SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA M.P.

(An Autonomous Institute Affiliated to RGPV Bhopal)

Department of Electronics Engineering

Syllabus applicable to July 2022 admitted and later batches

Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Course (DC)
Subject Code: EI-402	Subject Name: Analog Circuits

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

- Basic Electrical Engineering
- Electronic Devices and Circuits
- Network Analysis
- Network Synthesis

Course Objective:

1. To study the behaviour of opamp under open loop and closed loop, and understand its performance.
2. To study the impact of positive and negative feedback on opamp performance..
3. Study how to analyse opamp circuits.
4. Derive various linear and nonlinear circuit applications of opamp.

Course Outcomes:

On successful completion of this course student should be able to:

CO 1: **Acquire** knowledge and demonstrate the basics of Operational Amplifier, filters, oscillators, signal generators and other applications.

CO 2: **Analyze** different op-amp circuits and linear and nonlinear applications of opamp.

CO 3: **Evaluate** the performance of opamp circuits for different applications.

CO 4: **Design** active filters, oscillators and derive opamp circuits for different applications.

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	-	1	1	-	-	-	2	1
CO2	3	3	2	3	3	1	1		2	-	2	1
CO3	3	2	2	3	3	1	1	-	2	-	2	1
CO4	3	2	3	2	3	1	1	-	-	-	2	2
Avg.	3	2.5	2.5	2.75	2.25	1	1	-	1	-	2	1.25

UNITs	Descriptions	Hrs.	CO's
I	Feedback Amplifiers & Oscillators: Concept of feedback, positive and negative feedback, voltage and current feedback, series and shunt feedback, effect of feedback on performance characteristics of an amplifier, stability criterion. Condition for sustained oscillation, Barkhausan criterion.	5	1,2,3,4
II	Operational Amplifier Fundamentals: Introduction to op-amp, Block diagram representation, pin diagram , characteristics of ideal and practical op – amp, Equivalent circuit, open loop op amp, configuration, open loop and closed loop frequency response of opamp, op amp parameters - offset voltage and current, bias current ,drift ,CMRR, slew rate and its effect on frequency response, offset nulling methods, compensated and non compensatedopamp.	5	1,2,3,4

III	Linear Applications: Differential ,inverting and non-inverting , Differential amplifier with one op amp ,two op amp and three op amp, DC and AC amplifiers, summing, scaling and averaging amplifiers, Instrumentation amplifier, integrator, differentiator and comparator. Zero crossing detector, peak detector, window detector, Precision rectifiers.	10	1,2,3,4
IV	Non-linear Op-Amp Circuits: Schmitt trigger and applications, log and antilog amplifier, analog computation, voltage controlled oscillator. phase locked loop, principle and building block of PLL, Lock and capture ranges,capture process and application of PLL.	8	1,2,3,4
V	Analyze and Design Active filters, characteristics ,frequency response and different types of filters ,order and cut off frequency ,Butterworth Low pass filters , high pass filters ,band pass filter ,band stop filter R-C phase shift, Hartley, Colpitts, Crystal and Wein bridge Oscillators, Negative resistance Oscillator, Relaxation Oscillator. Square, triangular and sawtooth wave generator, Timer IC - 555, functional diagram Mono stable.	12	1,2,3,4
Guest Lectures (if any)		Nil	
Total Hours		40	

Suggestive list of experiments:

1. Draw and examine Decibels and Bode Plots—CO2
2. Design of Dual input Balance output Differential Amplifier using Transistor—CO4
3. Design of Comparator circuit using operational amplifier-CO4
4. Design of / Inverting/Non-inverting Voltage Amplifier -CO4
5. Design of Differential Amplifier. Using 741 opamp IC—CO4
6. Analysis of Gain-Bandwidth Product—CO2
7. Analysis of Slew Rate and Power Bandwidth—CO2
8. Analysis of Non-compensated OpAmp—CO2
9. Analysis of DC Offset voltage.—CO2 .
10. Design of Operational Trans-conductance Amplifier—CO4
11. Design of Precision Rectifiers—CO4.
12. Design of Triangle-Square waveform Generator—CO4
13. Design of WienBridge Oscillator—CO4.
14. Design of Integrator/ Differentiator circuit using 741 opamp IC—CO4
15. Design of Bandpass Filter using 741 opamp IC.—CO4

