

GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

Course Curriculum

AUTOMOBILE ELECTRICAL SYSTEM (Code: 3330203)

Diploma Programme in which this course is offered	Semester in which offered
Automobile	3 rd Semester

1. RATIONALE

Modern automobiles have many instruments for indicating different quantities such as speed, level of fuel, temperature and automatic control systems for doors/windows etc. Ignition system and lighting system also require power. It is therefore essential for automobile engineers to have the fundamental knowledge of automobile electrical systems. This course tries to develop this knowledge and skills in the students, which would help them in installation of various electrical components, operation and maintenance of automobile electrical system. Understanding of this course will also be helpful for diagnosis and testing of electrical system.

2. COMPETENCY (Programme Outcome according to NBA Terminology)

The course content should be taught and with the aim to develop different types of skills so that students are able to acquire following competency.

- **Install, inspect and maintain auto electrical systems.**

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** - Practical; **C** - Credit; **ESE** - End Semester Examination; **PA** - Progressive Assessment

4. COURSE DETAILS

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
Unit – I Electricity, Magnetism And Automobile Wiring	1a. Describe current, voltage, Magnetism, conductors, semi-conductors, Insulators & automobile wiring system. 1b. Explain Ohm's law, series and parallel circuits. 1c. Use various instruments for measuring current, voltage & resistance. 1d. Describe wiring harness, symbols for wiring.	1.1 A short history of auto-electrical system, constructional and functional details of conductors, semi-conductors and insulators. 1.2 Ohm's Law, EMF, potential difference and voltage drop, Series and parallel circuits, Effect of electric current, Measurement of DC-Current, Voltage, & resistance, 1.3 Application & principle of Multimeters, 1.4 Meaning of magnetism and law of magnetism, 1.5 Symbols used in wiring, Types of wiring system, wiring harness, Different electrical system
Unit – II Automobile Battery	2a. Explain principle and construction of lead acid battery. 2b. Describe characteristics of battery, rating, capacity and efficiency of batteries. 2c. Describe Charging methods & Battery maintenance.	2.1 Types of battery (dry & wet batteries.), Construction of battery, Function of lead acid battery, 2.2 Various charging processes, Maintenance of battery. 2.3 Modern developments in battery, Procedure of commissioning of new Battery in vehicle. The various battery rating, Battery performance.
Unit – III Ignition System	3a. Explain wiring diagram of various Ignition System. 3b. Describe construction & working of different types of Ignition system. 3c. Describe various spark advance mechanism. 3d. Describe Principal of Hall effect switch.	3.1 Types of ignition system and its layouts, wiring diagram. 3.2 Coil, Magneto & Capacitor discharge ignition system: construction and working. Comparison of systems. 3.3 H.T. Coil & Distributor: - Types, construction and working. 3.4 Distributor less electronic & direct ignition system, mechanical & electronic spark advance mechanism. Hall Effect switch. 3.5 Spark plug: -construction, function, types.
Unit – IV Starting System	4a. Describe construction & working of Starter motor. 4b. Describe different types of Starting units & starter switch.	4.1. Principal of starter motor, 4.2. Constructional and functional details of starter, 4.3. Torque characteristic of starter, Starter drive mechanism: its types

Unit	Major Learning Outcomes (Course Outcomes in Cognitive Domain according to NBA terminology)	Topics and Sub-topics
		(bendix, and folothru & over running Clutch Drives, axial drive), construction, function and comparison of different drive mechanism. 4.4. Solenoid switch.
Unit – V Charging System	5a. Describe necessity, construction & working of various charging system. 5b. Describe voltage & current regulatory system.	5.1 Necessity of charging system, 5.2 Introduction & basic principle of generators, Function, Circuit arrangement, 5.3 Working Principle of Alternator Charging System, Differences between Generator & Alternator, and Advantages of alternator over DC generator. 5.4 Advanced charging system technology & new developments , 5.5 Requirement of regulating current & voltage in alternator.
Unit– VI Lighting System & Automobile Auxiliaries	6a. Explain functioning of various lighting and Auxiliaries units of automotive vehicle.	6.1 Lighting Fundamentals, Lighting Circuits, Gas discharge & LED lighting, types of lamps. 6.2 Meaning of auxiliaries, Construction, function & circuit arrangement of various auxiliary units such as :- Horn, Wiper, Flashers, fuel gauge, temp gauge, oil pressure gauge, warning lights, Mechanical & digital Speedometer & odometer, Electrical Fan for cooling system, Wind shield washer & Defogger, car stereo. 6.3 Power window, central locking with remote control & without remote control, key less entry.

5. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Electricity, Magnetism And Automobile Wiring	07	3	5	2	10
2	Automobile Battery	08	4	6	4	14
3	Ignition System	08	3	8	3	14
4	Starting Systems	06	2	4	3	09
5	Charging System	06	4	4	4	12
6	Lighting System & Automobile Auxiliaries	07	2	5	4	11
Total		42	18	32	20	70

Legends: R = Remember; U = Understand; A = Apply and above levels (Bloom's revised taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

6. SUGGESTED LIST OF PRACTICAL/EXERCISES

The practical/exercises should be properly designed and implemented with an attempt to develop different types of practical skills (**Course Outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies (Programme Outcomes). Following is the list of practical exercises for guidance.

Note: Here only Course Outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of **Programme Outcomes/Course Outcomes in affective domain** as given in a common list at the beginning of curriculum document for this programme. Faculty should refer to that common list and should ensure that students also acquire those Programme Outcomes/Course Outcomes related to affective domain.

S. No.	Unit No.	Practical Exercise (Any seven) (Course Outcomes in Psychomotor Domain according to NBA terminology)	Approx. Hrs. Required
1	I	Demonstrate cable size, color code, wiring and symbols used in auto wiring.	4
2	II	Demonstrate construction and working of automobile batteries.	4
3	III	Demonstrate construction and working of different types of ignition systems.	4
4	IV	Demonstrate construction and working of different types of	4

S. No.	Unit No.	Practical Exercise (Any seven) (Course Outcomes in Psychomotor Domain according to NBA terminology)	Approx. Hrs. Required
		starter, motor, its drive and switches.	
5	V	Study of working principle of D.C. generator.	4
6	V	Demonstrate working principle of A.C. generator and its regulators.	4
7	VII	Demonstrate automobile bulbs and lights.	4
8	VII	Demonstrate various instruments & gauges (Dash board units).	4
9	VII	Demonstrate construction of various electrical accessories e.g. horn, wiper & flashers etc.	4
Total			28

7. SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- a. Seminar by Students on construction & operation of various electrical components & associate systems like charging system, starting system etc.
- b. Prepare Display Board such as ignition system etc., & Chart like hall effect switch, parallel & series circuit.
- c. Internet Base Assignment, Teacher guided self learning activity etc.
(These could be Individual or group base.)

8. SPECIAL INSTRUCTIONAL STRATEGIES (If Any)

- a. Lectures cum discussion using Chart (such as distributor less ignition system, Principle of magnetism), Cut Section Model (such as alternator & starter motor), and Display board (such as ignition system).
- b. Use of animations, video or power point presentation.

9. SUGGESTED LEARNING RESOURCES

(A) List of Books:

S. No.	Title of Books	Author	Publication
1	P. L. Kholi	Automobile Electrical Equipments	Tata McGraw-Hill Co., Ltd., New Delhi,.
2	R. B. Gupta	Automobile Engineering	Satya Prakashan
3	K.M.Gupta	Automobile Engineering	Umesh Publication
4	Dr. Kirpal Singh	Automobile Engineering	Strandard Publishers
5	Jain K.K., Asthana R.B.	Automobile Engineering	Tata Mc-Graw Hill Publishing Co. Ltd.
6	H. M. Sheti	Automobile Technology	Tata McGraw-Hill Co., Ltd., New Delhi
7	W.H.Crouse & D.L. Anglin	Automotive Mechanics	Tata McGraw-Hill Co., Ltd., New Delhi

(B) List of Major Equipment/Materials

- a. Measuring instruments.
- b. Battery with cut section.
- c. Various component of electrical & electronic ignition system.
- d. Various starters with drive & its cut section.
- e. Alternator (its component) & d.c. generator & its cut section.
- f. Various accessories like Flasher unit, Speedo meter etc..

(C) List of Software/Learning Websites

1. http://www.youtube.com/watch?v=a_nsgzlrZGU
2. <http://www.youtube.com/watch?v=RzDqEorOXxk>
3. <http://www.youtube.com/watch?v=XDWGtWmB1D0>
4. http://mail.faribault.k12.mn.us/~Mark_Lessman/S00CF9F37.4/STARTING%20SYSTEM.ppt
5. Howstuffworks.com
6. Wikipedia.com

10. COURSE CURRICULUM DEVELOPMENT COMMITTEE**Faculty Members from Polytechnics**

- **Prof. M. J. Pathak**, Head of Automobile Engineering Department, Sir Bhavsinhji Polytechnic Inst., Bhavnagar.
- **Prof. A. C. Desai**, Lecturer, Automobile Engineering Department, Shree N. M. Gopani Polytechnic, Ranpur.
- **Prof. A. C. Suthar**, Lecturer, Automobile Engineering Department, M.L. Institute of Diploma Studies, Bhandu.
- **Prof. Sanjay Kumar Ghaiye**, Head of Automobile Engineering Department, Kalaniketan Polytechnic, Jabalpur (MP).

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. K. K. Jain**, Professor, Department of Mechanical Engineering
- **Dr. C. K. Chugh**, Professor, Department of Electronic Media