# 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-VII**

| | |
|---|---|
| **Subject Code : PC - AUE 701** | **Category :** Professional Core Courses |
| **Subject Name : Vehicle Dynamics** | **Semester** : Seventh |
| **L-T-P : 3-0-0** | **Credit : 3** |
| **Pre-Requisites:** Engineering Mechanics and Aerodynamics | |

**Objectives:**

1. To understand the principle and performance of vehicle in various modes such as longitudinal, vertical and lateral directions.
2. To identify the various forces and loads and performance under acceleration, ride and braking.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Resistance to Motion: Air gradient and Friction resistance, Tractive effort Draw bar pull, Tractive effort vs speed graph, Gear Ratio Selection, Power calculation of vehicle. | 4 |
| 2 | Aerodynamic Effect: Objectives, Vehicle drag and types, various types of forces and moments, Effects of forces and moments, side wind effects on forces and moments, various body optimization techniques for minimum drag. Wind tunnel testing: Flow visualization techniques, scale model testing. Component balance to measure forces and moments. | 5 |
| 3 | Stability of vehicle: Stability analysis, when vehicle is moving on level ground, reaction and maximum Tractive effort for the front wheel, rear wheel and all wheel drive vehicle. Stability analysis when vehicle traveling on both longitudinally and laterally inclined road. Stability of vehicle when taking turn on level and inclined road. | 6 |
| 4 | Forces on suspension: Load on suspension in force and apt direction. Load on suspension both for rigid and independent suspension system. Effect of braking and acceleration on suspension. Conditions for maximum load on suspension, considering gyroscopic effect. Stability of 2 wheelers and 3 wheeler vehicle. | 6 |
| 5 | Vehicle Handling: Slip angle, over steer and under steer and its relation with slip angle, Ackerman angle, Steady state and transient cornering, Lateral force developed during cornering. Cornering stiffness, Power consumed by tyre. | 4 |
| 6 | Effect of braking: Braking torque inside the drum brake and disc brake system, Force analysis on brake pedal, master cylinder and wheel cylinder, Wheel braking torque on the surface of tyre, requirement of antilock braking system. | 4 |
| 7 | Gyroscope: Precisional motions and gyroscopic stability, gyroscopic couple, effect on stability of four and two wheel vehicle. | 4 |

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|---|---|---|
| 8 | Riding characteristic: Effect of inflation pressure on tyre, tyre life, tyre wear. Over loading and wrong loading Driving habit. Wheel wobble and its effect. | 3 |

**Course Outcomes:**

1. Describe the basic terms within vehicle dynamics; create simple models of vehicles for dynamic analysis
2. Formulate the equations of motion for vehicles in order to perform an analysis of the bounce and pitch motions that arise due to for example acceleration, braking and uneven road surfaces
3. Formulate the equations of motion for a vehicle during stationary and non-stationary cornering and to analyze the vehicle directional stability and roll behavior.
4. Calculate and refer the loads and forces associated to the vehicles.
5. Analyze the behavior of the vehicles under acceleration, ride and braking.

**Learning Resources:**

1. Babu A.K., Automobile Mechanics, Khanna Publication, 2018.
2. Giri N.K., Automotive Technology, 1st Edition, Khanna Publication, 2004.
3. Gupta K.M., Autobobile Engineering, Vol. I & II, 1st Edition, Umesh Publication, 2006.
4. De. A., Automobile Engineering, Revised Edition, Galgotia Publications Pvt. Ltd., 2010.
5. De. A., Vehicle Dynamics, Galgotia Publications Pvt. Ltd., 2010.
6. Pacejka H., Tire and Vehicle Dynamics, Elsevier, 2012.

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**SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING**

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|---|---|
| **Subject Code** : **PE – AUE 711A** | **Category:** Professional Elective Courses |
| **Subject Name** : **Alternate Fuels and Energy Systems** | **Semester** : Seventh |
| **L-T-P** : **3-0-0** | **Credit: 3** |
| **Pre-Requisites: Nil** | |

**Objectives:**

The course is designed by considering following objectives:

1. Create awareness about alternative fuels and their need.
2. Student should be able to differentiate the conventional fuels and Alternative fuels.
3. Student should get the knowledge about application of alternative fuels.
4. Student should understand the Emission norms up to Bharat Stage VI.
5. Student should get knowledge of emission from different automotive vehicles and its control.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Conventional Fuels and Need for alternative fuels: Estimate of petroleum reserve and availability- comparative properties of fuels-diesel and gasoline, quality rating of SI and CI engine fuels, fuel additives for SI and CI engines, thermodynamics of fuel combustion-introduction to chemical thermodynamics, chemical reaction- fuels and combustion, enthalpy of formation and enthalpy of combustion, first law analysis of reacting systems, adiabatic flame temperature, need for alternative fuels, applications, types etc. | 8 |
| 2 | Alternative Fuels I– Gaseous Fuels and Biofuels: Introduction to CNG, LPG, ethanol, vegetable oils, bio-diesel, biogas, Hydrogen and HCNG, study of availability, manufacture, properties, storage, handling and dispensing, safety aspects, engine/ vehicle modifications required and effects of design parameters performance and durability. | 6 |
| 3 | Alternative Fuels II- Synthetic Fuels: Introduction to Syngas, DME, P-Series, GTL, BTL, study of production, advantages, disadvantages, need, types, properties, storage and handling, dispensing and safety, discussion on air and water vehicles. | 6 |
| 4 | Emission Control (SI Engine): Emission formation in S.I. engines - Hydrocarbons, carbon monoxide, oxides of nitrogen, poly-nuclear aromatic hydrocarbon, effects of design and operating variables on emission formation in spark ignition engines, controlling of pollutant formation in engines exhaust after treatment, charcoal canister control for evaporative emission control, emissions and drivability, positive crank case ventilation system for UBHC emission reduction. | 6 |
| 5 | Emission Measurement and Control (CI Engine): Chemical delay, intermediate compound formation, pollutant formation on incomplete combustion, effect of design and operating variables on pollutant | 6 |

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|---|---|---|
| | formation, controlling of emissions, emissions and drivability, exhaust gas recirculation, exhaust after treatment– DOC, DPF, SCR and LNT measurement and test procedure (NDIR analyzers, FID, chemiluminescence $NO_x$ analyzer, oxygen analyzer, smoke measurement, constant volume sampling, particulate emission measurement, Orsat apparatus.). | |
| 6 | Health effects of Emissions from Automobiles: Emission effects on health and environment. Emission inventory, ambient air quality monitoring, Emission Norms: As per Bharat Standard up to BS – VI. | 4 |

**Course Outcomes:**

1. A student will acquire the ability to understand the importance of Alternative Fuels, its properties and their application.
2. A student will be able to select an alternative fuel for specific application.
3. A student will get knowledge of emission norms.
4. One will be able to identify the emission parameters from engine emission, its causes and remedies.

**Learning Resources:**

1. Gupta O.P., Elements of Fuel & Combustion Technology, Khanna Publishing House.
2. Thipse S.S., Alternative Fuels, Jaico Publications.
3. Pundir B.P., Engine Emission, Narosa Publication.
4. Ganesan V., Internal Combustion Engines, Tata McGraw Hill.
5. Crouse W.M. and Anglin A.L, Automotive Emission Control, McGraw Hill.
6. Thipse S.S., IC Engines, Jaico Publications.
7. Springer G.S. and Patterson D.J., Engine Emissions, Pollutant Formation, Plenum Press.
8. ARAI Vehicle Emission Test Manual.

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| | |
|---|---|
| **Subject Code** : **PE – AUE 711B** | **Category:** Professional Elective Courses |
| **Subject Name** : **CAD/CAM and Modern Manufacturing Methods** | **Semester** : Seventh |
| **L-T-P** : **3-0-0** | **Credit: 3** |
| **Pre-Requisites:** Primary manufacturing processes | |