Text Book-

- Linear integrated circuit- RamakantGayakwad (PHI)
- OP-Amps their Design and Application- Tobbyet all. (Tata Mcgraw Hill)
- Linear integrated circuit- D. Roychowdhary and Shail B. Jain (New Age International)
- Integrated Electronics- MillmanHalkias (Tata Mcgraw Hill)

Reference Books-

- Analog Integrated Circuit Design - Ken Martin and David Johns
- Op Amps for Everyone- Texas Instruments

List and Links of e-learning resources:

- NPTEL Course.
- MOOC, IIT Bombay.

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	05.06.2023
Approval by Academic council on	
Compiled and designed by	Dr.Jyotsna.V.Ogale

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Department of Electronics Engineering
Syllabus applicable to July 2022 admitted and later batches

Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Core (DC)
Subject Code: EI-403	Subject Name: Process Instrumentation-I

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

- Fundamental of Instrumentation

Course Objective:

1. To impart students with the fundamental concepts, working principles and applications of various transducers for sensing physical parameters such as RPM, Acceleration, vibration, shock, Force, torque, weight etc.
2. To enable the students to analyze and solve various problems on the sensors and develop suitable designs for practical applications.

Course Outcomes:

- CO1: Acquire knowledge of different Primary sensing elements of physical variables measurements & apply them in instrumentation systems.
- CO2: Understand the theory and working of various Strain Gauge sensors by acquiring the knowledge and apply them in industrial weight and Torque measuring Transducers
- CO3: Analyze, design and evaluate different transducers for RPM & Torque measurement
- CO4: Understand the working of Proximity sensors and analyze the overview of Sensor-Actuator Networks

CO-PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2										
CO2	3	2										
CO3	3	2	2									
CO4	3	2										

UNITs	Descriptions	Hrs.	CO's
I	**Primary Sensing Elements**- Transducer: classification of transducers, resistive transducers, POT and Inductive transducers, LVDT, Capacitive Transducers, piezoelectric, Magnetic type (eddy current, magnetostrictive, magnetoresistive), Hall Effect transducers. Photo transducers and Optoelectronic Transducers	10	CO1
II	**Strain Guages-** Theory of Strain Gauges, Piezoresistive effect, guage factor, Bridge configuration (Wheatstone bridge) Various types-their construction and applications, Weight Measurement using load cells-column type and bending beam type, application consideration of load cells, weigh-feeders.	8	CO2
III	**RPM & Acceleration Measurement-** Tacho-generators, tachometers, stroboscopes, strobotron, encoders, non contact rpm measurement techniques,	8	CO3

	seismic accelerometers- piezoelectric, piezoresistive and capacitive types.		
IV	**Torque Measurement-** feedback torque sensors, torsion bar dynamometer, Torque measurement using strain gauge, Shaft power: Dynamometer (servo control and absorption power measurement) Prony Brake and rope brake methods Introduction to vibration measurement and monitoring - Eddy current type, piezoelectric	8	CO3
V	**Proximity Sensors:** Inductive, optical, magnetic, capacitive and ultrasonic. Pneumatic systems: Flapper-nozzle assembly Introduction to smart sensors, smart transmitter and receivers sensor-actuator networks	8	CO4
Guest Lectures (if any)		Nil	
Total Hours		42	

Suggestive list of experiments:

1. Displacement measurement by inductive pick up.
2. Measurement of angular displacement using capacitive type transducer.
3. To measure the speed of motor using photoelectric pick-up.
4. To measure the air velocity by using hot wire anemometer.
5. To measure the intensity of light on different distance by using photo transducer.
6. Demonstration of ultrasonic transmitter and receiver in remote control mode and intruder alarms.
7. To measure the flux density by gauss meter.
8. To measure the torque by torque transducer.
9. Measurement of weight using Strain Gauge
10. Study of Tachometer
11. Study of Sound sensor

Text Books -

1. H.N. Norton-Handbook of Transducers, Prentice Hall; Facsimile Edition
2. D. Patranabis-Principle of industrial Instrumentation, McGraw Hill Education; 3 Edition
3. E.O. Doebelin - Measurement Systems Applications and Design, Tata McGraw Hill Education; 5th Edition

Reference Books

1. Nakra and Chaudhary-Instrumentation Measurement and Analysis, McGraw Hill Education India Private Limited; Fourth edition.
2. A. K. Sawhney -Electronic Instruments & Measurement, Dhanpat Rai Publications

List and Links of e-learning resources:
www.nptel.ac.in - Dr.AlokBarua IIT Kharagpur/Industrial Instrumentation Lecture Series

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid-semester tests, quiz/ assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Naveen Malviya

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Department of Electronics Engineering

Syllabus applicable to July 2022 admitted and later batches

Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Course (DC)
Subject Code: EI-404	Subject Name: Analog & Digital Communication

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:

Basic Electronics, Signal & Systems.

Course Objective:

This course provides a thorough introduction to the basic principles and techniques used in analog and digital communications. The course will introduce different analog and digital modulation techniques, communication receiver and transmitter design, baseband and band pass communication techniques, noise analysis, and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

Course Outcomes:

After completion of the course, students would be able to -

CO 1: Acquire knowledge, understand and demonstrate about different modulation, demodulation techniques of analog and digital signals. (BL1,BL2)

CO 2: Conduct analysis of baseband signals in time domain and frequency domain. Analyse error performance of a communication system in presence of noise and other interference.(BL3,BL4)

CO 3: Design communication systems to meet desired needs.(BL3,BL6)

CO4: Evaluate the performance of modulation and demodulation techniques in various transmission environments. And evaluate fundamental communication system parameters such as bandwidth, power and signal to noise ration.(BL3,BL5)

CO-PO Mapping

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2										
CO2	3	3		2	2							
CO3	3	2	3	2	2							
CO4	3	2		2	2							

UNITs	Descriptions	Hrs.	CO's
I	Basic block diagram of wireless communication, Need of Modulation, Types of Modulation, Amplitude modulation (AM): Analysis of single tone and multi-tone AM, Bandwidth, Power, modulation efficiency, under, critical and over modulation, Generation of AM, Demodulation of AM. DSB-SC: Basic concepts, generation and demodulation, SSB-SC: Basic concepts, generation and demodulation, VSB, Frequency division multiplexing (FDM).	09	All COs
II	Frequency modulation (FM), NBFM, Power, Bandwidth and Modulation efficiency calculation, Generation of FM, Phase Modulation, Generation of FM from PM and vice-versa, Maximum phase and frequency deviation of FM & PM, Demodulation of FM, Mixer, Tuned Radio Frequency AM Receiver, Super Heterodyne AM Receiver, Image frequency, Image rejection ratio, Fidelity, Pre-emphasis and de-emphasis, FM Receiver.	09	All COs
III	Concept of Sampling: Sampling Theorem, Aliasing, Types of Sampling	09	All COs

	(Instantaneous, Natural and Flat Top), Pulse Amplitude Modulation (PAM), Pulse Position Modulation (PPM), Pulse Width Modulation (PWM).		
IV	Pulse Code Modulation (PCM), Quantization process, Quantization error, transmission bandwidth, Noise in PCM, regenerative repeaters, Intersymbol Interference (ISI), Time division multiplexing (TDM), Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM), Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio, Companding& expanding.	09	All COs
V	Amplitude Shift Keying (ASK), Phase Shift Keying (PSK), Frequency Shift Keying (FSK), M-Array Signalling Schemes: M-ary PSK, M-ary FSK, Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Minimum Shift Keying, Quadrature Amplitude Modulation (QAM).	09	All COs
Guest Lectures (if any)		Nil	
Total Hours		45	

