NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Teacher, Paper Setter & Examiner Manual

for

Second Year Instrumentation Engineering

Faculty of Engineering and Technology

SEMESTER – III and IV

W.E.F 2013 – 2014

Engineering Mathematics-III

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit – I

Teacher should facilitate learning of linear differential equations:

Liner differential equation		**Lectures required**	**Reference No**
a	Solution of LDE of order n with constant coefficients	02	1,3,6
b	Method of variation of parameters (Only Second Order)	02	1,3,6
c	Cauchy's linear equation.	02	1,3,6
d	Legendre's linear equation.	02	1,3,6
e	Applications of Linear differential equations to electrical circuits.	01	1,3,6
Guidelines for the examiner and paper setter. 1) No question should be asked on introductory part			

Unit – II

Teacher should facilitate learning of Function of Complex Variable

Function of Complex Variable		**Lectures required**	**Reference No**
b	Analytic Functions, Cauchy-Riemann equations.	03	1,6
c	Cauchy's Integral theorem and Cauchy's Integral Formula (without proof).	02	1,6
d	Cauchy's Residue theorem (Without proof)	02	1,6
e	Conformal mapping, Bilinear transformations.	02	1,6
Guidelines for the examiner and paper setter. 1. No theoretical questions from analytical function or C-R equation should be asked. 2. Questions from conformal mapping restricted to bilinear transformation only should be asked.			

UNIT III

Teacher should facilitate learning of Laplace Transform.

Laplace Transform		**Lectures required**	**Reference No**
a	Definition and Existence of Laplace transforms.	01	1,3,5,6
b	Laplace Transform of elementary/standard functions.	02	1,3,5,6
c	LT of some special Functions viz., error, Periodic, Unit step, unit Impulse.	01	1,3,5,6
d	Theorems & Properties of Laplace Transform (without proof).	01	1,3,5,6
e	Inverse Laplace Transform.	01	1,3,5,6
f	Applications of LT for Network Analysis	01	1,3,5,6
g	Applications of LT to solution of linear differential equation.	01	1,3,5,6
Guidelines for the examiner and paper setter. 1) Questions from application of LT to solution of linear differential equation should be restricted to second order.			

Unit – IV

Teacher should facilitate learning of Fourier Transform and Z-Transform.

Fourier Transform and Z-Transform		**Lectures required**	**Reference No**
a	**Fourier Transform**: Introduction to Fourier Integral theorem.	01	2,4,6
b	Fourier Transforms, Fourier Cosine Transforms, Fourier Sine Transform and their inverse	03	2,4,6
c	**Z-Transform**: Definition and standard properties (without proof)	01	2,4,6
d	Region of Convergence.	01	2,4,6
e	Z-Transform of standard /elementary sequences.	01	2,4,6
f	Inverse Z-transform.	01	2,4,6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part.			

Unit – V

Teacher should facilitate learning of Vector Calculus and its applications

Vector Calculus and its applications		**Lectures required**	**Reference No**
a	Introduction to Gradient, Divergence, Curl, Solenoid and Irrotational vector fields.	02	1,6
b	Vector integration: Line Integral, Surface and Volume integrals.	02	1,6
c	Gauss's Stokes and Green's Theorems (without proof).	02	1,6
d	Applications to Maxwell's equation.	02	1,6
Guidelines for the examiner and paper setter. 1. No theoretical questions should be asked.			

Reference Books:

1. H.K. Dass "Advanced Engineering Mathematics" S. Chand Publication, New Delhi.
2. Erwin Kreyszig "Advanced Engineering Mathematics" Wiley Eastern Ltd.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi
4. Wylie C.R. & Barrett , "Advanced Engineering Mathematics," Mc Graw Hill
5. B.V. Raman "Engineering Mathematics"Tata Mc- Graw – Hill.
6. N. P. Bali, "A Text Book of Engineering Mathematics", Laxmi Publication
7. http://nptel.iitm.ac.in

Electrical Machines and Network

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of Basics of A.C. circuit and power measurement in three phase AC supply

1.	A.C. circuits & Three phase circuits		Lecture required	Reference No
	a	Thevenin's and Norton's theorems application for solution of A.C. network.**(Numerical)**	03	01
	b	Relation between line & phase voltages and currents in Star connected and Delta connected load system with phasor diagrams.	02	01
	c	Explanation of three phase power measurement by single watt meter method, two Watt meter method	02	01
	d	Calculation of Active, reactive, apparent power and power factor in three phase circuit with balance load for star and delta connections. **(Numerical)**	02	01

Unit – II

Teacher should facilitate learning of Basic of D C machine and its Application

2.	DC Machines		Lecture required	Reference No
	a	**DC machine :** Constructional features of DC machine, Working principal of Generator and EMF equation (series & shunt).	03	2,4
	b	Working principal of Motor, back EMF equation (series & shunt).	01	2,4
	c	Derivation of torque and speed equation of motor.	01	2,4
	d	**Characteristics of :** Shunt and series motors for performance parameter.	01	2,4
	e	**Losses and power stages:** Losses and power flow diagram of dc generator & motor **(Numerical)**.	01	2,4
	f	Explain the necessity of starter and 3-point starter.	02	2,4

