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
2015-16

GOVERNMENT COLLEGE OF ENGINEERING, JALGAON.

Department of Instrumentation Engineering.

Scheme for B. Tech. (Instrumentation Engineering)

SEM III

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TUT	PR	Total	ISA	ISE1	ISE2	ESE	ICA	ESE		
SH201	Engineering Mathematics-III	A*	3	1	---	4	10	15	15	60	---	---	100	4
EE221	Electrical Machines & Networks	B	3	---	---	3	10	15	15	60	---	---	100	3
IN201	Analog Circuits & Analysis	D	3	1	---	4	10	15	15	60	---	---	100	4
IN202	Measurement Fundamentals	D	3		---	3	10	15	15	60	---	---	100	3
IN203	Computational Methods & Programming	D	3	---	---	3	10	15	15	60	---	---	100	3
SH204	General Proficiency II	C	1	---	2	3	---	---	---	---	25	25	50	2
EE222	Electrical Machines & Networks Lab	B	---	---	2	2	---	---	---	---	50	---	50	1
IN204	Analog Circuits & Analysis Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
IN205	Measurement Fundamentals Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
IN206	Computational Methods & Programming Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
Total			**16**	**2**	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

SEM IV

Course Code	Name of the Course	Group	Teaching Scheme				Evaluation Scheme							Credits
							Theory				Practical		Total	
			TH	TUT	PR	Total	ISA	ISE1	ISE2	ESE	ICA	ESE		
IN251	Automatic Control Systems	D*	3	1	---	4	10	15	15	60	---	---	100	4
IN252	Signals & Systems	D	3	1	---	4	10	15	15	60	---	---	100	4
IN253	Electronic Instumentation	D	3	---	---	3	10	15	15	60	---	---	100	3
IN254	Sensors & Transducers	D	3	---	---	3	10	15	15	60	---	---	100	3
IN255	Digital Circuits Design	D	3	---	---	3	10	15	15	60	---	---	100	3
IN256	Programming in MATLAB	B	1	---	2	2					50	-	50	2
IN257	Electronic Instumentation Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
IN258	Automatic Control Systems Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
IN259	Sensors & Transducers Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
IN260	Digital Circuits Design Lab	D	---	---	2	2	---	---	---	---	25	25	50	1
Total			**16**	2	**10**	**28**	**50**	**75**	**75**	**300**	**150**	**100**	**750**	**23**

TH: Theory Lecture, TUT: Tutorial, PR: Practical
ISA: Internal Sessional Assessment ISE: In Semester Examination ESE: End Semester Examination
ICA: Internal Continuous Assessment

SH201: ENGINEERING MATHEMATICS – III

Teaching Scheme : 03L+01T; Total: 04 **Credits:** 04
Evaluation Scheme: 15 ISE 1 + 15 ISE 2 +10 ISA +60 ESE **Total Marks:** 100
Duration of ESE : 03 Hrs

Course description:

The course is intended to provide understanding of concepts of mathematics and its application to engineering. This course introduces the student to the second and higher order differential equations and their solution, function of a complex variable. Students will study the integral transforms such as Laplace transform, Fourier transforms and their inverses. Students will learn the important theorems of vector integration like Green's, Gauss', Stokes' theorems and Maxwell's equations. Students will become familiar with statistical techniques, probability distributions and complex variables. This course is designed to inculcate analytical ability among the students.

Course Objectives:

1. To strengthen the analytical abilities of the students.
2. To make strong foundation of the integral transforms and their inverses.
3. To make students familiar with complex variable, theorems of vector integration and Maxwell's equations.
4. To create zeal of working with higher mathematics in the widespread field of engineering.

Course Outcomes:

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

1. solve engineering problems using the principles of solution of differential equations.
2. understand analytic function of a complex variable and able to apply Cauchy integral theorem and residue theorem to solve contour integrations.
3. use Fourier transforms and its inverse in practical applications of electronics engineering.
4. apply Laplace transform and its inverse to solve initial value and other related problems.
5. know basic statistical techniques required for electronics engineering.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	3
g	Participate and succeed in competitive examinations and engage in life-long learning.	2
i	Model and simulate the automatic control system	1

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

Course contents

Higher order linear differential equations: nth 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: R-L- C circuits.

Laplace transform: Definition of Laplace transform, Laplace transform of elementary functions, properties of Laplace transform, Laplace transform of special functions: unit step function, Dirac-delta function and periodic functions, inverse Laplace transform: definition and properties, inverse Laplace transform by partial fraction, convolution theorem, using standard results, application of Laplace transform to linear differential equations.

Fourier transform: Fourier integrals, Fourier sine and cosine integrals, Fourier transform, Fourier sine and cosine transform, inverse Fourier transform, application to difference equations.

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 & probability distributions: Measures of central tendency, dispersion, moments, skewness and kurtosis, correlation coefficient, 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 text book of Engineering Mathematics (Vol-I and II), P. N. Wartikar and J. N. Wartikar, 07th edition, Pune Vidhyarthi Griha Prakashan, Pune, 2013.
2. A text book of Engineering Mathematics, by N. P. Bali & Manish Goyal, 09th edition, Laxmi Prakashan, 2014.

Reference books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition, Willey Eastern Ltd. Mumbai, 2013.
2. Higher Engineering Mathematics by B. S. Grewal, 33rd edition , Khanna Publication, New Delhi, 1996.
3. Advanced Engineering Mathematics by H. K. Dass, 12th edition, S. Chand Publication, New Delhi, 2003.
4. Higher Engineering Mathematics by B. V. Ramana, 12th edition, Tata McGraw Hill, Delhi, 2011.

EE221 ELECTRICAL MACHINES AND NETWORKS

Teaching Scheme: 03L Total: 03 **Credits:** 03
Evaluation Scheme: 10 ISA + 15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

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:

Upon successful completion of this course the students 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 PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**2**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**3**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Network Theorems and Network Functions

The concept of complex frequency, transform impedance and transform circuits, series and parallel combination of elements, Thevenin's, superposition, Millman's, Tellegen's, reciprocity, Norton and maximum power transfer theorems, network functions for one port and two-port network, calculation of network functions, ladder networks, general networks. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, time domain behaviour from pole and zero plot.

