GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: AUTOTRONICS
(COURSE CODE: 3362006)

Diploma Programme in which this course is offered	Semester in which offered
Mechatronics	Sixth

1. RATIONALE

As we know that, in present times, automobile industries has undergone wide variety of technological development and because of this the need of industries has changed significantly. Modern cars are as much electronic as they are mechanical, thus creating a new Autotronic area (Automobile+Electronic). A modern car has several control modules, which monitor and manage most of the major systems in the vehicle. The growing demands for complex features, including increased safety, increased comfort, and driver assistance systems or to comply with legal requirements also increases the demands placed on diagnostics, maintenance and repair. As a result of the growing technical complexity of cars a continuous need to upgrade the technical competencies of diploma holder is must. Some automobile companies have already developed driver less cars. So, it is must for mechatronic engineers, interested to work in automobile sector, to be skilled in these technologies.

2. COMPETENCY

The course should be taught and curriculum should be implemented with the aim to develop required skills in students so that they are able to acquire following competency:

- **Maintain electronic control devices and circuits used in automobiles.**

3. COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire required learning outcomes in cognitive, psychomotor and affective domain to demonstrate following course outcomes:

i. Identify electronic components in automobiles.
ii. Create a Logic circuit by logic gates.
iii. Use Programmable logic control in automobiles.
iv. Select right type of transducer, sensor and actuator.
v. Select microprocessor for application in automobiles.

4. TEACHING AND EXAMINATION SCHEME

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

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

5. COURSE CONTENT DETAILS

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
Unit – I Basic Electronics	1a. Select electronics components as per the requirement 1b. Explain rectifier, TRIAC and DIAC. 1c. Describe amplifier and Oscillators.	1.1. Semiconductors; Diode :- PN Junction, Zener Diode, ; Rectifier- Half, Full, Bridge type with filters; 1.2. TRIAC, DIAC, Silicon Control Rectifier (SCR), 1.3. Amplifier and Oscillators 1.4. Common Emitter Configuration only; Power Device: - Photodiode, LED, LDR, Phototransistor 1.5. Integrated Circuits
Unit-2 Digital Electronics	2a. Create logic gates. 2b. Explain working of flip flop circuit. 2c. Describe working of resistors, counters, encoders and decoders. 2d. Use Multiplexer and Demultiplexer	2.1. Analog/Digital Signal; Logic gates (NOT, OR, NOR, AND, NAND), Symbol and Truth Table; 2.2. Flip Flop, RSandD: Symbol and Truth Table; 2.3. shift resister and counter; Encoder/Decoder; 2.4. multiplexer/demultiplexer, 2.5. LED display
Unit-3. Programmable Logic Controller (PLC)	3a. Explain working of PLC 3b. Select wired sensor for sinking or sourcing operation. 3c. Select PLC for a given application	3.1. PLC working principle 3.2. Difference Between Relay Panel and PLC, concept of skin/source, set/reset, latch/unlatch 3.3. Troubleshooting and Maintenance of PLC.
Unit-4. Sensors, Actuators and Their Applications	4a. Select a right type of transducer for a given application. 4b. Select the actuators for pressure, temperature, flow, speed and force. 4c. Select the transducers for any application. 4d. Explain working of different types of actuators. 4e. Explain working of different types of sensors.	4.1. AC/DC Electronic timer block; 4.2. Pressure gauge, Thermocouple vacuum gauge and Pirani vacuum gauge 4.3. Measurement of Flow: Hot wire Anemometer, Ultrasonic flow meter; 4.4. Measurement of Temperature: Thermopiles and Thermistor; 4.5. Measurement of Speed : Contact less electrical tachometer, Inductive, Capacitive type tachometer, Stroboscope 4.6. Measurement of Force: Strain gauge load cell; Electrical method for moisture measurement 4.7. Electromechanical Type Transducer: Potentiometric resistance type, Inductive, Capacitive, Piezometric 4.8. Photoe Transducer: Photo emissive, Photovoltaic, Photoconductive;

Unit	Major Learning Outcomes (in cognitive domain)	Topics and Sub-topics
		4.9. Applications: Mass Air flow rate sensor, Exhaust gas Oxygen concentration, Throttle plate angular position, Crankshaft angular position, Coolant temperature, Intake air temperature, Manifold absolute pressure (MAP), Vehicle speed Sensor. Transmission gear selector position, Methanol sensor, Rain Sensor; Solenoid Actuators motorized Actuators, Stepper motors.
Unit- 5 Microprocessor and Microcontroller	5a.Explain Basics of 8085 microprocessor 5b.Explain Basics of 8051 microcontroller 5c.Describe working of microcontroller 5d.Distinguish between microprocessor and microcontroller	5.1 8085 Microprocessor Architecture, Pin configuration, microprocessor and application; 5.2 8051 Microcontroller Architecture, Pin configuration 5.3 Microcontroller and application;

6. SUGGESTED SPECIFICATION TABLE WITH HOURS and MARKS (THEORY)

Unit	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Basic Electronics	8	4	4	4	**12**
II	Digital Electronics	6	3	4	3	**10**
III	Programmable Logic Controller (PLC)	7	3	3	4	**10**
IV	Transducers / Sensors and Actuators and their applications	14	8	12	8	**28**
V	Microprocessor and Microcontroller	7	3	4	3	**10**
Total		**42**	**21**	**27**	**22**	**70**

Legends: R = Remember**, U** = Understand**, A=** Apply and above Level (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.

