# VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELGAUM

**Applied Mathematics**
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU11 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Credit | 04 | | |

**Course objectives:** The main objective of the course is to enhance the knowledge of principles of numerical methods, partial differential equations, linear transformations, solution of linear algebraic equations and Eigen value problems with a greater accuracy required for the general applications of mechanical engineering sciences.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module-I** | |
| **Approximations and round off errors**: Significant figures, accuracy and precision, error definitions, round off errors and truncation errors. Mathematical modeling and engineering problem solving: Simple mathematical model, Conservation laws of engineering. Roots of polynomial-polynomials in engineering and science, Muller's method, Bairstow's Method Graeffe's root squaring method. | 10 Hours |
| **Module -2** | |
| **Roots of Equations**: False position method, Newton- Raphson method. Multiple roots by Newton-Raphson method. Simple fixed point iteration method- Acceleration of convergence- $\Delta^2$ - Aitken's method. Numerical Differentiation and Numerical Integration: Newton –Cotes and Guassian Quadrature Integration formulae, Integration of Equations, Romberg integration, Numerical Differentiation Applied to Engineering problems, High Accuracy differentiation formulae. | 10 Hours |
| **Module -3** | |
| **Numerical Solution for Partial Differential Equations:**<br>Classification of second order partial differential equations. Solution of one dimensional heat equation by explicit method and Crank-Nicolson method. Solution one dimensional wave equation and two-dimensional Laplace equation by explicit method. | 10 Hours |
| **Module -4** | |
| **System of linear algebraic equations and eigen value problems**: Introduction, Direct methods, Gauss elimination method, triangularization method, Cholesky method, Partition method, Error analysis for direct methods. Eigen values and eigen vectors: bounds on eigen values, Jacobi method for symmetric matrices, Givens and Householder's method for symmetric matrices. Power method and Inverse power method. | 10 Hours |
| **Module -5** | |
| **Linear Transformation**: Introduction to linear transformation. The matrix of linear transformation, linear models in science and engineering. Orthogonality and least squares: inner product, length and orthogonality, orthogonal sets, orthogonal projections. Gram-Schmidt process, least-square problems, inner product spaces.. | 10 Hours |

**Course outcomes:** At the end of the course, students are able to:

1. Employ numerical techniques in order to achieve more accurate values in the computation of roots of polynomials and non-linear equations.
2. Understand vector spaces, basis, linear transformations and the process of obtaining matrix of linear transformations arising in magnification and rotation of images.
3. Utilize standard numerical schemes to solve partial differential equations applicable to mechanical

engineering problems.

4. Apply the numerical linear algebra techniques to solve algebraic, transcendental and matrix eigen value problems.
   Employ the idea linear transformations, inner product spaces and orthogonality to design linear models occurring in science and engineering

**Question paper pattern:**

- The question paper will have **ten** full questions carrying equal marks.
- Each full question consisting of **16** marks.
- There will be **two** full questions (with a **maximum** of **four** sub questions) from each module.
- Each full question will have sub question covering all the topics under a module.
- The students will have to answer **five** full questions, selecting **one** full question from each module.

**Text Books:**

1. S.S.Sastry: Introductory Methods of Numerical Analysis, Prentice Hall of India, 4th Edition, 2006.
2. Steven C. Chapra: Applied Numerical Methods with MATLAB for Engineers and Scientists, Tata Mcgraw Hill, 3rd Ed, 2011.
3. David C.Lay, Steven R.Lay and J.J.McDonald: LinearAlgebra and its Applications, 5th Edition, Pearson Education Ltd., 2015.

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**Reference Books:**

1. B.S.Grewal: Numerical methods in Engineering and Science (with C,C++,&MATLAB), Khanna Publishers, 2014.
2. M. K. Jain, S.R.K. Iyengar and R. K. Jain, "Numerical Methods for Scientific and Engineering Computation", New Age International Publishers, 9th Edition, 2014.
3. PervizMoin, Fundamentals of Engineering Numerical Analysis, Cambridge University Press, 2010.

