**GOVERNMENT POLYTECHNIC**

**CHHAPRA**



COURSE FILE (Lecture Plan)

OF

**Automotive Electrical & Electronic Systems (1633602)**

Faculty Name:

Prof. SAURAV KUMAR

Lecturer

**DEPARTMENT OF AUTOMOBILE ENGINEERING**

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| **STATE BOARD OF TECHNICAL EDUCATION** |
| Bihar, PatnaSS.JPG&CC.JPG |

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Department of Automobile Engineering

**Vision**

To be a centre of excellence in the field of Automobile Engineering offering value based world class education and research producing well qualified engineers, who can contribute favorably to the technological and socio-economic development of the nation.

**Mission**

1. To ensure sufficient modern technological exposure to the students in order to create skilled professionals.

2. To frequently update the labs keeping in view the requirement of the current industry scenario.

3. To extend counseling and career guidance facility to the students to help them to achieve their goal.

4. To encourage faculties and staffs to pursue higher education and to do the research work.

5. To encourage faculties and staffs to participate in various seminars, conferences and workshops to keep themselves updated of the state-of-the-art technology.

**Course Description:-**

It offers Gaining a working knowledge of basic automotive electrical and electronic systems in this thorough course. Discuss general automotive electrical and electronic theories such as Ohm’s law, ESD magnetism, circuit characteristics, batteries, starters, charging systems and much more. Note: Safety boots and safety goggles must be worn in the lab areas. You will be denied access to labs if you are dressed inappropriately.

**Course Objectives:-**

The aim of this course is to help the students to attain the following industry identified competency through various teaching learning experiences:

The students should be able to

1. Students will become familiar with the various electronic components and systems in a typical automobile.
2. Students will become familiar with the various automotive communication busses and be able to select an appropriate bus for a particular application.
3. Students will learn to obtain information about a vehicle’s status or performance by monitoring the various communications busses.
4. Students will become familiar with automotive design and development cycles and how vehicle electronics fits in to this process.
5. Students will learn to recognize factors that are likely to impact the cost and reliability of electronic components.

**Course Syllabus**

**AUTOMOTIVE ELECTRICAL & ELECTRONIC SYSTEMS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Subject Code****1633602** | **Theory** |  | **Credits** |
| **No. of Periods Per Week** | **Full Marks** | **:** | **100** | **03** |
| **L** | **T** | **P/S** | **ESE** | **:** | **70** |
| **03** | **—** | **—** | **TA** | **:** | **10** |
| **—** | **—** | **—** | **CT** | **:** | **20** |

**Automobile engineering group**

|  |  |  |
| --- | --- | --- |
| **Name of the Topic** | Hrs/ week | Marks |
| Unit -1 | **Electrical & Electronic Components*** 1. Purpose and operation of electrical components like switches, relays, solenoids, buzzers, and resistors.
	2. Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links

Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop. Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge, Speedo-meter gauge. Features of scan tester.1.6 Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock | **12** | **18** |
| Unit -2 | **Battery*** 1. Lead acid battery – components & operation.
	2. Maintenance free battery – construction.
	3. Concept of Low maintenance battery.
	4. Hybrid Battery – construction.
	5. Battery ratings and specifications.
	6. Battery maintenance and safety precautions.
	7. Battery testing – Battery terminal test, Leakage test, Specific Gravity. Test, Open circuit test, Capacity test, Battery drain test.
	8. Battery charging – Initial charging procedure, dry charged battery- precautions. Slow and fast rate charging and trickle charging.
	9. Jump starting-Procedure and precautions. 2.10Factors affecting battery life.

2.11Battery failures – cycle failure ,internal short circuit, overcharging, local action and sulphation | **08** | **12** |
| Unit - 3 | **Starting And Charging System Part A*** 1. Construction and working of starting system.Types of starter drive (Bendix and overrunning clutch types only) construction and working.
	2. Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test.

**Part B*** 1. Construction & operation of alternator. Initial excitation and self excitation.
	2. Alternator testing – Current out put test, Field current draw test. Regulator output test.
	3. Alternator components testing- rotor, stator, Internal regulator and rectifier.
	4. Regulation- Electronic, Computer Regulation circuit layout and operation.
	5. Operation of charge indicator light circuit.
 | **04** | **06** |
|  | **06** | **10** |