7. SUGGESTED EXERCISES/PRACTICALS

The practical should be properly designed and implemented with an attempt to develop different types of skills **(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 outcomes in psychomotor domain are listed as practical. However, if these practical are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes (**as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Unit No.	**Practical Exercises** (outcomes in Psychomotor Domain)	Approx Hours.
1	I	Test electrical and electronic components like diode, LED, SCR, diac, triac, Zener diode, indicator, capacitor using multimeter.	2
2	II	Measure shaft speed by using Stroboscopeand tachometer . Verify truth tables for logic gates: - NOT, AND, OR, NAND, NOR.	4
3	III	Identify the parts of PLC and demonstrate the working of PLC.	2
4	IV	Observe the characteristics of LVDT.	2
5	IV	Demonstrate the working of strain gauge.	2
6	IV	Identify and demonstrate working of different sensors and actuators.	2
7	IV	Demonstrate the working of various digital to analog and analog to digital converters.	2
8	III	Develop a ladder diagram for:- a) Measurement of speed of a motor. b) Motor start and stop by using two different sensors. c) Simulation of a pedestrian traffic controller. d) Simulation of four road junction traffic controller. e) Lift/elevator control. f) Washing machine control. g) Tank level control. h) Soft drink vending machine control.	4
9	IV	Identify and demonstrate working of various sensors and actuators for multi cylinder modern petrol engines.	3
10	IV	Identify and demonstrate working of various sensors and actuators for multi cylinder diesel engines	3
11	V	Identify different parts and configuration of microprocessor and microcontroller and demonstrate the working.	2
		TOTAL	**28**

8. SUGGESTED STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i. Prepare journals based on practical performed in laboratory.
ii. Visit nearest automobile service station, collect different parts, dismantle and explain working of it.
iii. Study operation manuals of different vehicles and visit websites of reputed automobile makers
iv. Download videos and make presentations of various technologies of automations provided in vehicles.

9. SPECIAL INSTRUCTIONAL STRATEGIES (if any).

i. Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of sensors, actuators and microprocessors.
ii. Arrange a visit to nearby automobile industries manufacturer of electrical drives.
iii. Use flash/animations to explain the working of different types of sensors and actuators
iv. Give mini projects to students (in groups of 3 to 4) on different aspect of autotronics and ask them to present in class seminars.
v. Use simulation software and PPT's
vi. Arrange expert lectures.

10. SUGGESTED LEARNING RESOURCES

A) Books

S. No.	Author	Title of Book	Publication
1.	Mehta V.K., Mehta Rohit	Principle of Electronics	S. Chand publication, New Delhi, 2005 edition.
2.	Malvino A.P.	Electronic Principles with simulation CD	McGraw Hill Education New Delhi 7th Edition,
3.	Rajput R.K	Text book of Mechatronics	S. Chand New Delhi 2012 edition.
4.	Morris Mano M., Ciletti Michael D.	Digital Design	Pearson Education New Delhi 5th Edition
5.	Ali Mazidi Muhammad	The 8051 Microcontroller and Embedded Systems : Using Assembly and C (VTU)	Pearson Education , New Delhi 2nd Edition
6.	Gaonkar Ramesh S.	Microprocessor Architecture, Programming, and Applications with the 8085	PHI Learning , New Delhi 5th Edition

B) Major Equipment/ Instrument with Broad Specifications

S. No.	Equipment	Specification
1	PLC Kit	PLC with minimum 10 I/O, 24 V DC, Simulator
2	Strain Gauge Kit	Minimum 100 kg. Measurement capacity.
3	RTD or Thermistor Measurement Kit	Minimum 0-200 degree measurement capacity
4	Microprocessor Kit	8085 microprocessor with 7 segment display
5	Logic Gates Electronics Kit	With AND, OR, NOT gates

C) Software/Learning Websites

i. http://www.schneider-electric.us/sites/us/en/support/product-support-resources/software-and-calculators/software/zelio-soft.page 8085 simulator
ii. http://www.nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors%20and%20Microcontrollers/pdf/Lecture_Notes/LNm1.pdf
iii. https://www.youtube.com/watch?v=20WdriMuNr8
iv. https://www.youtube.com/watch?v=GmFVoendk_o

11. COURSE CURRICULUM DEVELOPMENT COMMITTEE.

Faculty Members from Polytechnics:

- **Prof. V.K.Patel**, In-Charge H.O.D. In Mechatronics Engineering, B. S. Patel Polytechnic (1st Shift), Mahesana.
- **Prof. P. A. Solanki**, Sr. Lecturer In Mechatronics Engineering, B. S. Patel Polytechnic, Mahesana.
- **Prof. B. D.Prajapati**, In-Charge H.O.D. In Mechatronics Engineering, B. S. Patel Polytechnic (2nd Shift), Mahesana**.**

Coordinator and Faculty Members from NITTTR Bhopal

- **Dr. V. Somkuwar**, Associate Professor, Department of Mechanical Engineering.
- **Dr. Joshua Earnest**, Professor, Department of Electrical and Electronics Engineering