Cummins College of Engineering for Women

(An autonomous institute affiliated to Savitribai Phule pune university)
Karve Nagar, Pune - 411 052.

Curriculum for UG Degree Course in BTech. Instrumentation and Control Engineering (Academic Year: 2024-25 Onwards)												
Second Year | Semester-III												
			Teaching Scheme			**Examination Scheme**						
Sr. No.	**Course Code**	**Course Title**	**Lecture**	**Tutorial**	**Practical**	**In sem**	**End sem**	**Practical**	**Oral**	**Marks**	**Credits**
1	23PCIN301	Analog and Digital Electronics	3	1	0	50	50	0	0	100	4
2	23PCIN302	Sensors and Transducers	3	0	0	50	50	0	0	100	3
3	23PCIN303	Fundamentals of Computer Networks	3	0	0	50	50	0	0	100	3
4	23PCIN304	Applied Mathematics: Transforms and Statistics	2	1	0	50	50	0	0	100	3
5	23OE301	Open Elective-I*	3	0	0	50	50	0	0	100	3
6	23VEC301	Universal Human Values	2	1	0	50	50	0	0	100	3
7	23AEC301	Design Thinking	1	1	0	50	0	0	0	50	2
8	23PCIN301L	Analog and Digital Electronics Lab	0	0	2	25	0	25	0	50	1
9	23PCIN302L	Sensors and Transducers Lab	0	0	2	25	0	25	0	50	1
		Total =	**17**	**4**	**4**	**400**	**300**	**50**	**0**	**750**	**23**

* 23OE301: Open Elective-I

A. Intellectual Property Rights
B. Digital Marketing
C. Law for Engineers
D. Organizational Behavior
E. Project Management

Instrumentation and Control Department

APPROVED BY
Secretary Academic Council
MKSSS's Cummins College of Engineering
For Women, Pune-411052

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Chairman Academic Council
MKSSS's Cummins College of Engineering
For Women, Pune-411052

23PCIN301 Analog and Digital Electronics

Teaching Scheme
Lecture: 3 Hrs/week
Tutorial: 1 Hr/week

Examination Scheme
In semester: 50 Marks
End semester: 50 Marks
Credits: 4

Prerequisite: Concepts in basic electronics engineering, logic gates, number systems, flip-flops

Course Objectives:

1. To illustrate the concepts of the basic characteristics, construction, open loop & close loop operations of Operational-Amplifier (Op-amp)
2. To enable students to analyze and design different linear and non-linear circuits using Op-amp
3. To enable students to demonstrate different digital circuits.
4. To design different applications using digital circuits.

Course Outcomes:

At the end of this course, students will be able to:

1. Define different characteristics of analog and digital ICs
2. Select proper analog components and simplification techniques for different applications.
3. Design analog and digital circuits using the various components.
4. Develop different applications using analog and digital building blocks.

Unit I: Operational Amplifier Fundamentals

Block Diagram of Operational Amplifier, Characteristics of Operational Amplifier, Comparative study of different amplifiers

Unit II: Linear Applications of Op Amps

Introduction to Feedback, Non-inverting, Inverting and Differential Amplifier, Instrumentation Amplifier, Equation solving with Op-amp, I/V and V/I Converter, Voltage Regulator, SMPS, Filters

Unit III: Non-Linear Applications of Op Amps

Comparator, Zero Crossing Detector (ZCD), Schmitt Trigger, Window Detector, Wein Bridge Oscillator, LM555 Timer

Unit IV: Combinational and Sequential Circuits
Simplification Techniques, Mux, Demux, Decoders, Encoders, Interfacing of TTL & CMOS, Flip-Flops

Unit V: Shift Registers & Counters
Shift Registers, Ring & Johnson Counter, Flip-flop based Counters, BCD & Binary Counters, Sequential & Non-sequential Counters, Programmable Counter

Unit IV: Applications of Counters & Shift Registers
Digital Clock, Alarm Annunciator, Digital Timer, Pulse Train Generator and similar applications

