**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**WORK INTEGRATED LEARNING PROGRAMMES**

**M. Tech Automotive Electronics**

**I Semester 2019-20**

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| **Course Title** | **Automotive Vehicles** |
| **Course No(s)** | **AEL ZC441** |
| **Credit Units** | 4 |
| **Credit Model** |  |
| **Content Authors** | **Dr. Kiran D. Mali** |

**Course Description:**

Automotive Chassis Layout, Frame and body Construction, I.C. Engine Construction and Components. Engine Cooling and Lubrication System, Clutches, Transmission System, Drive Line System, Steering System, Suspension and Shock Absorber System, Braking System, Automotive Vehicle Performance.

**Course Objectives**

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| **No** |  |
| **CO1** | To study of main components/systems of an automobile, such as an engine, transmission, drive-axle system, suspension system, brake system, etc. |
| **CO2** | Understanding the fundamental working principles of different systems. |
| **CO3** | To learn the performance analysis along with working, and important aspects of various components of automotive vehicles |
| **CO4** | To get acquainted with advanced concepts through projects, assignments which will be conducted during the semester |

**Text Book(s)**

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| **TB1** | N. K. Giri, *Automotive Mechanics*, Khanna Publishers, Eighth edition |
| **TB2** | Kripal Singh, *Automobile Engineering*, - Vol. I & II, Standard Publishers & Distributors |

**Reference Book(s) & other resources**

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| **RBa** | V. Ganeshan, *Internal Combustion Engines*, Tata McGraw-Hill Education |
| **RBb** | Joseph Heitner, *Automotive Mechanics – Principles and Practice*, - Affiliated East West Press, 2nd edition, 1980 |
| **RBc** | K.K. Jain , R. B. Asthana, Automobile Engineering TTTI *Bhopal* - Tata McGraw-Hill |
| **RBd** | S. Srinivasan, *Automotive Mechanics*,- Tata McGraw-Hill Education |
| **RBe** | Sudhir Kumar Saxena, Automobile Engineering, University science Press,2009 |

**Learning Outcomes:**

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| **No** | **Learning Outcomes** |
| LO1 | To be able to recognize and identify different vehicle systems and components. |
| LO2 | To be able to analyze the functions and evaluate the performance of vehicle systems. |
| LO3 | Understanding importance of each system and how it may affect safety, reliability and performance of vehicle. |
| LO4 | Apply technical knowledge and skills necessary to remove, replace mechanical related small components. |