**AUTOMOIVE ENGINE AND SYSTEMS**

[As per Choice Based Credit System (CBCS) scheme]

SEMESTER – I

| Subject Code | 16MAU12 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Credit | 04 | | |

**Course objectives:**This course is designed to impart technical aspects of

1. Engine fuel supply system
2. Combustion in spark ignition engine and compression ignition engine
3. Engine cooling and lubrication systems
4. Engine management system and recent developments
5. Engine testing

| **Modules** | **Teaching Hours** |
|---|---|
| **Module-I** | |
| **Introduction**<br>Definition of a heat engine; external and internal combustion engine; basic engine components and nomenclature; the working principles of engines; classification of IC engines; application of IC engines.<br>**Fuel Supply Systems**<br>**SI Engine:**Principle of elementary carburettor, Mixture requirements for steady state and transient operation, Gasoline Fuel Injection.<br>**C.I. Engines:** Fuel injection pump systems- Types, constructional features and operation, Factors influencing fuel spray atomization, penetration and dispersion of diesel**,** Fuel Injection Pumps (inline, rotary), Filters, Governors – Types of Governors - fuel feed pumps and Types, injectors and nozzles – types, functions and necessities, injection lag, pressure waves in fuel lines. | 10 Hours |
| **Module -2** | |
| **Combustion in SI engines:** Essential features of ignition timing and ignition voltage, MBT timing, knock detection and control strategies, thermodynamic analysis of SI engine combustion, analysis of cylinder pressure data.<br>**Combustion in CI engines:** Essential features of injection timing and delay period, correlations for ignition delay in engines, effect of fuel properties, types of combustion chambers and merits of the different types, analysis of cylinder pressure data, fuel spray behavior. | 10 Hours |
| **Module -3** | |
| **Cooling and Lubrication System :**<br>**Cooling System**: Necessity, variation of gas temperature, Areas oh heat flow, heat transfer, piston and cylinder temperature,. Heat rejected to coolant, quantity of water required, cooling system, air cooling, water cooling, thermodynamics of forced circulation, thermostats, pressurized water cooling, regenerative cooling, comparison of air and water cooling, radiators types, cooling fan – power requirement, antifreeze solution<br>**Lubrication System:** Lubricants, lubricating systems, Lubrication of piston rings, bearings, oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, oil filters, pumps, and crankcase ventilation – types | 10 Hours |
| **Module -4** | |
| **Engine Management System:** Combined ignition and fuel management systems., Digital control techniques. Complete vehicle control systems, Artificial intelligence and engine management, Exhaust emission control in SI and CI engines, Techniques<br>**Recent Developments in Automotive Engines :** Supercharger, Working Principle, Effect of Super charging, Types and Methods of Super charging, Turbo Charger, Working Principle , Turbo-lag, VVT, V-TEC i-VTEC and IDTEC. ATFT, CRDI system – working Principle, Advantages and Effect of CRDI on emission reductions, Hybrid vehicles and fuel cells | 10 Hours |

| **Module -5** | |
|---|---|
| **Engine Performance Testing: E**ngine performance parameters; Methods of determination of BP, IP, FP, volumetric, thermal, mechanical, scavenging efficiencies, etc., types of dynamometers, Morse Test, Numerical Problems in Engine Testing , Engine Performance and heat balance sheet. | 10 Hours |

**Course outcomes:** On completion of the course the student will be

1. The detailed concept, construction and principle of operation of engine and various engine components and subsystems of engines.
2. Combustion in SI and CI engines.
3. Various engine cooling and lubrication systems
4. Engine management system and recent developments.
5. Automotive engine and its performance testing.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be twofull questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. **Internal Combustion Engine Fundamentals -**John B.Heywood, McGraw-Hill Book Company(1988)
2. **Introduction to Internal Combustion Engines** -Dr K. K. Ramalingam, ScitechPublication, 2004
3. **Internal Combustion Engines** V.Ganesan, Tata McGraw Hill Publications.

**Reference Books:**

1. Tom Denton , **"Automotive Electrical and Electronics"-** SAE, 2000
**2.** Heinz Heisler, **Advanced Engine Technology**. SAE Publications, 1995**.**
3. Richard Van Basshuysen, Fred Schaefer, **"Internal Combustion Engine Hand Book –** Basics, Components, Systems and Perspectives", SAE (2004)
4. Bosch, **Automotive Hand Book** , SAE , 8th Edn,
5. Cook R. D., Finite Element Modeling for Stress Analysis, Wiley, 1995.