Text Books:

1. Ramakant Gaikwad, "Operational Amplifiers" PHI, 4th ed., 2010
2. William D. Stanley, "Operational Amplifiers with Linear Integrated Circuits", 4th edition, Pearson Education India, 2002.
3. Malvino and Leach, "Digital Principles & Applications", 4th Edition, Tata-McGraw-Hill
4. Gothman, "Digital Electronics", 2nd Edition, PHI

Reference Books:

1. Paul Horowitz, Winfield Hill , "The Art of Electronics", 2nd Ed., Cambridge University press
2. Ronald J. Tocci, Neal S. Widmer and Gregory L. Moss, "Digital Systems, Principles and Applications", 10th Edition, Pearson Education International.

Tutorials:

Minimum 8 assignments based on the course contents

23PCIN302 Sensors and Transducers

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: -

Course Objectives:
1. To acquire the knowledge of basic principles of sensing various parameters
2. To study principles, working, mathematical relation characteristics, advantages and limitations of various sensors and transducers
3. To select appropriate transducer for the typical application

Course Outcomes:
The student will be able to
1. Comprehend the working of different sensors and transducers.
2. Compare features of different sensors and transducers.
3. Select sensors and transducers for given applications.
4. Analyze the performance of sensors and transducers for various applications.

Unit I: Temperature Measurement
Temperature scales, classification of temperature sensors, working principle, types, materials, design criterion: Non electrical sensors (thermometer, thermostat), electrical sensors (RTD, thermocouple, thermistors), radiation sensors (pyrometers).

Unit II: Pressure Measurement
Definition, Pressure scales, units and relations, types of manometers, various types of elastic pressure sensors, Calibrating Instruments, various types of Gauges, high pressure gauges. Direct and Indirect types of pressure measurement.

Unit III: Level Measurement
Standards, working principle, types, materials, design criterion: float, displacers, bubbler, and DP- cell, ultrasonic, capacitive, microwave, radar, radioactive type, laser type transducers, level gages, resistance, thermal, TDR/ PDS type, solid level detectors, fiber optic level detectors.

Unit IV: Flow Measurement

Standards, working principle, types, materials, design criterion: primary or quantity meters (positive displacement flow meter), secondary or rate meter (obstruction type, variable area type), electrical flow sensors (turbine type, Electromagnetic type, and ultrasonic type.

Unit V: Allied Sensors

Standards, working principle, types, materials, design criterion: chemical sensors (pH and conductivity), leak detector, flame detector, smoke detector, humidity, density, viscosity sensors, touch and tactile sensors, sound sensors, displacement sensor, vibration, speed and acceleration sensor, application based case studies

Unit VI: Smart and MEMS sensors and Actuators

Significance of Smart sensor, MEMS system, Classification and terminology of smart sensors, smart material, MEMS sensor (Piezoresistive sensor, capacitive sensor). Actuators: Micro Pump, Micro Relay, Microjet Print head. Modeling of sensor, application based case studies

Text Books:

1. A.K. Sawhney, “Electrical & Electronic Instruments & Measurement”, Dhanpat Rai and Sons, Eleventh ed., 2000.
2. B. C. Nakra and K. K. Choudhari, “Instrumentation Measurements and Analysis”, Tata McGraw Hill Education, Second ed., 2004.
3. D.V.S. Murty, “Instrumentation and Measurement Principles”, PHI, New Delhi, Second ed. 2003.
4. C. D. Johnson, “Process Control Technology”, PHI-Seventh Edition, 1988
5. C.S. Rangan ,G..R.Sharma, V.S.V Mani , “Instrumentation Devices and Systems” McGraw Hill Education, Second ed. 2003.
6. V.K Aatre, Anantsuresh, K.J. Vinoy, S. Gopalakrishnan, K.N. Bhat, “Micro and Smart Systems " Wiley India 2010
7. HKP Neubert, “Instrument Transducers”, Oxford university Press, Second ed. 1999

Reference Books:

1. E.O. Doebelin, “Measurement Systems”, McGraw Hill, Seventh ed., 2019.
2. D. Patranabis, “Principle of Industrial Instrumentation”, Tata McGraw Hill, Second ed., 1999.
3. Sabrie Soloman, “Sensors Handbook”, McGraw Hill Publication, Second ed., 2010.
4. B.G. Liptak, “Process Measurement & Analysis”, Chilton Book Company, Third ed., 1995.

