IME-325 Automotive Electrical Systems
Course Syllabus - Spring 2011

Catalog Data: The study and simulation of electrical power production, regeneration, storage uses and control in current and alternative automobiles and trucks. Focus on the wide variety of electronic operational enhancements as they air vehicle, safety, and comfort with the reductions of emissions, fuel consumption driver effort and skill. The manufacture of components and systems, interaction with other systems, efficiency, on-board diagnosis, and life cycle testing.

Prerequisite Topics:

1. Mathematics that includes the understanding of algebra, geometry and basic calculus
2. Physics that include the understanding and measurement of energy including electricity light, acceleration and speed
3. Materials that include the understanding of physical and thermal properties as well as manufacturing techniques used with these materials
4. Chemistry that includes the understanding of chemical relationships used in production of materials including insulators, conductors, magnets and non-magnets
5. Computers that include the use of software packages for simulation, problem solving and record keeping
6. Technical writing that includes the ability to report scientific observations and performance results
7. Technical illustration that includes the use of computers to report graphical information and manufacturing process and records
8. Statistics and metrology of the determination of manufacturing tolerances and accuracy of process control
9. IME-122 Automobile in Society, The technological and sociological challenges of the automobile
10. ECE-100, Fundamentals of Electricity

Textbooks: (Purchase)

Bosch, Robert GmbH (2004), Automotive Handbook, 6th Ed., Stuttgart (Distributed by the Society of Automotive Engineers International, ISBN0-7680-1513-8

Refrences; (In Waldo Library)

Bosch, Robert GmbH (1999), Gasoline-Engine Management, Stuttgart (Distributed by the Society of Automotive Engineers International

Bosch, Robert GmbH (1999), Diesel-Engine Management, Stuttgart (Distributed by the Society of Automotive Engineers International

Bosch, Robert GmbH (1999), Driving Safety Systems, Stuttgart (Distributed by the Society of Automotive Engineers International

Ribbens, William B. (1998), Understanding Automotive Electronics, Warrendale (Society of Automotive Engineers International)

Denton, Tom (2000), Automobile Electrical and Electronic Systems, Warredale (Co-published by the Society of Automotive Engineers International and Edward Arnold

SAE Handbook, Warrendale, Published by the Society of Automotive Engineers International

Jurgen, R. K. (1999), Automotive Electronics Handbook, McGraw-Hill, (Distributed by the Society of Automotive Engineers International

Crompton, T. R. (1996), Battery Reference Book, Warrendale, Co-published by the Society of Automotive Engineers and Butterworth-Heinemann

Reasbech, P and Smith, J. G. (1997), Batteries for Automotive Use, John Wiley and Sons Inc. (Distributed by the Society of Automotive Engineers International

Electronics Reliability Handbook, AE-9 (1987), Warrendale

Subscription to: SAE Transactions and Technical Papers, 1950 to 2006, (Paper/Microfiche), Warrendale (Society of Automotive Engineers International)

SAE Digital Library on line at WMU Libraries, Data Bases, SAE Digital from your home or on campus computer. If full text is not available on line a request to the library will give 2-3 day service.

SAE, (1999), SAE Energy Transfer System for Electric Vehicles Parts 1 and 2, Warrendale

SAE, (1999), SAE Surface Vehicle Electromagnetic Compatibility Standards Manual, Warrendale

USCAR, (1997), Standards for Automotive Electrical Connection Systems, Warrendale

Course Learning Objectives – By the end of the semester the student should be able to:

1. Use schematics to identify current vehicle electrical systems functions. Systems may be power, communication, power train management, body function management, information or safety.
2. Use schematics and test equipment to understand and test and vehicle bus information transmission.
3. Use schematics to describe, assemble and diagnose systems such as power development, traction/starting power storage and power use including 12/24/42 /150 and 300 volt systems.
4. Explain the operation, assembly and diagnosis of DC and AC motors used in starting, regeneration, driving, power assist and accessory systems.
5. Calculate and recommend conductor sizing when given operational characteristics and loads.
6. Explain, and test solid state control devices such as phase, pulse width/duty cycle modulator controllers.
7. Identify and understand electro magnetic compatibility (EMC) problems both onboard and outside vehicles and be able to suggest solutions.

Topics:

Lectures

1. Progression of electrical common automotive conventional and contemporary simple /complex, actual and schematic
2. Electrical measurement and instrumentation in systems
3. Batteries and cranking systems, components and wiring conventional/hybrid and no-idle
4. Problems with and solutions to EMC
5. Energy change from mechanical to electrical and electrical to mechanical
6. Theory, control, construction, assembly and diagnosis of electrical traction motors, generators, regenerators
7. Theory, control, communication, construction, assembly and diagnosis of 12/24/42/150 and 300 volt electrical systems
8. Theory, assembly, and diagnosis of electrical accessory systems including lighting, security, comfort, information and safety

9. Theory, assembly, and diagnosis of management systems involved with fuel cells, IC engines, and drive train control

Labs

1. Evaluation of electrical system construction, sizing and properties including design of circuits and measurement devices
2. Evaluation of EMC from IC engines, accessories and outside sources
3. Evaluation of electrical storage devices
4. Evaluation and control of power conversion to electricity driving and storage
5. Evaluation and control of electrical energy conversion to mechanical energy for traction and starting
6. Evaluation IC engine control systems
7. Evaluation of inter-computer communication systems (Can Data Bus networking)
8. Evaluation of electrical accessory, enjoyment, and safety systems
9. Evaluation of modern and contemporary electrical system construction

Evaluation:

1.	Exams and Quizzes:	25%
2.	Lab assignments	25%
3.	Weekly assignments on the week's component and/or system	25%
4.	Participation and research on weeks assignment	25%

Performance Criteria: (Learning Outcomes), based on the course learning objectives

1. Read and write electrical system schematics such as used in current and contemporary automotive information and communication systems
2. Assemble and troubleshoot systems using logic, schematics, oscilloscopes, meters and other electrical test equipment
3. Using schematics and specifications will be able to assemble, wire, control DC and AC motors used in 12/24/42/150/300 volt systems of modern and contemporary automobiles.
4. Using schematics and specifications determine and apply wire size, terminations and circuit safety devices.
5. Assemble and trouble shoot alternators and generators/regenerators, connecting controls and circuits.
6. Build and apply pulse width modulators and duty cycle controls for motors and alternators.
7. Identify and apply controls to sources and controls of EMC problems.

Computer Usage:

The computer will be used to identify standards, circuit information, references and to document student designed circuits. The computer will also be used in the process of simulation of hybrid vehicle activities. The automotive lab includes a database system of current and past automotive information called All-Data

Student will spend a minimum of 2 hours per researching and evaluating web based technical electronic and electrical components and systems

Laboratory Projects:

1. Study of power train, anti-theft, comfort/convenience, information, safety, driving-safety system schematics, construction, logic, communication and testing

2. Study of power systems used in automobiles for starting, launch, mechanical conversion to electrical energy, regeneration and electrical power storage
3. Study of wire sizing with appropriate voltage drop measurements, circuit building, construction of terminations and installation procedures
4. Study of in use generators, alternators actuators and motors for 12/24/42/150/300 volt systems
5. Study and application of circuit and system test devices for modern and contemporary automotive electrical systems
6. Study the sources and solutions available to combat the effects of electro magnetic compatibility

Library Usage:

The use of the materials listed in references in incorporated and housed in the library. This information is the latest and most complete as applied to the automobile

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