NOISE, VIBRATION AND HARSHNESS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU13 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Credits | 04 | | |

**Course objectives:**this course is aimed at imparting knowledge about

1. basic principles of the design aspects for NVH in cars.
2. sources of noise and vibration in cars, the dominant transmission paths including their relative importance at different driving conditions.
3. the critical design issues and their relations for NVH, in particular the aspects of objective and subjective design

| **Modules** | **Teaching Hours** |
|---|---|
| **Module-I** | |
| **Fundamentals of sound:** Definition of NVH, Vehicle noise - Direct sound generation mechanism: airborne sound; Indirect sound generation mechanism: structure borne sound; Subjective response sound, Acoustic variables, basic attributes of sound such as wavelength, period, frequency; speed of sound, Decibel scale, Wave equation, types of sound fields, Measures of sound: Sound pressure, sound intensity and sound power, Combining sources: dB arithmetic, Standing wave, Beating, Impedance, Human hearing: frequency Versus sound pressure level, Loudness: phons and sones as noise descriptors; Weighting networks, $L_{eq}$and various noise metrics for road noises. | 10 Hours |
| **Module -2** | |
| **Noise measurements and instrumentation:**, Measuring microphones, Sound level meter, time and frequency weighting, Sound spectra – Octave band analysis, Order analysis and waterfall plot, Various types of acoustic testing chambers, Sound power measurement from Sound pressure: Free field method, Reverberant field method, Semi- Reverberant field method and Comparison method (using calibrated Sources) Two- microphone probe for measuring; Sound power measurement from Sound Intensity | 10 Hours |
| **Module -3** | |
| **Sound fields and Room Acoustics:** Characterizing sound sources; Directivity; Sound Fields; Various approaches to modeling sound sources; Transmission loss (TL) and Insertion loss (IL); Reverberation time and Acoustic Absorption Coefficient; Effects of leaks on barrier and TL of composite barriers; measurement Absorption Coefficient and Transmission loss (TL).<br>**Vehicle Interior and Exterior noise:** Internal noise sources in vehicles such as engine noise; road noise; aerodynamic (wind) noise; brake noise; squeak, rattle and tizz noises; sound package solution to reduce the interior noise: acoustic isolation, acoustic absorption and damping material solutions; Exterior noise sources in vehicles such as air intake systems and exhaust systems; Tyre noise. | 10 Hours |
| **Module -4** | |
| **Sources of Vehicle vibration:** Power train and Engine vibrations; driveline vibrations; chassis and suspension vibrations; Control strategies; Human response to vehicle vibrations, concept of harshness; subjective and objective evaluation of vehicle harshness.<br>**Vibration Isolation and Control:** Introduction; damping of vibrations; vibration isolation and absorption; design of a Vibration Absorbers, unconstrained and constrained layer damping treatment, add on dampers and stiffeners, Introduction to Active Vibration Control. | 10 Hours |
| **Module -5** | |
| **Vibration Measurement and Instrumentation**: Definition of Modal Properties, Modal analysis theory, FE & Experimental modal analysis, Transducers and accelerometers Excitation sources Impact Excitation, Shaker excitation, Excitation signals, applications of Modal Analysis, laser based vibration measurements; analysis and presentation of vibration data. | 10 Hours |

**Course outcomes:** On completion of the course the student will be

1. An overview of state-of-the art in Computer Aided engineering applied to NVH together with examples of NVH issues treated by CAE and to understand the limitations of the models used.
2. a basic understanding of the difference between objective and subjective (human response) design criteria and how they influence the design process.
3. an overview of modern design solutions in NVH, the materials used and their principle function, together with the current trends in the development of new solutions

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.
5. The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Bies D A and Hansen C H,**Engineering Noise Control: Theory and Practice,** Spon Press, Taylor &Francis, NYUSA, 2003.
2. **Vehicle Noise & Vibration Refinement,** edited by Xu Wang, Elsevier Publishing Limited, 2010.
3. Mathew Harrison**Vehicle Refinement – Controlling Noise & Vibration in Road Vehicles,** Elsevier Publication (2004)

ADVANCED MACHINE DESIGN
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU14 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 50 | Exam Hours | 03 |
| Credits | 04 | | |

**Course objectives:** The student will be able to

1. Design machine components which are subjected to fluctuating loads.
2. Use LEFM approach for crack growth.
3. Design machine components/parts based on creep criterions. They are able to implement the concept of reliability for designing a machine parts or machine.
4. Explain the contact stresses and implementation of Hertz contact phenomenon to the real field problem. Identify failure modes and evolve design by analysis methodology.
5. Design against fatigue failure is given explicit attention.