Suggestive list of experiments:

1. Study of Amplitude modulation (AM) and demodulation. CO1
2. Study of Frequency Modulation (FM) and demodulation. CO1
3. Study of Phase Modulation (PM) and demodulation. CO1
4. Study of PAM, PWM, PPM techniques. CO1
5. Study of ASK. CO1
6. Study of PSK. CO1
7. Study of FSK. CO1
8. Study of QPSK. CO1
9. Design of pre-emphasis and De-emphasis circuits. CO4
10. Signal sampling and reconstruction. CO3
11. Communication Signals: Generation and Interpretation using MATLAB. CO2
12. Communication Signals: Operations using MATLAB. CO2
13. To generate and demodulate AM, ASK, PSK and FSK technique using MATLAB. CO2

Text Book-

- Singh and Sapre: Communication System, TMH
- B.P. Lathi: Modern Analog and Digital Communication System, Oxford University Press

Reference Books-

1. Taub and Schilling: Principles of Communication System, TMH
2. Simon Haykins: Communication Systems, 4th Edition, John Wiley.

List and Links of e-learning resources:

- NPTEL Course.
- MOOC

Modes of Evaluation and Rubric

The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Dr.AnkitaShrivastava

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Department of Electronics Engineering
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Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Departmental Laboratory (DLC)
SubjectCode:EI-406	Subject Name: Simulation Lab-1

Maximum Marks Allotted							Contact Hours			Total Credits
Theory			Practical			**Total Marks**				
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
-	-	-	60	20	20	50	0	2	2	3

Prerequisites:

Basic Electrical Concepts, Mathematics (Matrices, Laplace Transform, Differential Equations and Complex Variables).

Course Objective:

The primary objective of this course is to introduce students to the fundamental concepts and techniques of programming in the MATLAB language. This course helps students understand programming concepts and understand how to use them in a variety of engineering, scientific and mathematical applications. It is a mathematics-oriented language suitable for solving engineering problems and creation of graphical user interfaces (GUIs). This course covers topics like creating scripts, developing functions, executing programs, debugging, visualizing and creating plot, creating Simulation and GUI and more. By successfully completing this course, students will be able to write programs for various calculations and simulations in MATLAB. This course is highly recommended for engineering students who are interested in solving the mathematical problems and programming with MATLAB.

Course Outcomes:

Upon completion of the course, student will be able to

CO1: Ability to know about the syntax of the language used to solve engineering problems.
CO2: Ability to understand the concept of programming.
CO3: Ability to write programs, visualize and plot data and simulate engineering applications.
CO4**:** Ability to use programming skill required for the development of projects at higher semester.

CO- PO Mapping

PO / COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
CO2	**2**	**3**	**-**	**2**	**3**	**1**	**-**	**-**	**3**	**-**	**3**	**3**
CO3	**2**	**-**	**3**	**-**	**3**	**3**	**2**	**-**	**3**	**-**	**3**	**3**
CO4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO5	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**

UNITs	Descriptions	Hrs.	CO's
I	Introduction of MATLAB and history, MATLAB Windows, Elementary Math built in Functions.	4	CO1
II	Mathematical operations including Arrays, Mathematical Operations with arrays, Matrices, Matrix algebra with MATLAB.	4	CO2
III	Curve Plotting with MATLAB, Control Structures -Conditional	4	CO2,

	statements, loops, Branch control structure,		CO3
IV	Input/output Functions,Script Files, Functions and Function files, Cell Arrays, Structure Arrays.	4	CO3, CO4
V	Basics of Toolboxes, Simulink and GUI.	4	CO4
Guest Lectures (if any)		Nil	
Total Hours		20	

Text Books -

1. Getting Started With Matlab: A Quick Introduction For Scientists And Engineers by RudraPratap, Oxford University Press
2. MATLAB and its applications in Engineering, R.K. Bansal, A. K. Goel, M. K. Sharma
3. MATLAB - An Introduction with Applications, Amos Gilat ,Wiley India.

