### K. E. Society’s
**Rajarambapu Institute of Technology, Rajaramnagar**
(An Autonomous Institute)

**Teaching & Evaluation Scheme for**
**Third Year B. Tech. in Automobile Engineering**
(To be implemented from Year 2015 - 16)

#### Semester-V

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<th>Subject Code</th>
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<th>Teaching Scheme</th>
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**Total Credits**: 24
**Total Contact Hours/Week**: 29 hrs


**ISE**: In Semester Evaluation  
**MSE**: Mid Semester Examination  
**ESE**: End Semester Examination

(To be Implemented from Year 2015-16)
# Semester-VI

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ISE : In Semester Evaluation  
MSE : Mid Semester Examination  
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Chairman (B.O.S.)  
Automobile Engg. Dept.  
R.I.T., Rajaramnagar.

(To be Implemented from Year 2015-16)
AE 3011 DYNAMICS OF MACHINES

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RATIONALE:

Basically, Theory of Machines deals with study of machines & mechanisms with & without consideration of forces causing the motions in these (i.e. kinetics & kinematics). The subject under consideration, i.e. Dynamics of Machines is concerned with study of machines & mechanisms while considering the forces causing motions in these. The balancing of reciprocating & rotating components & vibrations of single degree of freedom of vibrations are the major contents of the syllabus.

PREREQUISITES:

Students must have undergone kinematic study of the machines & mechanisms and have adequate knowledge about graphical skills and analytical skills, which can be enhanced further.

COURSE LEARNING OUTCOMES:

At the end of the course the student will be able to:

1. Select appropriate gears to be used in gear train for typical power transmission application.
2. Analyze gear train to find speed of its elements.
3. Analyze the forces and torques acting on slider crank mechanism.
4. Apply balancing methods to balance rotating and reciprocating components.
5. Indentify and analyze vibrations of single degree of freedom systems.
6. Comprehend gyroscopic principle and effect of gyroscopic couple on naval ship, aero plane etc.

CURRICULUM:

1. Gears & Gear Trains:

Introduction, types of gears, law of gearing, gear terminology, gear tooth profiles, interference in involute tooth gears, Efficiency and center distance of spiral gears.

Types of Gear trains, speeds of elements in epicyclic gear train, Differential gear box (No numerical treatment).
2. Kinetic Analysis of Mechanisms:
Inertia force and torque, D’Alembert’s principle, Dynamically equivalent system, force analysis of reciprocating engine mechanism.

3. Gyroscope:

4. Balancing:
Static and dynamic balancing, balancing of rotary and reciprocating masses, primary and secondary forces and couples, balancing of single cylinder, multi cylinder, in-line and V-engines.

5. Free Vibrations:
Basic concepts and definitions, types of vibrations, equivalent Springs, vibration measuring instruments, Equation of motion, Types of damping, SDOF Free vibrations with and without damping, logarithmic decrement.

6. Forced Vibrations:
SDOF Forced vibrations with and without damping, types of excitations, Forced vibrations with viscous damping, magnification factor, frequency response curves, vibration isolation and transmissibility, Whirling of Shafts and Critical speeds,

TEXT BOOKS:
3. V.P.Singh, Mechanical Vibrations, Dhanpat Rai & Co. (P) Ltd.

REFERENCE BOOKS:
1. Thomas Bevan, Theory of Machines, C.B.S. Publishers & Distributors
RATIONAL:

This course is one of the core courses to be offered in Automobile Engineering. The course introduces the students to various automotive chassis systems like steering, suspension, brakes, wheels & tyres and frames. The students learn the constructional features, operational principles, types and various configurations of these chassis systems along with advanced chassis systems. Laboratory demonstrations and videos are used for better understanding of these systems.

This course serves as foundation for two final year courses; namely, Vehicle Dynamics and Automotive System Design. So as to be able to design automotive systems and evaluate or predict vehicle behaviour; sound understanding of these systems is essential; and that's what precisely, this course aims at.

COURSE LEARNING OUTCOMES:

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

1. Elaborate the constructional details and operations of chassis systems like steering system, suspension system etc.
2. Interpret the underlying mechanics of the chassis systems.
3. Apply steering geometry for a given vehicular application.
4. Select/Configure components or subsystems for integration into main chassis system.
5. Explain various advanced chassis systems like adaptive suspensions, TCS etc.

PREREQUISITE: Theory of Machines.

CURRICULUM:

1. Front Axle and Steering System:
   Front Axle: Constructional details and types
   Steering System: Front wheel steering geometry, Steering characteristics, Rear & four wheel steering, Steering system layouts, Ackerman & Davis steering mechanisms, Steering gear boxes, Power steering, Numerical problems on Ackerman steering, Four wheel steering

2. Vehicle Suspension Systems:
   Need and functions of suspension system, Terminology associated with suspension systems, Types of suspension springs - leaf spring, coil spring, rubber spring, air and torsion bar springs, Types of suspension systems - Partial, McPherson and independent suspension, Hydro-
3. Braking Systems:
Function and requirements of braking system, Fundamentals, Elementary theory of shoe brake, Drum and disc brake arrangements, Self energizing, Brake friction materials, Hydraulic brake system, Air brakes, Vacuum servo and hydraulic servo brakes, Engine exhaust brake, Parking brakes, Regenerative brake system, Fail-safe brake, Anti skid brakes

4. Wheels and Tyres:
Wheels: Basic requirements, types and constructional details, wheel balancing
Tyres: Construction, materials, types, Tyre sizes and designation, Aspect ratio, Tyre trade pattern, Tyre ratings, Factors affecting tyre life and performance, Tyre retreading.

5. Carriage unit:
Chassis frame, Types, Loads, Integral and chassis less construction, Chassis lubrication

6. Advanced Chassis Systems:
Steer-by wire, Active steering, Semi active and Active suspension, Adaptive Suspension, Anti-lock brake system (ABS), Traction control system (TCS), Electronic Stability Program (ESP), Electronic Brake Force Distribution and Vehicle Dynamics Control

TEXT BOOKS:
2. Henz Heisler, Vehicle and Engine Technology, SAE International
3. Henz Heisler, Advanced Vehicle Technology, SAE International
4. N. K. Giri, Automotive Mechanics, Khanna Publishers

REFERENCE BOOKS:
2. Giles J. G., Steering, Suspension & Tyres, Illiffe Book Ltd. London
3. William Crouse, Donald Anglin, Automotive Mechanics, McGraw-Hill

Note: Weightage of unit four and five together, to be considered equivalent to weightage of a single unit.
Third Year B. Tech. (Automobile) Semester – V & VI

Third Year B. Tech. (Automobile) Semester – V

AE 3071 AUTOMOTIVE TRANSMISSION

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RATIONALE:

Chassis, body and transmission forms the core of automobile engineering. The subject aims at imparting knowledge and skills regarding clutch system, transmission system, automatic transmissions of vehicles.