**Objectives:**

1. To introduce new and exciting field of Intelligent CAD/CAM with particular focus on engineering product design and manufacturing.
2. To develop a holistic view of initial competency in engineering design by modern computational methods.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Computer Graphics and Techniques for Geometric Modeling: Computer Graphics: Two dimensional computer graphics, Computer Graphics: concept of rasterisation, linear interpolation algorithms (DDA and Bressenham), different geometrical transformations, The parametric representation of geometry, Bezier curves, Cubic Spline curve, B-Spline curve, parametric representation of line, circle, ellipse & parabola. Constructive solid geometry (CSG), Boundary Representation (B-Rep), Wire Frame Modeling, Solid Modeling, Surface Modeling, Parametric Modeling, feature based modeling, Feature recognition, Design by feature, Artificial Intelligence in Design & Manufacturing, Representation of Knowledge, and Knowledge base Engineering. | 12 |
| 2 | NC & CNC Technology: Tape coding & format, Manual Part Programming, Computer Aided Part Programming, CNC functions & advantages, DNC, adaptive Control, CNC programming concepts, Trends & new developments in NC, Part programmers job, functions of a post processor, NC part programming languages, Elements of a APT language, The Macro Statement in APT, NC programming with interactive graphics. Constructional details of CNC machines, Feedback devices- Velocity & displacement, Machining Centers and its types, Automated Material Handling & storage Systems like Robots, AGVs and AS/RS etc. | 12 |
| 3 | Computer Integrated Manufacturing & Technology Driven Practices: Introduction, Evolution, Objectives, CIM Hardware and Software, CIM Benefits, Nature and role of the elements of CIM, Identifying CIM needs, Data base requirements of CIM, Role of CAD/CAM in CIM, Obstacles to Computer Integrated Manufacturing, Concept of the future CIM systems, Socio -techno- economic aspects of CIM. | 8 |

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|---|---|---|
| 4 | Rapid Prototyping and Tooling: Introduction to RP, Technology Description, Overview of RP, Benefits and Application. RP Processes: Process overviews, STL file Generation, Classes of RP systems: Stereo-lithography Approach (SLA), SLA with liquid thermal polymerization, Selective Laser Sintering (SLS), Fused deposition modelling, Laminated object manufacturing, Laser powder forming. Prototype properties, RP Applications: Design, Concept Models, Form & fit checking, Functional testing, CAD data verification, Rapid Tooling, Rapid manufacturing, RP processes for MEMS, Photolithography. | 4 |

**Course Outcome:**

A learner will be able to

1. Identify proper computer graphics techniques for geometric modelling.
2. Transform, manipulate objects and store and manage data.
3. Prepare part programming applicable to CNC machines.
4. Use rapid prototyping and tooling concepts in any real life applications.
5. Identify the tools for Analysis of a complex engineering component.

**Learning Resources:**

1. Groover M.P. and Zimmers, Jr.E.W., CAD/CAM Computer Aided and Manufacturing, Eastern Economy Edition.
2. Zeid I. and Sivasubramanian R., CAD/CAM, Theory & Practice, McGraw Hill Publication.
3. Radhakrishan P., Subramanyan S. and Raju V., CAD/CAM/CIM, New Age International Publisher.
4. Rao P.N., CAD/CAM Principles and Applications, McGraw Hill Publication.
5. Pabla B.S. and Adithan M., CNC Machines, New Age International Publisher.
6. Kundra T.K., Rao P.N. and Tiwari N.K., Numerical Control and Computer Aided Manufacturing, McGraw Hill.
7. Groover M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice-Hall of India Pvt. Ltd.
8. Noorani R., Rapid Prototyping: Principles and Applications, Wiley.

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## (Effective from academic session 2018-19)

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|---|---|
| **Subject Code PE – AUE 712A** | **Category:** Professional Elective Courses |
| **Subject Name** : **Automotive Component and System Design** | **Semester** : Seventh |
| **L-T-P** : **3-0-0** | **Credit: 3** |
| **Pre-Requisites: Machine Design** | |

**Objectives:**

1. Provide students with the fundamental knowledge in the field of automotive design.
2. Develop analytical abilities to give solutions to automotive design problems.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Design of following principal parts of I.C. Engines:<br>Cylinder and cylinder liner- Material Selection, Design of cylinder, Piston, piston rings and piston pin or gudgeon pin- Material Selection. Design considerations, Design calculations of Connecting rod with small and big end bearing-forces acting on it. | 9 |
| 2 | Design of Crank, crankshaft and crank pin, Cam shaft and Valve Operating mechanism. | 5 |
| 3 | Design of Clutches and Gear Boxes: single plate, multiple plates, centrifugal clutch, lining material, lever design, sliding mesh, constant mesh, synchromesh gear box, gear ratio and gear shifting lever, sliding mechanism. | 7 |
| 4 | Design of Drive train: Design of propeller shaft and U-joints, Design of propeller shaft, criteria, failure theories-joint design, Design of Final drive and differential. | 7 |
| 5 | Brakes and Suspension: internal expanding shoe brake, friction lining material, leaf spring, coil spring, materials, suspension system and linkages, independent suspension. | 4 |
| 6 | Advanced automotive Body Structures: Emphasis is on body concept for design. Material selection and manufacturing constraints. | 4 |

