Limits for passenger comforts.	8
3	Sound & sound measurement: Fundamentals of acoustics, General sound propagation, Plane wave propagation, Spherical wave propagation, Human response to sound– the audible range, Sound measurement, Instrumentation, Sound level meters, Frequency intensity analyzers, Real time measurements.	8
4	Automotive noise: Automotive noise criteria, Drive by noise test, Noise from stationary vehicles, Interior noise in vehicles, Automotive noise, Sources and control methods: Engine noise, Transmission noise, Intake and exhaust noise, Aerodynamic noise, Tyre noise, Brake noise.	6
5	General noise control principles: Sound in enclosures, Sound energy absorption, Sound transmission through barriers.	4
6	Harshness: Causes, Frequency limits.	4

Course Outcomes:

Learner will be able to

1. Identify and analyze vibrations and noise coming out of automobiles.
2. Investigate level of harm caused by noise and harshness and to provide measures to control it.

Learning Resources:

1. Rao S.S., Mechanical Vibrations, Addison Wesley Longman, New Delhi, 1995.
2. Heinz H., Advanced Engine Technology, SAE, 1995.

3. SAE, Automobiles and Pollution, SAE Transaction, 1995.
4. Seto, Mechanical Vibrations, Schaum Outline Series, McGraw Hill Book Company, New York, 1990.
5. Springer and Patterson, Engine Emission, Plenum Press, 1990.
6. Thomson W.T., Theory of Vibration with Applications, CBS Publishers and Distributors, New Delhi, 1990.
7. Mallik A.K., Principles of Vibration Control, Affiliated East-West Press (P) Ltd., New Delhi, 1990.
8. Grover G.K., Mechanical Vibrations, New Chand and Brothers, Roorkey, 1989.
9. Morse T. and Hinkle, Mechanical Vibration, Prentice Hall of India Ltd., New Delhi, 1987.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : PE – AUE 812C	**Category :** Professional Elective Courses
Subject Name : Finite Element Method & Its Applications	**Semester** : Eighth
L-T-P : 3-0-0	**Credit : 3**
Pre-Requisites: Engineering Mathematics and Solid Mechanics	

Objectives:

1. To illustrate the principle of mathematical modeling of engineering problems.
2. To introduce the basics and application of Finite Element Method.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.	6
2	One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies.	9
3	Two dimensional equations, variational formulation, finite element formulation, triangular elements shape functions, elemental matrices and RHS vectors; application to thermal problems, torsion of non-circular shafts, quadrilateral and higher order elements. Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements.	9
4	Natural coordinate systems, isoparametric elements and shape functions, numerical integration and application to plane stress problems, matrix solution techniques, solution of dynamic problems, introduction to FE software.	6

Course Outcomes:

Upon completion of the course, students will understand the FEM formulation and its application to simple structural and thermal problems

Learning Resources:

1. Reddy J.N., An Introduction to Finite Element Method, 3rd Ed., McGraw Hill, 2005.
2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.
3. Rao S.S., The Finite Element Method in Engineering, 3rd Ed., Butterworth Heinemann, 2004.
4. Chandraputla & Belegundu, Introduction to Finite Elements in Engineering, 3rd Ed., Prentice Hall, 1990.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : OE – AUE 811A	**Category :** Open Elective Courses
Subject Name : Tribology	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit: 3**
Pre-Requisites: Nil	

Objectives:

1. To provide students with the fundamental knowledge in the field of Industrial tribology.
2. To provide basic concepts in the design of automotive lubrication system.
3. To provide knowledge of friction and wear mechanism in automotive system.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to Tribology: Introduction to Tribology, Tribology in design, Tribology in industry, economic aspects of Tribology, lubrication, basic modes of lubrication, lubricants, properties of lubricants-physical and chemical, types of additives, extreme pressure lubricants, recycling of used oils and oil conservation, disposal of scrap oil, oil emulsion. Types of sliding contact bearings, comparison of sliding and rolling contact bearings.	6
2	Friction and Wear: Friction: Introduction, laws of friction, kinds of friction, causes of friction, friction measurement, theories of friction, effect of surface preparation. Wear: Types of wear, various factors affecting wear, measurement of wear, wear between solids and liquids, theories of wear.	6
3	Hydrodynamic lubrication: Theory of hydrodynamic lubrication, mechanism of pressure development in oil film, two-dimensional Reynold's equation, infinitely long journal bearing, infinitely short journal bearing, finite bearing. Hydrodynamic thrust bearing: Introduction, flat plate thrust bearing, pressure equation, load, centre of pressure, friction in tilting pad thrust bearing.	6
4	Hydrostatic Lubrication: Hydrostatic lubrication: Basic concept, advantages and limitations, viscous flow through rectangular slot, load carrying capacity and flow requirement of hydrostatic step bearing, energy losses, optimum design of step bearing. Compensators and their actions. Squeeze film lubrication: Introduction, circular and rectangular plates approaching a plane.	6
5	Elasto-hydrodynamic Lubrication and Gas Lubrication: Elastohydrodynamic Lubrication: Principle and application, pressure-viscosity term in Reynolds equation, Hertz theory. Ertel-Grubin Equation. Gas lubrication: Introduction, merits and demerits, applications. Lubrication in metal working: Rolling, forging, drawing and	6