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 connectivity, star/star-delta/delta-star/delta-delta/star open-delta or V-V connection, Scott connection.

DC Machines.

D.C. motor principle, comparison of generator and motor action significance of back emf, voltage equation of a motor, condition for maximum power, 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

AC Machines

Induction motor: General principle, construction, stator 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, effect of changes in supply voltage on torque and speed, 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.

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.

Text Books

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

Reference Books

1. Networks and Systems by D Roy Choudhury, New Age International Publishers 1998.
2. Electrical and Electronic Technology by Edward Hughes, Pearson Education 2002.
3. Electrical Machines by Ashfaq Husain, Dhanpat Rai and Co. 2007.

EE 222 ELECTRICAL MACHINES AND NETWORKS LAB

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

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 it's 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 EE221. The list given below is just a guideline.

List of Experiment:

1. Verification of Maximum power transfer theorem.
2. Verification of Thevenin's theorem.
3. Verification of Superposition theorem.
4. Plot characteristics of D.C. Motor.
5. Plot characteristics of D.C. Generator.
6. Speed control of D.C. motor.
7. Appreciate construction of D.C. Motor starter.
8. Short circuit and open circuit test of transformer.
9. Power measurement in 3- Ǿ start connected load.
10. Appreciate construction and operation of induction motor.
11. Appreciate construction and operation of alternator.
12. Appreciate construction and operation synchronous motor.

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).**

IN 201 ANALOG CIRCUITS AND ANALYSIS

Teaching Scheme: 03L+ 01T Total: 04 **Credits:** 04
Evaluation Scheme: 10 ISA + 15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Course Description:

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

Course Objectives:

1. Familiarize with construction and working principal of BJT and Field Effect Transistor and its applications.
2. Understanding construction and design of multivibrators and oscillators.
3. Understand the characteristics of operational amplifiers and apply it in various circuits.
4. Understand concept of negative and positive feedback applications.

Course Outcomes:

Upon successful completion of this course the students will be able to

1. analyze the characteristics, testing and controls and applications of transistors.
2. design, analyze and test multi-stage amplifiers, feedback amplifiers.
3. apply the analog electronics components for designing circuits.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**3**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**3**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Diode Theory

Basic review of diode theory, types of diode and their applications, rectifiers, filters, clippers, clampers. voltage multipliers-doubler, trippler, quadrapler, voltage regulator, diode current equation.

Transistors

Introduction to BJT characteristics and configurations, DC analysis of BJT, power considerations. BJT as amplifier, amplifier step response and frequency response, transistor at low frequencies, transistor at high frequencies, h parameters

Field Effect Transistor

Small signal FET analysis and FET applications, Single stage amplifier, analog switches, voltage variable resistance, UJT and its application, MOSFET and its application, IGBT and its application.

Feedback Amplifiers

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 oscillator: RC, LC and crystal oscillators, astable, bistable, and monostable multivibrators.

Differential Amplifiers

Dual input-balanced output ; single input-balanced output; their analysis, constant current bias, current mirror, level translators, basic operational amplifier; equivalent circuit, IC operational amplifiers-characteristics, specification, parameter measurements, frequency response, types (741,308,356,OP07) and their properties.

Text Books

1. A Text Book of Applied Electronics by R.S. Sedha 5^{th} Edition, S Chand and company, 2006.
2. Principles of Electronics by V.K. Mehta, 10^{th} edition S Chand and company 2006.
3. Opamps and Linear Integrated Circuits by Ramakant Gaikwad, Prentice Hall, 2000.

Reference Books

1. Electronic Devices and Circuits, An Introductionby A. Mottershead , PHI.1979.
2. Electronic Principles byb Albert Malvino, David J Bates, 7^{th} edition, Tata McGraw-Hill Publishing Company Limited India. 2007.
3. Electronic Devices and Circuits by J. Millman and C. Halkis, Tata McGraw Hill Publication Company Limited India, 2001.
4. Electronic Devices and Circuits by Thoeodore F. Bogart, Jeffrey S. Beasley, 6^{th} edition, Pearson Education, 2009.
5. Electronic Devices and Circuit Theory by Robert L. Boylestad, Louis Nashelsky, Eighth edition, PHI, 2004.
6. A Monograph on Electronic Design Principles by N. C. Goyal and R. K. Khetan, Khanna Publishers, 2013.

IN 204 ANALOG CIRCUITS AND ANALYSIS LAB

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

Course Description:

In this laboratory course emphasis is on imparting the practical knowledge and understanding of basic principles, characteristic, 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.

Minimum Ten experiments shall be performed to cover entire curriculum of course IN201. The list given below is just a guideline.

List of Experiment:

1. Plot characteristics of JFET and MOSFET.
2. Design and implement clipping circuits.
3. Design and implement clamping circuits.
4. Design and implement voltage multiplier circuits.
5. Design and implement half wave rectifier.
6. Design and implement full wave rectifier.
7. Plot frequency response of two-stage RC coupled amplifier.
8. Design and implement Hartley oscillator and Colpitt's oscillator.
9. Design and implementation of Astable multivibrator and Monostable multivibrator.
10. Design and implement class AB push-pull power amplifier.
11. Analyze the performance of emitter follower/Darlington emitter follower.

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

IN202 MEASUREMENT FUNDAMENTALS

Teaching Scheme: 03L Total: 03 **Credits:** 03
Evaluation Scheme: 10 ISA + 15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

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. Familiarize with different measurement techniques.
2. Understand the operation of instruments in the electrical and electronic engineering applications.
3. Gain proficiency in the use of common measuring instruments.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. understand the concept of measurement system.
2. apply and design analog measuring devices
3. identify, formulate and solve a problem of electrical and electronic measurement.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**3**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**2**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Introduction Measurement System

Definition of measurement, working of measurement system/Instrument, classification of instruments, static and dynamic characteristics of instruments, dead zone, hysteresis, threshold, resolution, input and output impedance, loading effects, calibration of instruments, traceability, types of errors and their remedies, statistical treatment of experimental data, system accuracy calculation, comparison of analog and digital instruments, instrument specifications, terminology as per ISA standards, standards for time, current, voltage, frequency etc.

