

Course Title: Automobile Electrical and Electronics systems	Course Code: 15AT42T
Credits (L:T:P) : 4:0:0	Core/ Elective: Core
Type of course: Lectures	Total Contact Hours: 52
25 Marks	100 Marks

Prerequisites: Basic knowledge of Science & Automobile Engineering-I & II.

Course Objectives:

The students should be able to

1. Acquire the knowledge of Electrical and Electronics engineering concepts.
2. Understand the construction and applications of Electrical and electronics components in various automotive electrical circuits.
3. Understand the construction and working of various automotive electrical systems and components.
4. Identify, demonstrate and compare the various components and systems of Auto electrical systems.

On successful completion of the course, the students will be able to attain CO'S:

Course Outcome		CL	Linked PO	Teaching Hrs
CO1	Explain basic terminologies, components and concepts of electrical engineering.	<i>R/U</i>	1,2	08
CO2	Explain basic terminologies, components and concepts of electronics engineering.	<i>R/U</i>	1,2	07
CO3	Understand the purpose, construction and working of different batteries and electrical systems used in Automobiles.	<i>R/U/A</i>	1,2,3,10	08
CO4	Explain the purpose, circuits, construction and working of components of charging and starting system.	<i>R/U/A</i>	1,2,3,10	11
CO5	Understand purpose, circuits, construction and working of components of ignition system.	<i>R/U/A</i>	1,2,3,10	09
CO6	Explain purpose, circuits, construction and working of components of lighting and accessories system.	R/U	1,2,10	09
		Total sessions		52

COURSE-PO ATTAINMENT MATRIX

Course	Programme Outcomes									
	1	2	3	4	5	6	7	8	9	10
Automobile Electrical and Electronics systems	3	3	3	-	-	-	-	-	-	3

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

Method is to relate the level of PO with the number of hours devoted to the COs which address the given PO.

If $\geq 40\%$ of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 3

If 25 to 40% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 2

If 5 to 25% of classroom sessions addressing a particular PO, it is considered that PO is addressed at Level 1

If $< 5\%$ of classroom sessions addressing a particular PO, it is considered that PO is considered not-addressed.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Hour	Questions to be set			Marks weightage (%)
			R	U	A	
I	Basic Electricity	08	10	10		13.8
II	Basic electronics	07	5	15		13.8
III	Introduction to Automotive Electrical System	08	05	10	05	13.8
IV	Charging system & Starting system	11	05	20	05	20.7
V	Ignition system	09	05	20	05	20.7
VI	Lighting system & Electrical accessories	09	05	20		17.2
	Total	52	145			100

Legend: R; Remember, U: Understand A: Application

Course Delivery: The course will be delivered through lectures, presentations and classroom discussions.

Course Content:

UNIT-I

Basic Electricity

08hrs

Electrical energy-definition-Benefits-sources-effects of electrical current with applications, electrical current-definition-units-DC current-definition-applications-AC current-definition-

applications, Definitions and units -frequency-amplitude-instantaneous value-RMS value-average value-form factor-cycle-, voltage-definition-units, resistance-definition-unit, conductors, insulator, semiconductors, capacitors-working principle-capacitance unit-types-applications, Ohms law-series and parallel circuits, magnetism-magnetic lines of force-magnetic field-reluctance-flux density, electromagnetism-faraday's law of electromagnetic induction-self induction-mutual induction-units of inductance, Switches-function-types.

UNIT-II

Basic electronics

07hrs

Semiconductors- P type- N type, Diode-introduction-half wave rectification-full wave bridge rectifier-full wave bridge rectifier with capacitor filter, zener diode-introduction, zener diode as voltage regulator, LED and photo diode-introduction-applications, transistor-introduction-NPN and PNP transistor-applications-transistor as switch.

UNIT-III

Introduction to Automotive Electrical System

08hrs

Automotive Electrical Systems–function of each system, Earth and Insulated return system-circuit diagram-merits and demerits, Positive and negative earth return system-merits and demerits, Electrical and electronics symbols used in Auto electrical system.

