GOVERNMENT COLLEGE OF ENGINEERING, JALGAON [M.S]

(An Autonomous Institute of Government of Maharashtra)

"Globally Accepted Engineers with Human Skills"

Curriculum for
Second Year B. Tech. Instrumentation
2019-20

SH 226U: ENGINEERING MATHEMATICS [ET, IN, EE]

Teaching Scheme : 03L+ 01T Total: 04 **Credit:** 04
Evaluation Scheme: 10 ISA + 30 MSE +60 ESE **Total Marks:** 100
Duration of ESE : 03 Hrs

COURSE DESCRIPTION:

This course introduce the student to higher order differential equation, integral transforms, vector calculus, statistics and probability distribution and complex variables and their applications in engineering.

DESIRABLE AWARENESS:

Basic of differential equation, statistic, vector calculus and complex numbers

COURSE OBJECTIVES:

The objectives of offering this course are to-

1. teach them to solve differential equation, integral transforms, vector, calculus, statistic and probability distribution and complex functions.
2. equip the students with standard concept and tools at an intermediate
3. advanced level that will serve them well towards lacking various problems in discipline.

COURSE OUTCOMES:

On the successful completion of this course, students will be able to -

1. solve differential equations and apply the knowledge to engineering problems
2. apply the idea of statistics, probability distribution calculus for problem analysis and solution.
3. apply the idea of integral transform for problem analysis and solution.
4. apply the idea of vector calcus for the problem analysis and solution
5. demonstrate the knowledge of complex variables, complex functions and related concepts.

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	3	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	3	-	-	-	-	-	-	-	-	-	-	1	-	-
	1	3	1	-	-	-	-	-	-	-	-	-	-	-	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content:

Higher Order Linear Differential Equations: n^{th} order linear differential equations with constant coefficient, complementary function and particular integrals, general method, short cut method, method of variation of parameters, linear differential equations with variable coefficient: Cauchy's differential equations and Legendre's differential equations, simultaneous linear differential equations, applications: L-R-C circuits.

Integral Transform: Laplace Transform: - definition, Laplace transform of elementary functions, properties of Laplace transform, Inverse Laplace transform: - definition and properties, Inverse Laplace transform by partial fraction, convolution theorem and standard results, Application of Laplace transform to LDE. (Fourier integral, Fourier sine and cosine integrals), Fourier transforms:- definition & properties, Inverse Fourier transforms:- definition and properties.

Vector Calculus: Vector differentiation and its physical interpretation, vector differential operator, gradient, divergence and curl, directional derivatives, solenoidal and irrotational fields, vector identities, vector integration: line integral, surface integral, volume integral, green's lemma, gauss divergence theorem, stokes theorem.

Statistics And Probability Distributions: Measures of central tendency, dispersion, moments, skewness and kurtosis, covariance, Karl Pearson coefficient of correlation, lines of regression, curve fitting, method of least square, straight lines, second degree parabola, exponential and power curves. Probability distribution: binomial distribution, Poisson distribution, normal distribution.

Complex Variables: Functions of complex variables, analytic functions, C-R equations, conformal mapping, bilinear transformation, Cauchy's theorem, Cauchy's integral formula, Cauchy's residue theorem.

Text books:

1. A Textbook of Engineering Mathematics (Vol-I and II) by P.N.Wartikar and J.N.Wartikar, 7^{th} edition, Pune Vidhyarthi Griha Prakashan, Pune, 2013.
2. A Textbook of Engineering Mathematics, by N.P.Bali & Manish Goyal, 9^{th} edition, Laxmi Prakashan, 2014.

Reference books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8^{th} edition ,Willey Eastern Ltd. Mumbai, 2013.
2. Higher Engineering Mathematics by B. S. Grewal, 33^{rd} edition , Khanna Publication, New Delhi, 1996.
3. Advanced Engineering Mathematics by H. K. Dass, 12^{th} edition, S. Chand Publication, New Delhi, 2003.
4. Higher Engineering Mathematics by B. V. Ramana, 12^{th} edition , Tata McGraw Hill, Delhi, 2011.
5. Statistical methods by Dr. S.P.Gupta, 43^{rd} edition, Sultan chand & Sons, Delhi, 2014.

EE231U ELECTRICAL MACHINES

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 30MSE + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

The course considers the basic principles of electrical machines. This course comprises of the basic concepts and terminology that are used in modern electrical engineering. The students can use this knowledge to analyze electrical networks, D.C. machines, A.C. machine & transformer etc.

COURSE OBJECTIVES:

1. Understand the concepts of network theorems and functions.
2. Acquire basic principles, operation, performance and control of dc machine and transformer.
3. Study construction and design issues associated with electrical machines and networks.
4. Apply special purpose machines.

COURSE OUTCOMES:

After completion student will be able to:

1. Apply basic science and mathematics for understanding the subject electrical machines.
2. Understand the working principles, classifications of dc and ac electrical machines.
3. Analyze the characteristics, controls, power stages and applications of dc machine and ac machines.
4. Apply the electrical machines and networks in manufacturing fields.

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	2	1	-	-	-	-	-	-	2	-	-	-	1
CO3	2	2	2	1	2	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	1	-	2	-	-	-	1	-	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Transformer

Single phase transformer construction and practical consideration, transformer reactance and equivalent circuits, testing, polarity test, open circuit (O.C.) and short circuit (S.C.) test, instrument transformers-current transformer and application potential transformer, pulse transformer and application, three phase transformers, three phase transformer connections: star-star, delta-delta, star-delta, delta-star.

DC Machines

D.C. motor principle, comparison of generator and motor action significance of back emf, voltage equation of a motor, torque - armature torque of a motor, shaft torque, speed of d. c. motor, speed regulation, motor characteristics, characteristics of shunt motors, speed control of d. c. shunt motor and applications of DC motors.

AC Machines

Induction motor: General principle, construction, rotor: squirrel cage rotor, Rotor rotation, slip, frequency of rotor current, starting torque for squirrel cage motor, slip-ring motors, condition for maximum starting torque, relation between torque and slip, full load torque and maximum torque, equivalent circuits of rotor, and an induction motor, single phase I.M. revolving theory, equivalent circuit of a single-phase motor, types of single phase motors, DOL and Star Delta Starter.

Synchronous Machines

Basic principles, construction, star and delta connection, equation of induced emf, synchronous motor principle of operation, method of starting, motor on load, effect of increase in load.

Special Machines

Brushless DC motors, PM motor, Servo Motor, Stepper motor.

Text Books

1. A Textbook of Electrical Technology Vol II, by B.L.Theraja, A.K. Theraja, S.Chand and Co. 2nd edition New Delhi 2005.
2. Electrical Machinery, by P. S Bimbhra, 2nd edition, Khanna Publishers 2007
3. Network Analysis by M. E. Van Valkenburg, PHI / Pearson Education 2013, third edition

Reference Books

1. Electrical and Electronic Technology by Edward Hughes, Pearson Education 2002, tenth edition
2. Electrical Machines by Ashfaq Husain, Dhanpat Rai and Co. 2000, third edition

IN 201U ANALOG ELECTRONICS

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 30MSE + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course provides knowledge about basic electronics to familiarize students with construction, their working, operation, performance and applications.

COURSE OBJECTIVES:

1 To inculcate knowledge of basic analog devices in electronics circuits.
2 To understand the construction, operating principles and analysis of electronics device
3 To develop the students' ability on conducting engineering experiments, analyze experimental observations scientifically

DESIRABLE AWARENESS/SKILLS:

Basic Electronics.