**Course Outcome:**

Learner will be able to

1. Design automotive component to meet desired needs
2. Apply the fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials and Theory of Machine for actual design problems

**Learning Resources:**


1. Ramamurhti V., Computer Aided Mechanical Design and Analysis, 3rd Ed., TMH.
2. Burr A.H. and Cheatham J.B., Mechanical Analysis and Design, 2nd Ed., PHI, 1995.
3. Shigley J.E., Mechanical Engineering Design, McGraw Hill, 2003.
4. Schmid, S.R., Hamrock B.J. and Jacobson B.O., Fundamentals of Machine Elements, McGraw Hill, 1993.
5. Bhandari V.B., Design of Machine Elements , McGraw Hill Pub.
6. Sadhu Singh, Machine Design, Khanna Book Publishing House, 2016.

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| | |
|---|---|
| **Subject Code PE – AUE 712B** | **Category:** Professional Elective Courses |
| **Subject Name : Two and Three Wheelers** | **Semester** : Seventh |
| **L-T-P : 3-0-0** | **Credit: 3** |
| **Pre-Requisites: Nil** | |

**Objectives:**

The course is designed to understand different types of two and three wheelers types, construction and working. Students will also be able to learn about different functions of two and three wheelers.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Introduction: Development, history, Classification & layouts of two & three wheeler vehicles. | 2 |
| 2 | Systems requirements for Engine lubrication, cooling & engine starting. Fuels used Valve timing and port timing diagram, scavenging, types of scavenging and relative merits and demerits with one another. | 5 |
| 3 | Chassis & Sub Systems, Chain and shaft drive, Clutch, CVT-Continuously Variable Transmission, gear box– construction and working principle - gear controls & shifting mechanism. | 5 |
| 4 | Suspension & Steering Handle bar, Instrumentation & Controls: Two wheeler / three wheeler panel meters & controls. All types Switches, Indicators, warnings indicators / buzzers & actuating levers on steering handle bar. Starting / Ignition and steering lock key switch on Steering Handle Shaft. | 4 |
| 5 | Brakes and Wheels: Brake types, Brake circuit Layout for two wheeler and three wheeler vehicles. Wheels - Front and Rear – Wheel rim types, Tyre – functions – materials, methods vulcanizing of Tubes & Tyres for Tubeless tyres. | 8 |
| 6 | Two & three wheeler Maintenance: Importance of maintenance – general maintenance, scheduled maintenance, Servicing of two wheeler vehicles, periodic checkups. | 7 |
| 7 | Electrical Systems & Instruments: Battery specifications, Charging system, Lighting (front & rear), Ignition key switch, Horn, Side Signalling, Instruments & Indicators. | 4 |
| 8 | Helmets: Types & purpose. Safety standards related to helmets. | 1 |

**Course Outcomes:**

1. Learning of different types of two and three wheelers.
2. Learning of special parts and their importance and working in two and three wheelers.
3. Learning of maintenance of two and three wheelers.

**Learning Resources:**

1. Steed N., The Motor Vehicle, McGraw Hill Book Co. Ltd., New Delhi.
2. Herrmann S., The Motor Vehicle, Asia Publishing House, Bombay.
3. Two stroke Motor Cycles, Staff & Motor Cycles, London llefe Books.
4. Narang G.B.S., Automobile Engineering, Khanna Publishers, New Delhi.
5. Panchal D.U., Two and Three Wheeler Technology, PHI Learning Pvt. Ltd., New Delhi.
6. Service Manuals of Manufacturers of Indian Two & Three wheelers.
7. Service Manual, Jeep Utility Vehicles, Villys Motors, Ioc., USA.