Battery

Battery -purpose-types, construction and working-Lead acid and alkaline battery-differences between lead acid and alkaline battery, Explain-Cell voltage -Battery capacity-Battery efficiency, Battery ratings- types.

UNIT-IV

Charging system

11hrs

Charging system-purpose-circuit diagram with D C generator, D C generator-principle-construction and working, need of cut-out relay, current and voltage regulator, Alternator-charging circuit with alternator-working principle-construction and working-regulation, Electronic voltage regulators-construction and working, comparison between generator and alternator.

Starting system

Starting system-requirements-circuit diagram-working principle, construction and working-series shunt wound motor Drive mechanism-need-types, construction and working-Standard Bendix drive- positive engaging drive with shift lever and over running clutch drive-axial sliding armature drive, Solenoid switch with two winding-construction and working.

UNIT-V

Ignition system

9hrs

Ignition system-requirements-types, battery coil ignition system-circuit diagram-function of each component, Ignition coil-function-construction and working ,Ignition timing-definition-need of ignition timing advance based on speed and load, Firing order-definition-need, Magneto ignition system-circuit diagram of High tension rotating magnet type ignition system-function of each component, spark plug-classification-construction-specification, spark plug gap, heat range and reach- definition and importance.

UNIT-VI

Lighting system

09hrs

Circuit diagram-head light-parking light, side indicator, brake light, reverse gear light, Head light-construction, bulbs, Dipper switch, Fuses, cable colour codes, cable connectors, Wiring harness.

Electrical Accessories

Circuit diagram and explain- fuel level gauge-coolant temperature gauge, oil pressure gauge, horn, wind screen wiper, construction and working- Speedo meter, odometer, wind screen wiper, electric horn, purpose, types, construction-relays.

Resources

Reference books

SI NO	Title of the book	Author	Publisher
1	Automobile Electrical Equipment	Kohli	Tata McGraw-Hill
2	Automobile Engineering Vol-2	Kirpal Singh	Standard Publications
3	The Automobile Engineering Vol-2	K.M Guptha	Umesh publications
4	Diesel Engineering Electricity & Electronics	Joseph Bell	Ceangage
5	Principals of Electrical Engineering & Electronics	V. K Mehta & Rohit Mehta	S Chand & Co
6	A system approach to Automotive Technology	Jack Erjavec	Ceangage
7	The Automobile Engineering	Harban Singh Reyath	S Chand & Co
8	The Automobile Engineering	Er S K Gupta	S Chand & Co
9	Automobile Electrical Equipment	W. H. Crouse	Tata McGraw-Hill

Websites:

- <http://www.electrical4u.com/electric-current-and-theory-of-electricity/>
- <http://www.studyjaar.com/index.php/module-video/watch/272-electrical-circuits-prerequisites>
- <https://www.youtube.com/watch?v=l8JS8BbrVOg>
- <https://www.youtube.com/watch?v=m75jvmtVyVY>
- <https://www.youtube.com/watch?v=XiHVe8U5PhU>
- <https://www.youtube.com/watch?v=EJeAuQ7pkpc>
- <https://www.youtube.com/watch?v=Gc1wVdbVI0E>
- <https://www.youtube.com/watch?v=Gc1wVdbVI0E>
- <https://www.youtube.com/watch?v=5qwCmyETAva>
- <https://www.youtube.com/watch?v=X5bzjs3ByBU>
- <https://www.youtube.com/watch?v=BcIDRet787k>
- <https://www.youtube.com/watch?v=xUSSTV0Hs0s>
- <https://www.youtube.com/watch?v=KGTZPTnZBFE>
- <https://electronicspani.com/nickel-cadmium-battery/>
- <https://www.youtube.com/watch?v=ZDBfDTEMGaQ>
- <https://www.youtube.com/watch?v=s6rQI7t9XM4>
- <https://www.youtube.com/watch?v=OyC02DWq3ml>
- <https://www.youtube.com/watch?v=CfoKSkzK6jg>
- <https://www.youtube.com/watch?v=rF0WMIH8BBk>
- <https://www.youtube.com/watch?v=WGskIUxzcZ8>
- <https://www.youtube.com/watch?v=TK2mvyi1YiU>
- <https://www.youtube.com/watch?v=Mj-5hbQAWe8>
- <https://www.youtube.com/watch?v=WjvUVjuHRtc>
- <https://www.youtube.com/watch?v=SyZ3s45StaM>
- <https://www.youtube.com/watch?v=BH9LI973H8w>
- <https://www.youtube.com/watch?v=YsdPjY58Go8>
- <https://www.youtube.com/watch?v=HTQQnl1pArk>
- <https://www.youtube.com/watch?v=mDUTTLCM2K8>
- <https://www.youtube.com/watch?v=BDEyvgrp8N4>
- <https://www.youtube.com/watch?v=rJV2iu3BzmY>
- https://www.youtube.com/watch?v=3_vfyt6-2lc
- <https://www.youtube.com/watch?v=1Ww5-pmiokc>