COURSE OUTCOMES:

CO	After the completion of the course the student will be able to	Bloom's Cognitive	
		Level	Descriptor
CO1	Draw characteristics, testing and controls and applications of diode and transistors.	1,2	Understanding Remembering,
CO2	Understand the various theorems, utilizing equivalent circuits or developing models and applying the fundamental circuit theorems rather than memorizing the equations.	2,3	Understanding, Applying
CO3	Practice different biasing circuits using equivalent models to illustrate various circuit parameters, particularly with application to diodes, Metal Oxide Semiconductor (MOS) field-Effect Transistors (FET), Bipolar Junction Transistors (BJT).	3,4	Applying, Analyzing
CO4	Design power amplifier and its applications in circuit design	3,4,5,	Understanding, Applying, Analyzing
CO5	Construct oscillator, multivibrators and feedback amplifiers	5,6	Evaluating, Creating

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	1	2	1	-	-	-	-	-	-	2	-	-	-	1
CO3	2	2	2	1	2	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	1		2	-	-	-	1		-
CO5	3	-	3	3	2	1	-	-	-	-	-	2	-	-	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Diodes and BJT's

Diode junction characteristics, breakdown, photodiode, LED, wave shaping by diodes, Basic construction, operation and characteristics; regions of operation; biasing; current mirror biasing, Transistor as an amplifier; various configurations viz. CE, CB and CC; load line analysis; design for maximum symmetrical swing, thermal stabilization.

Power Amplifiers

Class A, Class B and Class C operation. Push pull amplifier. Complementary symmetry configuration.

Feedback Amplifiers and Oscillators

Classification, feedback concept, transfer gain with feedback, general characteristics of negative feedback amplifier, Input and output resistance, method of analysis of feedback amplifier, voltage-series, current-series, voltage–shunt, current-shunt feedback. Positive feedback in amplifiers, Barkhausen's criterion and stability of oscillators, sinusoidal oscillators – RC, LC, Hartley, Colpitt's and crystal oscillators.

MOSFETs

Field Effect Transistors: Construction and characteristics of JFETs, transfer characteristics, depletion type MOSFET, enhancement type MOSFET. FET amplifiers: JFET small signal model, fixed bias configuration, self bias configuration, voltage divider configuration, Common Gate configuration. Source-Follower Configuration, Cascade configuration.

Text Books:

1 Electronic Devices and Circuit Theory ,Robert L. Boylestad, Louis Nashelsky, eighth edition, PHI publishers, 2004

2 Principles of Electronics , V.K. Mehta, 10th edition S Chand and company 2006.

3 The Art of Electronics Horowitz and Hill, 3rd edition, Cambridge 2015.

Reference Books:

1 Integrated Electronics: Analog and Digital Circuits and Systems, J. Millman and C. C. Halkias, Tata McGraw-Hill Publishing Company, 50th edition 1991

2 Electronic Principles, B Albert Malvino, David J Bates, 7th edition, Tata McGraw-Hill Publishing Company Limited India. 2007.

3 Electronic Devices and Circuits ,Thoeodore F. Bogart, Jeffrey S. Beasley, 6th edition, Pearson Education, 2009.

4 Electronic Devices and Circuit Theory , Robert L. Boylestad, Louis Nashelsky, eighth edition, PHI, 2004.

5 A Monograph on Electronic Design Principles , N. C. Goyal and R. K. Khetan, Khanna Publishers, 2013.

IN202U MEASUREMENT TECHNIQUES

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 30MSE + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

This course provides knowledge about measuring instruments and standards. It also gives introduction to recorders, oscilloscopes, errors in measurements. It also covers the active and passive electronic components measuring circuits.

COURSE OBJECTIVES:

1. To introduce the fundamentals of electrical measurements and instrumentation
2. To explain the working principle of analog and digital instruments for various quantities.
3. To study different bridge circuits used for measurement of electrical parameters such as Resistance, Inductance and Capacitor
4. To learn the operation of Oscilloscope, Signal Generator, Digital instruments and Recorders
5. To introduce digital measurement instruments and its applications

DESIRABLE AWARENESS/SKILLS:

Basic Measurements, AC and DC Fundamentals, single phase AC circuits and poly phase AC circuits.

COURSE OUTCOMES:

CO	**After the completion of the course the student will be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Acquire the knowledge of system of units, classification and essentials of measuring instruments.	01,02	Remembering, Understanding
CO2	Understand the construction and operation of various measuring instruments.	01,02	Remembering, Understanding
CO3	Identify the measuring instruments and apply them for quantifying measurements of parameters.	03	Applying
CO4	Analyse and select proper instrument for given application	03,04	Applying, Analyzing
CO5	Calibrate and monitor a variety of electronic instruments	05, 04	Analyzing, Evaluating

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	3	2	-
CO3	2	3	2	3	2	-	-	-	-	-	-	-	2	2	1
CO4	2	2	3	2	-	-	-	-	-	-	-	-	2	2	2
CO5	2	2	3	2	2	1		3	-	-	1	2	2	2	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Introduction: Fundamentals of measurement need of instrumentation, general instrumentation System, types of errors, statistical analysis, Probability of Errors, Calibration of instruments, calibration report and certification, traceability and traceability chart. Static and dynamic characteristics of instruments and standards

AC indicating instruments: EDM type instruments, EDM Wattmeter (single phase) and errors present, 1 Φ induction type energy meter, Potential and current transformers.

Bridge Circuits: DC bridges: Wheatstone bridge and Kelvin bridge design, bridge sensitivity, errors in bridge circuits, null type and deflection type bridges, current sensitive and voltage sensitive bridges, applications of DC bridges AC bridges: Maxwell bridge, Hey bridge, Schering bridge, Wein bridge, storage and dissipation factor, applications of AC bridges

Measurement of Power: Construction, working principle, torque equation, errors and their compensation, advantages and disadvantages of dynamometer type wattmeter, low power factor wattmeter, poly-phase wattmeter. Active & reactive power measurement in three phase system for balanced and unbalanced load using three wattmeter method, two wattmeter method & one wattmeter method. Power analyzer, multi meter.

Measurement of Energy: Construction, working principle, torque equation, errors and adjustments of single phase conventional (induction type) energy meter. Calibration of energy meter. Block diagram and operation of electronic energy meter. Three phase energy meter, TOD meter.

Oscilloscope: General purpose oscilloscope, construction, front panel controls, deflection sensitivity, dual trace CRO, measurement of electrical parameters like voltage, current, frequency, phase, Z-modulation, digital storage oscilloscope.

Recorders: Rectilinear recorder, inject, ink pen, thermal galvanometric recording, magnetic, paperless, oscilographic, hybrid recording, Y-T, X-T single, multichannel recorders, driving systems for pen and chart, chart speed and their applications, digital recorders.

Text Books:

1. A Course in Electrical and Electronic Measurements and Instrumentation, A.K. Sawhney, 8th edition, Dhanpat Rai and Sons, 2002.
2. Electronic Measurements and Instrumentation, J. B. Gupta, 7th edition, S.K. Kataria & Sons, 2013.
3. Electronic Instrumentation, H. S. Kalsi, 4th edition, Tata McGraw Hill, 2019.
4. Mechanical and Industrial Measurements, R. K. Jain, 2nd edition, Khanna Publishers, 2008.
5. Instrumentation Measurement and Analysis, B. C. Nakra and K. K. Chaudhari, 4th edition, Tata McGraw Hill, 2016.

Reference Books:

1. Electronic Instrumentation and Measurements, David A. Bell, 3rd edition, Oxford University Press, 2013.
2. Student Reference Manual for Electronic Instrumentation Laboratories, Stanley Wolf, Richard Em. Smith, 2nd edition, Pearson, 2003.
3. Electrical Measurements and Measuring Instruments, Golding, E. W. and Widdis, F. C., 3rd edition, Reem Publications, 2011.