	extrusion. Bearing materials, bearing constructions, oil seals, shields and gaskets.	
6	Surface Engineering: Introduction to surface engineering, concept and scope of surface engineering, manufacturing of surface layers, solid surface geometrical, mechanical and physic chemical concepts, superficial -layer, development of concept, structure of superficial layer, general characteristics of superficial layer, obtained by machining, strengthening and weakening of superficial layer.	6

Course Outcomes:
Lerner will be able to
1. Apply knowledge of tribology for industrial component design.
2. Apply design concepts practically for automotive lubrication systems.

Learning Resources:
1. Cameron A., Basic Lubrication Theory, Wiley Eastern Ltd.
2. Wen S., Principles of Tribology, Wiley.
3. Majumdar B.C., Introduction to Tribology and Bearings, S. Chand and Company Ltd., New Delhi.
4. Fuller D.D., Theory and Practice of Lubrication for Engineers, John Wiley and Sons.
5. Halling J., Principles of Tribology, McMillan Press Ltd.
6. Bhushan B. and Gupta B.K., Handbook of Tribology: Materials, Coatings and Surface Treatments, McGraw-Hill.
7. Davis J., Surface Engineering for Corrosion and Wear Resistance, Woodhead Publishing, 2001.
8. Burakowski T., Surface Engineering of Metals: Principles, Equipments, Technologies, Taylor and Francis.

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : OE – AUE 811B	**Category :** Open elective courses
Subject Name : Internet of Things	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit: 3**
Pre-Requisites : Computer programming	

Objectives:

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to IoT: Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs.	4
2	IoT & M2M: Machine to Machine, Difference between IoT and M2M, Software define Network.	4
3	Network & Communication Aspects: Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.	8
4	Challenges in IoT: Design challenges, Development challenges, Security challenges, Other challenges.	6
5	Domain specific applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT applications.	4
6	Developing IoTs: Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python.	10

Course Outcomes:

On successful completion of the course, a student will

1. Understand the concepts of Internet of Things
2. Analyze basic protocols in wireless sensor network
3. Design IoT applications in different domain and be able to analyze their performance
4. Implement basic IoT applications on embedded platform

Learning Resources:

1. Jeeva Jose, Internet of Things, Khanna Publishing House.
2. Madisetti V. and Bahga A., Internet of Things: A Hands-On Approach.
3. Dargie W. and Poellabauer C., Fundamentals of Wireless Sensor Networks: Theory and Practice.

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : OE – AUE 811C	**Category :** Open elective courses
Subject Name : Soft Computing	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit : 3**
Pre-Requisites : Engineering Mathematics	

Objectives:

1. To give students knowledge of soft computing theories fundamentals.
2. To learn the fundamentals of non-traditional technologies and approaches to solving hard real-world problems.
3. To learn and apply artificial neural networks, fuzzy sets and fuzzy logic, and genetic algorithms in problem solving and use of heuristics based on human experience.
4. To introduce the ideas of fuzzy sets, fuzzy logic.
5. To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
6. To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Neural Networks– I: (Introduction and Architecture) Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning Techniques; Perception and Convergence Rule, Auto-Associative and Hetro-Associative Memory.	7
2	Neural Networks– II: (Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perception Model; Back Propagation Learning Methods, Effect of Learning Rule Co-Efficient; Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications.	8
3	Fuzzy Logic– I: (Introduction) Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion.	7
4	Fuzzy Logic– II: (Fuzzy Membership, Rules) Membership Functions, Interference in Fuzzy Logic, Fuzzy If-Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzifications and Defuzzificataions, Fuzzy Controller, Industrial Applications.	7
5	Genetic Algorithm (GA): Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications.	7

Course Outcomes:

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

1. Awake the importance of tolerance of imprecision and uncertainty for design of robust and low-cost intelligent machines.
2. Acquire knowledge of soft computing theories fundamentals and so they will be able to design program systems using approaches of these theories for solving various real-world problems.
3. Try and integrate the knowledge of neural networks, fuzzy logic, genetic algorithms, probabilistic reasoning, rough sets, chaos, hybrid approaches (combinations of neural networks, fuzzy logic and genetic algorithms).