- <https://www.youtube.com/watch?v=-SIIHGqDTc8>
- https://www.youtube.com/watch?v=4Ighj2Uim_0
- <https://www.youtube.com/watch?v=MhnVZ7ZPunw>
- https://www.youtube.com/watch?v=8WD5Q_PF3pM
- <https://www.youtube.com/watch?v=ITFW2PkgXWw>
- <https://www.youtube.com/watch?v=LaTPhANefQo>
- <https://www.youtube.com/watch?v=-JURAbC6oRE>
- <https://www.youtube.com/watch?v=GMjw6vxV5pg>
- <https://www.youtube.com/watch?v=LGB6ZEjGm7Q>
- <https://www.youtube.com/watch?v=W94iksaQwUo>
- <https://www.youtube.com/watch?v=dIQ4IWSpMO0>
- <https://www.youtube.com/watch?v=OMLSNwQiiKg>

Student Activities to be performed to award five marks in continuous internal evaluation:

1. Visit nearby two wheel/four wheeler service stations/garages and make report of different automotive electrical and electronic components seen with specification, materials used and manufacturing processes used along with photographs.
2. Visit nearby two wheel/four wheeler service stations/garages and collect different electrical circuits of vehicles.

Note:

1. Student should prepare a report on any one of the above/similar activity, which helps in achieving above course outcomes.
2. The report prepared should be approved by the concerned staff and HOD.
3. The activity group should consist of maximum of three students.

MODEL OF RUBRICS FOR ASSESSING STUDENT ACTIVITY

Note: The dimensions given below are only representatives and lecturer has to design/decide the dimensions based on the activity given.

Dimension	Scale					Students Score				
	Unsatisfactory 1marks	Developing 2marks	Satisfactory 3marks	Good 4marks	Exemplary 5marks	1	2	3	4	5
1. Research and gather information	Does not collect information relate to topic	Collects very limited information, some relate to topic	Collects basic information, most refer to the topic	Collects more information, most refer to the topic	Collects a great deals of information, all refer to the topic	2				
2.Full fills teams roles and duties	Does not perform any duties assigned to the team role	Performs very little duties	Performs nearly all duties	Performs almost all duties	Performs all duties of assigned team roles	3				
3.Shares work equally	Always relies on others to do the work	Rarely does the assigned work, often needs reminding	Usually does the assigned work, rarely needs reminding	Always does the assigned work, rarely needs reminding.	Always does the assigned work, without needing reminding	4				
4. listen to other team mates	Is always talking, never allows anyone to else to speak	Usually does most of the talking, rarely allows others to speak	Listens, but sometimes talk too much,	Listens and talks a little more than needed.	Listens and talks a fare amount	5				
Grand Average/Total=2+3+4+5/4=14/4=3.5=4						4				

Course Assessment and Evaluation Scheme:

Method	What		To whom	When/Where (Frequency in the course)	Max Marks	Evidence collected	Course outcomes
Direct Assessment	CIE(Continuous Internal Evaluation)	IA	Students	Three IA Tests; (Average of three Tests)	20	Blue books	1,2,3,4,5,6
				Activity	05	Activity Reports	1,2,3,4,5,6
	SEE (Semester End Examination)	End Exam		End of the course	100	Answer scripts at BTE	1,2,3,4,5,6
Indirect Assessment	Student Feedback on course		Students	Middle of the course		Feedback forms	1,2&3 Delivery of course
	End of Course Survey			End of the course		Questionnaires	1,2,3,4,5&6 Effectiveness of Delivery of instructions & Assessment Methods

*CIE – Continuous Internal Evaluation

*SEE – Semester End Examination

Note: I.A. test shall be conducted for 20 marks. Average marks of three tests shall be rounded off to the next higher digit.