COURSE LEARNING OUTCOMES:

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

1. Demonstrate the need of transmission and its classification.
2. Describe the construction and working of various types of clutches and gear boxes
3. Explain the working of advanced transmission systems.
4. Describe the working of final drive.
5. Select appropriate transmission system.

PREREQUISITE: Basic Mechanical Engineering.

CURRICULUM:

1. Friction clutch

Clutch fundamentals, clutch plate cushioning and torsion damping, Clutch friction materials, types of clutches, diaphragm clutch, multiplate type clutch, multiplate hydraulically operated transmission clutches, semi-centrifugal clutch, fully automatic centrifugal clutch, clutch pedal actuating mechanism.

2. Gear boxes and overdrive:

Necessity for a gear box, types of gear boxes, five speed and reserve synchromesh gearbox, Gear synchronization and engagement, gear selection and engagement, transfer box, power takeoff, overdrive considerations, gear ratios, trans-axle.

3. Fluid couplings and torque converters:

Fluid couplings, fluid coupling efficiency and torque capacity, three element torque converter, torque converter performance terms, overdrive clutches, torque converter with lock-up and gear change friction clutches.
4. Semi and automatic transmission:

Automatic transmission considerations, mechanical power flow, fundamentals of a hydraulic control system, basic principle of a hydraulically controlled gearshift, hydraulic gear selection control operation, the continuously variable belt and pulley transmission, five-speed automatic transmission with electronic-hydraulic control, semi-automatic transmission system.

5. Final drive transmission

Propeller shaft (Universal, CV and slip joint), Crown wheel and pinion axle adjustments, differential, differential lock, half shafts, four wheel drive arrangements, electro-hydraulic limited slip differential.

6. Automatic Transmission Applications:

Hydrostatic drives- advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives.

TEXT BOOKS:

1. Heldt P.M., Torque converters, Chilton Book Co.-1992
2. Newton and Steeds, Motor Vehicle, Illiffel Publisher- 2000

REFERENCE BOOKS:

AE 3131 INTERNAL COMBUSTION ENGINES

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RATIONALE:

Internal combustion engines are the engine in which combustion of fuel takes place and the heat produced by combustion of fuel is converted into rotational mechanical power. The I C Engines are mainly used for vehicle propulsion, power generation, ship propelling and for various machine as a source of prime mover. These engines are widely accepted because of high power to weight ratio, reliability and most efficient power plant over other types.

COURSE LEARNING OUTCOMES:

On successful completion of this course the Student will be able to –

1. Perform a primary thermodynamic analysis of Otto and Diesel cycle.
2. Select appropriate engine for specific application.
3. Select proper fuel system and subsystems for I C Engine.
4. Conduct performance testing of the I C Engine and portray operating characteristics of I C Engines.
5. Select proper lubricant and lubrication system for engine.

PREREQUISITE:

Basic Mechanical Engineering, Engineering Thermodynamics, Theory of Machines.

CURRICULUM:

1. I. C. Engine types and applications:

   Engine nomenclature, Classification, Cycle of operation, fuel used, cylinder arrangement, cooling method, Valve timing diagram, Port timing diagram, Engine selection criteria for different applications, Engine Cycles - Otto, Diesel and Dual air standard cycles, Comparison, fuel-air cycle, Actual cycle, Deviation of actual cycle from air standard cycle, Numerical.
2. Engine Performance:


3. Fuel Supply System S.I. Engine:

Carburetion, Factors affecting carburetion, Mixture requirements, Principal of carburetion, simple carburetor, Calculation of air fuel ratio, Limitations of carburetor, Altitude compensation, Gasoline injection- Direct, port, manifold injection, Electronic fuel injection system, Numerical.

4. C. I. Engine fuel systems:

Requirements & types of injection systems, Fuel injection pumps, injectors, Governor – Mechanical, Pneumatic, Common rail and Electronic injection system, Numerical.

5. Combustion:

Combustion in S. I. Engine: Stages of combustion in SI engine, Flame front propagation, factors affecting flame speed, abnormal combustion, control over abnormal combustion, Combustion chambers for SI engine

Combustion in C. I. Engine: Stages of combustion in CI engine, Ignition delay, factors affecting ignition delay, Abnormal combustion, control over abnormal combustion, Combustion chambers for CI engines

6. Induction and Exhaust System:

Air intake system, volumetric efficiency, filters & manifolds, Mufflers and resonators, Need, methods and types of superchargers, limitations, Need & methods of turbo charging, effect of turbo charging on engine performance, Scavenging of two stroke and four stroke engines, methods.

Engine Friction and Lubrication: Mechanical friction, factors affecting friction, pumping losses, blow by losses, Lubrication of engine components, lubricating systems,

TEXT BOOKS:

REFERENCE BOOKS:

(To be Implemented from Year 2015-16)
AE 3111 METROLOGY AND QUALITY CONTROL

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RATIONALE:

The reputation and success of any industry largely depends upon quality of its products. So, in modern industries, the whole plant has to contribute towards building quality to the product. As such, the concept of quality and its control has become one of the stringent requirements of modern industries. Hence, it is required to have a thorough understanding of the principle of the accurate and precise measurement techniques, concept of variability in measurement.

The subject Metrology and Quality Control aims at equipping the students with a strong foundation in metrology and quality control concepts and skills so that they can perform the job of an inspector and help the industries to produce quality products.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Select appropriate instrument/s for specific measurement.
2. Understand principle, working of various measuring instruments.
3. Construct and draw the control charts.
4. Design gauges & special inspection fixtures as per the requirement.
5. Analyze and interpret the data obtained from the different measurements processes and present it in the graphical form/statistical form.