Measuring Instruments

DC instruments: galvanometer, PMMC instruments and its characteristics, design and operation of multi-range ammeter, voltmeter, ohm meters, megger.

AC instruments: moving iron type, electrodynamometer type, phase and line frequency meter, wattmeter, energy meter, current transformer, potential transformer

Bridge Circuits

DC bridges: Wheatstone bridge and Kelvin bridge, 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, Heys bridge, Schering bridge, Wein bridge, measurement of storage and dissipation factor, applications of ac bridges.

Potentiometers and Recorders

Potentiometers: principle, calibration, sensitivity of potentiometer. self balancing potentiometer, multi-range potentiometer, applications of potentiometer.

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.

Oscilloscope

General purpose cathode ray oscilloscope (CRO), cathode ray tube block diagram, front panel controls, measurement of amplitude, phase, frequency, time, duration, rise and fall time. z-modulation, dual beam and dual trace oscilloscope, X-Y mode, sampling oscilloscope, analog storage oscilloscope, digital storage oscilloscope and its applications, CRO probes.

Text Books

1. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, 11th edition, Publication Dhanpat Rai and Sons, 1997.
2. Modern Electronic Instrumentation and Measurement Techniques by Helfrick and Cooper, Publisher-Pearson, 1990.

Reference Books

1. Electronics Instruments and Measurements by Jones and Chin, Tata McGraw Hill. 1987.
2. Electronic Instrumentation by Kalsi H. S. 2nd Edition, Tata McGraw Hill, 2004.
3. Electronic Instrumentation and Measurements by David Bell, 2nd Edition, Prentice hall India, 2003.

IN205 MEASUREMENT FUNDAMENTALS 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.

Minimum Ten experiments shall be performed to cover entire curriculum of course IN202. The list given below is just a guideline

List of Experiment:

1. Design of multi-range ammeter.
2. Design of multi-range voltmeter.
3. Design of series type ohmmeter.
4. Design of shunt type ohmmeter.
5. Design of Wheat stones bridge.
6. Measurement of low resistance using Kelvin double Bridge
7. Measurement of capacitance using Schering Bridge.
8. Measurement of frequency using Wein Bridge
9. Voltage and frequency and phase measurement on CRO using lissajous pattern.
10. Study of recorders.
11. Measurement of energy using energy meter
12. Power measurement using wattmeter

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

IN203 COMPUTATIONAL METHODS AND PROGRAMMING

Teaching Scheme: 03L Total: 03 **Credits:** 04
Evaluation Scheme: 10 ISA + 15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Course Description:

This course provides knowledge about numerical methods and their use in engineering with number system computations, polynomial equations, concept of roots of an equation etc.

Course Objectives:

1. To familiarize with number system in computations, polynomial equations.
2. Concept of roots of an equation and methods to find the same.
3. To study various differentiation and integration methods.
4. To understand the trade off between programming ease, computational time, data storage, truncation and round off errors.

Course Outcomes:

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

1. apply numerical methods to solve polynomial and transcendental equations,
2. solve linear algebraic equations, simultaneous equations.
3. solve Interpolate by Lagrange's and Newton methods.
4. solve different differentiation and integration methods.
5. solve ordinary differential equations by using Euler's method, Runge-Kutta method, Taylor's Method, Predictor - Corrector method etc.
6. develop computer program for higher studies in system optimizations.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**2**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**2**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**3**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Computer Arithmetic

Floating point representation, arithmetic operation with normalized floating point numbers, inherent errors, absolute and relative error, solution of simultaneous algebraic equation, Gauss elimination method, Iterative methods, their convergence, three conditions equation, decomposition methods.

Interpolation

Lagrange's Interpolation, difference table, Newton's interpolation, iterated linear interpolation technique, solution of nonlinear equations, bisection method, false position method, Newton raphson method and method of successive approximation.

Numerical Integration

Trapezoidal mile, Simpson's 1/3 and 3/8 rule, Romberg integration, Newton's cote's integration formula, error in false formulae, simplex method (graphical and numerical)

Solution of Ordinary Differential Equation

Taylor series method, Picard's method, Euler method, Runga-Kutta second order method, Runga-Kutta fourth order method, predictor corrector method numerical solution of partial differential equation, finite difference, approximation to derivative, Laplace equation, iterative methods for the solution of equation.

Least Square Approximation of Functions

Linear regression, polynomial regression, fitting exponential and trigonometric function, data fitting with cubic splines, approximation of function.

Numerical Solution of Integral Equation

Finite difference method, Chebyshev series method, method using generalized quadrature, method for degenerate kernels.

Text Books

1. Computer Oriented Numerical Method by V.Rajaraman, Prentice Hall of India, 2004.
2. Numerical Methods for Engineers by Steven C. Chapra and Raymond P. Canale, Mc-Graw-Hill Publications, 1988.

Reference Books

1. Introduction to numerical methods and FORTRAN programming by Thomas Rechard Mecalla, Wiley International Edition, 1964.
2. Introductory Methods of Numerical Analysis by S. S. Shastry, Prentice Hall of India, 1984.
3. Numerical Methods In Engineering and Science by B. S. Grewal, Khanna Publishers, 1999.

IN 206 COMPUTATIONAL METHODS AND PROGRAMMING LAB

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

Course Description:

In this laboratory, course emphasis on imparting the practical knowledge and understanding of numerical methods and simulate the methods.

Minimum Ten experiments shall be performed to cover entire curriculum of course IN203. The list given below is just a guideline.

List of experiments:

1. To find out the roots of the given polynomial by using Bisection method.
2. To find out the roots of the given polynomial by using false position method.
3. To find out the integration by using Trapezoidal method.
4. To solve the differential equation by using Runga kutta second order and forth order method.
5. To solve the differential equation by using Euler's method.
6. To find out the roots by using Newton-Raphson method.
7. To find out the integral by using Simpson's 1/3 rule and 3/8 rule.
8. To plot the straight line to the given data by using Simplex method.
9. To find out the optimal solution by using Least squares method.
10. To solve the differential equation by using Adam's Bashforth predictor and corrector method.