FORMAT OF I A TEST QUESTION PAPER (CIE)

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th week of sem 10-11 Am	I/II SEM		20			
	Year:					
Name of Course coordinator :			Units: __			
CO's: ____						
Question no	Question		MARKS	CL	CO	PO
1						
2						
3						
4						

Note: Internal choice may be given in each CO at the same cognitive level (CL).

MODEL QUESTION PAPER (CIE)

Note: The lecturer has to follow the question paper blue print given in above table to prepare CIE Question paper also.

Test/Date and Time	Semester/year	Course/Course Code	Max Marks			
Ex: I test/6 th week of sem 10-11 Am	IV semester	Automobile electrical and electronics systems	20			
	Year: 2015-16	Course code: 15AT42T				
Name of Course coordinator :			Units: 1,2 Co: 1,2			
Note: Answer all questions						
Question no	Question		CL	CO	PO	
1	State the definition of electrical energy and list its sources. 5marks		R	1	1,2	
2	List any five benefits of using electrical energy. 5marks Or Compare conductors and insulators with examples of different materials. 5marks		A	1	1,2	
3	Explain Full wave bridge rectifier with a circuit diagram. 5marks Or Explain the working of transistor as a switch with a circuit diagram. 5marks		U U	2	1,2	

Legend: R; Remember, U: Understand A: Application

MODEL QUESTION BANK

CO1: Explain basic terminologies, components and concepts of electrical engineering.

FIVE MARKS QUESTIONS

1. State the definition of electrical energy and list its sources. (R)
2. State the definition of electrical energy and list the effects of current flow in a conductor (R)
3. List any five benefits of using electrical energy. (R)
4. State the definition of electrical current and voltage with their respective units. (R)
5. State the definition of capacitance and inductance with their respective units. (R)
6. Explain the working principle of capacitor and list its applications in Automobiles. (U)
7. Explain the working principle of capacitor and list types of capacitors. (U)
8. Write a short note on Ohms law. (U)
9. Explain how to find equivalent resistance in series and parallel circuits. (A)
10. Explain how to find total capacitance in series and parallel circuits. (A)
11. State the definition of DC current and list its applications. (R)
12. State the definition of AC current and list its applications. (R)
13. State the definitions of frequency and amplitude with respective units. (R)
14. State the definitions of instantaneous value, RMS value and cycle of AC current. (R)
15. Compare conductors and insulators with examples of different materials. (A)
16. Write a short note on Semiconductors with examples of different materials. (U)
17. Explain the terms Flux density and reluctance. (U)
18. Explain Faraday's law of electromagnetic induction. (U)
19. Define the terms self induction and mutual inductance with applications. (R)
20. State the function of switch and list types of switches. (R)

TEN MARKS QUESTIONS

1. Define AC current and explain different terms used to explain AC current. (R)
2. Define the terms resistance, inductance and capacitance with their respective units. (R)

CO2: Explain basic terminologies, components and concepts of electronics engineering.