4. Fundamentals of electrical measurements, C. T. Baldwin, 2nd edition, George G. Harrap & Co, 1973
5. Electronic Measurements & Instrumentation, Dr. Rajendra Prasad, 4th edition, Khanna Publishers, 2012.
6. Introduction to Measurements and Instrumentation, Arun K. Ghosh, 4th edition, Prentice Hall India Learning Private Limited, 2012.
7. Electronics Instruments and Instrumentation Technology, M. M. S. Anand, 2nd edition, Prentice Hall India Learning Private Limited, 2004.

IN203U TRANSDUCERS-I

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 30MSE + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

The course is intended to develop the basic understanding as well as the competency to install, calibrate and test various transducers and sensors for measuring displacement, force, acceleration, vibration velocity and other parameters.

COURSE OBJECTIVES:

1. To make students familiar with the constructions and working principle of different types of sensors and transducers.
2. To make students aware about the measuring instruments and the methods of measurement and the use of different transducers

DESIRABLE AWARENESS/SKILLS:

Basic knowledge of measurement fundamentals

COURSE OUTCOMES:

CO	**After the completion of the course the student will be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	define the principals of displacement ,vibration, strain etc transducers	1	Remember
CO2	Classify and compare the transducers	2	Understand
CO3	Apply the principles of transducers for applications	3	Apply
CO4	Analyse the transducers according to applications	4	Analyze
CO5	understand the basic concept of smart sensor	2 3	Understand Apply

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	2	2	-	-	-	-	2	3	2	-
CO2	3	2	1	1	2	2	2	-	-	-	-	2	3	2	-
CO3	2	3	2	2	2	2	1	-	-	-	-	2	2	2	-
CO4	3	3	2	2	2	2	2	-	-	-	-	2	2	2	-
CO5	3	1	1	1	3	1	1	-	-	-	-	2	2	2	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Introduction to Transducers: Basics of transducers, classification of transducers, characteristics of transducers, specifications of transducers selection criteria.

Displacement Measurement: Resistive: Potentiometer, Linear and rotary, Loading Effect types, strain gauges and its types. Inductive: LVDT and Eddy current type Transducers. Capacitive: Capacitance pickups, Differential capacitive cells. Piezoelectric, Ultrasonic transducers and Hall effect transducers Optical transducers, applications of displacement sensors.

Velocity and speed measurement: Standards, working principle, types, materials, design criterion: Moving magnet and moving coil, Electromagnetic tachometer, Photoelectric tachometer, Toothed rotor variable reluctance tachometer. Magnetic pickups, Encoders, Photoelectric pickups, Shaft speed measurement. Applications of velocity measurement **sensor**

Vibration and acceleration measurement: Standards, working principle, types, materials, design criterion: Eddy current type, piezoelectric type, Seismic Transducer, Accelerometer: Potentiometric type, LVDT type, Piezo-electric type. Applications of Acceleration and vibration sensors

Force and torque measurement: Basic methods of force measurement, elastic force traducers, strain gauge, load cells, piezoelectric force transducers, vibrating wire force transducers, Strain gauge torque meter, Inductive torque meter, Magnetostrictive transducers, torsion bar dynamometer, etc. Dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement.

Smart Sensors: Introduction to smart sensor, Primary sensors, Excitation, Amplification, Filters, Converters, Compensation, Nonlinearity, Approximation and regression, Noise and interference, response time, drift, cross-sensitivity, Information Coding/Processing, Data communication, standards for smart sensor interface, the Automation.

Text Books:

1. "Instrumentation and Measurement Principles", D.V.S. MurthiPHI, New Delhi, Second ed. 2003.
2. "Principle of Industrial Instrumentation",D. Patranabis, Tata McGraw Hill, Second ed., 1999.
3. "Instrumentation Measurements and Analysis" by, B. C. Nakra and K. K. Choudhari, Tata McGraw Hill Education, Second ed., 2004**.**

Reference Books:

1. "Process Measurement & Analysis", B.G. Liptak, Chilton Book Company, Fourth ed., 2003.
2. "Measurement Systems" , E.O. Doebelin, McGraw Hill, Fifth ed., 2003.
3. "Sensors Handbook" ,SabrieSoloman, McGraw Hill Publication, First ed., 1998.
4. "Electrical & Electronic Instruments & Measurement", A. K. Sawhney, Dhanpat Rai and Sons, Eleventh ed., 2000.
5. "Engineering Metrology", R.K.Jain, Khanna Publisher, Delhi, Eighteenth ed.,2002.
6. "Silicon Sensors", Middlehook S. and Audet S. A., Academic Press, London 1999

EE 232U ELECTRICAL MACHINES LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

In this laboratory, course emphasis shall be on imparting the practical knowledge and understanding of basic principles, characteristic, performance and testing of network circuits, DC and AC machines, speed control of motors and its applications. It also gives the platform to understand construction, working, performance, testing and selection of transformer. Minimum ten experiments shall be performed to cover entire curriculum of course EE231U. The list given below is just a guideline.

LIST OF EXPERIMENT:

1. Plot characteristics of D.C. Motor.
2. Plot characteristics of D.C. Generator.
3. Speed control of D.C. motor.
4. Appreciate construction of D.C. Motor starter.
5. Short circuit and open circuit test of transformer.
6. Study of appreciate construction and operation of induction motor.
7. Study of appreciate construction and operation of alternator.
8. Study of appreciate construction and operation synchronous motor.
9. Study of three point starter
10. Study of star-delta starter

Note:

- ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

- ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute

IN 205U ANALOG ELECTRONICS LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

In this laboratory course emphasis is on imparting practical knowledge and understanding of basic principles, characteristics, performance of electronic components such as diodes, transistors and their applications is studied. It also gives the platform to understand construction, working, performance feedback amplifiers.

It should consist of a record of at least 10 experiments using discrete electronic components / devices from the following list for circuits' implementation. The list given below is just a guideline

LIST OF EXPERIMENT:

1. Design and implement clipping circuits.
2. Design and implement clamping circuits.
3. Design and implement voltage multiplier circuits.
4. Design and implement half wave rectifier.
5. Design and implement full wave rectifier.
6. Design and set up the BJT common emitter amplifier using voltage divider bias with and without feedback and determine the gain- bandwidth product from its frequency response
7. Plot frequency response of two-stage RC coupled amplifier.
8. Plot characteristics of JFET and MOSFET.
9. Design and implement Hartley oscillator and Colpitt's oscillator.
10. Design and implementation of Astable multivibrator and Mono stable multivibrator.
11. Design and implement class AB push-pull power amplifier.
12. Analyze the performance of emitter follower/Darlington emitter follower.
13. Design and set-up the crystal oscillator and determine the frequency of oscillation

Note:

- **ICA – Internal Continuous Assessment** shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).

- **ESE – The End Semester Examination (ESE)** for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute

IN206U MEASUREMENT TECHNIQUES LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of measuring instruments, design and use of meters, recorders and oscilloscope.

LIST OF EXPERIMENTS:

1. Demonstration of working parts of various types of meter by opening the instrument & explanation of symbols & notations used on instruments.
2. Extension of instrument range: ammeter, voltmeter, watt meter.
3. Measurement of active & reactive power in three phase circuit using two wattmeter methods (balanced & unbalanced loads).
4. Measurement of active & reactive power in three phase balanced circuit using one wattmeter method with two way switch.
5. Calibration of single phase static energy meter at different power factors.
6. Measurement of voltage, current, time period, frequency & phase angle using CRO.
7. i) Measurement of resistance by ammeter voltmeter method.
   ii) Measurement of low resistance using Kelvin's double bridge.
8. Measurement of inductance using Anderson's bridge/ Maxwell's bridge.
9. Measurement of capacitance using Schering Bridge.
10. Measurement of frequency using Wein Bridge
11. Design of series type ohmmeter.
12. Design of shunt type ohmmeter.
13. Design of Wheat stones bridge.