| **Modules** | **Teaching Hours** |
|---|---|
| **Module-I** | |
| . Introduction: Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory, Numerical examples.<br>Fatigue of Materials: Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods ,Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features. | 10 Hours |
| **Module -2** | |
| Stess-Life (S-N) Approach: S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using SN approach.<br>Strain-Life(ε-N)approach: Monotonic stress-strain behavior ,Strain controlled test methods ,Cyclic stress strain behavior ,Strain based approach to life estimation, Determination of strain life fatigue properties, Mean stress effects, Effect of surface finish, Life estimation by $\varepsilon$-N approach. | 10 Hours |
| **Module -3** | |
| LEFM Approach: LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects, Crack growth life estimation. Notches and their effects: Concentrations and gradients in stress and strain, S-N approach for notched membranes, meanstress effects and Haigh diagrams, Notch strain analysis and the strain – life approach, Neuber's rule, Glinka's rule, applications of fracture mechanics to crack growth at notches. | 10 Hours |
| **Module -4** | |
| Fatigue from Variable Amplitude Loading: Spectrum loads and cumulative damage, Damage quantification and the concepts of damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach. | 10 Hours |
| **Module -5** | |
| Surface Failure: Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General | 10 Hours |

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|---|---|
| contact, Dynamic contact stresses, Surface fatigue strength. | |

**Course outcomes:** On completion of the course the student will be

1. Design machine components which are subjected to fluctuating loads.
2. Distinguish different design criterions and their procedure to carry out the required design steps for designing mechanical components.
3. Explain LEFM approach for crack growth.
4. Design machine components/parts based on creep criterions. They are able to implement the concept of reliability for designing a machine parts or machine.
5. Explain the contact stresses and implementation of Hertz contact phenomenon to the real field problem. Identify failure modes and evolve design by analysis methodology.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**Text Books:**

1. Ralph I. Stephens, Ali Fatemi, Robert, Henry o. Fuchs, "Metal Fatigue in engineering", John wileyNewyork, Second edition. 2001.
2. Failure of Materials in Mechanical Design, Jack. A. Collins, John Wiley, Newyork 1992.
3. Robert L. Norton , "Machine Design", Pearson Education India, 2000

**Reference Books:**

11. S.Suresh , "Fatigue of Materials", Cambridge University Press, -1998
2. Julie.A.Benantine , "Fundamentals of Metal Fatigue Analysis", Prentice Hall,1990
3. Fatigue and Fracture, ASM Hand Book, Vol. 19, 2002.

Elective –I

| AUTOMOTIVE MATERIALS<br>[As per Choice Based Credit System (CBCS) scheme]<br>SEMESTER – I | | | |
|---|---|---|---|
| Subject Code | 16MAU151 | IA Marks | 20 |
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |
| Credits | 03 | | |

**Course objectives:** this course is designed to impart education regarding

1. Various conventional automotive materials, their properties and testing methods.
2. Various composite material their classifications, applications and manufacturing techniques.
3. Advantages and applications and limitations of MMC
4. Micro and macro mechanical analysis of a lamina.
5. Selection of materials for various automotive components and manufacturing techniques for a broad range of materials.

| Modules | Teaching Hours |
|---|---|
| **Module-I** | |
| **Aluminium Alloys & Lightweight Magnesium for Automotive Applications:** Introduction; Wrought Aluminum alloys; Cast aluminum processes Technologies; Cast aluminum metallurgy and properties; New Lightweight alloys; Process technologies; mechanical and physical properties; Case studies of applications.<br>**Testing Automotive Materials:** Evaluation of materials under realistic loading and environmental conditions**;** different test methods for evaluation of properties for specific applications. | 08 Hours |
| **Module -2** | |
| **Composite Materials for Automotive Applications:** Definition, Classification, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, prepegs, sandwich construction.<br>**Manufacturing Composite Materials:**Lay up and curing – open and closed mould processing – Hand lay –up techniques – Bag moulding and filament winding. Pultrusion, pulforming, Thermoforming, Injection moulding, Cutting, Machining and joining, tooling, Quality assurance – Introduction, material qualification, types of defects, NDT methods. | 08 Hours |
| **Module -3** | |
| **Metal matrix composites:** Reinforcement materials, types, Characteristics & selection, base metals, selection, applications in automotive engineering. | 08 Hours |
| **Module -4** | |
| **Micro mechanical analysis of a lamina:** Introduction, Evaluation of the four elastic modules – Rule of mixture, ultimate strengths of unidirectional lamina.<br>**Macro mechanics of a lamina:** Hooke's law for different types of materials, number of elastic constants; Two – dimensional relationship of compliance & stiffness matrix. Hooke's law for two dimensional angle lamina, engineering constants – angle lamina, Invariants,Theories of failure. | 08 Hours |
| **Module -5** | |
| **Macro Mechanics of Laminates:** Laminates Coding, ABD Matrices, Classical Laminates Theory, Special cases of Laminates, Strength Theories of Laminates. | 08Hours |