PREREQUISITE:

The basic knowledge of manufacturing processes and machineries.

CURRICULUM:

1. Measurements

Length-line and end measurement, Errors, Slip gauges, Precision & accuracy

Tolerances and gauging: Unilateral and bilateral tolerances, Limits, fits, types of fits, IS specifications of limits.
2. Magnification

Vernier, Micrometers, Dial Indicators, Mechanical, optical, electrical & pneumatic method of magnification, Comparators

**Flat surface measurement**

Flatness measurement devices, CLA, RMS values, Numerical assessments of surface finish
CLA, RMS values, Ra values, Methods of surface finish measurement.

3. **Measurement of angles, tapers and radius:** Angle measuring devices, Sine bar, Standard balls rollers for angle measurement, angle slip gauges, measurement of concave and convex surface radius, analytical method of for measurement of V groove angle.

4. **Measurement of External Threads & Spur Gears**

Different errors in screw threads, Measurement of forms of thread with profile projector, Measurement of threads effective diameter with standard wire, Run out checking, Profile checking Pitch measurement, Backlash checking, tooth thickness measurement, alignment checking

5. **Quality Control.**

Concept of Quality and quality control, Balance between cost and quality and value of quality, Specification of quality, planning through trial lots and for essential, Quality circles, quality management, Kaizen, Kanban, Six sigma.

6. **Statistical Quality Control.**

Statistical method in quality control, measuring of statistical control variables and attributes, Measurement/inspection, Different types of control charts(X Bars, R, P. charts) and their constructions and their application
Acceptance Sampling: Sampling inspection and percentage inspection, Operating characteristic curves.

**TEXT BOOKS:**


**REFERENCE BOOKS:**

1. E.L. Grant & R.S. Leavenworth, Statistical Quality Control
2. K. Shridhar Bhatt, Total Quality Management, Himalaya Publication House
RATIONAL:

Industrial Organization and Management is a course that will make students perceive the role and importance of Management in the Industrial Environment. The course intends to build the competency of the students with respect to basic functions of management in an organization. The subject provides students an insight into various functional areas of management.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Comprehend the basic functions of management.
2. Describe the basic concepts of functional areas of management.
3. Apply basic concepts of management in an industry
4. Gain an insight into Entrepreneurship management.

PREREQUISITE: Nil.

CURRICULUM:

1. Business Environment and Functions of Management


2. Financial Management


3. Marketing

Introduction to marketing – core concepts, Functions of marketing manager, Porter’s 5 forces Model, Market research-meaning and process, 4 P’s of marketing, Market
Segmentation, Targeting, Positioning, Consumer behavior - process, Branding, Introduction to Sales Management and Value Chain.

4. Material Management:
Definition of Material Management, Materials Requirements Planning, Purchasing objectives, Functions of Purchase department, 5-R Principles of purchasing, Purchasing cycle, Inventory Control - ABC Analysis, Economic Order Quantity

5. Human Resource Management:

6. Entrepreneurship
Concept of an Entrepreneurship, Qualities of an Entrepreneurs, Innovation and Entrepreneurship, Definition of MSMED industries, Sources of finance for an entrepreneur, preparation of project report, content of Project report, Government schemes available for an entrepreneur.

TEXT BOOKS:

1. M. T. Telsang Industrial Organization & Management, S. Chand
2. M. T. Telsang, Industrial Engineering & Production Management, S. Chand

REFERENCE BOOKS:

3. Philip Kotler, Marketing Management, Prentice Hall of India New Delhi
5. Horold Koontz and Iteinz Weibrich, Essential of Management, McGrawhills International
Third Year B.Tech. (Automobile) Semester - V

AE 3511 THEORY OF MACHINES LAB.

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RATIONALE:

The term work under the subject Dynamics of Machines for third year students is designed in order to make the students acquainted with dynamic analysis of the machines considering the forces and torques responsible for the motions of the machines and components. To do this, the practicals based on balancing of rotary masses, determination of damping, determination of natural frequency of the structures and demonstration of vibration measuring instruments, generation of involute tooth profile are included in the syllabus. Through these practicals, students are also supposed to determine M.I. of any rigid body, critical speed of shaft and verify gyroscopic principle.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Comprehend gyroscopic principle and effect of gyroscopic couple.
2. Apply balancing methods to balance rotating and reciprocating components
3. Identify and analyze vibrations of single degree of freedom systems.
4. Critical speed of whirling of shafts
5. Plot and interpret the polar diagram based on the experimental readings on Hooks joint.
6. Use principles of kinematics and dynamics in operation of various mechanisms and equipments.

PRE-REQUISITES:

Student must have adequate knowledge of the methodology to be adopted for the above exercises, which they can come across during theory sessions. In addition to this, the students are also expected to be fine enough in mathematical & graphical skills.

List of Experiments (Any Ten)

1. Generation of involute gear tooth profile.
2. Experiment on Gyroscope.
3. Determination of M.I. by Bi-filar suspension/Trifilar suspension / Compound pendulum.
5. Determination of logarithmic decrement (Free Damped Vibrations) – Water damping/ Air damping

(To be Implemented from Year 2015-16)
6. Forced vibration characteristics (Undamped and Damped vibrations).
7. Experiment on Critical speed of shafts.
10. Demonstration of various mechanisms and their inversions.
11. Verification of ratio of angular displacement of shafts connected by Hooks joint.
12. Plot of displacement, velocity and acceleration curves for different types of cam-follower combinations.
13. Governor characteristics for Porter governor
Third Year B. Tech. (Automobile) Semester - V & VI

Third Year B. Tech. (Automobile) Semester - V

AE 3531 AUTOMOBILE ENGINEERING LAB. - I

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RATIONALE:

This laboratory is essential for supplementing classroom learning of the courses on Automotive Chassis Systems and Automotive Transmission. The students shall have demonstration of various automotive chassis systems and transmission elements/systems. They shall have an opportunity to observe the constructional details and working of these systems physically so as to be able to identify, draw and compare various elements/systems. The experience through this laboratory shall enable the students to design, evaluate and maintain these systems and also lay foundation for advanced courses like vehicle dynamics and automotive system design.

PREREQUISITE:

Automotive Chassis Systems and Automotive Transmission.