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

SH 204 GENERAL PROFICEINCY-II

Teaching Schemes: 01 L + 02PR; Total: 03 **Credits:** 02
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 50

Course Description:

This course is mainly designed to inculcate human skills among students community. It includes both soft skill development and human behavior at work. The student will learn the speaking, listening, drafting and presentation skills. Student will study the organization of meeting, GD/PI principles, general etiquettes & manners and organizational communication. This course will help to develop thinking ability, positive attitude, leadership ability, emotional competence and to perform well under varied circumstances.

Desirable awareness/skills:

Basic principles of communication and English as a language.

Course Objectives:

The objectives of offering this course are
1. to strengthen the persona of student.
2. to learn use of concepts and applications of ICT based presentation skills.
3. to sharpen the soft skills to enhance employability.

Course Outcomes:

On successful completion of this course; student shall be able to
1. apply basic knowledge of public speaking, listening and presentation skills
2. draft a document and write a technical/non-technical report.
3. demonstrate good etiquettes and manners in his/her life and face GD/PI confidently.
4. understand the organizational human behavior
5. use ICT based presentation.

Relevance of PO's and strength of co-relation:

Sr No	PO	Level of co-relation
g	Participate and succeed in competitive examinations and engage in life-long learning.	2
h	Communicate effectively and work in multidisciplinary teams	3
j	Follow industrial safety norms and work to benefit environmental and societal context.	2

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

Course Content

Organizational Communication:

Overview: Meaning, definition, classification, purpose and importance of communication; communication structure in organization, communication in conflict, crisis and cross-cultural setting; oral communication, reflection and empathy: two sides of effective oral communication; general etiquettes and manners; significance of body language in communication and assertiveness training.

Written Communication: Purpose of writing, clarity in writing, principles of effective writing, the 3x3 writing process for business communication, pre writing, writing, revising, specific writing features – coherence; technical report writing (IEEE standards).

Business Letters and Reports: Types of business letters, writing routine and persuasive letters, positive and negative messages; writing reports - purpose, kinds and objectives of reports; organization and preparing reports, short and long reports; writing proposals: structure & preparation; writing memos.

Group Communication: Meetings- planning, objectives, participants, timing, venue of meetings; meeting documentation: notice, agenda, agenda notes, book of enclosures and resolution & minutes of meeting.

Presentation skills: Elements of presentation – designing and delivering business presentations, advanced technological support for presentation, computer based power point presentation.

Employment communication: Introduction, Composing Application, Writing CVs, Group discussions, Interview skills, do's and don'ts at GD/PI; technology-enabled communication - communication networks, intranet, internet, videoconferencing.

Organizational Behavior

Overview: Definition, historical development, fundamental principles of OB, contributing disciplines, challenges and opportunities.

Individual Behavior: Foundations of individual behavior. Ability: Intellectual abilities, Physical ability, the role of disabilities.

Personality: Meaning, formation, determinants, traits of personality, big five and MBTI, personality attributes influencing OB.

Attitude and Perception: Formation and components of attitudes, positive attitude, impact of attitude on behavior and decision making**.** Process of perception, factors influencing perception, link between perception and individual behavior/decision making.

Emotions: Affect, mood and emotion and their significance, basic emotions, emotional intelligence, emotional quotient, emotion management at individual and group level.

Motivation: Meaning and significance; theories of motivation-needs theory, two factor theory; application of motivational theories.

Leadership: Meaning, functions and styles of leadership; leadership theories - trait theory, behavioral theories, , path goal theory, charismatic leadership theory, situational theories-Fiedler's model; transactional and transformation leadership.

Group Behavior: Definition, types, formation of groups, building effective teams; conflict**:** meaning, nature, types, process of conflict, conflict resolution.

Topics for Assignment /Practical

Minimum ten number of assignments/practical shall be performed to cover entire curriculum of the course. The list given below is just a guideline.

1. Speech preparation and delivery.
2. Power point presentation on general topics/ latest trends
3. Preparation of meeting agenda/ conducting meeting / taking minutes of meeting
4. Demonstration of general etiquettes and manners through role playing.
5. Demonstration of attitude/leadership etc through role playing.
6. Conducting mock meeting and preparing related documents.
7. Writing application letter along with resume
8. Reporting positive and negative information to seniors
9. Preparing notice/ circular/ memo/ enquiries/ quotations
10. Conducting group discussions and personnel interview
11. Report writing/Paper presentation.
12. Drafting policies/ procedures/ rules
13. Sharing experience to motivate others or to demonstrate mood /emotion and their significance.
14. Determination of emotion quotient/Intelligent quotient and personality analysis.

Text Books:

1. Business Communication for Managers, Penrose, Rasberry, Myers, 5th edition, Cenage Learning, 2007.
2. Business Communication, Rai and Rai, 2nd edition, Himalaya Publishing House, 2014.
3. Organization Behavior, Suja R. Nair, Himalaya Publications, 2014.
4. Organization Behavior, V. S. P. Rao, 1st edition, Excel Publications, 2009.

Reference Books:

1. Business Communication, Raman and Singh, 2nd edition, Oxford Publication, 2012.
2. Business Communication Today, Bovee, Thill, 6th edition, Schatzman, Pearson Education, 2000.
3. Business Communication (BCOM), Lehman Sinha, 2nd edition, Cengage Learning, 2012.
4. Organization Behavior, Stephen P. Robbins, 13th edition, Pearson Education, 2009.
5. Organization Behavior, Fred Luthans, 12th edition, TMH, 2012.
6. Organization Behavior, K. Ashwathappa, 7th edition, Himalaya Publications, 2007.

Note:

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

ESE – The End Semester Exam for this course shall be based on one or more parameters among performance/oral examination/assignment etc to judge the skills acquired by student. It shall be evaluated by two examiners out of which one examiner shall be out of institute.