**Course outcomes:** On completion of the course the student will be

1) Explain various conventional automotive materials, their properties and testing methods.
2) Acquire knowledge of various composite material their classifications, applications and manufacturing techniques.

3) Learn the advantages, applications and limitations of MMC
4) Carryout micro and macro mechanical analysis of a lamina.
5) Acquire knowledge of selection of materials for various automotive components and decision making skills on the latest component manufacturing techniques for a broad range of materials.
6) Identify the process need to be followed for the production of components.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**Reference Books:**

1. James M Boileau"Developments in Lightweight Alloys for Automotive Applications"-, 2001-2005", SAE (Product Code PT-130).
2. ThomesRuden, "Lightweight Magnesium Technology-2001 through 2005", SAE (Product code PT-131)
3. Donald H Wright, **"**Testing Automotive Materials & Components"- SAE (Product Code R – 124)
4.Krishan K. Chawla,"Composite material science and Engineering"- Springer.
5. P.C. Mallik,"Fibre reinforced composites"- Marcel Decker.

AUTOMATIC CONTROL SYSTEM
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU152 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |
| Credits | 03 | | |

**Course objectives:** At the end of completion of this course, students will be able

1. To understand the basics and different types of control system required for the Automotive vehicle for improvement of performance of vehicle
2. To understand Engine Management System
3. To gain knowledge of safety and security systems
4. To study improvement of Comfort and Vehicle Control System
5. To understand the Intelligent Transportation System.

| Modules | Teaching Hours |
|---|---|
| **Module-I** | |
| **Chassis and Drive Line Control**<br>Components of chassis management system – role of various sensors and actuators pertaining to chassis system – construction – working principle of wheel speed sensor, steering position, tyre pressure, brake pressure, steering torque, fuel level, Engine and vehicle design data<br>**Drive Line Control**: Speed control – cylinder cut - off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - power steering, collapsible and tiltable steering column – steer by wire | 08 Hours |
| **Module -2** | |
| **Engine Management System:** Basic Engine Operations – Fuel Control, Ignition control, Lambda Control, Idle Speed Control, Knock Control , Open Loop and Closed Loop Control<br>**Sensors:** Basic sensor arrangement; Types of sensors such as oxygen sensors, Crank angle position sensors, fuel metering/vehicle speed sensors and detonation sensors, altitude sensors, flow sensors, throttle position sensors, solenoids, | 08 Hours |
| **Module -3** | |
| **Safety and Security Systems :** Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement – Static and Dynmic bending of Head light, road recognition system, Anti theft technologies, smart card system, number plate coding, central locking system. | 08 Hours |
| **Module -4** | |
| **Comfort and Vehicle Control System:** Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, adaptive noise control. ABS Control System – Torque Balance at Wheels road contact – Control cycle of ABS System – Advantages – Traction control system- Combination of ABS with Traction control system | 08 Hours |
| **Module -5** | |
| **Intelligent Transportation System:** Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Data communication within the car, Driver conditioning warning - Route Guidance and Navigation Systems – vision enhancement system - In-Vehicle Computing – Vehicle Diagnostics system. VANET usage in Automobiles | 08 Hours |

**Course outcomes:** At the end of the course students will

1. Have understanding of control system required for vehicles and basics of control system development. Also
2. Gets the knowledge of control system being used in automotive vehicle.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. U. Kiencke, and L. Nielsen, "Automotive Control Systems", SAE and Springer-Verlag, 2000.
2. LjuboVlacic, Michel Parent, Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth- Heinemann publications,Oxford, 2001.