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:
1) Identify and list elements of various transmission and chassis systems.
2) Draw sketches/schematics of transmission and chassis systems.
3) Describe the operating principles, functions, constructional details and working of transmission and chassis systems.
4) Compare various configurations/subtypes of transmission & chassis systems.
5) Select appropriate configuration/types for transmission and chassis system requirements in automotive applications.

List of Experiments

Automotive Chassis System

1. Demonstration of front wheel steering geometry
2. Demonstration of steering system layout
3. Experiment on Ackerman steering geometry
4. Demonstration of power steering
5. Demonstration of hydraulic brake and air brake systems
6. Demonstration of conventional & independent suspensions
7. Demonstration of suspension dampers
8. Demonstration of wheel and tyre assembly
Automotive Transmission

1. Demonstration of various type of automotive clutches like single plate, multiplate, and centrifugal clutch
2. Demonstration of conventional (manual) gear box
3. Demonstration of continuous variable transmission (CVT) gear box
4. Demonstration of semi-automatic & automatic transmission
5. Demonstration of propeller shaft assembly
6. Demonstration of final drive and differential assembly
7. Demonstration of type of axles

Note: Any five experiments to be chosen from automotive chassis systems and automotive transmission. Minimum ten experiments to be conducted in the semester.
Third Year B. Tech. (Automobile) Semester - V & VI

Third Year B.Tech. (Automobile) Semester - V

AE 3611 I. C. ENGINE LAB.

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RATIONALE:

This course is designed in two phases. First phase includes the study and demonstration of I.C. Engine, its working along with various sub-systems like fuel supply - both for S.I. and C.I. engines, MPFI and CRDI system, cooling & lubrication systems. The second phase includes the testing of I.C. engines to determine the engine performance to the students. This course explains the process of conducting testing of single cylinder & multi cylinder petrol & diesel engines (Constant Speed & Variable Speed Tests), heat balance sheet calculations, air/fuel ratio determination etc.

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:

1. Demonstrate the construction and working of fuels supply system and its components, lubrication, cooling systems.
2. Handle instruments like tachometer, thermometer, digital temperature indicator etc.
3. Conduct the test on single cylinder and multi cylinder petrol & diesel engines (Constant Speed & Variable Speed Tests) plot the engine performance characteristics curves and interpret the curves.
5. Conduct the test and prepare heat balance sheet.

PREREQUISITE: I. C. Engines

LIST OF EXPERIMENTS (ANY TEN)

1. Demonstration of petrol & diesel engine fuel system
2. Demonstration of fuel injection pump, injector and governor.
3. Demonstration of M.P.F.I. & CRDI.
4. Demonstration of lubrication and cooling system of engine.
5. Demonstration of valve timing diagram.
6. Trial on single cylinder diesel engine – Heat Balance Sheet
7. Trial on single cylinder diesel engine - William’s line method
8. To trial on multi-cylinder petrol engine – Morse test
9. Trial on multi-cylinder petrol engine – Variable speed test
10. Trial on single cylinder petrol engine
11. Measurement of air/fuel ratio of petrol or diesel engine
12. Trial on computerized single cylinder & multi cylinder diesel engine

(To be Implemented from Year 2015-16)
Third Year B.Tech. (Automobile) Semester - V

AE 3551 METROLOGY AND QUALITY CONTROL LAB.

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RATIONALE:

This lab is essential for supplementing classroom learning of metrology and quality control. The students shall perform various metrology and quality control experiments like linear measurement, angular measurement etc. The experience through this laboratory shall enable the students to design, evaluate process capability with analyzing product process using statistical charts.

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:

1) Identify various of manual & instrumental errors & take proper cares to prevent them while using measuring instrument
2) Measure angle of tapered components, template and thread form using tool maker’s microscope, sine bar and with standard balls and rollers.
3) Measure, analyze & interpret the data obtained from different measurements
4) Plot “X bar” and “R” charts & comment on whether the manufacturing process is in control or not. If not, suggest the means to bring the process in statistical control.

Experiments (Any Ten)

1. Demonstration and use (care & maintenance) of various measuring instruments
3. Screw thread measurement using floating carriage diameter measuring machine
4. Gear measurement using gear tooth vernier caliper.
5. Measurement of template using tool makers microscope
6. Angle measurement using sine bar.
8. Thread measurement by Tool Makers microscope.
9. Use of X Bar and R chart.
10. Use of P chart.
11. Use of Comparators.
12. Surface finish measurements.

(To be Implemented from Year 2015-16)
SH 3511 PROFESSIONAL SKILL DEVELOPMENT - II

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RATIONAL:
Professional Skills Development-II is designed to make third year B. Tech (Automobile Engineering) students ready with advance level communication skills to sustain in professional scenario. It also equip them to formulate their engineering innovative ideas and findings in various forms of technical reports and presentation of it. In a nutshell, it prepares them to take professional as well as academic challenges in future.

COURSE LEARNING OUTCOMES:
At the end of successful completion of this course, the student will be able to:
1) Interact with others observing etiquettes in the context.
2) Incorporate leadership traits while heading activities in personal and professional life.
3) Develop meeting styles, planning and participation.
4) Hone team work skills in diverse groups and working creatively.
5) Enhance presentations in academic and professional writings.

COURSE PREREQUISITE:
A Student who is going to enroll himself for this course, should have following English language abilities:
1. A student should have an ability to interact with others in English.
2. A student should have adequate skills of oral and written communication.
3. A Student should have good reception (listening and reading) skills.

