

7 th Semester	RAU7D004	Metrology and Measurements for Automobile Engineers	L-T-P 3-0-0	3 Credits
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MODULE I**INTRODUCTION TO METROLOGY AND MEASUREMENTS**

Basic concept - scientific, industrial and legal metrology - linear and angular measuring instruments, measurement of screw thread - two, three wire method, measurement with optical flats, laser interferometer, coordinate measuring machine

Sensors: functions- classifications- main technical requirement and trends units and standards- calibration methods- classification of errors- error analysis- limiting error- probable error- propagation of error- odds and uncertainty- principle of transduction- classification.

Static characteristics- mathematical model of transducers- zero, first and second order transducers- dynamic characteristics of first and second order transducers for standard test inputs.

MODULE II**VARIABLE RESISTANCE, INDUCTANCE AND CAPACITIVE SENSOR**

principle of operation- construction details- characteristics and applications of resistive potentiometer- strain gauges- resistive thermometers- thermistors- piezoresistive sensors inductive potentiometer- variable reluctance transducers:- EI pick up and LVDT

Special sensors

Variable air gap type, variable area type and variable permittivity type- capacitor microphone piezoelectric, magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-humidity sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

MODULE III**AUTOMOTIVE PRESSURE SENSOR****Pressure sensor:**

Typical automotive applications- thick film pressure sensor- semiconductor pressure sensor- integrated silicon intake-manifold pressure sensor-integrated silicon combustion-pressure sensor- piezo electric sensor-high pressure sensor with metal diaphragm.

MODULE IV**AUTOMOTIVE FORCE/TORQUE SENSOR**

Typical automotive applications- magneto elastic bearing-pin sensor- magneto elastic tension/compressive-force sensor – basic principle of torque measurement – steering-angle measuring torque sensor

MODULE V**AUTOMOTIVE POSITION AND RPM/VELOCITY SENSORS**

Position sensors:- typical automotive applications- wiper potentiometers- short-circuiting ring sensor- half-differential sensor- eddy-current pedal-travel sensor- integrated hall IC's - hall acceleration sensor- knock sensors-rpm and velocity sensors: - inductive rotational speed sensor- hall effect sensor

Temperature sensors:- typical automotive applications -sintered-ceramic resistors-thin film resistors-thick film resistors- monocrystalline silicon semiconductor resistor-thermopile sensors **flow sensors:-** ultrasonic flow sensors-pitot tube air-flow sensor- hot wire air-mass flow meter-

Micro mechanical hot-film air-mass flow meter- lambda sensor -imaging sensor-rain sensor introduction to mems

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Text books:

1. Doebelin e.o, "measurement systems : applications and design", 5th edition, tat mcgraw-hill publishing co,2007
2. Robert brandy, " automotive electronics and computer system", prentice hall, 2001
3. William kimberley," bosch automotive handbook", 6th edition, robert bosch gmbh, 2004

References:

1. Bentley j.p ,," principles of measurement systems", 4th edition, AddisonWesley longman ltd., u.k, 2004
2. Jain r. K. "engineering metrology" Khanna publishers, New Delhi, 2012
3. Murthy d.v.s, "transducers and instrumentation", prentice hall of India, 2007
4. Neubert h.k.p.,," instrument transducers- an introduction to their performance and design" , oxford university press, cambridge, 2003
5. Patranabis.d, " sensors and transducers", 2nd edition, prentice hall India ltd, 2003.