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| --- | --- | --- | --- |
| Unit – 4 | **Ignition Systems*** 1. Need of ignition system.
	2. Triggering of Primary circuit – Inductive, Hall Effect and Optical method. Mutual Induction.
	3. Classification of ignition systems on basis of – a) triggering system

b) source-battery & magneto c) spark timing- dual spark timing (vacuum and centrifugal advance), electronic spark timing* 1. Magneto ignition system- construction and working of CDI system.
	2. Components of ignition system:- Ignition coil types, Distributor, spark plug, cords, and condenser.
	3. Advance & retard timing mechanism-construction and working.
	4. Electronic (or solid state) ignition system with distributor- circuit diagram and working.
	5. Distributor less/ computer controlled coil ignition system operation.
	6. Sensors and Ignition Control Module for triggering and timing of spark.
 | **08** | **12** |
| Unit – 5 | **Advanced lighting accessories -fundamentals*** 1. Operation of automatic headlight dimming.
	2. Operation of automatic on/off headlight with time delay.
	3. Use and working of fiber optics & its diagnosis
	4. Operation of keyless entry
	5. Operation of common anti-theft system
	6. Purpose & operation of automatic door lock system
 | **05** | **06** |
| Unit - 6 | Diagnosis of electronic components & Systems* 1. Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air

temp. sensor, Throttle position sensor, Manifold absolute pressure sensor.* 1. Electronic fuel Injector testing:- only sound test, Ohmmeter test.
	2. Onboard diagnosis (OBD):-
		1. Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light.
		2. OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only)
		3. SAE J2012 standards Diagnostic Trouble Code(DTC) :-5 digits only
	3. Troubles of electronic gauges like.
		1. Gauge reads low constantly.
		2. Gauge reads high constantly.
		3. Inaccurate Gauge reading.
 | **05** | **06** |
|  | **Total** | **48** | **70** |

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| Text / Reference Books: |
| Titles of the Book | Name of Authors | Name of the Publisher |
| Automotive Electricity, Electronics & Computer Controls | Barry Hollenbeck | Delmar Publishers |
| Automotive Technology: A System Approach | Jack Erjavec, RobertScharff | Delmar Publisher Inc |
| Automotive Electrical Equipment | P. L. Kohli | Tata McGraw-Hill |
| Automotive electronic systems | Trevor Mellard | ELBS |
| Automobile electrical & electronic systems | Tom Denton |  |
| Diagnosis and troubleshooting of automotive electrical,electronics & computer engineering | James Haldeman |  |

**Course outcomes:** Upon the successful completion of the course, students will be able to:

* Enumerate the construction, characteristics and maintanance of battery, lighting system and different accessories in a typical automobile after careful inspection.
* Explain the construction, characteristics and maintenance of starting and ignition system and diagnose the ignition system fault of any vehicle.
* List out the principles and characteristics of charging system components and demonstrate their working with suitable tools.
* Describe the principles and architecture of electronics systems and its components present in an automobile related to instrumentation, control, security and warning systems.
* Enumerate the principles, application, construction and specification of different sensors and actuators usable in typical automobile by suitable testing.

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<https://www.gpchhapra.org.in/2022/07/13/class-routine-notice/>

**TIME TABLE**

**FACULTY:-** Prof.Saurav Kumar (Electronics Engineering Department)

**GOVERNMENT POLYTECHNIC CHAPRA**

**CLASS ROUTINE FOR DIPLOMA 6th SEMESTER EC- Automobile Engineering**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 1st10:00-11:00 | 2nd1:00-12:00 | 3rd12:00-1:00 |  | 4th2:00-3:00 | 5th3:00-4:00 | 6th4:00-5:00 |
| MON | **Automotive Electrical & Electronic Systems 1633602 (Saurav Kumar)** |  |  | LUNCH |  |  |  |
| TUE | **Automotive Electrical & Electronic Systems 1633602 (Saurav Kumar)** |  |  |  |  |  |
| WED |  |  |  |  |  |  |
| THU |  | **Automotive Electrical & Electronic Systems 1633602 (Saurav Kumar)** |  |  |  |  |
| FRI |  |  |  |  |  |  |
| SAT |  |  |  |  |  |  |

**Student list**

**Automobile Engineering.**

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| --- | --- |
| **Roll Number** | **Name Of the Student** |
| 401/A/20 | SUDHANSU KUMAR |
| 402/A/20 | ANIKET KUMAR |
| 601/A/20 | SUNIL KUMAR SAH |
| 602/A/20 | DHANNU KUMAR |
| 603/A/20 | RAUSHAN KUMAR |
| 604/A/20 | MD. PARVEJ ALAM |
| 605/A/20 | IMAMUDDIN ANSARI |
| 606/A/20 | AMIT SHARMA |
| 607/A/20 | ANJEET KUMAR |
| 608/A/20 | RAVIRANJAN KUMAR |
| 609/A/20 | MONU KUMAR |
| 610/A/20 | ANKUSH KUMAR |
| 611/A/20 | SAMRAT KUMAR PRASAD |
| 612/A/20 | VIKASH KUMAR PANDIT |