DETAILS OF THE PRACTICAL
1. **Introduction to Corporate Etiquettes:** Business dress and grooming – Office etiquettes – Telephone etiquettes – Dining etiquettes – Meeting etiquettes – Travel etiquettes – Students will be given case studies or will be asked to perform role plays and will be assessed in presence of the student
2. **Learn to Excel as a Leader:** Leader as visionary – Leader as a problem solver - Leader as a team builder - Leader as a manager - Leader as a communicator - Leader as a power distributor - Leader as a liaison - Leader as a planner
3. **Building Successful Teams:** Improving team effectiveness (Characteristics of an effective team) – Effective recruitment – Developing, coaching and motivating your team – Managing different types of people at workplace
4. **Formal Meeting and Decision Making:** Set objectives - Assemble attendees - Create an agenda - Maintain control - Minutes of the meeting - Follow-up – Mock meeting of students
on an issue will be conducted and assessed - Decision making models – Choosing between options – Deciding whether to go ahead – Financial decisions – Improving decision making – Impact of ethics and values – Group decision making

5. **How to Write Proposals:** Executive summary – Need – Objectives – Methods – Evaluation – Timetable – Budget – Items in the proposal will be discussed with students with the help of one or two sample proposals

6. **Writing Project Reports:** Structuring your document effectively (title page, introduction, summary, analysis) – Use of figures, graphs and tables – Conclusion and recommendations – Appendices – References

7. **Writing Scientific Articles and Research Papers:** General form – Title page – Abstract – Introduction – Materials and methods – results – Literature cited – Proof reading – Grammar and spelling – Common mistakes – Students will be asked to select a paper and analyse it on the basis of discussed items

8. **An Introduction to RTI:** A General overview of the RTI Act, 2005 – RTI movement in India: A historical perspective - RTI legislations in states - Key terms and concepts in the act - Public authorities and their obligations under the act - Accepting an information request, processing and disposing it - Exemptions from disclosure of information, partial disclosure and “Third Party” information - Information commission: Powers and functions

**REFERENCE TEXT (FOR TEACHER):**

Third Year B.Tech. (Automobile) Semester - V & VI

Third Year B.Tech. (Automobile) Semester - V

AE 3591 PRACTICING SCHOOL - I

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(PRACTICING SCHOOL – I: Two weeks garage training carried out after S.Y. B. Tech. Semester IV, during vacation)

RATIONALE

This course gives opportunity to work in garages and get acquainted with simple diagnosis techniques. Apart from technical knowledge, he/she can explore interpersonal skills as well as ability to learn independently and handle tools & equipments. This course brings the awareness about systematic and logical report writing and presentation of the technical efforts.

COURSE LEARNING OUTCOMES:

At the end of the course student will be able to:
1. Acquaint with garage environment and processes to be carried out.
2. Handle various tools and equipments used in garages.
3. Diagnose minor faults of vehicle.
4. Summarize the uses of advanced tools and equipments.
5. Communicate and present his ideas / work in front of peers and superiors.

DETAILED GUIDELINES FOR EVALUATION

Every student has to undergo two weeks training in garages after the end of fourth semester and submit the certificate of completion in the first week of starting of fifth semester; after that no submission will be done and it will be assumed that the student has not undergone garage training and no credit will be awarded.

After submission of certificate student has to give presentation in front students and faculty. Assessment will be made on originality of training, learning outcomes, presentation, knowledge addition and confidence.

Faculty will conduct students’ presentations in tutorial hours.
RATIONAL\E:

This course is required to assist in the design and development of prototype and other equipments. For this, it is essential, that students should made conversant with the principles related to design of component s and application of these principles for designing.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Discuss steps of design and steps of machine design elements.
2. Design joints for different loading conditions.
3. Design shafts keys and couplings to transmit required amount of torque.
4. Design four types of gears namely spur, helical, bevel and worm by using different considerations.
5. Design basic components like spring and levers.


CURRICULUM:

1. Fundamentals of Machine Design:


2. Design of Joints:

Types of joints, stresses in joints, Bolted joints in tension and shear, design for eccentrically loaded Joint, Design of Cotter Joint, Socket & Spigot Joint, Knuckle Joint & Turn Buckle for static loading.

3. Design of Shafts, Keys and Couplings:

Design of shafts for torsion, bending, combined loading and rigidity. Design of keys and splines, Design of muff and flange couplings.
4. Design of Spur and Helical Gears:

Spur Gears: Force analysis, Number of teeth, Face width & Beam strength of gear tooth, Incremental dynamic tooth load, Effective load on gear tooth, Estimation of module based on beam strength and wear strength, Spur gear design for maximum power transmission.

Helical Gears: Virtual number of teeth, Tooth proportions, Force analysis, Beam strength and Wear strength of helical gears, Effective load on gear tooth, Herringbone gears

5. Design of Bevel and Worm Gears

Bevel Gears: Types, Terminology of bevel gears, Force analysis, Beam strength and Wear strength of bevel gears, Effective load on gear tooth, Spiral bevel gears

Worm Gears: Terminology, Force analysis, Friction in worm gears, Vector method, Strength rating and wear rating of worm gears, Thermal considerations

6. Design of Levers and springs:

Applications, design of levers – Rocker arm lever, hand and foot levers, Helical springs and leaf springs, stresses and deflection in round wires, helical springs, accounting for variable stresses, concentric springs, design of leaf springs - stress and deflection equations.

TUTORIALS:

1. Assignment on engineering material selection
   (Students are required to prepare a chart/table on A2 size sheet which will comprise of various engineering materials, composition, properties for given applications)
2. Problems on welded and bolted joints subjected to eccentric loading
3. Shaft design
4. Design and drawing of rigid or flexible coupling
5. Design and drawing of knuckle joint
6. Design and Drawing of cotter.
7. Design of levers
8. Design of spur
9. Design of helical gears
10. Design of bevel gear
11. Design of worm and worm wheel

TEXT BOOKS:

REFERENCE BOOKS:

5. PSG Design Data Book.
Third Year B. Tech. (Automobile) Semester – VI

AE 3081 ALTERNATIVE FUELS AND EMISSIONS

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RATIONALITY:

This is one of the core subjects of Automobile Engineering. The course introduces the students to various alternative fuels for IC engines like Bio- diesel, Biogas, Methanol, Hydrogen etc. with its properties and performance characteristics. The course contributes in achieving program outcomes of Automobile Engineering by giving brief knowledge about emission norms and its measurements. Course also discuss brief about emission formation mechanism in IC engine with its control technologies.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Explain the various alternative fuels for IC engines with its properties and performance characteristics.
2. Describe the utilization of hydrogen fuel and fuel cell with respect to its forms of energy in automotive vehicles.
3. Analyze the pollutant formation mechanisms in IC engine emissions.
4. Select the various emission measurement techniques as per the recent technologies in the world.
5. Select and analyze different emission control technologies in IC engines.