23PCIN303 Fundamentals of Computer Networks

Teaching Scheme
Lecture: 3 Hrs/week

Examination Scheme
In semester : 50 Marks
End semester : 50 Marks
Credits : 3

Prerequisite: -

Course Objectives:

1. To define computer networks and describe their purpose
2. To understand the types and components of networks
3. To understand the functions of each layer in a network

Course Outcomes:

The students will be able to

1. Identify various functions of different components and layers of network model
2. Identify the steps involved in communication within networks
3. Compare various protocols and standards
4. Suggest a network framework for the given scenario/ application.

Unit I: Introduction to Computer Networks

Type of Networks LAN, WAN, MAN, Ad-hoc Networks. Networking Topologies: Bus, Mesh, Star, Ring and Hierarchical. Types of Connection- Point to Point, Point to MultiPoint, Network Standards. Network components: Switches, Routers, Hubs, Gateways, Repeaters, Modems, Cables, NIC and access points.

Unit II: Network Models and Physical Layer

ISO-OSI 7-layer model, Functions of each layer, TCP/IP model. Protocol Data Units, encapsulation and decapsulation Digital modulation and multiplexing methods: FDM, TDM, PCM, FSK, GFSK, Spread Spectrum Technique Transmission

Unit III: Data Link Layer

Data Link Layer Design Issues, Error Detection and Error Correction, Medium Access Control Sublayer, Ethernet MULTIPLE ACCESS PROTOCOLS, ALOHA, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols

Unit IV: Network Layer

IP Addressing, Communication from Host to Host, Network Layer Protocol, Packaging the Transport Layer PDU, IPv4 and IPv6 Packet Header, Comparison of IPv4 and IPv6, Subnetting, Static Routing, Dynamic Routing, Routing Protocols Introduction to NFV (Network Function Visualization).

Unit V: Ethernet Basics

Ethernet Basics, Collision Domain, Broadcast Domain, Half-Duplex and Full-Duplex Ethernet, Ethernet at the Data Link Layer, Ethernet Addressing, Ethernet Frames, Channel Bonding, Ethernet at the Physical Layer. Demonstration of network fundamentals using a simulation tool.

Unit VI: Protocols and QoS framework in Networks

UDP, HTTP, FTP, SMTP and equivalent Internet QoS: Introduction, Architecture, Traffic Policing, Traffic Shaping, Traffic Scheduling, Integrated and Differentiated Service Architecture, Network Security

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw- Hill, Publications, 2017.
2. Mark A. Dye, Rick McDonald, Antoon W. Rufi, “Network Fundamentals”, Cisco Press, 2008
3. William Stallings “Data and computer communication”, Pearson, 10th Edition, 2015

Reference Books:

1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”,6th edition (March 5, 2012), Pearson , ISBN-10: 0132856204.
2. Andrew S. Tenenbaum, “Computer Networks”, 5th Edition, PHI, ISBN 81-23- 2175-8

23PCIN304 Applied Mathematics: Transforms and Statistics

Teaching Scheme	**Examination Scheme**
Lecture: 2 Hrs/week	In Semester: 50 Marks
Tutorial: 1 Hr/Week	End Semester: 50 Marks
	Credits: 3

Prerequisites: Basics of integral and multiple integral, Beta function, Gamma function, Partial fractions, First order linear differential equation, Basic statistics and basic probability

Course Objectives:
1. To provide sound knowledge of engineering mathematics
2. To analyze and solve engineering problems in their respective areas.