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| | |
|---|---|
| **Subject Code : OE - AUE 711A** | **Category:** Open Elective Courses |
| **Subject Name : Quality Control & Reliability Engineering** | **Semester** : Seventh |
| **L-T-P : 3-0-0** | **Credit : 3** |
| **Pre-Requisites : Nil** | |

**Objectives:**

1. To apply the knowledge of descriptive statistics.
2. To understand and apply different types of sampling methods used in control engineering.
3. To develop a basic understanding concepts of reliability engineering.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Basics of quality: Quality objectives, Quality control, Quality Assurance, Quality costs, Quality loss function, Statistical tolerance, quality assurance statistical tools used in quality in SQC, Quality planning, Organization for quality. Bureau of Indian standards, ISO 9000: 2008-quality circles KAIZEN-TQM concepts-Quality audit. | 4 |
| 2 | Statistical Process Control: Variation in processes, Factors, Process capability, Analysis of process capability, control charts, variables, Attributes, Establishing and interpreting control charts, X,R, chart for variables, defects, P chart, C-chart and U chart-Con-troll charts for defective quality rating. | 8 |
| 3 | Acceptance Sampling: Lot-by-lot sampling, types probability of acceptance in single double, multiple sampling techniques- O.C. curves, procedure's Risk and consumers Risk AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans. | 5 |
| 4 | Life Testing-Reliability-Systems Approach: Life testing-objectives-classification-failure characteristics-failure data analysis-mean time to failure-maintainability and availability-reliability-system reliability-series and parallel systems-systems reliability in terms of probability of failure-MTBF-Acceptance sampling based on reliability test OC curves. | 7 |
| 5 | Quality and Reliability: Reliability improvement- techniques, use of Pareto analysis- Design for reliability, Redundancy, standby redundancy, failsafe systems- optimization in reliability, product design, product analysis, product development product cycle. | 7 |
| 6 | Quality function deployment: FMEA, Quality circles, ISO 9000 series and 14000 series, 3 Sigma and 6 Sigma concepts. | 5 |

**Course Outcome:**

1. A student will be able to express the knowledge about various concepts of descriptive statistics like mean, mode, median, standard deviation, standard deviation etc and learn their application.
2. Apply and use different tools and techniques used in quality control engineering.
3. Develop a basic understanding of concepts of reliability engineering along with use of statistical and design model in reliability engineering.
4. Understand and apply different types of sampling methods used in control engineering.
5. Understand and Analyze different types of failures and apply techniques to overcome these failures in reliability engineering.

**Learning Resources:**

1. Betsterfield D.H., Quality Control, Revised Edition, Prentice Hall Pub, 1993.
2. Montgomery D.C., Statistical Quality Control: A Modern Introduction, 6th Ed., Wiley India.
3. Sharma S.C. & Poonia M.P., Total Quality Management, Khanna Publishing House, New Delhi 2016.
4. Bank J., The Essence of Total Quality Management, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Samson D., Manufacturing & Operations Strategy, Prentice Hall, New York, 1991.
6. Ganapathy K., Narayana V. and Subramaniam B., Quality Circle Concepts and Implementation, QCFI, Secondrabad.
7. Bagchi T.P., ISO9000 Concepts Methods and Implementation, Wheeler Publisher Allahabad, 1994.
8. Ross P.J., Taguchi Techniques for Quality Engineering, McGraw Hill, New York, 1998.

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**(Effective from academic session 2018-19)**

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|---|---|
| **Subject Code : OE - AUE 711B** | **Category:** Open Elective Courses |
| **Subject Name : Machine Learning** | **Semester** : Seventh |
| **L-T-P : 3-0-0** | **Credit : 3** |
| **Pre-Requisites:** Advanced Engineering Mathematics, Programming Knowledge | |

**Objectives:**

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To have a thorough understanding of the Supervised and Unsupervised learning
3. techniques
4. To study the various probability based learning techniques
5. To understand graphical models of machine learning algorithms