PREREQUISITES: Engineering Chemistry and Internal Combustion Engine

CURRICULUM:

1. Alternative Fuels, Sources and Production Methods:
Sources of fuels – Bio fuels, Edible & non edible vegetable oils, hydrogen, LPG, CNG, Biogas, Methanol & Ethanol. Engine modification required to use alternative fuels, Dual fuel engine, Fuel efficiency, fuel requirement, rating of fuels.

2. Hydrogen & Fuel Cells:
Properties of hydrogen with respect to its utilization as renewable forms of energy, sources of hydrogen, production, transportation, storage, application & economics of hydrogen.
Fuel cells: Principle, Types, Full cell for Automotive application (PEM), PEM fuel cell stack construction, performance

(To be Implemented from Year 2015-16)
3. SI & CI Engine Emissions:
Automobile emission scenario, Sources of emission from vehicle, Formation of pollutants, CO, NOx, UBHC, Soot & Particulate formation.
SI engine Emission: Emissions from SI engine, Compression ratio, equivalence ratio, Ignition timing, Mixture preparation, Residual gas dilution, engine speed, coolant temperature, fuel injection and in cylinder liquid fuel during warm up.
CI engine Emission: Emissions from CI engine, Compression ratio, combustion chamber dead volumes, in cylinder air swirl, multi valves, fuel injection variables, engine load, engine speed.

4. Emission Measurement, Test Procedures & Regulations:
Test cycles for light & medium duty vehicles, test procedure for evaporative emissions, Emission standards for light and heavy duty vehicles & motor cycle emission standard, NDIR analyzers, FID, Chemiluminescence NOx analyzer, oxygen analyzer, smoke measurement, constant volume sampling, particulate emission measurement, Orsat apparatus.

5. SI Engine Emission Control Technologies:
Engine design parameters, add on systems for treatment of emissions with engine, thermal exhaust after treatment, catalytic exhaust after treatment, types of cat con.

6. CI Engine Emission Control Technologies:
Fuel injection variables, electronic fuel injection system, EGR, turbo charging, catalytic exhaust gas after treatment, diesel particulate filters

TEXT BOOKS:
1. B. P. Pundir, Engine Emissions, Narosa Publications

REFERENCE BOOKS:
AE 3061 AUTOMOTIVE ELECTRICAL AND ELECTRONICS

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RATIONALITY:
In Automobiles the electrical systems are important. It has number of subsystems like starting system, charging system etc. Also most of the control systems are being converted from mechanical to electronics. An Automobile engineer must have knowledge of electrical and electronic systems in vehicle because proper function of automobile depends on some important parts of electrical and electronic system. In this course the function and construction of various electrical components and electronic components and system are described.

COURSE LEARNING OUTCOMES:
After the successful completion of this course, the student should be able to:
1. Describe the role of the electrical and electronics in controlling various automotive functions and subsystems.
2. Select and justify automotive electrical components like battery, alternator and starting motor for particular application.
3. Design automotive electrical systems.
4. Select and justify sensors and actuators used for automotive systems.

PREREQUISITE: Electrical Technology

CURRICULUM:

1. Electrical Systems, Accessories:
Vehicle electrical circuits and wiring diagrams, circuit protection devices, vehicle networking, forty two volts systems, EMI, EMC, Vehicle lighting system, interior, external and auxiliary, headlights, Gas discharge and LED headlights, dazzling and preventive methods, Electrical accessories like gauges – temperature, oil pressure and fuel, horns, wipers, signaling devices, and speedometers.

2. Automotive Batteries
Principle and construction of lead acid battery, alkaline battery, hybrid battery, maintenance free battery, Battery ratings, battery efficiency, various battery tests, battery maintenance and battery charging.

(To be implemented from Year 2015-16)
3. Starting and Charging System:

Starting system: Requirements, circuit diagram, principle and construction of starter motor, starter motor drives, switches, starter motor characteristics and design considerations.

Charging system: Purpose, layout and circuit diagram, Construction and working of alternator, rectification, types of voltage regulators, alternator characteristics, design considerations.

4. Ignition System:

Need, basic ignition circuit, Types of ignition systems, Battery ignition system, components details and working, Magneto ignition system, Electronic and distributorless ignition systems, waste-spark and coil-on-plug ignition systems, ignition timing, spark advance and retarding mechanisms.

5. Automotive Electronic Systems:


6. Sensors and Actuators:

Automotive sensors like air flow rate sensor, MAP sensors, engine crankshaft angular position sensor, magnetic reluctance position sensor, engine speed sensor, hall-effect position sensor, optical crankshaft position sensor, throttle angle sensor, temperature sensor, EGO sensor. Automotive actuators like fuel injector-solenoids, stepper motors, relays.

TEXT BOOKS:

3. William B. Ribbens, Understanding Automotive Electronics, SAE International

REFERENCE BOOKS:

AE 3121 VEHICLE BODY AND STRUCTURE

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RATIONALE:

An automobile engineer must have a sound knowledge of the vehicle body to give maximum comfort for the passengers while designing. An automobile engineer must design a vehicle body to minimize drag by stream lining. In this course, concept of aerodynamics, ergonomics, safety design, advanced body materials are described. Engineers should design passenger and commercial vehicles for various body layouts along with analysis of vehicle body with different loading conditions. Curriculum of Vehicle body and structure includes fundamental concepts used in industrial applications.

COURSE LEARNING OUTCOMES:

At the end of the course, the students will be able to –

1) Apply various concepts of vehicle aerodynamics while designing a car body.
2) Identify and draw various types of body designs.
3) Apply various concepts of aesthetics and ergonomic while designing a vehicle body.
4) Apply design concepts while designing driver and passenger seating arrangement.

PREREQUISITE:

Automobile chassis system and Automobile transmission

CURRICULUM:

1. Car Body Details:

Types of car bodies, evolution of body shapes, body components, Visibility: driver’s visibility, tests for visibility, methods of improving visibility and space in cars. Safety: safety design, safety equipments for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model, Dummies and instrumentation, Design of welded joints.

2. Vehicle Aerodynamics:

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.
3. Bus Body Details:

Types of bus bodies, classification, Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction, Design of riveted joints.

4. Commercial Vehicle Details:

Types of commercial vehicle body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Ergonomics of driver seat position. Driver’s cab design. Specialist commercial vehicles: Refrigerated vehicle, Paramedic ambulances, Half car/van pickup.

