SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology

Bachelor of Technology (B. Tech.)

Instrumentation and Control

B. Tech.Year- III Semester – VI

Subject Name: Automotive Instrumentation **Subject Code: BTIC14603**

Type of course: Professional Elective Course

Prerequisite (if any): Sensor/ Transducer, Fundamental of engineering mechanics, Control systems design

List of Courses where this course will be prerequisite : Not applicable

Rationale:
The automobiles are getting converted from mechanical system to highly modernized Electro-mechanical systems and from driver to driver-less vehicle. The manufacturers of automobiles are increasing usage of sensors and control system to improve safety measures and also to increase comfort of users. This subject is intended to make student aware with sensors and other technologies used in modern automobiles.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	5	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory non-credit course

Content:

Sr. No.	Content	Total Hrs	Module Weightage
1	**Introduction of Automobile System** Current trends in automobiles with emphasis on increasing role of electronics and software, overview of generic automotive control ECU functioning, overview of typical automotive subsystems and components, AUTOSAR.	06	**13%**
2	**Engine Management Systems** Basic sensor arrangement, types of sensors such as oxygen sensors, crank angle position sensors, Fuel metering/ vehicle speed sensors, flow sensor, temperature, air mass flow sensors, throttle position sensor, solenoids etc., algorithms for engine control including open loop and closed loop control system, electronic ignition, EGR for exhaust emission control.	06	**13%**
3	**Vehicle Power Train and Motion Control** Electronic transmission control, adaptive power Steering, adaptive cruise control, safety and comfort systems, anti-lock braking, traction control and electronic stability, active suspension control.	06	**13%**
4	**Active and Passive Safety System** Body electronics including lighting control, remote keyless entry, immobilizers etc., electronic instrument clusters and dashboard electronics, aspects of hardware design for automotive including electro-magnetic interference suppression, electromagnetic compatibility etc., (ABS) antilock braking system, (ESP) electronic stability program, air bags.	07	**16%**
5	**Automotive Standards and Protocols** Automotive standards like CAN protocol, Lin protocol, flex ray, OBD-	06	**13%**

	II, CAN FD, automotive Ethernet etc. Automotive standards like MISRA, functional safety standards (ISO 26262).		
6	**System Design and Energy Management** BMS (battery management system), FCM (fuel control module), principles of system design, assembly process of automotive and instrumentation systems.	06	**13%**
7	**Basics of Unmanned Aerial Vehicle(UAV)** Types and sizes of Unmanned Aerial Vehicles, the parts and applications of a Drone, types of primary data collected by drone, applications, commercial drone rules and regulations, commercial drone	08	**19%**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
25 %	**25 %**	**20 %**	**10 %**	**10 %**	**10 %**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's 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.

Reference Books:

S. N.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Understanding Automotive Electronics	William B. Ribbens	Butterworth Heinemann ISBN:9780128104347	2017	8th ed
2	Sensors for Automotive Technology	Jiri Marek, Hans Peter Trah	Wiley ISBN:9783527605071	2006	1st ed.
3	Automotive Computers and Control system	Tom Weather Jr. & Cland C. Hunter	Prentice Hall ISBN: 9780130546937	1964	1st ed.
4	Bosch Automotive Hand Book	Dipl.-Ing. H. Bauer	Bentley (Robert) Inc. ISBN: 9780837616865	2011	8th ed.
5	Introduction To Uav Systems	Fahlstrom	Wiley ISBN:9788126560141	2016	4th ed.

Course Outcomes:

After learning the course the students should be able to:

Sr. No.	CO statement	Marks % weightage
CO-1	evaluate the sensor and measuring system of automobile.	25
CO-2	acquire knowledge of various automotive standards and Protocols.	20
CO-3	design the basic modeling and control scheme for automotive systems.	20
CO-4	evaluate safety measures, environmental and ergonomics consideration in automotive vehicles.	20
CO-5	evaluate the application of unmanned vehicle and different sensors used with it.	15

Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO-1	2	1	1	1	3	2	2	1	1	1	2	2	3	2	2
CO-2	1	1	1	2	2	3	2	1	1	1	1	1	2	2	2
CO-3	1	1	3	3	2	2	2	1	1	1	1	1	2	3	2
CO-4	1	1	1	2	2	3	3	2	1	1	1	1	2	2	3
CO-5	1	2	1	2	2	2	2	2	1	1	2	2	2	2	2

List of Open learning website:
http://nptel.ac.in/video.php
http://coep.vlab.co.in/

List of Open Source Software:
https://ardupilot.org/
https://opensource.com/tags/automotive

FOR LAB SESSIONS:

List of Experiments:

1. Study of speedometer, Tachometer, Odometer, Trip odometer
2. Study of battery/ charging system lamp, low oil pressure lamp, airbag lamp
3. Study of oil pressure gauge and coolant temperature gauge
4. Study of hand-brake lamp, door ajar lamp, high beam lamp, malfunction indicator lamp/ check engine lamp
5. Study of fuel gauge and low fuel lamp
6. Study of hand brake indicator, turn light and engine service indicator
7. Study of wheel balancing instruments
8. Study of automatic vehicular washing system
9. Study of electronic engine management system
10. Study of CAN protocol
11. Study of safety and security systems of vehicle
12. Study of heating and air-conditioning system of vehicle.
13. Design based Problems: Design PLC based/ micro-controller based automatic control system for different systems of vehicle.
14. Study of basic components of drones and issues related with it.
15. Simulation of control strategy of any autonomous vehicle.
16. Experiencing the flying of drone.

Major Equipment Needed:

Computers, transducers for automotive applications, simulation software, drone, etc.