Course Outcomes: The student will be able to
1. Form differential equations for electrical, mechanical or equivalent systems
2. Compute transforms for various signals and systems
3. Select Transforms for different time and frequency domain applications.
4. Apply Statistics and Probability functions for data analysis

Unit I: Higher Order Linear Differential equation and application
Higher order linear differential Equation with constant coefficients, complementary function, Particular integral, short cut methods, Method of variation of parameter. Cauchy's and Legendre's D.E., Modeling of electrical, mechanical or equivalent systems

Unit II: Laplace Transforms
Definition of Laplace Transform, Inverse Laplace transforms (LT), Properties and theorems, LT of standard functions, LT of some special functions viz. periodic, unit step, unit impulse, application of LT on differential equations of control systems

Unit III: Statistical Measures
Measures of central tendency, Standard deviation, Coefficient of Variation, Covariance, Correlation and Linear Regression, Moments, Skewness, Kurtosis, Applications of statistical measures in real life applications

Unit IV: Fourier Transforms
Periodic functions, Complex form of Fourier series,Continuous Fourier Transforms, Discrete Signals,

Discrete Fourier Transforms (DFT) of standard sequences, Existence of DFT, Properties of DFT, Inverse DFT, Application of FT for 1D signal processing

Unit V: Z- Transform

Definition, standard properties, Z- Transform of standard sequences, Inverse Z – Transform using standard results, Inversion integral method, solution of difference equation, Relation between Fourier , Z and Laplace Transforms, Application of ZT for system stability

Unit VI: Probability and Probability Distribution

Theorems on probability, Random Variables – Discrete & continuous, Mathematical expectations, Probability density functions, Standard discrete and continuous distributions like Binomial, Poisson, Normal, Introduction to Testing of hypothesis, Chi-square distribution test. Application of PD in data analysis for real life applications

Text Books:

1. B. V. Ramana, 'Higher Engineering Mathematics', Tata McGraw Hill Publications, (2007).
2. B.S. Grewal, 'Higher Engineering Mathematics', Khanna publishers, Delhi (40th edition), (2008)
3. S.C. Gupta, V. K. Kapoor, 'Fundamental of Mathematical Statistics', S. Chand & Sons (10th revised edition), (2002).
4. P. Ramesh Babu, “Digital Signal Processing”, Sci-Tech Publications (7th Edition) (2018)

Reference books:

1. C.R.Wylie, L.C. Barrette, 'Advanced Engineering Mathematics', McGraw Hill Publications, New Delhi (6th edition), (2003).
2. Erwin Kreyszig, 'Advanced Engineering Mathematics', Wiley Eastern Ltd. (8th Student Edition),(2004).
3. Peter V. O'neil, 'Advanced Engineering Mathematics', Thomson Brooks / Cole, Singapore (5th edition), (2007).

List of Tutorials:

Minimum 8 assignments based on the course contents

23VEC301 Universal Human Values

Teaching Scheme
Lecture: 2 Hrs/week
Tutorial: 1 Hr/Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisites: -

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes: After completion of the course, the student will be able to

1. Understand the significance of value inputs in formal education and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Analyze the value of harmonious relationship based on trust and respect in their life and profession
4. Examine the role of a human being in ensuring harmony in society and nature.
5. Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.

Unit I: Introduction to Value Education

Understanding Value Education ,Self exploration as the Process for Value Education, Continuous Happiness and Prosperity which is the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Current Scenario for Happiness and Prosperity, Method to Fulfill the Basic Human Aspirations.

Unit II: Harmony in the Human Being

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between

the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Program to ensure self-regulation and Health.

Unit III: Harmony in the Family and Society

Harmony in the Family, Family being the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Trust which is the Foundational Value in Relationship, Respect as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order.

Unit IV: Harmony in the Nature or Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels and the Holistic Perception of Harmony in Existence.

Unit V: Implications of the Holistic Understanding, a Look at Professional Ethics

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models, Typical Case Studies with Strategies for Transition towards Value-based Life and Profession.