5. Body Materials, Trim and Mechanisms:

Various body materials: Steel sheet, timber, plastic, BIW, Advanced body materials: GRP, Carbon fiber, fiberglass, Shape-Memory Polymers (SMP’s), technologies to reduce the noise vibration & harshness (NVH) properties of materials; corrosion & anticorrosion methods. Selection of paint and painting process, Body trim and Body mechanisms. Repair of vehicle body: hand & power tools, major and minor accident damage, damage assessment.

6. Body Loads:

Different loading situations, chassis frame design, idealized structure, structural surface, shear panel method, symmetric and asymmetrical, vertical loads in car, longitudinal load.

TEXT BOOKS:


REFERENCE BOOKS:

3. Wolf Heinrich Hucho Wolf-Heinrich Hucho, Aerodynamics of Road Vehicles, SAE International, USA
Third Year B. Tech. (Automobile) Semester – VI

AE 3101 AUTOMOTIVE DIAGNOSTICS

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RATIONALE:

Automobile Engineer should have reasonable practice on fault diagnosis with the help of latest machines like engine analyzer etc. Stress has also to be laid on the use of exhaust gas analyzer and other machines for the maintenance of automobile e.g. for wheel balancing and wheel alignment. Student should also be proficient in maintenance of vehicle's other systems like clutch, transmission etc.

COURSE LEARNING OUTCOMES:

After the successful completion of this course, the student should be able to:
1. Describe the importance and significance of automotive maintenance.
2. Use advanced equipments and machines in the process of automotive maintenance.
3. Troubleshoot and carry out basic maintenance of automotive systems.
4. Discuss developments in automotive maintenance technology.

PREREQUISITE

Automobile engines, automobile chassis and transmission

CURRICULUM:

1. Maintenance Records and Schedule:

Importance of maintenance, scheduled and unscheduled maintenance, preventive maintenance details, breakdown maintenance details vehicle log books, maintenance record forms, different service garages & its layout.

2. Maintenance, Servicing of Auxiliaries:

Cooling system service, radiator, water pump service aspect, anti corrosion additives, anti freezing solutions Petrol fuel and diesel fuel system maintenance, lubrication system service, engine oil change, engine oil topping up, oil filters maintenance, oil relief valve, Chassis lubrication, lubrication charts, head light focusing and adjustment.
3. Maintenance, Repair and Overhauling of Engine:

Dismantling of engine, cleaning, inspection and checking of components visually and dimensionally, reconditioning methods of engine components, engine tune-ups, assembly of engine components, special tools used for maintenance, repair and overhauling of engine.

4. Maintenance, Repair and Overhauling of Drive-line Components:

Servicing, repair & maintenance of clutch, maintenance, repair and servicing of gear box, servicing of propeller shaft, servicing and maintenance aspects of differential unit, and servicing of steering system, wheel balancing, wheel alignment, maintenance of tyres, tyre rotation.

5. Maintenance, Repair and Overhauling of Chassis Components:

Servicing of front axle and rear axle, suspension system of both rigid and independent types, servicing of brake systems, hydraulic, air systems, brake bleeding and brakes adjustments, maintenance.

6. Advanced Maintenance Techniques

Introduction to Reliability Availability and Maintainability (RAM), Development of RAM Engineering, Reliability Availability and Maintainability utilization factors, Ob-board diagnosis, Reliability centered maintenance.

TEXT BOOKS:

2. P. M. Heldt, Automotive Chassis, Chilton Co. NK

REFERENCE BOOKS:

3. Heisler Hein Z., Advance Vehicle Technology, A Member of the Hodder Head Line Group-
AE 3141 CONTROL ENGINEERING

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RATIONALE:

Basically, Control Engineering is the engineering discipline that applies control theory to design systems with desired behaviors. Control engineering is a field that gained significant attention in the mechanical as well as in Automobile Engineers with advancement in technology. The topics under consideration, i.e., types of control systems and their applications in automobile control systems with mathematical models, control system components, steady state analysis, transient response, state space analysis etc.

COURSE LEARNING OUTCOMES:

At the end of the course, the learners will be able to:

1. Explain various mechanisms and types of control systems.
2. Represent the control systems by using block diagrams.
3. Apply various mathematical tools to express control systems.
4. Develop analogous electrical systems for mechanical systems.
5. Verify stability of given control systems.

PRE-REQUISITES:

Basics of electrical and electronics. The students must have adequate knowledge about graphical, mathematical and analytical skills.

CURRICULUM

1. Introduction to Automatic Control:


2. Block Diagram Algebra and Control Components:
3. Linearization of non-linear function:

Linearization of operating curves and examples, Steady state analysis.

4. Transient Response:

General Form of Transfer Function, Concept of Poles and Zeros, Distinct, Repeated and Complex Zeros. Response of systems (First and Second Order) to Various Inputs (Impulse, Step, Ramp & Sinusoidal). Damping Ratio and Natural Frequency. Transient Response specification.

5. Stability and Root Locus Technique:


6. State Space Analysis:

System Representation, Direct, Parallel, Series and General Programming, Conversion of state space model to Transfer Function.

TEXT BOOKS


REFERENCE BOOKS

1) A. Anand Kumar, Control Systems, Prentice Hall Publi.
3) B.C. Kuo, Automatic Control Systems, 7th Ed, Willey India Ltd./ Prentice Hall Publi.
4) D. Roy and Choudhari, Automatic Control Engineering, Orient Longman Publi.Calcutta
**Third Year B. Tech. (Automobile) Semester - VI**

**AE 3521 AUTOMOBILE ENGINEERING LAB. - II**

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**RATIONALE:**

An automobile engineer must have a sound knowledge of the vehicle body to give maximum comfort for the passengers while designing, along with various electrical and electronic systems. In this laboratory course, students will observe and draw various body layouts, interior and exterior components, and driver and passenger ergonomics, carry out testing of various electrical components like starter motor, alternators etc.

**COURSE LEARNING OUTCOMES:**

At the end of successful completion of this course, the student will be able to:

1. Identify various body layouts and draw surface model of the same.
2. Design vehicle interior components considering human ergonomics.
3. Demonstrate the construction and working of various automotive electrical systems.
4. Test automotive batteries, alternators, starting motors, auto electric components and carryout head light beam alignment.
5. Diagnosis the automotive electrical faults with the help of ECU diagnostic systems.