Learning Resources:

1. Rajasekaran S. and Pai V.G.A., Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications, Prentice Hall of India, 2003.
2. Padhy N.P., Artificial Intelligence and Intelligent Systems‖, Oxford University Press, 2005.
3. Jang J.S.R., Sun C.T. and Mizutani E., Neuro-Fuzzy and Soft Computing, Pearson Education, 2004.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : OE – AUE 812A	**Category :** Open Elective Courses
Subject Name : Computational Fluid Dynamics	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit : 3**
Pre-Requisites : Engineering Mathematics	

Objectives:

1. To understand mathematical characteristics of partial differential equations.
2. To understand basic properties of computational methods– accuracy, stability, consistency.
3. To learn computational solution techniques for time integration of ordinary differential equations.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction to CFD: Evaluation Method, References and Application of CFD in Engineering.	3
2	Governing Equations and Boundary Conditions: Introduction to models of flow, conservation law of physics, derivation of Continuity, Momentum and Energy equation in Cartesian coordinate system, Transformation of these equations from Non conservative form to conservative, Implementation of boundary condition – Inlet, Outlet and Wall boundary condition.	10
3	Numeric Discretization Process: Concept and structure, Methods of deriving the discretized equations, Finite difference, Finite Volume Methods, stability criteria, errors in calculation, Mathematical behaviour of PDE's, structured grid, staggered grid, Mesh less Techniques.	9
4	Solution Algorithm: One way and Two way coordinates, Explicit Taylor series expansion, The four basic rules for the control volume formulation, staggered grid Pressure correction as Poisson's pressure equation, Quick, Simple and PISO Algorithms, TMDA, Point Iterative Methods, Explicit Methods– Crank Nicolson, Implicit Methods. Usage of Plotting software (open source, commercial), Contour plots, velocity vectors and Heat maps.	14

Course Outcome:

1. A student will understand mathematical characteristics of partial differential equations.
2. Will understand basic properties of computational methods– accuracy, stability, consistency.
3. Will learn computational solution techniques for time integration of ordinary differential equations.
4. Will learn computational solution techniques for various types of partial differential equations.
5. Will learn how to computationally solve Euler and Navier-Stokes equations.

6. To acquire basic programming and graphic skills to conduct the flow field calculations and data analysis

Learning Resources:

1. Hirsch C., Numerical Computation of Internal and External Flows, 2nd Ed., Butterworth-Heinemann, 2007, ISBN 9780750665940 (E-Book available).
2. Pletcher R.H., Tannehill J.C. and Anderson D., Computational Fluid Mechanics and Heat Tranfer, 3rd Ed., CRC Press, 2011.
3. Moin P., Fundamentals of Engineering Numerical Analysis, 2nd Ed., Cambridge University Press, 2010.
4. Ferziger J.H., Numerical Methods for Engineering Application, 2nd Ed., Wiley, 1998.
5. Ferziger J.H. and Peric, M., Computational Methods for Fluid Dynamics, 3rd Ed., Springer, 2002.
6. LeVeque R., Numerical Methods for Conservation Laws, Lectures in Mathematics, ETH Zurich, Birkhauser, 1992.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : OE – AUE 812B	**Category :** Open Elective Courses
Subject Name : Entrepreneurship Development	**Semester** : Eighth
L-T-P : 3-0-0	**Credit: 3**
Pre-Requisites : Nil	

Objectives:

1. To develop and strengthen entrepreneurial quality and motivation in students and to impart basic entrepreneurial skills.
2. To understand how to run a business efficiently and effectively.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Entrepreneurship: Types of Entrepreneurs– Difference between Entrepreneur and Intrapreneur, Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth	5
2	Motivation: Major Motives Influencing an Entrepreneur– Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test– Stress Management, Entrepreneurship Development Programs – Need, Objectives.	8
3	Business: Small Enterprises– Definition, Classification– Characteristics, Ownership Structures– Project Formulation– Steps involved in setting up a Business– identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment– Preparation of Preliminary Project Reports– Project Appraisal– Sources of Information– Classification of Needs and Agencies.	8
4	Financing And Accounting: Need– Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation– Income Tax, Excise Duty– Sales Tax.	8
5	Support To Entrepreneurs: Sickness in small Business– Concept, Magnitude, Causes and Consequences, Corrective Measures– Business Incubators– Government Policy for Small Scale Enterprises– Growth Strategies in small industry– Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	7

Course Outcome:

1. A student shall gain knowledge and skills needed to run a business successfully
2. Interpret key regulations and legal aspects of entrepreneurship in India
3. Understand the concept of business plan and ownerships

Learning Resources:

1. Khanka S.S., Entrepreneurial Development, S. Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.

2. Kuratko D.F., Entrepreneurship- Theory, Process and Practice, 9th Edition, Cengage Learning.
3. Hisrich R.D. and Peters M.P., Entrepreneurship, 8th Edition, McGraw-Hill, 2013.
4. Manimala M.J., Entrepreneurship Theory at Cross Roads: Paradigms and Praxis, 2nd Edition, Dreamtech, 2005.
5. Roy R., Entrepreneurship, 2nd Edition, Oxford University Press, 2011.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