Text Books:

1. R. R. Gaur, R. Asthana, G. P. Bagaria, "The Textbook A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, (2nd Revised Edition), (2019).
2. R. R. Gaur, R. Asthana, G. P. Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, (2nd Revised Edition), (2019).

Reference Books:

1. A. Nagaraj,"Jeevan Vidya: EkParichaya", Jeevan Vidya Prakashan, Amarkantak, (1999).
2. A.N. Tripathi, "Human Values", New Age Intl. Publishers, New Delhi, (2004).
3. Mohandas Karamchand Gandhi, "The Story of My Experiments with Truth", Prakash books Publishers, Daryaganj, New Delhi, (1983).
4. E. F. Schumacher, "Small is Beautiful", Harper CollinsPublishers, Noida, Uttar Pradesh, (2010).
5. Cecile Andrews, "Slow is Beautiful", New Society Publishers, Canada, (2006).
6. J. C. Kumarappa, "Economy of Permanence", Sarva Seva Sangh Prakashan, Wardha, Sevagram, (2017).
7. Pandit Sunderlal ,"Bharat Mein Angreji Raj", Prabhat Prakashan, New Delhi (2018).
8. Dharampal,"Rediscovering India", Society for Integrated Development of Himalayas, (2003).
9. Mohandas Karamchand Gandhi, " Hind Swaraj or Indian Home Rule", Navajivan Publication

House, Ahemadabad (2003).

10. Maulana Abdul Kalam Azad, "India Wins Freedom", Orient BlackSwan, (1989).
11. Romain Rolland, " Swami Vivekananda", Advaita Ashram Publication Ramkrishna Math, (2nd Edition), (2010).
12. Romain Rolland, "Gandhi", Srishti Publishers & Distributor, (2002).
13. Annie Leonard, "The story of stuff", Little, Brown Book Group, (2005).

Online Resources:

NPTEL course on Humanities and social sciences

https://nptel.ac.in/courses/109/104/109104068/

23AEC301 Design Thinking

Teaching Scheme
Lecture: 1 Hr/week
Tutorial: 1 Hr/Week

Examination Scheme
In Semester: 50 Marks
Credits: 2

Prerequisites: -

Course Objectives:
Familiarize students with
1. Design Thinking process
2. User centric approach for designing a solution.
3. Problem analysis with various methods
4. Applications of Design Thinking

Course Outcomes:
Students should be able to
1. Apply the design process for real world problems.
2. Apply types of thinking ideas into visuals or prototypes.
3. Analyze problems with various methods and approaches for innovative user centric solutions.
4. Recommend a solution based on stages of Design Thinking.

Unit I: Introduction to Design thinking
Human Centred Design approach, Concept of Design Thinking. Features of Design Thinking, Process of thinking, Creative thinking, Lateral thinking, User centric approach and personas, Thinking hats.

Unit II: Stages of Design Thinking
Empathy: Difference Between Empathy and Sympathy, Empathy Techniques, Empathy Maps, define: Identification of Problem, Defining and Refining of Problem Statement, Ideate: Process of Ideation, Prototyping, Testing.

Unit III: Design thinking approaches
Visualization, Journey Mapping, Value Chain Analysis, Mind Mapping, Development, Assumption Testing, Prototype, Co-Creation, Learning Launches, Story Telling.

Unit IV: Design Thinking for Strategic Innovations and its applications

Strategic Management, Innovation Management, Frameworks for Innovation, Types of Innovations: Disruptive vs. Sustaining innovation, Radical vs. incremental innovation, Architectural vs. Modular Innovation, The Innovation Matrix, Business Model Innovation

Applications: Product Development, Process Development, Service Management.