- Internal Continuous Assessment (**ICA) –** It shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

- **ESE –**The End Semester Examination (ESE) for this laboratory course shall be based on Performancein one of the experiments performed by student in the semester followed by sample questions to judgethe depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

IN207U TRANSDUCERS-I LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

Minimum ten experiments shall be performed to cover entire curriculum of course IN207U. The list given below is just a guideline.

LIST OF EXPERIMENT:

1. Characterization of displacement measurement system using LVDT
2. Characterization of vibration measurement system. (Piezo-resistive Vibration Pick-up
3. Characterization of speed measurement system. (Photoelectric and Magnetic Pick-up).
4.. Calibration of load cell for weight measurement
5. Calibration of ultrasonic sensor for displacement measurement
6. Displacement measurement using inductive transducer
7. Calibration of capacitive transducer for angular displacement measurement
8. Displacement measurement using potentiometer
9. Measurement of weight using piezoelectric transducer
10. Measurement of force using strain gauge
11. Measurement of acceleration using accelerometer
12 .Study of smart sensor measurement of physical parameter

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on Performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

IN208U COMPUTATIONAL ENVIRONMENT LAB

Teaching Scheme: 01L 02 P Total: 03 **Credit:** 02
Evaluation Scheme: 50 ICA **Total Marks:** 50

COURSE DESCRIPTION:

The course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, students will be learning how to practice and culture the art of programming with Python as a language.

Course Content

Introduction To Python

Installation and Working with Python, Understanding Python variables, Python basic Operators, Understanding python blocks

Python Data Types

Declaring and using Numeric data types: int, float, complex Using string data type and string operations, Defining list and list slicing Use of Tuple data type

Python Exception Handling

Avoiding code break using exception handling, Safeguarding file operation using exception handling Handling and helping developer with error code, Programming using Exception handling

Python Program Flow Control

Conditional blocks using if, else and elif Simple for loops in python, For loop using ranges, string, list and dictionaries Use of while loops in python, Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block

Text Book :-

1. Python Programming Fundamentals- A Beginner's Handbook, Nischaykumar Hegde, eBooks 2go Inc , 2018.
2. Learn and Practice Python, Swapnil Saurav, Ekapress Publisher, 2018.

Reference book:-

1. Python: The Complete Reference, Martin C. Brown , McGraw Hill Education; Fourth Edition, 2018.

2. Python: Programming For Beginners, Michael Knapp, Amazon Asia-Pacific Holdings Private Limited, 2018

SH200AU ESSENCE OF INDIAN TRADITION KNOWLEDGE

Teaching Scheme: 00L: **Credit: 00**
Evaluation Scheme: 60 ESE **Total Marks: 60**

COURSE DESCRIPTION:

This course is intended to provide basic understanding of Indian traditional knowledge. This course introduces students to the fundamental concept of basic and modern Indian knowledge system as well as Indian tradition.

DESIRABLE AWARENESS:

Basic structure of Indian knowledge system and various Indian traditions

COURSE OBJECTIVES:

After complication student will be able to-

1. Understand Indian knowledge system
2. Understand Indian perspective of modern scientific world view
3. Understand basic principles of yoga and holistic health care system
4. Develop ability to understand, connect up and explain basics of Indian traditional knowledge
5. Understand Indian philosophical tradition

COURSE OUTCOMES:

After complication Students will able to –

1. Remember & apply Indian knowledge system in their personal as well as academic life.
2. Apply Indian perspective of modern scientific world view.
3. Analyzing basic principles of yoga and holistic health care system.
4. Evaluate and explain basics of Indian traditional knowledge.
5. Understand basic knowledge about Indian philosophical tradition.

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	-	-	-	3	-	-	3
CO2	-	-	-	-	-	2	-	-	-	-	-	3	-	-	3
CO3	-	-	-	-	-	2	-	-	-	-	-	3	-	-	3
CO4	-	-	-	-	-	2	-	-	-	3	-	3	-	-	3
CO5	-	-	-	-	-	2	-	-	-	3	-	3	-	-	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content:

Basic structure of Indian Knowledge System:
Ashtadashavidya –Types of vedas - rigveda, yajurveda ,samveda ,atharvveda, types of upaved- ayurveda ,dhanurveda ,gandharva veda ,stapatya veda, limbs of vedang, types of upanga

Modern Science and Indian Knowledge System: Logic, mathematics, phonetics, life sciences, physics, military science

Yoga and Holistic Care: General introduction to yoga, aims and objectives of yoga , psychological aspects and mythological concepts of yoga

Philosophical Tradition (Sarvdarshan): Various Indian Philosophical Tradition (Heterodox): jain, buddhist, ajivika, ajnana, carvaka

Indian Linguistic Tradition: phonology, morphology, syntax, semantics

Indian Artistic Tradition: Understanding key terms in art appreciation: art, craft:
Sculpture - iconography: hindu, buddhist and jaina ,modern sculpture
Architecture - temple architecture -nagara, dravida and vesara ,mosques and mausoleums -tajmahal (any one)
Painting - mural painting – ajanta , mughal and rajput- miniature styles ,modern and contemporary artists
Music - traditional music**:** classical, folk, bhajan, thumri, dadra, sufi, modern music **:** bhangra, blues, dance, jazz, rock
Dance- classical, semi-classical, folk, tribal, shiva and natraja, bharatan atyam, kathak

Text Book:

1. An Introduction to Indian Philosophy, S.C. Chaterjee & D.M. Datta, University of Calcutta, 1984.
2. Arts of India, Krishna Chaitanya, Abhinav Publications, 1987.
3. वासुदेवशरण अग्रवाल, कलाएवंसंस्कृत, साहित्य भवन, इलाहाबाद,1952.
4. Cultural Heritage of India-course material, Sivaramakrishnan (Ed.), Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014.

References:

1. Foundations of Indian Art, R. Nagaswamy, Tamil Arts Academy, 2002.
2. The Wave of life, Fritzof Capra.
3. Ed. RN Jha, GN Jha (Eng. Trans.),Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016
4. India Arts, Pramod Chandra, Howard Univ. Press, 1st Edition, 1983

IN251U AUTOMATIC CONTROL SYSTEMS

Teaching Scheme: 03L+ 00 T; Total: 03 **Credits:** 03
Evaluation Scheme: 30MSE + 10 ISA + 60 ESE **Total Marks:** 100
ESE Duration: 3 Hrs.

COURSE DESCRIPTION:

The course is intended to develop the basic understanding as well as the competency for modeling, characteristics, and performance of feedback control systems and analyze the stability using root locus, frequency response methods.

COURSE OBJECTIVE:-

1. The objective of this course is to apply knowledge of mathematics and engineering to analyze and design a control system to meet desired specifications.
2. Students should learn to analytically determine a control system's functionality and select appropriate tests to demonstrate system's performance and finally design a control system to meet a set of requirements.
3. Develop an understanding of the elements of classical control theory as applied to the control of general systems.