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Introduction: Learning– Types of Machine Learning– Supervised Learning– The Brain and the Neuron– Design a Learning System– Perspectives and Issues in Machine Learning – Concept Learning Task– Concept Learning as Search– Finding a Maximally Specific Hypothesis– Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants– Perceptron– Linear Separability– Linear Regression. | 7 |
| 2 | Linear Models: Multi-layer Perceptron– Going Forwards– Going Backwards: Back Propagation Error– Multilayer Perceptron in Practice– Examples of using the MLP– Overview– Deriving Back Propagation – Radial Basis Functions and Splines– Concepts– RBF Network– Curse of Dimensionality– Interpolations and Basis Functions– Support Vector Machines. | 7 |
| 3 | Tree and Probabilistic Models: Learning with Trees– Decision Trees– Constructing Decision Trees– Classification and Regression Trees– Ensemble Learning– Boosting– Bagging– Different ways to Combine Classifiers– Probability and Learning– Data into Probabilities– Basic Statistics– Gaussian Mixture Models– Nearest Neighbour Methods– Unsupervised Learning– K means Algorithms– Vector Quantization– Self Organizing Feature Map. | 7 |
| 4 | Dimensionality Reduction and Evolutionary Models: Dimensionality Reduction– Linear Discriminant Analysis– Principal Component Analysis– Factor Analysis– Independent Component Analysis– Locally Linear Embedding– Isomap– Least Squares Optimization– Evolutionary Learning– Genetic algorithms– Genetic Offspring: Genetic Operators– Using Genetic Algorithms– Reinforcement Learning– Overview– Getting Lost Example– Markov Decision Process. | 8 |
| 5 | Graphical Models: Markov Chain Monte Carlo Methods– Sampling– Proposal Distribution– Markov Chain Monte Carlo– Graphical Models– | 7 |

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|---|---|---|
| | Bayesian Networks– Markov Random Fields– Hidden Markov Models– Tracking Methods. | |

**Course Outcomes:**

Upon completion of this course, the students will be able to:

1. Distinguish between, supervised, unsupervised and semi-supervised learning
2. Apply the appropriate machine learning strategy for any given problem
3. Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem
4. Design systems that uses the appropriate graph models of machine learning
5. Modify existing machine learning algorithms to improve classification efficiency

**Learning Resources:**

1. Marsland S., Machine Learning– An Algorithmic Perspective, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2. Mitchell T.M., Machine Learning, First Edition, McGraw Hill Education, 2013.
3. Flach P., Machine Learning: The Art and Science of Algorithms that Make Sense of Data, First Edition, Cambridge University Press, 2012.
4. Bell J., Machine learning- Hands on for Developers and Technical Professionals, First Edition, Wiley, 2014.
5. Alpaydin E., Introduction to Machine Learning, 3rd Edition, Adaptive Computation and Machine Learning Series, MIT Press, 2014.
6. Dr. Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House, 2019.

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|---|---|
| **Subject Code : OE - AUE 711C** | **Category:** Open Elective Courses |
| **Subject Name** : **Cloud Computing** | **Semester** : Seventh |
| **L-T-P** : **3-0-0** | **Credit : 3** |
| **Pre-Requisites :** Knowledge of operating systems, Networking, Understanding of virtualization. | |

**Objectives:**

1. To understand the concept of cloud and utility computing.
2. To understand the various issues in cloud computing.
3. To familiarize themselves with the lead players in cloud.
4. To appreciate the emergence of cloud as the next generation computing paradigm.
5. To be able to set up a private cloud.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Introduction: Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack. | 6 |
| 2 | Virtualization: Data Center Technology - Virtualization - Characteristics of Virtualized Environments – Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization - Implementation Levels of Virtualization - Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V. | 7 |
| 3 | Cloud Computing Mechanism: Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System. | 8 |
| 4 | Hadoop and Map Reduce: Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/ODeveloping a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features – Hadoop Cluster Setup – Administering Hadoop. | 8 |
| 5 | Security in the Cloud: Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images. | 7 |

**Course Outcomes:**

Upon completion of the course, the students will be able to

1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Explain the core issues of cloud computing such as security, privacy and interoperability.
4. Choose the appropriate technologies, algorithms and approaches for the related issues.

**Learning Resources:**

1. Thomas E., Mahood Z. and Puttini R., Cloud Computing, Concept, Technology and Architecture, Prentice Hall, 2013.
2. Velte T., Velte A. and Elsenpeter R.C., Cloud Computing- A Practical Approach, Tata McGraw-Hill Edition, 2010.
3. Buyya R., Vecchiola C. and Selvi S.T., Mastering Cloud Computing, Tata McGraw-Hill, 2013.
4. Bahga A. and Madisetti V., Cloud Computing: A Hands-On Approach, Universities Press, 2014.
5. White T., Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media, 2015.
6. Smith J.E. and Nair R., Virtual Machines, Elsevier, 2005.
7. Rittinghouse J. and Ransome J., Cloud Computing, Implementation, Management and Strategy, CRC Press, 2010.