Textbooks:

1. Bryan Lawson, "How designers think: The design process demystified", 4th Edition, Butterworth Architecture
2. Nigel Cross, "Design Thinking", Berg Publishers – 2011

Reference Books:

1. Makarand Ramesh Velankar, Leena Manojkumar Panchal, "Design Thinking Primar", Techknowledge Publications- September 2023, ISBN: 978-93-5563-711-6
2. Ben Crothers, "Design Thinking Fundamentals", O'Reily
3. Tim Brown, "Change by Design: How Design Thinking Transforms Organizations", HarperCollins – 2009
4. Susan Weins Chenk, "Hundred things every designer needs to know about people", New Riders Publication
5. Vijay Kumar, "101 Design Methods: A Structured Approach for Driving Innovation in Your Organization", Wiley Publication
6. Roger L. Martin, "Design of Business: Why Design Thinking is the Next Competitive Advantage" Harvard Business Press
7. Karl Ulrich, "Design: Creation of Artifacts in Society" - 2011
8. Bala Ramadurai, "Karmic Design Thinking"
9. T. Amabile, "How to kill creativity", SAGE Publication - 2006
10. William Lidwell, Kritina Holden, Jill Butler, "Universal principles of Design ", Rockport Publishers
11. Bella Martin, Bruce Hanignton, Bruce M Hanington "Universal methods of design", Rockport Publishers - 2012
12. Roman Kizanie, "Empathy: Why it matters, how to get it", Tarcher Perigee Publishers
13. Karla McLaren, "The Art of Empathy: A complete Guide to life's most essential skill", Sounds True Publishers

23PCIN301L Analog and Digital Electronics Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In semester: 25 Marks
Practical: 25 Marks
Credits: 1

Course Outcomes:
The student will be able to
1. Verify the performance characteristics of different configurations of OPAMP.
2. Identify appropriate components for given application
3. Design various analog and digital circuits
4. Implement analog and digital circuits for various applications

List of Practical Assignments:
(Any 4 from)
1. Measurement of CMRR, Slew Rate and Output Offset Voltage
2. Verification of gain for Inverting and Non- inverting Amplifier
3. Design and implementation of Instrumentation Amplifier
4. Design and implementation of Wien Bridge Oscillator
5. Design and implementation of Comparator
6. Design & implementation of Schmitt Trigger
7. Designing and implementation of Flasher Light using suitable components

(Any 4 from)
1. Design & implementation of logic circuit using Mux/Demux
2. Design & implementation of Johnson & Ring Counter using D-FF IC or Shift Register IC
3. Design & implementation of Presettable Up/Down Counter
4. Design & implementation of Non Sequential Counter using flip –flop ICs
5. Implementation of running light using suitable components
6. Design & implementation of Alarm Annunciator using suitable components
7. Simulation of Digital Clock using suitable components

Or similar type of practical assignments based on the course contents

23PCIN302L Sensors and Transducers Lab

Teaching Scheme
Practical: 2 Hrs/week

Examination Scheme
In semester: 25 Marks
End Semester: 25 Marks
Credits: 1

Course Outcomes: by the end of the course, students should be able to
1. Identify various test instruments required for finding characteristics of various sensors and transducers.
2. Draw connection diagram for measuring various parameters using sensors and transducers
3. Find the characteristics of various sensors and transducers.
4. Comment on the characteristics of the sensors and transducers

List of Practicals (Any 8)

1. Calibration of pressure gauge using Dead weight pressure gauge tester
2. Calibration of a vacuum gauge using Dead weight vacuum gauge tester
3. Plot the characteristics of RTD and Thermistor calculate its time constant.
4. Plot the characteristics of Thermocouple and study cold junction compensation.
5. Design and Test Air purge probe /capacitive for Level Measurement
6. Flow measurement using Rotameter/orifice /Electromagnetic flow meter.
7. Measurement of viscosity of various liquids using Redwood Viscometer.
8. Water level measurement using Piezoresistive MEMS sensor.
9. Weight measurement using cantilever beam/load cell.
10. Displacement measurement using linear encoder/LVDT
11. Simulate the performance of a chemical sensor using virtual lab
12. Mini project/ Open ended assignment to design / simulate sensor based application.

Or similar type of practical assignments based on the course contents