**Reference Books:**

1. Crouse, W.H. &Anglin, D.L., "Automotive Mechanics", Intl. Student edition, 9th edition, TMH, New Delhi, 2002.
2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn,1998.
3. Bosch, "Automotive HandBook", 8th edition, SAE, 2007.
4. Internet References.

VEHICLE MAINTENANCE AND FLEET MANAGEMENT
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU153 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |
| Credits | 03 | | |

**Course objectives:** The main objectives of this course are to:

1) Study standard tools and records used in vehicle maintenance shops.
2) Understand the Importance of maintenance and different types of maintenance.
3) Impart knowledge of Power Plant Repair and Overhauling
4) Understand the Concept of Transport
5) Understand the MV acts and legal aspects of transportation.

| Modules | Teaching Hours |
|---|---|
| **Module-I** | |
| **Maintenance Tool, Shop, Schedule, Records:** Standard tool set, torque wrenches, compression and vacuum gauges, engine analyzer and scanner, computerized wheel alignment and balancing, gauges for engine tune up and pollution measurement, spark plug cleaner, cylinder re boring\ machine, fuel injection calibration machine. | 08 Hours |
| **Module -2** | |
| **Importance of maintenance:** Schedule and unscheduled maintenance. Scope of maintenance. Equipment downtime. Vehicle inspection. Reports. Log books. Trip sheet. Lay out and requirements of maintenance shop. | 08 Hours |
| **Module -3** | |
| **Power Plant Repair and Overhauling:** Dismantling of power plant and its components. Cleaning methods. Inspection and checking. Repair and reconditioning methods for all engine components. Maintenance of ignition system, fuel injection system, cooling system,- lubrication system. Power plant trouble shooting chart. | 08 Hours |
| **Module -4** | |
| **The Concept of Transport:** The means of transport, classifications, and road transport - advantages of road transport, advantages of motor transport, and motor transport in India - types of road and their features. Transit Operation: Route planning - route location, stop location, route schedules, vehicle and labor scheduling, traffic control - traffic signals, signal timing, freeway control systems.<br>**Forms Of Ownership:** Sole proprietorship, partnership, private limited company, public limited company, statutory company, local authority undertaking / municipal transport company, joint venture.<br>**Costs and Fares:** Operating costs and types of vehicles - production economics, requirement of buses and frequency, garages and bus stations, garage organisation, construction of bus station. | 08 Hours |
| **Module -5** | |
| **Legal Aspects:** Motor vehicle act- registration, necessity of permits, insurance, test of competence to drive, mistake / offences for which a driver can be punished, adult workers - hours of work, running time, split duty, journey time, round journey time, layover, frequency. | 08 Hours |

**Course outcomes:**

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

1. Explaindifferent vehicle maintenance procedures and schedules, their importance.
2. Carryout calibration of equipments.
3. Explain Concept of Transport management and their legal aspects.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**Reference Books:**


1. A.W.Judge, Motor Vehicle Servicing, 3rd Edition, Pitman Paperpack, London , 1969.
2. W.Crouse, Everyday Automobile repair, Intl.student edition, TMH, New Delhi, 1986.
3. John Dolu, Manage "Fleet management ", McGraw-Hill Co., 1984.
4. Government of India Publication, "The Motor vehicle Act ", 1989.
5. Kitchin L D, "Bus operation ", llliffe and Sons Ltd., London, III Edition, 1992.
6. Frazee, fledell, Spicer,-Automobile collision Work, American technical publications, Chicago, 1953.
7. A,W.Judge, Maintenance of high speed diesel engines, Chapman Hall Ltd., London, 1956.
8. V.L.Maleev, Diesel Engine operation and maintenance, McGraw Hill Book CO., New york, 1995.
9. Vehicle servicing manuals.

AUTOMOTIVE EMBEDDED SYSTEMS
[As per Choice Based Credit System (CBCS) scheme]
SEMESTER – I

| Subject Code | 16MAU154 | IA Marks | 20 |
|---|---|---|---|
| Number of Lecture Hours/Week | 04 | Exam Marks | 80 |
| Total Number of Lecture Hours | 40 | Exam Hours | 03 |
| Credits | 03 | | |