FIVE MARKS QUESTIONS

1. Write a short note on P type and N Type semiconductors. (U)
2. Explain N type semiconductor with a sketch of lattice structure. (U)
3. Explain P type semiconductor with a sketch of lattice structure. (U)
4. Define the term rectification and Draw the circuit diagram of half wave rectification with its parts. (R)

5. Draw the circuit diagram of full wave bridge rectifier and name its parts. (R/U)
6. Draw the circuit diagram of full wave bridge rectifier with filter and name its parts. (R/U)
7. Write a short note on Zener diode. (U)
8. Explain the function of Zener diode as voltage regulator with a simple circuit. (U)
9. Write short note on LED with applications. (U/A)
10. Write a short note on Photo diode with applications. (U/A)
11. Explain the construction of PNP transistor with its symbol. (U)
12. Explain the construction of NPN transistor with its symbol. (U)

TEN MARKS QUESTIONS

1. Explain half wave rectifier with a circuit diagram. (U)
2. Explain Full wave bridge rectifier with a circuit diagram. (U)
3. Explain full wave bridge rectifier with a filter with a circuit diagram. (U)
4. Explain LED and Photo diode with their symbols and applications. (U)
5. Explain the working of transistor as a switch with a circuit diagram. (U)

CO3: Understand the purpose, construction, working and ratings of different batteries and electrical systems used in Automobiles.

FIVE MARKS QUESTIONS

1. List different automotive electrical systems with their functions. (R)
2. List merits and demerits of earth return system. (R)
3. List merits and demerits of insulated system. (R)
4. List merits and demerits of positive earth return system. (R)
5. List merits and demerits of negative earth return system. (R)
6. Draw symbols of any five automotive electrical components. (R/U)
7. State the difference between lead acid battery and nickel alkaline battery. (A)
8. Explain charging and discharging of lead acid battery with a chemical equation. (U)
9. Explain the terms cell voltage and battery capacity. (U)
10. Explain the term battery rating and list its types. (U)
11. Explain the terms battery efficiency and cell voltage. (U)
12. Explain the need of separators and ribs at the bottom of battery casing. (U)
13. Explain the construction of plates with a sketch. (U)

TEN MARKS QUESTIONS

1. Explain the construction and working of lead acid battery with charging and discharging chemical reactions. (U)
2. Explain the construction and working of nickel iron battery with charging and discharging Chemical reactions. (U)

3. Explain the construction and working of nickel cadmium battery with charging and discharging chemical reactions (U)

CO4: Explain the purpose, circuits, construction and working of components of charging and starting system.

FIVE MARKS QUESTIONS

1. Draw the circuit diagram of charging system with DC generator and state the functions of each part of the circuit. (U)
2. Explain the working principle of DC generator with a sketch. (U)
3. Illustrate the need of cut-out relay and current regulator. (A)
4. Illustrate the need of current regulator and voltage regulator. (A)
5. Explain the working principle of alternator with a sketch. (U)
6. State the differences between generator output regulation and alternator output regulation. (A)
7. State any five comparisons between generator and alternator. (A)
8. State the functions of rectifier and voltage regulator in alternator. (A)
9. Draw the circuit diagram of electronic voltage regulator and label its parts. (U)
10. Draw the circuit diagram of starting system and state the functions of each part of the circuit. (U/A)
11. Explain the working principle of starting motor with a sketch. (U)
12. Explain the need of copper as brush material, series and shunt field winding in starting motor. (A)
13. Explain the need of solenoid switch and drive mechanism in starting system. (A)
14. Explain the construction and working of solenoid switch with a sketch. (U)
15. Explain the construction and working of over running clutch with a sketch. (U)

TEN MARKS QUESTIONS

1. Explain the construction and working of DC generator with a sketch. (U)
2. Explain the construction and working of Alternator with a sketch. (U)
3. Explain the construction and working of electronic regulator with a circuit diagram. (U)
4. Explain the construction and working of series shunt motor with a sketch also explains the need of shunt field winding. (U)
5. Explain the construction and working of Standard Bendix drive mechanism with a sketch. (U)
6. Explain the construction and working of positive engaging drive with over running clutch mechanism with a sketch. (U)
7. Explain the construction and working of axial sliding armature drive with a sketch. (U)

CO5: Understand purpose, circuits, construction and working of components of ignition system

FIVE MARKS QUESTIONS

1. State the functions of ignition system and list types. (R)
2. Draw the coil ignition system circuit and label the parts. (R/U)
3. Explain the construction and working of ignition coil with a neat sketch. (U)
4. Explain the need of changing ignition timing with engine speed and load. (A)
5. State the meaning of firing order and explain the need of firing order. (A)
6. State the comparisons between battery coil ignition system and High tension magneto ignition system. (A)
7. State the meaning of heat range of spark plug and its importance. (A)
8. State the meaning of reach of spark plug and its importance. (A)
9. State the meaning of spark plug gap and its importance. (A)