Reference Books

1. MATLAB Programming for Engineers S.J.Chapman, Thomson Learning
2. Essential MATLAB for Engineers and Scientists, B.H.Hahn, D.T.Valentine, Elsevier

Modes of Evaluation and Rubric

The evaluation modes consist of performance in term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	05.06.2023
Approval by Academic council on	
Compiled and designed by	Dr.D.K.Shakya

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Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Open Elective (OE-II)
SubjectCode:OE-405(A)	Subject Name: Digital Electronics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

Applied Physics, Basic Electronics

Course Objective:

The objective of this course is to provide the fundamental concepts associated with the digital logic and circuit design. To familiarize students with the different number systems, logic gates, minimization of logic circuits and combinational and sequential circuits utilized in the different digital circuits and systems. The course will help student to design and analyze the digital circuits and systems.

Course Outcomes:

Upon completion of this course, the student will be able to:

- CO1: Convert different number systems and codes used in digital circuits and systems.
- CO2: Simplify and analyze the digital logic circuits using Boolean algebra and other mapping techniques.
- CO3: Analyze and design different combinational using different mapping techniques and mathematical tools.
- CO4: Analyze and design different sequential logic circuits using different mapping techniques and mathematical tools.

CO-PO Mapping

PO COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	1	1								2
CO2	3	3	3	3	2							
CO3	3	3	3	3	2							
CO4	3	3	3	3	2							

UNITs		Descriptions	Hrs.	CO's
I		**Introduction to Digital Electronics**: Review of number system and conversions; Binary Arithmetic, Signed and Unsigned representation, Binary codes, Gray Code, Code Conversions, Error detection and correction codes - parity check codes and Hamming code.	10	CO1

II		**Boolean Algebra and Switching Functions -** Study of basic logic gates, Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map and Quine-McCluskey tabular methods.	10	CO2
III		**Combinational Logic Modules and their applications**: Adders, Subtractors, Code Converters, parity generators and comparators, Encoders & Decoders, BCD to seven-segment decoder, Multiplexers & Demultiplexers and their applications.	09	CO3
IV		**Sequential Circuits- Flip Flops:** Set-Reset latches and flip flops, D-flipflop, R-S flip-flop, J-K Flip-flop, Master slave Flip flop, edge triggered flip-flop, T flip-flops.	08	CO4
V		**Sequential Circuits - Shift Registers and Counters** Introduction to shift registers, classification of shift registers, Introduction to counters, classification: asynchronous counters, synchronous counters, Types of memories: ROM, RAM, PROM, EPROM, EEPROM etc.	08	CO4
	Guest Lectures (if any)		May be arranged as required	
	Total Hours		45	
	Text Book- ● M. Mano, "Digital Logic and Computer Design", Pearson Education. ● T. L. Floyd, “Digital Fundamentals”, Pearson Education. ● A. Anand Kumar, “Fundamentals of Digital Circuits”, PHI.			
	Reference Books- ● R.J. Tocci, "Digital Systems Principles &: Applications". ● W.H. Gothman, "Digital Electronics" (PHI).			
	List and Links of e-learning resources: 1. https://nptel.ac.in/courses/108/105/108105132/ 2. https://de-iitr.vlabs.ac.in/			
	Modes of Evaluation and Rubric			
	The evaluation modes consist of performance in Two mid-semester Tests, Quiz/ Assignments, lab work, end-semester examinations, and end-semester practical examinations.			