**Course objectives:** The main objectives of this course are

1. To know the basic of Automotive Embedded system concepts,
2. To understand different application of embedded system in automotive and
3. To get knowledge of hardware and usage software in Automotive Embedded System
4. To know different software development tools
5. To understand the integration of Software and Hardware

| **Modules** | **Teaching Hours** |
|---|---|
| **Module-I** | |
| **Electronics in Automotive:** Introduction Body and convenience electronics: vehicle power supply controllers and lighting modules, door control modules, Safety electronics: active safety systems: ABS,ASR, ESP passive safety systems: Restraint systems and their associated sensors in an automobile. Powertrain Electronics: Gasoline engine management, Infotainment electronics: Dashboard/instrument cluster, car audio, telematic systems, navigation systems, multimedia systems, cross application technologies. 42V vehicle power supply system. | 08 Hours |
| **Module -2** | |
| **Drive by Wire:** Challenges and opportunities of X-by-wire: system & design requirements steer-by-wire, brake-by-wire, suspension-by-wire, gas-by-wire, power-by-wire, shift by-wire. Future of Automotive Electronics | 08 Hours |
| **Module -3** | |
| **HARDWARE MODULES**: MC9S12XD family features -Modes of operation-functional block diagram overview-programming model. Memory Map Overview Pulse Width Modulator (PWM) –On-chip ADC Serial Communication Protocol: SCI, SPI,IIC, CAN. | 08 Hours |
| **Module -4** | |
| **Software Development Tools**: Introduction to HCS12XDT512 Student Learning Kit & PBMCU (Project Board) –Introduction to Code Warrior IDE-Editing-Debugging-Simulating simple programs. Flashing code into HCS12XDT512 SLK board and testing | 08 Hours |
| **Module -5** | |
| **Integration of Software and Hardware** : Downloading the Software from Host Machine to Target Machine. Implementing application prototype: Power Window and Automotive Lighting System | 08 Hours |

**Course outcomes:**

At the end of this course student will have

1. The understanding of embedded system concepts and how it is being used in automotive vehicles.
2. Understanding of designing of Automotive Embedded system using software and hardware.

**Question paper pattern:**

1. The question paper will have ten questions.
2. Each full question consists of 16 marks.
3. There will be 2full questions (with a maximum of four sub questions) from each module.
4. Each full question will have sub questions covering all the topics under a module.

The students will have to answer 5 full questions, selecting one full question from each module.

**TEXT BOOKS:**

1. Semiconductors: Technical Information, Technologies and characteristic data, PublicisCorporate Publishing 2nd revised and considerably enlarged edition, 2004,
2. Freescale MC9S12XDP512 data sheet
3. Ronald K Jurgen ,"Automotive Electronics Handbook" , McGraw Hill , 2000.
4. Werner Klingenstein& Team, "Semiconductors: Technical Information, Technologies and Characteristic Data", Publicis Corporate Publishing, 2nd edition, 2004
5. LjuboVlacic, Michel Parent &FurnioHarshima, "Intelligent Vehicle Technologies: Theory and Applications", Butterworth-Heinemann publications, 2001.

| AUTOMOTIVE ENGINEERING LAB –I<br>[As per Choice Based Credit System (CBCS) scheme]<br>SEMESTER – I | | | |
|---|---|---|---|
| Subject Code | 16MAU16L | IA Marks | 20 |
| Number of Lecture Hours/Week | 03 | Exam Marks | 80 |
| Total Number of Lecture Hours | 36 | Exam Hours | 03 |

**List of Experiments**

| | |
|---|---|
| 1 | Linear Static (Stress) Analysis of Automotive Engine Components such as Connecting Rod, Piston, Cylinder wall, Crank Shaft using FEA software Such as MSC Patran / MSC Nastran and etc |
| 2 | Modal Analysis of Automotive Engine Components using FEA software |
| 3 | Dynamics Analysis of Automotive Engine Components using FEA Software |
| 4 | Heat Transfer Analysis of Automotive Engine Components using FEA Software |
| 5 | Random Vibration analysis |
| 6 | Testing of Single Cylinder, Twin Cylinder and multi cylinder SI / CI engines for performance, Calculate BP, Thermal, volumetric efficiencies, and BSFC with emission testing |
| 7 | Conduct Morse test for finding FP, IP, Indicated thermal efficiency and Mechanical efficiency and tuning the engine parameters |
| 8 | Performance test on computerized IC engine test rig using conventional fuels and Alternate Fuels. |
| 9 | Study and tuning of CRDI engine |
| 10 | Performance test on Variable Compression Ratio Engine |