IN251 AUTOMATIC CONTROL SYSTEM

Teaching Scheme: 03L+ 01T Total: 04 **Credits:** 04
Evaluation Scheme: 10 ISA +15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Course Description:

This course is about control systems and their classifications. It helps student to understand the concepts, operation, and performance of feedback control systems. It is also helpful in the study of technological aspects such as stability of control systems, frequency domain analysis and time domain analysis.

Course Objectives:

1. Understand basic concepts, operation and performance of feedback control systems.
2. Design mathematical model of a system and simplify it.
3. Study and analysis of control systems in time and frequency domain.
4. Conduct stability analysis and apply compensators to control System.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. understand control system concept, basic control configurations and types of control systems.
2. review of Laplace transform and learn how to find mathematical model of system.
3. perform Time domain analysis of control systems and able to get knowledge about stability of control systems.
4. analyse frequency response analysis of control systems.
5. apply and design compensators
6. demonstrate proficiency in programming language related to basic control concepts.

Relevance of Pos and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	2
c	Apply concepts of control system and automatic control for the operation of continuous and discrete systems.	3
f	Use modern engineering tools, software and equipments to design and analyze problems.	2
g	Participate and succeed in competitive examinations and engage in life-long learning.	1
i	Model and simulate the automatic control system	3

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

Course Content

Introduction to Control System

Open loop and closed loop control system, types of feedback control systems-linear v/s non linear systems. Time invariant v/s time varying, effect of feedback on gain, sensitivity, noise, modelling of dynamic systems (mechanical, electrical, electromechanical systems), analogous systems, force-voltage, force-current and torque- current analogies, transfer function and impulse response, MIMO and SISO systems, block diagram reduction techniques, signal flow graphs, Mason's gain formula, application of gain formula to block diagrams.

Time Domain Analysis

Standard test signals, transient response, steady state error and error constants, dynamic error series, time response of first and second order systems and transient response specifications, effect of adding poles and zeros to transfer functions, dominant poles of transfer function, basic control actions and response of control systems, effects of integral and derivative control action on system, time delay systems.

Stability of Linear Control System

Concept of stability, BIBO stability: condition, zero input and asymptotic stability, methods of determining stability of linear control systems, Routh-Hurwitz criterion, relative stability analysis.

The Root–Locus technique

Introduction, basic properties of the root loci, rules for construction of the root loci, root- locus analysis of control systems, root loci for systems with pure time delays, root-contour plots, sensitivity of the roots of the characteristics equation.

Frequency Domain Analysis

Frequency response of closed loop systems, frequency domain specifications of the prototype second order system, correlation between time and frequency response, effect of adding a pole and a zero to the forward path transfer function, polar plots, Bode plots, phase and gain margin, stability analysis with Bode plot, Log magnitude versus Phase plots, constant M and N circles, Nichols chart, gain adjustments, sensitivity analysis in frequency domain, Nyquist stability criterion, mathematical preliminaries, stability and relative stability analysis.

Compensators

Introduction, different types of compensators (electrical, electronic and mechanical type), their transfer functions, bode plots and polar plots, design of lead, lag, lead-lag compensator using root locus and Bode diagrams.

Text Books:

1. Automatic control systems by Benjamin C. Kuo, Fifth Edition, Prentice-Hall of India.1987
2. Control Systems Engineering by I.J. Nagrath and M. Gopal Third Edition, New age International Publishers, India, 2001.

Reference Books:

1. Control Systems: Principles And Design by M. Gopal, 2nd edition Tata MC-Graw-Hill.2002
2. Modern control engineering by K. Ogata, 3rd edition, PHI,1997
3. Control Systems Engineering by Norman S. Nise, Third Edition, John Wiley and Sons.Inc, Singapore, 2001.
4. Modern Control Systems by R. C. Dorf and R.H. Bishop, Eighth edition, Addison-Wesley, 1999.

IN258 AUTOMATIC CONTROL SYSTEM LAB

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

Minimum Ten experiments shall be performed to cover entire curriculum of course IN251.
The list given below is just a guideline.

List of Experiment

1. Study of multivariable control system.
2. Analysis of second order (R-L-C) system in time domain.
3. Verify the second order (R-L-C) using MATLAB and Simulink.
4. Charecteristics of type 0 and type 1 system.
5. Verify type 0, type 1, type 2 system using MATLAB and Simulink.
6. To find the transfer function of unknown system (electrical network).
7. Write a program to find Routh table and comment on its stability in MATLAB.
8. Draw root locus in using basic commands MATLAB.
9. Draw bode plot using basic commands in MATLAB.
10. Draw Nyquist plot using basic command in MATLAB.
11. Understand root locus tool for synthesis in MATLAB.
12. Find Laplace transform and inverse using MATLAB.
13. For the azimuth position control use MATLAB to obtain angular velocity response to step voltage input.

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 252 SIGNALS AND SYSTEMS

Teaching Scheme: 03L+ 01T Total: 04 **Credits:** 04
Evaluation Scheme: 10 ISA +15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Course Description:

The course is designed to provide the fundamental concepts in signals and systems. It covers applications of these fundamentals for designing, filtering, sampling, communications and feedback systems analysis. It also focuses mathematical transformations used in signal analysis.

Course Objectives:

1. To introduce the idea of signal and system analysis and characterization in time and frequency domain.
2. To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. understand significance of signals and systems in the time and frequency domains.
2. interpret and analyze signal and report results.
3. evaluate the time and frequency response of continuous and discrete time system, which is useful in understanding behaviour of communication and control systems.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**1**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**2**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Introduction to Signals and System

Definition of signal, basic operations on signal such as addition, multiplication, time scaling, time shifting, folding, and amplitude scaling, continuous time and discrete time signals, various classifications of signal as energy and power, causal and anti causal signals. The discrete-time unit impulse and unit step sequences, classification of system as static and dynamic, time invariant and time variant, linear and non linear, causal and non causal stable and unstable.