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## (Effective from academic session 2018-19)

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|---|---|
| **Subject Code : HM-HU 701** | **Category:** Humanities and Social Sciences including Management courses |
| **Subject Name : Economics for Engineers** | **Semester** : Seventh |
| **L-T-P : 2-0-0** | **Credit: 3** |
| **Pre-Requisites: Nil** | |

**Objective:**

Prepare engineering students to analyze cost/revenue data and carry out economic analyses in the decision making process to justify or reject alternatives/projects on an economic basis. Annual worth analyses on one of more economic alternatives.

**Course Contents:**

| Module No. | Description of Topic | Contact Hrs. |
|---|---|---|
| 1 | Economic Decisions Making– Overview, Problems, Role, Decision making process. | 2 |
| 2 | Engineering Costs & Estimation– Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models- Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits. | 4 |
| 3 | Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. | 3 |
| 4 | Cash Flow & Rate Of Return Analysis– Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate Of Return, Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector- Quantifying And Valuing Benefits & drawbacks. | 5 |
| 5 | Depreciation- Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation and Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. | 4 |
| 6 | Inflation And Price Change– Definition, Effects, Causes, Price Change With Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. | 3 |
| 7 | Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, | 3 |

| | | |
|---|---|---|
| | Indirect Cost Allocation. | |

**Course Outcomes:**

Upon completion of the course, the students will be able to:

1. Describe the role of economics in the decision making process and perform calculations in regard to interest formulas
2. Estimate the Present, annual and future worth comparisons for cash flows
3. Calculate the rate of return, depreciation charges.
4. Explain the importance of finance functions, financial ratios and solve related problems

**Learning Resources:**

1. Riggs J.L., Bedworth D.D. and Randhawa S.U., Economics for Engineers, 4th Edition, Tata McGraw-Hill.
2. Newnan D., Eschembach T. and Lavelle J., Engineering Economics Analysis, OUP.
3. White J.A., Case K.E. and Pratt D.B., Principle of Engineering Economic Analysis, John Wiley.
4. Sullivan and Wicks, Engineering Economy, Pearson.
5. Seelvan R.P., Engineering Economics, PHI.
6. Lindeburg M.R., Engineering Economics Analysis, Professional Pub.
7. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House.

# 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 791** | **Category :** Professional Core Courses |
| **Subject Name: Automobile Engineering Lab V (Automotive Electrical & Electronics System Lab)** | **Semester** : Seventh |
| **L-T-P : 0-0-3** | **Credit: 1.5** |
| **Pre-Requisites:** Basic electrical and electronics | |

**Course Objectives:**

To provide knowledge about application of electrical and electronics in automobile engineering.

**Contents (A minimum of 12 experiments are to perform from the list of experiments):**

Electrical

1. Battery testing
2. Alternator testing.
3. Starter motor testing.
4. Diagnosis of ignition system.
5. Diagnosis of automotive electrical wiring.
6. Fault finding of relay & fuses in car using Off Board Diagnostics Systems (OBDS).
7. Relay & fuse Fault diagnostic of a car using OBDS.

Electronics

1. Characteristics of rectifier.
2. Study of IC timer.
3. Study of Microprocessor 8085.
4. Simple ALP program using 8085 MEL Kit.
5. Data acquisition from sensors using 8085 MEL Kit.
6. Interfacing of stepper motor with 8085 MEL Kit.
7. Fault finding location of sensor in car using OBDS.

**Course Outcome:**

At the end of the course, the student shall be able to:

1. Explain different kinds of automotive wiring
2. Describe the action of basic electric circuits
3. To understand the basics of instrumentation, measurement, data acquisition, interpretation and analysis.
4. To learn rectifiers, filters, A/D and D/A convertors.

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**SYLLABUS FOR B. TECH IN AUTOMOBILE ENGINEERING**

## (Effective from academic session 2018-19)

| | |
|---|---|
| **Subject Code PW – AUE 781** | **Category:** Project |
| **Subject Name: Project III** | **Semester** : Seventh |
| **L-T-P** : **0-0-6** | **Credit: 3** |
| **Pre-Requisites:** All courses | |

**Objective:**

To develop the ability to identify, formulate and analyze engineering problems through literature survey, recent trends in industries and by applying the knowledge of science and engineering fundamentals.
To train students in preparing project reports, to face reviews 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.