Recommendation by Board of studies on		05.06.2023
Approval by Academic council on		
Compiled and designed by		

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Name of the course:	B. Tech in Electronics & Instrumentation Engineering
Semester and Year of study	B. Tech 2nd Year 4th Semester
Subject Category	Open Elective (OE-II)
Subject Code: OE-405(B)	Subject Name: Instrumentation-II

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			**Total Marks**				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	-	-	-	100	3	0	0	3

Prerequisites:

- Fundamentals of Instrumentation

Course Objective:

1. To impart students with the fundamental concepts, working principles and applications of various transducers for sensing physical parameters such as RPM, Acceleration, vibration, shock, Force, torque, weight etc.
2. To enable the students to analyze and solve various problems on the sensors and develop suitable designs for practical applications.

Course Outcomes:

- CO1: Acquire knowledge of different Primary sensing elements of physical variables measurements & apply them in instrumentation systems.
- CO2: Understand the theory and working of various Strain Gauge sensors by acquiring the knowledge and apply them in industrial weight and Torque measuring Transducers
- CO3: Analyze, design and evaluate different transducers for RPM & Torque measurement
- CO4: Understand the working of Proximity sensors and analyze the overview of Sensor-Actuator Networks

CO PO Mapping

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2										
CO2	3	2										
CO3	3	2	2									
CO4	3	2										

UNITs	Descriptions	Hrs.	CO's
I	**Primary Sensing Elements**- Transducer: classification of transducers, resistive transducers, POT and Inductive transducers, LVDT, Capacitive Transducers, piezoelectric, Magnetic type (eddy current, magnetostrictive, magnetoresistive), Hall Effect transducers. Photo transducers and Optoelectronic Transducers	10	CO1
II	**Strain Guages-** Theory of Strain Gauges, Piezoresistive effect, guage factor, Bridge configuration (Wheatstone bridge) Various types-their construction and applications, Weight Measurement using load cells-column type and bending beam type, application consideration of load cells, weigh-feeders.	8	CO2

III	**RPM & Acceleration Measurement-** Tacho-generators, tachometers, stroboscopes, strobotron, encoders, non contact rpm measurement techniques, seismic accelerometers-piezoelectric, piezoresistive and capacitive types.	8	CO3
IV	**Torque Measurement-** feedback torque sensors, torsion bar dynamometer, Torque measurement using strain gauge, Shaft power: Dynamometer (servo control and absorption power measurement) Prony Brake and rope brake methods Introduction to vibration measurement and monitoring - Eddy current type, piezoelectric	8	CO3
V	**Proximity Sensors:** Inductive, optical, magnetic, capacitive and ultrasonic. Pneumatic systems: Flapper-nozzle assembly Introduction to smart sensors, smart transmitter and receivers sensor-actuator networks	8	CO4
Guest Lectures (if any)		Nil	
Total Hours		42	

Text Books -

1. H.N. Norton-Handbook of Transducers, Prentice Hall; Facsimile Edition
2. D. Patranabis-Principle of industrial Instrumentation, McGraw Hill Education; 3 Edition
3. E.O. Doebelin - Measurement Systems Applications and Design, Tata McGraw Hill Education; 5th Edition

Reference Books

1. Nakra and Chaudhary-Instrumentation Measurement and Analysis, McGraw Hill Education India Private Limited; Fourth edition.
2. A. K. Sawhney -Electronic Instruments & Measurement, Dhanpat Rai Publications

List and Links of e-learning resources:

www.nptel.ac.in - Dr. Alok Barua IIT Kharagpur/Industrial Instrumentation Lecture Series

Modes of Evaluation and Rubric

The evaluation modes consist of performance in two mid-semester tests, quiz/ assignments, term work, end-semester examinations, and end-semester practical examinations.

Recommendation by Board of studies on	
Approval by Academic council on	
Compiled and designed by	Prof. Naveen Malviya