Linear Time Invariant Systems

Properties of LTI Systems (commutative, distributive, associative properties, causality, stability), the unit step response of an LTI system, LTI systems described by differential and the difference equations, convolution sum and convolution integral representation, block diagram representations, singularity functions, Fourier series representation of continuous-time and discrete time periodic signals, convergence of the Fourier series, properties of discrete-time and continuous-time Fourier series, Fourier series and LTI systems.

Fourier Transform

Representation of continuous time aperiodic signals and continuous time Fourier transform, the Fourier transform for periodic signals, properties of continuous time Fourier transform, Fourier transform and LTI systems, representation of discrete time aperiodic signals and the discrete-time Fourier transform, properties of the discrete-time Fourier transform, discrete-time LTI systems and discrete-time Fourier transform.

Analysis of Signals and Systems

The magnitude and phase representation of the Fourier transform, the magnitude and phase representation of the frequency response of LTI systems, time domain properties of frequency, first order and second order continuous-time and discrete time systems, time and frequency domain analysis of systems, sampling: representation of a continuous time signal by its samples, the sampling theorem, reconstruction of signals from its samples using interpolation, effect of under sampling (frequency domain aliasing), discrete time processing of continuous time signals.

Tools For Analysis of Signal And Systems

Laplace Transform: Introduction, region of convergence for Laplace transform, properties of Laplace transform, and analysis and characterization of LTI systems using the Laplace transform, the unilateral Laplace transform, solution of differential equations using the unilateral Laplace transform.

Z transform: Introduction, region of convergence for the Z transform, properties of Z transform, analysis and characterization of discrete time, LTI systems using Z transform.

Text Books:

1. Signals and Systems by Oppenhelm, Wilsky and Nawab, Pearson Education, 2nd edition, 2002.
2. Signals and Systems by I. J. Nagrath, 1st Edition, TMH, 2000.

Reference Books:

1. Signals and Systems, by S. P. Xavier, 2nd Edition, S. Chand and Co., 1998.
2. Signals and Systems by J.B. Gurung, 1st Edition, PHI, 2009.
3. Signals Processing by Reddy and Prasad, TMH, Vol. II, 1994
4. Principles of Signals and Systems by Taylor, McGraw Hill, 1994.
5. Signals and Systems by Haykin, Simon, John Wiley, New York, 1978.
6. Signals Processing and Linear Systems by Lathi B. P.,Oxford University Press, 2003.

7. Introduction to Signals and Systems byDouglas K. Lindner, TMH, 1999.
8. Signals and Systems-Continuous and Discrete by Rodger E. Ziemer, William H. Tranter, Pearson Education, 4th Edition, 2002.

IN253 ELECTRONICS INSTRUMENTATION

Teaching Scheme: 03L Total: 03 **Credits:** 03
Evaluation Scheme: 10 ISA + 15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

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.

Course Outcomes:

Upon successful completion of this course the students will be able to

1. comprehend advanced electronic measuring and testing instruments.
2. apply the principles and practices for instrument design and development to real world problems.
3. able to identify, formulate and solve a problem of electronic instruments.

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**2**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**3**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**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)

Analog and Digital Instruments

Analog instruments: Q meter, LCR bridge, RX meter.

Digital instruments: digital voltmeters, digital multimeters, digital frequency meter, digital Measurement of time, universal counter, electronic counter, sources of errors in electronic counters, automation in digital instruments, microprocessor based instruments, digital instruments with GPIB interface, virtual Instruments, data logger.

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.

IN257 ELECTRONICS INSTRUMENTATION LAB

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

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. Study and application of universal counter
7. Study of arbitrary waveform generator
8. Study of RLC Q meter
9. Study of distortion analyser/logic analyzer/network analyzer.
10. Study of logic analyzer.
11. Study of spectrum analyzer.

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.

IN254 SENSORS AND TRANSDUCERS

Teaching Scheme: 03LTotal: 03 **Credits:** 03
Evaluation Scheme: 10 ISA +15 ISE1 +15 ISE2 + 60 ESE **Total Marks:** 100
Duration of ESE: 03Hrs

Course Description:

This course provides details of construction principle, working and applications about sensors and transducers for measurement of different parameters such as pressure, temperature, level, flow, humidity, density, pH etc.

Course Objectives:

1. Understand the principles of different types of transducers.
2. Appreciate the selection criterion of transducers and apply it for the given application

Course Outcomes:

Upon successful completion of this course the students will be able to

1. understand the principals of different sensors and transducers.
2. appreciate the characteristics of transducers.
3. identify different sensors and transducers required and able to apply them.

Relevance of Pos and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	2
b	Identify different sensors and transducers required and able to apply them.	3
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	1
g	Participate and succeed in competitive examinations and engage in life-long learning.	1
h	Communicate effectively and work in multidisciplinary teams	1

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

Course Content

Transducers

Definition of transducer, sensor, calibration, range and span. classification: active, passive, primary, secondary, mechanical, electronic, analog and digital transducers, selection criteria, sources of errors and their analysis, characteristics of transducers.

Displacement measurement: potentiometers, strain gauges, LVDT and eddy current type transducers, magnetic pickups capacitive pickups, differential capacitive cells, piezoelectric, ultrasonic transducers and hall effect transducers, optical transducers, encoders, photoelectric pickups.

Force, Torque and Acceleration Measurement

Force and weight: basic methods of force measurement, elastic force traducers, strain gauge, load cells, shear web, piezoelectric force transducers, vibrating wire force transducers

Vibration and acceleration measurement: eddy current type, piezoelectric type, seismic type, jerk meter

Torque measurement: strain gages, feedback torque sensors, torsion bar dynamometer, etc. shaft power: dynamometer (servo control and absorption) instantaneous power measurement and alternator power measurement, tachometers.