DESIRABLE AWARENESS/SKILLS:

Mathematics and Linear Algebra

COURSE OUTCOMES:

CO	**After the completion of the course the student will be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Understand basics of Automatic Control Systems	2	Understand
CO2	Obtain mathematical modelling of physical systems	5	Evaluate
CO3	analyze responses of first order and second order systems	4	Analyze
CO4	Evaluate and apply the concepts of stability	3	Apply
CO5	Apply concepts of time and frequency domain	5	Evaluate

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	2	2	2	-	1	-	1	2	3	2	-
CO2	2	2	1	1	2	2	2	-	1	1	1	2	3	1	1
CO3	2	1	2	2	2	0	1	-	1	-	-	2	2	2	1
CO4	1	3	2	2	2	2	2	-	1	-	1	2	2	-	1
CO5	2	-	-	-	3	1	1	-	-	-	-	2	-	2	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Review of Laplace and inverse Laplace transform, Introduction to control systems, Introduction to design process, classification of control system,Concept of transfer function, modeling of mechanical, electrical, electromechanical systems.

Block diagram reduction techniques, signal flow graph, Mason's gain formula, signal flow graph from block diagram

Standard test signals, Time response analysis, 1st, 2nd and higher order systems, effect of addition of poles and zeros, steady state errors (SSE) for feedback systems, static error constants and system types, steady state errors for external disturbances. Design of system parameters from SSE

Stability of open loop and closed loop systems, Concept of Stability in s domain, classification of Stability (BIBO stability and asymptotic stability), Routh-Hurwitz criterion, Stability and Performance analysis.

Root locus techniques, root locus construction rules, sketching of root locus , relative stability study from root locus.

Frequency response analysis, Bode plot, asymptotic approximations and refining of plot, Gain Margin, Phase Margin via Bode plot, Polar plot, Nyquist plot, stability, gain margin, phase margin via Nyquist plot.

Text Books:

1. Control System Engineering, Norman Nise, Wiley International, sixth Edition, 2011
2. Control System Engineering,Nagrath and Gopal, New Age International Publication, Fifth Edition, 2003

Reference Books:

1. Control System Design ,G. Goodwin, S. Graebe, Mario Salgado, Pearson Education, 2000.
2. Feedback Control of Dynamic Systems,G. Franklin, J. Powell, A. Naeini, Pearson Education, Sixth Edition, 2010.
3. Control Engineering- K. Ogata, Modern Prentice Hall Publications, Fifth Edition, 2010.

IN252U NETWORK THEORY

Teaching Scheme: 03L+ 01T Total: 04 **Credits:** 04
Evaluation Scheme: 10 ISA + 30 MSE + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

The course is intended to develop the basic understanding as well as the competency of various electrical circuits. This course introduces the student to analyse, design and apply concepts of networks in electrical circuits using mesh and node analysis and its applications.

COURSE OBJECTIVES:

1 To understand fundamental concepts of node and mesh analysis for linear circuits.
2 To study network theorems and network functions.
3 To understand Laplace Transform technique for analysis of linear circuits.
4 To investigate initial conditions and obtain circuit response using Laplace Transform.
5 To study Two-port network parameters and their inter-relationships.

COURSE OUTCOMES:

CO	After the completion of the course the students will be able to	Blooms Cognitive	
		Level	Descriptor
CO1	Analyze electrical circuits using mesh and node analysis..	4	Analyze
CO2	Apply suitable network theorems to analyze electrical circuits.	3,4	Analyze Apply
CO3	Apply Laplace Transform for circuit analysis and evaluate the parameters.	3,4,5	Evaluate
CO4	Apply suitable Poles and zeros of network functions.	3	Apply
CO5	Relate various two port network and apply two-port network theory for network analysis.	3,4	Analyze

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	2
CO3	2	3	3	3	1	-	-	-	-	-	-	-	3	1	2
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	2
CO5	3	2	2	1	-	-	-	-	-	-	-	-	2	1	2

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Node and Mesh analysis: Basic circuit elements and waveforms, assumptions for circuit analysis; Sources and standard input signals; Source transformation, Kirchoff's laws, Node and Mesh analysis, Network equations for RLC circuit, Magnetic coupling.

Network Theorems: Introduction, Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem (Statement of above Theorems, their explanation, Steps for solving a network utilizing above theorems).

Sinusoidal Steady State Circuit Analysis: Introduction, element responses, Phasors, Impedance and Admittance, Voltage and Current Division in the frequency domain, The mesh Current Method, The Node Current Method, Thevenin's and Norton's Theorem, Superposition of AC Sources, Maximum Power Transfer Theorem for AC Networks.

Network Analysis using Laplace Transform: Review of Laplace transform, Gate function, Impulse function, Laplace transform of periodic signals, Transformed equivalent of inductance, capacitance, mutual inductance, Node and mesh analysis of the transformed circuits. Node admittance matrix and Mesh impedance matrix in transform domain. Solution of transformed circuits including mutually coupled circuits.

Network Functions, Poles and Zeros: Network functions for one port and two portnetwork, calculation of network functions: Ladder network, General network. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, Time domain behavior from pole and zero plot.

Two-Port Parameters: Relationship of two-port variables, short-circuit AdmittanceParameters, the open circuit Impedance parameters, Transmission parameters, The hybrid parameters, Relationships between parameter sets, Parallel connection of two-port networks.

Text books:

1 Network Analysis, Van Valkenberg M.E., 3rd Edition, Prentice Hall India New Delhi, 2006

2 Engineering Circuit Analysis, Hayt and Kemmerly, 7th Edition, Tata McGraw Hill, 2007

3 Networks and Systems, D. Roy Choudhary, New Age International.

Reference Books:

1 Basic Circuit Theory, Huelsman L.P., 3rd Edition, Prentice Hall India, New Delhi, 2002.

2 Circuit Theory: Continuous and discrete Time System Element network synthesis, C.P. Kouriokose, Prentice Hall India, New Delhi, 2005.

3 Circuit Theory (Analysis and Synthesis), A. Chakravarti, 1st edition, New Age International Publishers, 1998.

IN253U ELECTRONIC INSTRUMENTATION

Teaching Scheme: 03L Total: 03 **Credit:** 03
Evaluation Scheme: 10 ISA+ 30 MSE + 60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

Course Description:

The course is designed to provide the applications of Operational amplifier in designing amplifiers, multivibrators, filters timers etc. It covers fundamentals and design of different signal sources and voltage regulators, study and design of modern electronics instruments like signal generators and analyzers.

Course Objectives:

1. Understand fundamental of measurements using Electronic Instruments
2. Understand and describe specifications, features and capabilities of analog and digital instruments.

Desirable awareness/skills:
None

Course Outcomes:

CO	After the completion of the course the students will be able to	Blooms Cognitive	
		Level	Descriptor
CO1	Understand the basic concepts of circuit configuration.	1	Remeber
CO2	Develop skills to design circuits using OP-AMP	1,2	Remeber, understand
CO3	Design filter circuits and its application	3,4	Apply Evaluate
CO4	Understand the principles of measuring instruments, signal generators and its analysis	3	Understand Apply

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	-	-	-	2	-	-	-	-	3	-	2	-	2	-	-
CO3	2	1	3	2	1	-	-	-	2	-	-	-	3	-	2
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Applications of Operational Amplifier

Negative feedback applications: voltage amplifier, current amplifier, voltage to current and current to voltage converter, Op-amp as integrator and differentiator, instrumentation amplifier, precision rectifier, programmable amplifier.

Positive feedback applications: Crystal oscillator.

Filters and Timers

Low pass filter, high pass filter, band Pass filter, band reject filter, notch and all pass filters - I order and II order. IC 555 timer: Functional block diagram, astable multivibrator, monostable multivibrator and its applications, IC 565 PLL and its applications.