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Subject Code : OE – AUE 812C	**Category :** Open Elective Courses
Subject Name : Robotics and Robot Application	**Semester** : Eighth
L-T-P : **3-0-0**	**Credit : 3**
Pre-Requisites : Mathematics	

Objective:

To impart knowledge about the engineering aspects of Robots and their application.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Basic concepts- Robot anatomy- Manipulators- kinematics: Forward and inverse kinematics- Precision movement, robot specifications and Work volume, Types of Robot drives- Basic robot motions- Point to point control, continuous path contour.	6
2	End Effectors: End effectors- classification- mechanical, magnetic, vacuum and adhesive gripper- gripper force analysis and design. Robot control- Unit control system concept- servo and non-servo control of robot joints, adaptive and optimal control.	6
3	Sensors: Sensor devices, Types of sensors- contact, position and displacement sensors, Force and torque sensors- Proximity and range sensors- acoustic sensors- Robot vision systems- Sensing and digitizing- Image processing and analysis.	7
4	Robot Programming: Robot language classification- programming methods- off and on line programming- Lead through method- Teach pendent method- VAL systems and language, simple program.	9
5	Industrial Application: Application of robots- Material handling- Machine loading and unloading, Assembly, Inspection, Welding, spray painting, Mobile robot, Microbots- Recent developments in robotics- safety consideration.	8

Course Outcome:

1. A student will get familiarization with the basics of robots control system.
2. will get familiarization with end effectors, sensor technology and industrial application of robot.

Learning Resources:

1. Deb, S.R., Robotics Technology and Flexible Automation, McGraw Hill Publishing Company Limited, New Delhi, 1994.
2. Groover M.P., Industrial Robotics Technology Programming and Applications, McGraw Hill Book Co., Singapore, 1987.
3. Koren Y., Robotics for Engineers, McGraw Hill, New York, 1985.

4. Ranky P.G. and Ho C.Y., Robots Modelling Control and Applications with Software, Springer Verlag, 1985.
5. Craig J.J., Introduction to Robotics, Addison-Wesley, 2009.
6. Schilling R.J., Fundamentals of Robotics Analysis and Control, Prentice Hall of India, 1996.
7. Saha S.K., Introduction to Robotics, McGraw-Hill Publication, 2008.
8. Yoshikawa T., Foundations of Robotics Analysis and Control, Prentice Hall of India, 2010.
9. Fu K.S., Gonzales R.C. and Lee C.S.G., Robotics: Control, Sensing, Vision and Intelligence, McGraw Hill, 1997.
10. Stadler W., Analytical Robotics and Mechatronics, McGraw Hill Book Co., 1995.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PC – AUE 881	**Category:** Professional Core Courses
Subject Name : Comprehensive Viva Voce	**Semester** : Eighth
L-T-P : 0-0-0	**Credit: 2**
Pre-Requisites : All courses	

Objectives:

The objective of comprehensive viva-voce is to assess the overall knowledge, a student acquired in the relevant field of engineering over 4 years of study in the programme. In doing so, the main objective is to prepare the students to face interview both in the academic and the industrial sector.

Course Contents:

The Comprehensive Viva-Voce will be conducted by a Committee consisting of Head of the Department and all Faculty members of the department. The Comprehensive Viva-Voce is intended to assess the student's understanding of the courses he/ she studied during the 4 years B.Tech programme.

Maulana Abul Kalam Azad University of Technology, West Bengal

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SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING

(Effective from academic session 2018-19)

Subject Code : PW – AUE 882	**Category :** Project
Subject Name : Project - IV	**Semester** : Eighth
L-T-P : **0-0-12**	**Credit : 6**
Pre-Requisites : All courses	

Objective:

To develop the ability to conduct investigations of complex engineering problems using research knowledge, methods and other modern engineering tools.
To train the students in preparing project reports, to face review and viva voce examination.

Course Contents:

It is intended to start the project work early in the seventh semester and carry out both design and fabrication of a mechanical and automobile device whose working can be demonstrated. The design and formulation of the problem is expected to be completed in the seventh semester and the fabrication and demonstration will be carried out in the eighth semester. The students in a group of 4 to 6 works on a topic are to be approved by the head of the department under the guidance of a faculty member. The students prepare a comprehensive project report after completing the work to the satisfaction of the supervisor to be submitted at the end of the semester. The progress of the project is evaluated by a committee may be constituted by the Head of the Department. The project work is evaluated based on oral presentation and the project report may jointly by external and internal examiners constituted by the Head of the Department.