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| **Lect No.** | **Learning Objectives** | **Topics to be covered** | **Reference to Text** |
| 1-2 | An introduction to automobiles | Overview of the course and evaluation scheme  Development of automobiles, General classification, Basic structure and components of automobile | 1TB1,1TB2 |
| 3 | The chassis Construction and Body | Classification, Conventional construction, Sub frames, Frame less constructions, Classification of body, Numerical problems on chassis member bending. | 11TB1, 1 TB2 |
| 4 to 5 | Reciprocating Engine Construction and basics | Constructional details, Calculation of displacement velocity and acceleration of piston and connecting rod, Working of 2and 4 stroke engines.  Numerical problems on the above topics | 3TB1 |
| 6 | Cooling systems | Need. Variation of gas temperature. Piston temperature distribution. Theory of engine heat transfer and correlation. Parameters affecting engine heat transfer. Air-cooled systems. | 8TB1, 12RBa |
| 7 | Cooling systems | Types of water-cooling systems. Radiators. Fans. Correlation for the power required for engine cooling. Numerical problems on the above topics | 8TB1, 12RBa |
| 8 | Lubrication systems | Causes of engine friction. Function of lubrication. Mechanism of lubrication. Journal bearing lubrication. | 7TB1, 11RBa |
| 9 | Lubrication systems | Types of lubrication systems. Lubrication of engine components. | 7TB1, 11RBa |
| 10 | Clutch | Definition of clutch, requirements, classification, principle of working of friction clutches, Driving system and Plate clutch (uniform pressure and uniform wear). | 14TB1, 3TB2 |
| 11 | Clutch | Comparison of spring and diaphragm clutch, Cone clutch (uniform pressure and uniform wear). | 14TB1, 3TB2 |
| 12 | Clutch | Energy lost by plate clutch during engagement. Centrifugal clutch. Frction materials and properties, Numerical problems on the above topics | 14TB1, 3TB2 |
| 13 | Brakes | Fundamentals of brakes, Braking of vehicle. Heat generated due to braking operation. Theory of Internal expansion brake. | 18TB1, 10,11TB2 |
| 14-15 | Brakes | Hydraulic brakes. Hand or parking brakes. Braking of vehicle moving in a curved path. Numerical problems on the above topics | 18TB1, 10,11TB2 |
| 16-17 | Gear box | Fundamentals of gear train, need of gear box, types of gear boxes,Torque and tooth load in epicyclic gear trains. Sliding mesh and constant mesh gears. | 15TB1, 4TB2 |
| 18-19 | Gear box | Epicyclic gears and hydra-matic transmission. Numerical problems on the above topics | 15TB1, 4TB2 |
| 20 | Differential and rear axle | Differential. Rear axle. Axle shaft. Axle housing. Numerical Problems | 16TB1, 6TB2 |
| 21 | Propeller shaft, Universal joint | Types of driving shafts. Mechanics of Hotchkiss and torque tube drives. Slip joint. Hook’s joint. | 16TB1, 6TB2 |
| 22-23 | Suspension System | Object and basic requirement, Functions and types of suspension spring, Shock absorber, Independent Suspension, Stabilizer, Interconnected suspension systems, Numerical Problems on spring design | 12 TB1,7TB2 |
| 24-25 | Front Axle and Steering system | Ackerman steering gear. Devis steering gear. Turning circle radii. Standard steering gears. Power steering.  Numerical problems on the above topics | 17TB1, 8TB2 |
| 26-27 | Wheels and Tyres | Types of wheels. Design consideration of wheels. Wheel alignment. | 13TB1, 9TB2 |
| 28-30 | Vehicle Performance | Forces and couples on wheel, Vehicle drag, Power for propulsion, Traction and tractive efforts, Stability of vehicle on slope. | 20TB1 |
| 31 | Miscellaneous Topics | Accessories and vehicle safety | 12,13,14 TB2 |
| 32 | Revision and Review | Discussion on the topics studied |  |

**ISM:** Instructor Supplied Material

**Evaluation Scheme:**

Legend: EC = Evaluation Component; AN = After Noon Session; FN = Fore Noon Session

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| --- | --- | --- | --- | --- | --- |
| No | Name | Type | Duration | Weight | Day, Date, Session, Time |
| EC-1 | Assignments/Quizzes | Online | - | 20% |  |
| EC-2 | Mid-Semester Exam | Closed Book | 2 hours | 30% |  |
| EC-4 | Comprehensive Exam | Open Book | 3 hours | 50% |  |

**Note:**

Elearn portal: https://elearn.bits-pilani.ac.in.

Students are expected to visit the Elearn portal on a regular basis and stay up to date with the latest announcements and deadlines.

Evaluation Guidelines:

1. EC-1 consists of Quizzes, assignments, lab
2. For Closed Book tests: No books or reference material of any kind will be permitted.
3. For Open Book exams: Use of books and any printed / written reference material (filed or bound) is permitted. However, loose sheets of paper will not be allowed. Use of calculators is permitted in all exams. Laptops/Mobiles of any kind are not allowed. Exchange of any material is not allowed.
4. If a student is unable to appear for the Regular Test/Exam due to genuine exigencies, the student should follow the procedure to apply for the Make-Up Test/Exam which will be made available on the Elearn portal. The Make-Up Test/Exam will be conducted only at selected exam centres on the dates to be announced later.
5. Syllabus for Mid-Semester Test (Closed Book): Contact Hours 1 to 8
6. Syllabus for Comprehensive Exam (Open Book): Contact Hours 1 to 16

It shall be the responsibility of the individual student to be regular in maintaining the self-study schedule as given in the course handout, attend the lectures, and take all the prescribed evaluation components such as Quizzes, Assignments, Lab, Mid-Semester Test and Comprehensive Examination according to the evaluation scheme provided in the handout.

**Instructor-in-Charge**

**AEL ZC441**