Voltage Regulators and Power Supplies

Three terminal positive and negative voltage regulators, variable voltage regulators (3085,723), tracking regulators, introduction to the unregulated power supply, DC voltage regulation, AC ripple voltage, design procedure for a full-wave bridge unregulated supply, bipolar and two valve unregulated power supply, need for voltage regulation, linear IC voltage regulators, +/- 15V power supplies, adjustable three terminal positive voltage regulators (LM 317 HV) and negative voltage regulator (LM 337 HV)

Measuring Instruments

Q meter, digital voltmeters, digital multi-meters, automation in digital instruments, digital frequency meter, universal counter, Measurement of time, frequency, time interval, pulse width, sources of errors in electronic counters, microprocessor based instruments, digital instruments with GPIB interface.

Signal Generators and Analyzers

Fixed and variable AF oscillators, square and pulse generator, sweep generator, function generator, arbitrary waveform generator, frequency synthesizer, frequency selective wave analyser, heterodyne wave analyser, harmonic distortion analyser, spectrum analyser, network and logic Analyzer, OTDR.

Text Books

1. Modern Electronic Instrumentation and Measurements Techniques by William Cooper, Albert. D. Hellfrick, PHI, 2003.
2. Electronic Measurements and Instrumentation by Oliver. B.H and Cag. J. M. McGrawHill, 1992.

Reference Books:

1. A course in Electrical and Electronic Measurements and Instrumentation by Sawhney A. K Dhanapat Rai and Sons, New Delhi, 1995.
2. Electronic Instrumentation by H.S.Kalsi, Tata McGraw Hill, 1999.
3. Applied Electronic Instrumentation and Measurements by David Buchla, Wayne Melachlan PHI, 1992.
4. Digital Instrumentation by A. J. Bouwens , Tata McGraw Hill ,1997.
5. Instrumentation Devices and Systems by Rangan C S, Sharma G R, Mani V S N - TMH, New Delhi, 1983.

IN254U TRANSDUCERS-II

Teaching Scheme: 03L Total: 03 **Credits:** 03
Evaluation Scheme: 10 ISA+ 30 MSE + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

COURSE DESCRIPTION:

The course is intended to develop the basic understanding as well as the competency to install, calibrate and test various transducers and sensors for measuring Flow, Level, temperature, pressure, viscosity and other parameters.

COURSE OBJECTIVES:

1. To make students familiar with the constructions and working principle of different types of sensors and transducers.
2. To make students aware about the measuring instruments and the methods of measurement and the use of different transducers

DESIRABLE AWARENESS/SKILLS:

Transducer-I

COURSE OUTCOMES:

CO	After the completion of the course the student will be able to	Bloom's Cognitive	
		Level	**Descriptor**
CO1	define the principals of temperature, flow, pressure etc transducers	1	Remember
CO2	Classify and compare the transducers	2	Understand
CO3	measure different industrial parameters	5	Evaluate
CO4	Select the appropriate transducer for industrial applications	4	Analyze
CO5	determine characteristics of transducers	5	Apply

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	2	2	2	-	-	-	-	2	3	2	-
CO2	3	2	1	1	2	2	2	-	-	-	-	2	3	2	-
CO3	2	3	2	2	2	2	1	-	-	-	-	2	2	2	-
CO4	3	3	2	2	2	2	2	-	-	-	-	2	2	2	-
CO5	3	1	1	1	3	1	1	-	-	-	-	2	2	2	-

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course content

Flow Measurement: Units, Newtonian and non-Newtonian Fluids, Reynolds number, Laminar and turbulent flows, Velocity profile, Bernoulli's equation for incompressible flow, Density, Beta ratio, Reynolds number correction, Square root relation, Head type flow meters, Variable area type, Open channel flow measurement, Turbine , Electromagnetic , Ultrasonic , Vortex shedding, Positive displacement, Anemometers , Mass flow meters.

Level Measurement: Float, Displacer (Torque tube unit), Bubbler, Diaphragm box, DP cell, Ultrasonic, Capacitive, radioactive type, laser type transducers, level gages, resistance, thermal, radar, timedomain reflectometry (TDR) / phase difference sensor (PDS), solid level detectors, fiber optic level detectors, Level switch.

Temperature measurement: Temperature Scales, Standards and Units and relations, Classification of temperature sensors Bimetallic Thermometer, Filled system thermometers, SAMA classifications, Resistance Temperature Detectors (RTD), Thermistor, Thermocouples, Study of thermocouple tables (calculation of intermediate temperature and voltage), Lead wire compensation, Cold junction compensation techniques, Protection (Thermo well), Thermopiles, Pyrometers, Temperature IC sensors (AD590 and LM35).

Pressure measurement: Pressure measurement Definition, pressure scale, standards, working principle, types, materials, design criterion: Manometers, elastic pressure sensors, secondary pressure sensors, differential pressure sensors, force balance type, motion balance type, capacitive (delta cell), ring balance, vibrating cylinder type, high-pressure gauges, vacuum gauges, dead weight and vacuum gauge tester., Pressure switch.

Viscosity and Density Measurement: Viscosity: Saybolt, Searle's rotating cylinder, Cone and plate, Falling and rolling ball, Rotameter. Density Measurement: Chain-balanced float type, Hydrometer (Buoyancy type), U tube type, Hydrostatic Head (Air bubbler, DP Cell), Oscillating Coriolis, Float displacers, bubbler, and DP- cell, ultrasonic, capacitive.

Miscellaneous Sensors: pH and conductivity sensors: ph scale and standards, principle of pH measurement, different types of reference and measuring electrodes, principle of conductivity measurement, conductivity cells and bridgestheir application, effect of temperature on PH and conductivity sensors. Humidity and miscellaneous transducers: pyrometer, hygrometer (hair, wire and electrolysis type), dew point meter, piezoelectric humidity meter, infrared conductance and capacitive type probes for moisture measurement, flow detectors, leak detectors acoustic transducers and sound level measurement

Text Books:

1. D.V.S. Murthi, "Instrumentation and Measurement Principles", PHI, New Delhi, Second ed. 2003.
2. D. Patranabis, "Principle of Industrial Instrumentation", Tata McGraw Hill, Second ed., 1999.
3. B. C. Nakra and K. K. Choudhari, "Instrumentation Measurements and Analysis" by, Tata McGraw Hill Education, Second ed., 2004.

Reference Books:

1. B.G. Liptak, "Process Measurement& Analysis", Chilton Book Company, Fourth ed., 2003.
2. E.O. Doebelin, "Measurement Systems", McGraw Hill, Fifth ed., 2003.
3. SabrieSoloman, "Sensors Handbook" ,McGraw Hill Publication, First ed., 1998.
4. A. K. Sawhney, "Electrical & Electronic Instruments & Measurement", Dhanpat Rai and Sons, Eleventh ed., 2000

IN255U DIGITAL CIRCUITS DESIGN

Teaching Scheme: 03L + 01 T Total: 04 **Credit:** 04
Evaluation Scheme: 10 ISA+30 MSE +60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

COURSE DESCRIPTION

There is a notable increase in the use of the word 'digital' for products and services that are becoming part of our everyday life. Examples are digital camera, digital watch, digital weighing machine, digital signature, digital payment, digital art and so on. The digital prefix associates a term with digital technology and is considered a step up in the delivered performance at a given cost. The world of digital provides easy storage and reproduction, immunity to noise and interference, flexibility in processing, different transmission options, and very importantly, inexpensive building blocks in the form of integrated circuits. Digital systems represent and manipulate digital signals. Such signals represent only finite number of discreet values. A signal can be discreet by nature whereas, a continuous signal can be discretized for digital processing and then converted back. Manipulation and storage of digital signal involves switching. This switching is done through electronic circuits. Basic gates made from electronic circuits are primary building blocks of digital systems. These gates combine in different ways to develop digital circuits that are associated with different functionalities. This is helped by an understanding of Boolean Algebra. The functional blocks in turn, combine to generate a complex digital system.