**List of Experiments**

**Vehicle Body Engineering**

4. Sketching various vehicle body constructions.
5. Application of human ergonomics, driver’s seat position, size and construction.
6. Application of ergonomics to passenger seat position and construction, and requirement identification.
7. Demonstration of constructional and operational features of power window.
8. Testing the drivability of driver using driver testing unit.

**Automobile Electrical & Electronics**

1. Demonstration of battery charging & battery testing
2. Demonstration and testing of alternators
3. Demonstration and testing of starting motors
4. Demonstration of conventional ignition system
5. Demonstration of electronic ignition system
6. Testing of auto electrical components on multifunction tester
7. Demonstration of ECU diagnostic system
8. Demonstration of Electrical and Electronic Systems Modules

**Note:** Any five experiments to be chosen from vehicle body engineering and automobile electrical & electronics. Minimum ten experiments need to be conducted in the semester.

(To be Implemented from Year 2015-16)
AE 3601 AUTOMOTIVE DIAGNOSTICS LAB.

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RATIONALE:

Automobile Engineer should have reasonable practice on fault diagnosis with the help of latest equipments. Stress has also to be laid on the use of testing of components/systems for the maintenance of automobile e.g. for wheel balancing and wheel alignment. Student should also be proficient in maintenance of vehicle’s other systems like clutch, gear box, differential, braking system, electrical system etc.

PREREQUISITE: Internal combustion engines, Automobile chassis systems and Automobile transmission

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:
1. Identify problems occurred in engine system by performing engine tune up.
2. Illustrate the critical inspection parameters while engine top overhaul.
3. Carry out wear measurement of different engine components.
4. Carry out wheel balancing and wheel alignment.
5. Test the spark plug & fuel injector to check performance as per their specification.
6. Diagnosis of clutch, gearbox, braking system, electrical system, differential & axles for its trouble shooting.

List of Experiments (Any Ten Experiments)

1. Petrol / diesel engine tune up.
2. Engine top overhaul
3. Inspection & wear measurement of engine components.
4. Cleaning & testing of spark plug.
5. Cleaning & testing of injector.
6. Wheel alignment & balancing.
7. Headlight beam alignment.
8. Overhauling of clutch.
9. Overhauling of gear box.
11. Overhauling of braking system.
12. Visit to FIP testing unit.

Note: Some of the demonstrations are to be carried out by planning visits to automotive industries & garages.

(To be Implemented from Year 2015-16)
Third Year B.Tech. (Automobile) Semester - VI

AE 3581 MINI PROJECT ON MODELING / TECHNICAL THEME

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RATIONALE:

This course gives opportunity for the students to offer engineering solutions to a relevant problem by either working in a group or individually. Student is required to model an automotive or mechanical system using appropriate modeling software. The mini project is aimed at honing his/her modeling skills. He/she can explore interpersonal skills as well as ability to plan, execute and complete the tasks. This course brings the awareness about systematic and logical report writing and presentation of the technical efforts. It will give the students first hand exposure to final year projects.

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:
1. Demonstrate the ability to develop creative and original solutions to engineering problems.
2. Work as an individual or member of a team, with support from a supervisor, formulating solutions to day-to-day problems by integrating knowledge and experience gained so far.
3. Demonstrate the ability to apply modeling software for constructing models of engineering systems.
4. Demonstrate the ability to produce a formal engineering report.
5. Communicate and present his ideas / work in front of peers and superiors

CURRICULUM:

CAD modeling of any automobile or mechanical systems is to be developed. Student should take actual dimensions of components of automobile or mechanical systems. Student shall work on individual assignment.

OR

Student can do any project on technical theme, wherein they are supposed to identify an engineering problem and develop the solution for the same, in a group of 4-5.

Minimum 10 students per faculty for 2 hr. load.

(To be implemented from Year 2015-16)
Third Year B. Tech. (Automobile) Semester – V & VI

Third Year B.Tech. (Automobile) Semester - VI

AE 3621 MEASUREMENT AND CONTROL ENGINEERING LAB.

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RATIONALE:

This lab is combination of two field’s mechanical measurement and control engineering. These fields are working complimentary two each other. The knowledge of measurement of various parameters of system is essential for controlling it within specified limit as per design. In the field of research calibration of instrument is major part / focus which decide quality of results obtained. In measurement part, measurement of force, torque, speed, vibration, pressure is covered using different methods and using different instruments. MATLAB is introduced for design as well as analysis of various configurations of control systems.

COURSE LEARNING OUTCOMES:

At the end of successful completion of this course, the student will be able to:

1. Use various instruments for measurement of force, pressure, velocity etc.
2. Calibrate the measuring instruments.
3. Compare different methods of measurement.
4. Apply knowledge of MATLAB to design control system.

PRE-REQUISITES:

The students must have adequate knowledge about graphical, mathematical and analytical skills.

List of Experiments (Any Ten)

1. Measurement of temperature using, thermocouple RTD.
2. Calibration of thermocouple
3. Measurement of displacement using LVDT.
4. Flow measurement using rotameter.
8. Vibration testing using contact and non-contact type instruments.
9. Calibration of Dead weight pressure gauge tester.
10. Trial on ON/OFF temperature controller.
11. MATLAB programming for P/PI/PID controller.
12. MATLAB programming for root locus Technique.
13. MATLAB programming for state space analysis.
**Third Year B.Tech. (Automobile) Semester - VI**

**AE3641 SEMINAR**

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**RATIONALE:**

This one credit course is meant to give students practice of presenting technical/management topic in front of an audience. Students will search topics and organize presentations for faculty and other students. The topics may be on any aspect of the automobile / mechanical engineering and must be approved by the faculty.

**COURSE LEARNING OUTCOMES:**

At the end of successful completion of this course, the student will be able to:

1. Determine when information is needed and find it efficiently using a variety of reference sources.
2. Access information in a variety of ways appropriate to a discipline, including locating and using library collections and services and other search tools and databases.
3. Evaluate the quality and determine the point of view of information.
4. Obtain, select, store, create and use support materials appropriately.

**CURRICULUM:**

The topic for the seminar may be related to advancement in the field of various disciplines of automobile and mechanical engineering, management practices etc.

Seminar Load: Min. 10 students per faculty for 2 hrs. load.