Temperature Measurement

Temperature scales, classification of temperature sensors, bimetallic strip, metal expansion type, mercury in glass, liquid thermometer, vapor pressure, RTD: types- pt100, cu60, 2 wire, 3wire and 4 wire, bare and industrial RTD, lead wire compensation, self-heating effect, thermistors: types: NTC, PTC, thermocouples: terminology, types (J, K, E, R, S, T) and characteristics, laws of thermoelectricity, thermocouple tables, cold junction compensation methods, change of table reference construction and protection, thermowell, thermopile, semiconductor temperature sensors: diode and IC temp sensors. ultrasonic temp detector, quartz crystal temp, detector, radiation: pyrometers (total and radiation), infrared sensors. fiber optic thermometer.

.

Level and Flow Measurement

Level transducers: for liquid and solids- float type displacer, air plug method, diaphragm box level gauge. DP cell, load cell, bicolor direct reading, vibrating, ultrasonic, radioactive transducers, reed switches, microwave sensors.

Flow transducer: basic measurement principle, bernoulli's theorem, differential pressure type (orifice, venturi, pitot tube and nozzle), variable area type, target type, magnetic, ultrasonic vortex shedding, cross co-relation, positive displacement type, mass flow meter, anemometer, total flow meter.

Pressure and Viscosity Measurement

Pressure transducer: pressure scale and standards, manometer, elastic (bellows, bourdon tube, diaphragm) type, dead weight and vaccum gauge, testers, electrical pressure sensors (LVDT, strain gauge, load cell, piezo- electric, capacitive), tuning fork type, differential sensors (capacitive, force balance and vibrating cylinder type). vacuum pressure measurement- mcleod gauge, thermal conducting and ionization type, transducers for very high pressure measurement,

Viscosity and density measurement: capillary type, shearle's rotating cylinder, cone and plate, falling and rolling ball type viscometers, gravity meters, buoyancy type, DP cell type and electrical density sensors.

pH, Conductivity and Humidity Measurement

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 bridges-their 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. Transducers and Instrumentation, Murthy, D.V.S., Prentice Hall of India Pvt. Ltd PHI Second Reprint 1995.
2. Instrumentation Measurements and Analysisby by B. C. Nakra and K.K.Choudhari, Tata McGraw Hill Education, 2nd ed., 2004.
3. Sensors and Transducers, Patranabis, D Tata McGrawhill-7th Reprint, 1986.

Reference Books

1. Principles of Measurement Systems by Bentley J.P, Third Edition, Pearson Education Asia pvt.ltd.2000
2. Measurement Systems ,by Doebelin, E.O., McGraw Hill Book Co. 1998
3. Instrument Transducers by Neubert, H.K.P, Clarenden Press, Oxford. 1988.
4. Mechanical and Industrial Measurement by R. K. Jain Khanna Publishers, New Delhi, 1999.
5. A Course in Electrical and Electronic Measurements and Instrumentation by A.K. Sawhney, 11th edition, Publication Dhanpat Rai and Sons,1997
6. The Measurement, Instrumentation, and Sensors Handbook by John G. Webster, Springer, 1999
7. Instrumentation Devices and Systems - Rangan C S, Sharma G R, Mani V S N - TMH, New Delhi, 1983

IN259 SENSORS AND TRANSDUCERS

Teaching Scheme: 2P Total: 02 **Credit:** 01
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks:** 50
Duration of ESE: 03Hrs

Minimum Ten experiments shall be performed to cover entire curriculum of course IN254. The list given below is just a guideline.

List of Experiments

1. Characterization of Displacement measurement system. (Strain Gauges and LVDT)
2. Characterization of Vibration measurement system. (Piezo-resistive Vibration Pick-up).
3. Characterization of Speed measurement system. (Photoelectric and Magnetic Pick-up).
4. Characterization of Flow measurement system. (Orifice, Venturi and Rotameter).
5. Characterization of Temperature measurement system. (Thermocouple and RTD).
6. Characterization of Level measurement system. (Capacitive, resistive, Air purge).
7. Characterization of Sound measurement system.
8. Calibration of Pressure Gauges using Dead Weight Tester.
9. Calibration of Vacuum Gauges using Vacuum Gauge Tester.
10. Characterization of pressure measurement system.
11. Characterization of Humidity Sensor
12. 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

IN255 DIGITAL CIRCUITS DESIGN

Teaching scheme: 03 Total: 03 **Credits:** 03
Evaluation Scheme: 10 ISA + 15 ISE1 + 15 ISE2 +60 ESE **Total Marks:** 100
Duration of ESE: 03 Hrs

Course Description:

This course provides knowledge about number systems, digital circuits, combination logic design, sequential logic design, different converter circuits and different digital storage device such as ROM, RAM, EPROM, EEPROM, and CAM.

Course Objective:

1. Grasp the principles of design of combinational logic circuits.
2. Grasp the principles of design of sequential logic circuits.
3. Study different logic families.

Course Outcomes:

Upon successful completion of this course the students will be able to

1. understand the conversion of different number system.
2. analyze digital signals and different digital circuits.
3. analyze the characteristics of different digital ICs.
4. understand the different types of codes and code convertor circuit.
5. compare of digital logic families such as RTL, TTL, DCTL, DTL, PMOS and CMOS.
6. design DAC and ADC circuits

Relevance of PO's and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
a	Demonstrates basic knowledge in concepts of Science, mathematics and electrical / electronics to measurement and control systems.	**2**
d	Apply the concepts of digital, analog electronics, microprocessor systems and functionality of system components/devices for the automation of processes.	**3**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**2**
g	Participate and succeed in competitive examinations and engage in life-long learning.	**1**

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

Course Content

Number System And Fundamental Concepts of Digital Circuits

Number system: different types of number system like binary octal, decimal and hexadecimal, signed binary numbers, conversion methods of one type number system to another type, fundamental concepts: digital circuits.(AND,OR,NOT,NOR,NAND and Exclusive-OR operation), different types of codes – binary code, gray code, BCD code, Excess- 3 code, Hamming code, ASCII code, comparison of digital logic families such as RTL, DCTL, DTL, HTL, TTL, PMOS and CMOS causes, boolean algebra laws.

Combinational Logic Design

Standard representation for logical function, SOP and POS form, min-term and max-term, simplification of logical function specified in min-term and max-term or along with don't care condition using K-map, design examples such as half and full adder ,half and full subtractor, BCD to seven segment decoder.