COURSE OBJECTIVES

This course is aimed at developing a deep understanding of digital electronic circuits. At the end of the course, one would be able to analyze and synthesize different kind of combinatorial and sequential digital systems for real-world use.

COURSE OUTCOMES

CO	**After the completion of the course the student will be able to**	**Bloom's Cognitive**	
		Level	**Descriptor**
CO1	Demonstrate the understanding and working of logic families and logic gates.	1,2	Remember Understand
CO2	Develop a digital logic and apply it to solve real life problems.	3,4	Apply Analyze
CO3	Analyze, design and implement combinational logic circuits and sequential logic circuits.	3,4,5	Apply Analyze Evaluate
CO4	Demonstrate the process of Analog to Digital conversion and Digital to Analog conversion.	2	Understand

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	2	2	2	1	1	1	1	2	3	2	1
CO2	-	3	-	-	2	2	2	1	1	1	1	2	3	2	1
CO3	-	-	3	3	2	2	1	1	1	1	1	2	2	2	1
CO4	3	-	-	-	2	2	2	1	1	1	1	2	2	2	1

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Fundamental Concepts of Digital Circuits

Introduction; Relation between switching and logic operation; Use of Diode and Transistor as switch; Concept of noise margin, fanin, fanout, propagation delay; TTL, Schottky TTL, Tristate; CMOS Logic, Interfacing TTL with CMOS

Basic logic gates, Universality of NAND, NOR gates, AND-OR-Invert gates, Positive and Negative Logic; Boolean algebra axioms and basic theorems; Standard and canonical representations of logic functions, Conversion between SOP and POS; Simplification of logic functions, Karnaugh Map, Don't Care Conditions

Combinational Logic Design

Minimization using Entered Variable Map, Minimization of multiple output functions, Minimization using QM algorithm; Static-0, Static-1 and Dynamic Hazards and their cover

Multiplexer; Demultiplexer / Decoder, BCD to 7-segment decoder driver; Encoder, Priority encoder; Parity generator and checker

Number systems-binary, Signed binary, Octal, hexadecimal number; Binary arithmetic, One's and two's complements arithmetic; Codes, Code converters; Adder, Subtractor, BCD arithmetic

Carry look-ahead adder; Magnitude comparator; ALU; Error detecting and correcting codes

Sequential Logic Design

Bistable latch, SR, D, JK, T Flip-Flop: level triggered, edge triggered, master – slave, Various representations of flip-flops; Analysis and synthesis of circuits that use flip-flop

Register, Shift register, Universal shift register; Application of shift register: ring counter, Johnson counter, sequence generator and detector, serial adder; Linear feedback shift register

Up and down counter, Ripple (asynchronous) counters, Synchronous counters; Counter design using flip flops, Counter design with asynchronous reset or preset; Applications of counters

Design of synchronous sequential circuit using Mealy model and Moore model: state transition diagram, algorithm state machine (ASM) chart; State reduction technique

Convertor Circuits And Digital Storage Devices

Digital to analog converters: weighted resistor/converter, binary ladder, converter, accuracy and resolution; Analog to digital converter: quantization and encoding, different types of conversion, accuracy and resolution

Memory organization and operation, Memory expansion; Memory cell; Different types of memory, ROM, PROM, PAL, PLA, CPLD, FPGA

Text Books

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

Reference Books

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

IN256U AUTOMATIC CONTROL SYSTEM LAB

Teaching Scheme: 02 PR Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

COURSE DESCRIPTION

At the end of the laboratory work, students will demonstrate the ability to:
1. Stability analysis of Control System.
2. Develop mathematical model for electrical systems.
3. Analyze second order systems and validate using MATLAB.

LIST OF EXPERIMENTS:

1. Study of single variable control system.
2. Analysis of second order (R-L-C) system in time domain.
3. Analysis of type 0 and type 1 system
4. Study of signal flow graph with suitable example
5. To find the transfer function of unknown system (electrical network)
6. Write a program to find time domain parameters
7. Develop simulation model to obtain impulse, step input response of second order system.
8. Write a program to find Routh table and comment on its stability
9. Write program to find gain for stability
10. Write a program to design controller using root locus technique
11. Write a program to draw bode plot of a given transfer function
12. Write a program to find step and ramp response of a second order system and verify with physical system
13. Write a program to draw Nyquist plot of a given transfer function
14. Develop a Simulink model to find steady state error for a type 0, type 1 and type 2 system.

ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**

ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

IN257U ELECTRONICS INSTRUMENTATION LAB

Teaching Scheme: 02 PR Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

COURSE DESCRIPTION

Minimum Ten experiments shall be performed to cover entire curriculum of course IN253. The list given below is just a guideline.

LIST OF EXPERIMENTS

1. Design and testing of instrumentation amplifier.
2. Design and testing of precision rectifier.
3. Design and testing of active filters.
4. Design and testing of waveform generators using op-amps square, triangular.
5. Design and testing of multivibrators using 555
6. Design of voltage regulator.
7. Design of DC power supply.
8. Study and application of universal counter
9. Study of arbitrary waveform generator
10. Study of RLC Q meter
11. Study of distortion analyser/logic analyzer/network analyzer.
12. Study of logic analyzer.
13. Study of spectrum analyzer.
14. Study of OTDR.

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format **(S 10).**
- **ESE –** The end semester examination (ESE) for this laboratory course shall be based on oral examination to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

IN258U TRANSDUCERS-II LAB

Teaching Scheme: 02P Total: 02 **Credit:** 01

Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50

Duration of ESE: 03Hrs

COURSE DESCRIPTION:

Minimum Ten experiments shall be performed to cover entire curriculum of course IN301. The list given below is just a guideline

LIST OF EXPERIMENT:

1. Characterization of Flow measurement system. Orifice, Venturi
2. Rotameter Calibration FOR FLOW MEASUREMENT
3. Measurement of flow using DP cell
4. Level measurement using capacitive/ resistive/ air purge method.
5. Measurement of pH / Conductivity.
6. Measurement of Viscosity / Density.
7. Study of Proximity sensors. (03 types)
8. Characterization of Temperature measurement system. (Thermocouple and RTD).
9. Characterization of Level measurement system. (Capacitive, resistive, Air purge).
10. Characterization of Sound measurement system.
11. Calibration of Pressure Gauges using Dead Weight Tester.
12. Calibration of Vacuum Gauges using Vacuum Gauge Tester.
13. Characterization of Humidity Sensor
14. Measurement of PH and Conductivity of Solution

Note:

- **ICA –** Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her. The performance shall be assessed experiment wise using internal continuous assessment format (S 10).
- **ESE –** The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be out of institute

IN259U DIGITAL CIRCUITS DESIGN LAB

Teaching Scheme: 02 PR Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

COURSE DESCRIPTION:

Minimum Ten experiments shall be performed to cover entire curriculum of course IN255. The list given below is just a guideline.

LIST OF EXPERIMENT:

1. Verification of truth table of various TTL logic gates.
2. Verification of Boolean algebra laws.
3. Verification of given logical expression using universal gates.
4. To Design and test adder circuits (half and full adder) using K-map.
5. To Design and test binary to gray code converter circuits and test using IC7486.
6. To Design and test BCD to Exess-3 code converter circuit.
7. To Design and test one bit comparator circuit using K-map.
8. Verification of truth table of multiplexer using IC74153.
9. Verification of truth table of De-multiplexer using IC74155.
10. Verification of BCD to 7-segment display using IC7447.
11. Verification of ring counter using IC7493.
12. To design and test D/A converter (R/2R ladder network)
13. Design experiments using flip flops

Note:

• ICA – Internal Continuous Assessment shall support for regular performance of practical and its regular assessment. In addition; it shall be based on knowledge/skill acquired and record submitted by student (journal) based on practical performed by him/her.