**LECTURE PLAN**

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| --- | --- |
| **Topics** | **Lecture Number** |
| **Electrical & Electronic Components:** | **01-12** |
| Purpose and operation of electrical components like switches, relays, solenoids, buzzers, and resistors | 1-2 |
| Purpose of circuit protection devices like fuses, maxi fuses, circuit breakers (Manual and automatic resetting types.) and fusible links | 3-4 |
| Testing of circuit defects like open circuit, shorts, shorts to grounds, voltage drop | 5-6 |
| Working of Electromagnetic gauges like temp Gauges, fuel gauge, engine oil pressure gauge, Speedo-meter gauge | 7-8 |
| Features of scan tester | 9 |
| Working of electrical accessories like wind shield wiper, washer pumps, blower motor, electro chromic mirror, power window, power seat, power door lock | 10-12 |
| **Battery:** | **13-20** |
| Lead acid battery – components & operation, Maintenance free battery – construction | 13 |
| Concept of Low maintenance battery, Hybrid Battery – construction | 14 |
| Battery ratings and specifications, Battery maintenance and safety precautions | 15 |
| Battery testing – Battery terminal test, Leakage test, Specific Gravity. Test, Open circuit test, Capacity test, Battery drain test | 16 |
| Battery charging – Initial charging procedure, dry charged battery- precautions. Slow and fast rate charging and trickle charging | 17-18 |
| Jump starting-Procedure and precautions, Factors affecting battery life | 19 |
| Battery failures – cycle failure ,internal short circuit, overcharging, local action and sulphation | 20 |
| **Starting And Charging System:** | **21-30** |
| Construction and working of starting system.Types of starter drive (Bendix and overrunning clutch types only) construction and working | 21-22 |
| Testing of starting system – Quick testing, Current draw test, Insulated circuit resistance test, Ground circuit test, No crank test, free speed test | 23-24 |
| Construction & operation of alternator. Initial excitation and self excitation | 25-26 |
| Alternator testing – Current out put test, Field current draw test. Regulator output test | 27 |
| Alternator components testing- rotor, stator, Internal regulator and rectifier | 28 |
| Regulation- Electronic, Computer Regulation circuit layout and operation | 29 |
| Operation of charge indicator light circuit | 30 |
|  |  |
| **Ignition Systems:** | **31-38** |
| Need of ignition system | 31 |
| Triggering of Primary circuit – Inductive, Hall Effect and Optical method. Mutual Induction | 32 |
| Classification of ignition systems on basis of – a) triggering system b) source-battery & magneto c) spark timing- dual spark timing (vacuum and centrifugal advance), electronic spark timing | 33 |
| Magneto ignition system- construction and working of CDI system, Components of ignition system:- Ignition coil types, Distributor, spark plug, cords, and condenser | 34 |
| Advance & retard timing mechanism-construction and working | 35 |
| Electronic (or solid state) ignition system with distributor- circuit diagram and working | 36 |
| Distributor less/ computer controlled coil ignition system operation | 37 |
| Sensors and Ignition Control Module for triggering and timing of spark | 38 |
| **Advanced lighting accessories -fundamentals:** | **39-43** |
| Operation of automatic headlight dimming | 39 |
| Operation of automatic on/off headlight with time delay | 40 |
| Use and working of fiber optics & its diagnosis | 41 |
| Operation of keyless entry, Operation of common anti-theft system | 42 |
| Purpose & operation of automatic door lock system | 43 |
| **Diagnosis of electronic components & Systems:** | **44-48** |
| Sensor testing:- Oxygen sensor, Engine coolant sensor, Intake air temp. sensor, Throttle position sensor, Manifold absolute pressure sensor | 44 |
| Electronic fuel Injector testing:- only sound test, Ohmmeter test | 45 |
| Purpose of (onboard diagnostic second generation) OBD II, flash codes of Malfunction indicator light, OBD II terminology:- Drive cycle, Trip, Warm up cycle (Definitions only), SAE J2012 standards Diagnostic Trouble Code(DTC) :-5 digits only | 46-47 |
| Troubles of electronic gauges like, Gauge reads low constantly, Gauge reads high constantly, Inaccurate Gauge reading | 48 |

**This document is approved by**

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| **Designation** | **Name** | **Signature** |
| Course Coordinator | Prof. Saurav Kumar |  |
| HoD | Prof. Sushant kumar |  |
| Principal | Dr. Anil Kumar Singh |  |
| Date |  |  |