Combinational Logic Design Using MSI Circuits

Multiplexer and demultiplexer operations, adder and digital comparator circuits, parity generator /checkers, code convertors BCD to binary, binary to BCD, BCD to Excess-3, binary to gray.

Sequential Logic Design

1 Bit memory cell, clocked S-R flip-flop, master slave J-K flip flop, D and T types of flip flops, excitation tables of flip flop, conversion of one type of flip flop into another type, registers, classifications, shift registers, counters, synchronous, asynchronous analysis of clocked sequential circuits, state table, state diagram, next state equation and state reduction.

Convertor Circuits And Digital Storage Devices

Digital to analog converter, weighted register D/A converter, R/2R ladder D/A converter, analog to digital converter, parallel comparator, A/D converter, successive approximation A/D converter, dual slope A/D converter, digital storage devices such as ROM, RAM, EPROM, EEPROM, CAM (content addressable memory), CCD, ROM as PLD and PLA, PAL, field programmable gate arrays (FPGA), ERA (Electrically reconfigurable arrays).

Text Books

1. Modern Digital Electronics by R. P. Jain, 3rd edition, TMH, 2003.
2. Digital Principles and Applications by Malvino and Leach, TMH, 1995.
3. Digital Logic and Computer Design by Morris Mano, PHI.1979.

Reference Books

1. Digital Logic and Microprocessor by Hill and Peterson, John Wiley and Sons, 1984.

IN260 DIGITAL CIRCUIT LAB

Teaching scheme: 02 L; Total:02 **Credits:** 01

Evaluation Scheme: 25 ICA + 25 ESE **Total Marks:** 100

Duration of ESE: 03 Hrs

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

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)

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 256 PROGRAMMING IN MATLAB

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

Relevance of Pos and strength of co-relation:

Po No.	Programme Outcome	strength of co-relation
c	Apply concepts of control system and automatic control for the operation of continuous and discrete systems.	**2**
e	Understand and utilize programmable logic controllers (PLC), distributed control systems (DCS) and supervisory control systems for control of manufacturing and processing systems	**1**
f	Use modern engineering tools, software and equipments to design and analyze problems.	**3**
i	Model and simulate the automatic control system	**2**

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

Content

Introduction to MATLAB

Starting and ending MATLAB session MATLAB environment, command window, command history window, workspace current directory, edit window, figure window, help feature, help browser, help command, look for command types of files, m-files, script files, function files, mat files, mex files, platform, search path, some basic MATLAB commands such as cd, dir, mkdir etc. data types, constants, variables, operators, hirarchy of operations built in functions. some basic programs e.g conversion to convert temperature from 0c to 0f and vice versa, sum of series.

Vectors, Matrices and Polynomials

Scalars and vectors, assigning data to elements of a vector and scalar, vector product, vector transpose, creation of evenly spaced row vectors some useful commands entering data in matrices, line continuation, matrix subscripts, indices, sub-matrices, sub-arrays, multi-dimensional matrices and arrays matrix manipulations, generation of special matrices, some useful commands related to matrices, matrix and array operations, structure arrays, cell arrays. polynomials, entering a polynomial, polynomial evaluation, arithmetic operations on polynomial, formulation of polynomial equation characteristic polynomial of a matrix, polynomial differentiation, polynomial integration, polynomial curve fitting.

Input- Output Statements and MATLAB Graphics

Data input, interactive inputs, reading and sorting file data, output commands low level input output functions, file opening and closing functions, formatted input output functions, binary input output functions. MATLAB graphics, two dimensional plots, multiple plots, style options, legend command subplots, specialized two dimensional plots, three dimensional plots

Control Structures, Writing Programs and Functions

Loops, for loop, nested for loop, while loop branches control structures, if control structure, switch statement, break statement, continue statement, error statement, try-catch structure MATLAB editor, MATLAB programming, function sub programs, some illustrative examples types of functions, function handles, errors and warnings, MATLAB debugger

Ordinary Differential Equations And Simulink Basics

Ordinary differential equations solver, symbolic mathematics, study of ode solvers, study of commands. starting simulink, opening simulink model, simulink modeling, collecting blocks to create model, modifying block parameters, labeling blocks, collecting blocks, labelling single lines, saving the model. solvers, fixed step solvers, variable step solvers simulating a model, using variables from MATLAB, data import/ export, creating subsystem, creating masked subsystem getting help for simulink.

Text Books:

1. Programming in MATLAB by K. V. Krishnamurthy and S. K. Sen, East West Press.2003
2. Programming in MATLAB by M. E. Herniter, Thomson Brooks.2001

Reference Books:

1. Getting Started with MATLAB 7 A quick introduction for scientists and engineers, by R. Pratap, Oxford University Press.2009

2. MATLAB and its Applications in Engineering by R. K. Bansal, A. K. Goel, M. K. Sharma , Pearson Education.2012
3. MATLAB Programming, Y.K. Singh and B.B. Chaudhari, PHI, New Delhi,(2007).

Minimum ten experiments shall be performed to cover entire curriculum of course IN256. The list given below is just a guideline.

1. For given matrix write MATLAB statements to obtain all elements of all rows but first column, all elements of first row but all columns, elements in the second row and third column.
2. Create a n × n matrix of random numbers, multiply all elements by 10 and then round off all the elements to integers using appropriate commands.
3. Write a program to fit the polynomial of degree 2 and degree 3.
4. Write a MATLAB program to copy the data from one file to another file.
5. Write a program to illustrate how menu can be created using MATLAB.
6. Write a program to plot the curve for equation.
7. Assume suitable data and draw the following 2-D plots:
   a. Semilogx b. Loglog c. Bar d. Stem
8. Write a function that returns 1 if its argument is a prime number and returns 0 otherwise. Test for the numbers less than 100.
9. Obtain the solution of the following differential equation for the interval t=0 to 2 using MATLAB.
10. Draw the block diagram and obtain the system response using Simulink.
11. Write MATLAB Program using While loop.
12. Write MATLAB Program using nested for loop.

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).