TEN MARKS QUESTIONS

1. Explain the working of battery coil ignition system circuit diagram. (U)
2. Explain the working of High tension rotating magnet type ignition with a circuit diagram. (U)
3. Explain the construction and working of spark plug with a sketch. (U)
4. Explain the meaning of terms used in specification of spark plugs. (U)

CO6: Explain purpose, circuits, construction and working of components of lighting and accessories system.

FIVE MARKS QUESTIONS

1. Draw the circuit diagram of head light system and label the parts. (R/U)
2. Explain the need and working of dipper switch with a sketch. (A)
3. State the function of bulb in head light and list different types of bulbs used in automobile. (U/A)
4. State the need of fuses and list different types of fuses used in Automobile.(A)
5. Draw the circuit diagram of side indicator and label its parts. (U)
6. Explain the working of parking light with a circuit diagram .(U)
7. Explain the working of brake light with a circuit diagram. (U)
8. Explain the working of reverse gear light with a circuit diagram. (U)
9. Draw the circuit diagram of fuel level gauge and label the parts. (R/U)
10. Draw the circuit diagram of temperature gauge and label the parts. (R/U)
11. Draw the circuit diagram of pressure gauge and label the parts. (R/U)
12. Draw the circuit diagram of electrical horn and label the parts. (R/U)
13. Draw the circuit diagram of wind screen wiper and label the parts. (R/U)

14. State the functions of speedometer, odometer and relay. (A)
15. State the functions of windscreen wiper horn and relay. (A)
16. Explain the construction and working of odometer with a sketch. (U)
17. Explain the meaning and need of wiring harness and color codes of cables.(A)
18. Explain the meaning and need of wiring harness and cable connectors also list types of cable connectors. (A)

TEN MARKS QUESTIONS

1. Explain the working of head light system with a circuit diagram. (U)
2. Explain the construction and working of head light with a sketch. (U)
3. Explain the construction and working of electric horn with a sketch. (U)
4. Explain the construction and working of wind screen wiper mechanism with a sketch. (U)
5. State the need of speedometer and odometer and also explain the construction and working of Speedo meter with a sketch (U/A)

Board Of Technical Examination

MODEL QUESTION PAPER

Automotive Electrical and Electronics Systems

Max Marks: 100

Time: 3 Hr

- Note:** 1. Answer any **six** questions from **PART-A** and each question carries **five** marks.
2. Answer any **seven** questions from **PART-B** and each question carries **ten** marks.

PART-A

1. State the definition of electrical energy and list its sources.
2. State the definition of capacitance and inductance with their respective units.
3. Write a short note on Zener diode.
4. Explain N type semiconductor with a sketch of lattice structure.
5. List different automotive electrical systems with their functions.
6. List merits and demerits of earth return system.
7. Draw the circuit diagram of starting system and state the functions of each part of the circuit.
8. Explain the need of cut-out relay and current regulator.
9. State the functions of ignition system and list types.
- 10.
11. Explain the construction and working of ignition coil with a neat sketch.
12. State the need of fuses and list different types of fuses used in Automobile.
13. Draw the circuit diagram of head light system and label the parts.

PART-B

1. Define AC current and explain different terms used to explain AC current.
2. Explain Full wave bridge rectifier with a circuit diagram
3. Explain the construction and working of nickel iron battery with charging and discharging Chemical reactions.
4. Explain the construction and working of Alternator with a sketch.
5. Explain the construction and working of electronic regulator with a circuit diagram.
6. Explain the working of battery ignition system with a circuit diagram.
7. Explain the meaning of terms used in specification of spark plug s.
8. a. Explain the importance of spark plug gap.
b. Draw the circuit diagram of parking light system and label parts.
9. Explain the construction and working of head light with a sketch.
10. Explain the construction and working of windscreen wiper mechanism with a sketch.