• ESE – The End Semester Examination (ESE) for this laboratory course shall be based on performance in one of the experiments performed by student in the semester followed by sample questions to judge the depth of understanding/knowledge or skill acquired by the student. It shall be evaluated by two examiners out of which one examiner shall be from out of institute

SH299U EFFECTIVE TECHNICAL COMMUNICATION

Teaching Scheme: 00L+02 PR **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**

COURSE DESCRIPTION:

The course is intended to provide basic technical communication to engineering students. This course introduces various engineering ethics as well as self development & assessment of the student.

DESIRABLE AWARENESS:

Basic knowledge of technical communication skill and engineering ethics

COURSE OBJECTIVES:

After completion of this course, the student will be able to-

1. Identify and describe the basic communication process.
2. Appreciate the value of empathic listening and effective feedback.
3. Use technology appropriately to enhance communication success.
4. Prepare And Deliver An Effective Oral Presentation.
5. Understand the role of communication in personal & professional success.

COURSE OUTCOMES:

After completion of this course, the Students are able to –

1. Understand & apply business communication strategies and principles to prepare effective communication for domestic and international business situations.
2. Remember ethical, legal, cultural, and global issues affecting technical communication.
3. Evaluate accurate business documents using computer technology.
4. Apply an effective oral technical presentation.
5. Understand ethically use of document and integrate sources.

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

CO	PO												PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12	-	-	-
1	-	-	-	-	-	2	2	1	-	3	-	2	-	-	3
2	-	-	-	-	-	2	2	1	-	3	-	2	-	-	3
3	-	-	-	-	-	2	2	1	-	3	-	2	-	-	3
4	-	-	-	-	-	2	2	1	-	3	-	2	-	-	3
5	-	-	-	-	-	2	2	3	-	3	-	2	-	-	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course Content

Introduction to Technical Communication: Definition of technical communication, aspect of technical communication, forms of technical communication, importance of technical communication, technical communication skills, (listening, speaking, reading, writing), linguistic ability, style in technical communication.

Nature of Technical Communication: Communication as sharing, stages of communication, channels of communication, nature of technical communication, aspects of technical communication, forms of technical communication, general and technical communication, importance and need for technical communication, technical communication skills: listening, speaking, reading, writing, barriers to effective communication

Comprehension of Technical Material :(Information Design and Development)
Different kinds of technical documents, information development life cycle, organisation structures, factors affecting information and document design, strategies for organization, information design and writing for print and for online media

Technical Writing: Grammar and Editing- technical writing process, forms of discourse, writing drafts and revising, collaborative writing, creating indexes, technical writing style and language, basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style, introduction to advanced technical communication, usability, human factors, managing technical communication projects, time estimation, single sourcing, localization

Engineering Ethics: Senses of engineering ethics, variety of moral issues, types of inquiry, moral dilemmas, moral autonomy, Kohlberg's theory, consensus and controversy, professional ideals and virtues, attributes of an ethical personality, theories about right action, self interest, responsibilities and rights of engineers, collegiality and loyalty, respect for authority, collective bargaining, confidentiality, conflict of interest, professional rights

Self Development and Assessment: Self assessment, awareness, perception and attitude, values and beliefs, personal goal setting, career planning, self esteem, managing time, personal memory, rapid reading, taking notes, complex problem solving, creativity

Text Books:

1. Effective Technical Communication By M Ashraf Rizvi, 2nd Edition, The McGraw Hill Publication, 2017
2. Business Communication, Rai and Rai, 2nd edition, Himalaya Publishing House, 2014
3. Organization Behavior, Suja R. Nair, 2nd Edition, Himalaya Publications, 2014
4. Technical Communication: Principles And Practice, Meenakshi Raman, Sangeeta Sharma, 2nd Edition, 2012

Reference Books:

1. Goal Setting: How to Create an Action Plan and Achieve Your Goals, Susan Wilson and Michael Dobson, 2008
2. Business Communication, Raman and Singh, 2nd edition, Oxford Publication, 2012
3. Nonverbal Communication in Human Interaction by Mark L. Knapp, Judith A. Hall, Terrence G. Horgan Eighth Edition,2013
4. Business Communication (BCOM), Lehman Sinha, 2nd edition, Cengage Learning, 2012
5. Business Communication for Managers, Penrose, Rasberry, Myers, 5th edition, Cenage Learning,2004

It is a representative list of practical. The instructor may choose experiments as per his requirements (so as to cover entire contents of the course) from the list or otherwise. Ten practical should be performed to cover entire curriculum of course SH299U. The list given below is just a guideline.

List of practical / Assignments

1. Delivery of a speech on general topics by giving emphasis on non-verbal communication
2. Practical based on fourfold skills (Technical communication skills)
3. Delivery of a speech on technical topic
4. Role play on importance of time management
5. Performing a corporate meeting
6. Personal goal setting with priorities
7. Resume writingalong with application letter
8. Group discussion
9. Personal interview
10. Debate on recent topics
11. Practical based on reading skills
12. Writing business letter
13. Role play on engineering ethics

Guide lines for ICA:

Internal Continuous Assessment should support for regular performance of practical by student and his/her regular assessment with proper understanding practical carried out.

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SH 250AU INTRODUCTION TO THE CONSTITUTION OF INDIA

Teaching Scheme: 00L: **Credit: 00**
Evaluation Scheme: 60 ESE **Total Marks: 60**

COURSE DESCRIPTION:

The course provides knowledge about constitution of India, state and central policies, fundamental rights, fundamental duties, powers and functions of municipalities, panchayats and co-operative societies, electoral process and judiciary system.

DESIRABLE AWARENESS:

Basic knowledge of Indian Constitution

COURSE OBJECTIVES:

The objectives of the course are to-

1. Provide knowledge about legal literacy, state and central policies, fundamental rights, fundamental duties, powers and functions of municipalities, panchayats and co-operative societies, electoral process
2. enable the students to take up competitive examinations and also demonstrate the qualities of a responsible citizen.

COURSE OUTCOMES:

On the successful completion of this course, student shall be able to –

1. Understand & remember the knowledge of basic information about Indian constitution.
2. Analyse individual role and ethical responsibility towards society.
3. Apply the knowledge of human rights and its implications while behaving with other citizens.

RELEVANCE OF POS AND STRENGTH OF CORRELATION:

CO	PO												PSO1	PSO2	PSO3
	1	2	3	4	5	6	7	8	9	10	11	12	-	-	-
1	-	-	-	-	-	3	2	3	1	-	-	2	-	-	3
2	-	-	-	-	-	2	2	3	3	-	-	3	-	-	3
3	-	-	-	-	-	3	2	3	3	-	-	3	-	-	3

1-Weakly correlated 2 – Moderately correlated 3 – Strongly correlated

Course content:

Introduction to the constitution of India: the making of the constitution and salient features of the constitution. preamble to the constitution, fundamental rights and its limitations.

Directive principles of state policy and relevance of directive principles, state policy fundamental duties, union executives – president, prime minister, parliament, supreme court **State executives:** governor, chief minister, state legislature, high courts of state, electoral process in India, procedures for amendment in constitution

Human rights – meaning and definitions, emergency provisions, working of national human rights commission in India, powers and functions of municipalities, panchyats and co-operative societies

Text Books

1. Introduction to the Constitution of India, (Students Edn.) Durga Das Basu, Prentice –Hall EEE, 19th / 20th Edition., 2001
2. Introduction to the Constitution of India", Brij Kishore Sharma, PHI Learning Pvt. Ltd., New Delhi, 2011

Reference Books

1. An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication
3. Latest Publications of Indian Institute of Human Rights, New Delhi