Unit – III

Teacher should facilitate learning of fundamental of Single phase & three – phase transformers

3.	Transformers.		Lecture required	Reference No
	a	Construction & working Principle of 1ϕ and 3ϕ transformer & derive EMF equation.	02	2,4
	b	Phasor representation of Transformer no load & on load and Concept of equivalent circuit.	02	2,4
	c	Working Principle of Auto-transformer , C.T and P.T.	02	2,4
	d	**Open circuit and short circuit tests of transformer:** Explain open circuit and short circuit tests, Efficiency and regulation **(No Numerical)**.	02	2,4

Unit – IV

Teacher should facilitate learning of Synchronous Machines

4.	Synchronous Machines		Lecture required	Reference No
	a	**Alternator :** Constructional features of alternators and principle of operation.	02	2,4
	b	Derivation of Induced EMF equation of alternator **(No Numerical)**.	01	2,4
	c	**Synchronous Motors :** Working Principle of Synchronous Motors and method of starting	02	2,4
	d	Synchronous Motor on load with different excitation **(No Numerical).**	02	2,4
	e	Explain hunting in synchronous motor.	01	2,4

Unit - V

Teacher should facilitate learning of Three-phase & Single-phase Induction motors.

5.	Induction Motors		Lecture required	Reference No
	a	**Three phase Induction motors :** Constructional features of induction motor and principle of working.	01	2,4
	b	Define slip and derive torque equation, explain torque slip characteristics **(No Numerical).**	01	2,4
	c	Explain different types of starters and applications of induction motor (DOL, star-delta, auto-transformer).	02	2,4
	d	**Single phase Induction motors** - principle of operation, types, data analysis and applications.	02	2,4
	e	**Special purpose machines**: working, data analysis and application of stepper motor, servo motor, universal motors.	02	2,4

Reference Books:

1. B. Theraja, A. Theraja, "A Text book of Electrical Technology- Vol-I",S. Chand, 1st Edition, 2010.
2. B. Theraja, A. Theraja, "A Text book of Electrical Technology- Vol-II", S. Chand, 1st Edition, 2010.
3. P. S Bimbhra, "Electrical Machinery" 2/E, Khanna Publishers
4. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co.
5. http://nptel.iitm.ac.in

Analog Circuits and Analysis

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of basic electronic components and diode theory.

	Unit-I	Lecture required	References
a	Basic review of diode theory & Types of diode & their applications	01	1, 2, 3
b	Rectifiers. Half wave rectifier, Full wave rectifier and Bridge rectifier without filter	01	1, 2, 3
c	Half wave rectifier, Full wave rectifier and Bridge rectifier with filter	01	1, 2, 3
d	Clippers, clampers	01	1, 2, 3
e	Voltage Multipliers-Doubler, Trippler, quadrupler	01	1, 2, 3
f	Voltage regulator	01	1, 2, 3
g	Diode current equation	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical based on design of rectifiers, clippers, clampers, voltage multipliers can be asked.			

Unit - II

Teacher should facilitate learning of basic review of transistor configuration.

	Unit-II	Lecture required	References
a	Transistor biasing & Thermal stabilization. Bias compensation, Thermal runaway, Load line, Q -point.	01	1, 2, 3
b	Transistor at low frequencies (h-parameter).	01	1, 2, 3
c	Transistor at high frequencies (h-parameter).	01	1, 2, 3
d	Transistor amplifier class A, B & AB. Darlington circuits, Frequency response of amplifier.	01	1, 2, 3
e	Oscillators	02	1, 2, 3
f	Multi-vibrators	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical based on h-parameter, oscillators, multivibrators should be included.			

Unit - III

Teacher should facilitate learning of different transistors and their applications.

	Unit-III	Lecture required	References
a	Small signal FET analysis	01	3, 4, 5
b	FET applications	01	3, 4, 5
c	Single stage amplifier	01	3, 4, 5
d	Analog switches and Voltage variable resistance	01	3, 4, 5
e	UJT & its application	01	3, 4, 5
f	MOSFET & its application	01	3, 4, 5
g	IGBT & its application	01	3, 4, 5
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical are expect on each type of transistor.			

Unit - IV

Teacher should facilitate learning of basic network circuits such as RL, RC and RLC.

	Unit-IV	Lecture required	References
a	Charge & Energy, Relationship of field & Circuit concepts.	01	3, 4, 5
b	The Capacitance Parameter, The Inductance Parameter.	01	3, 4, 5
c	The resistance Parameter, Units & Scaling	01	3, 4, 5
d	Approximation of a physical system as a circuit	01	3, 4, 5
e	Topological Description of Network. Steady state & Transient Response	01	3, 4, 5
f	DC response of an RL, RC & RLC Circuits	01	3, 4, 5
g	Sinusoidal response of RL, RC & RLC circuits	01	3, 4, 5
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expected on DC and sinusoidal response of circuits.			

Unit - V

Teacher should facilitate learning of network analysis.

	Unit - V	Lecture required	References
a	Network Definition, Network Equations ,Kirchhoff's laws. The Number of Network Equation , Source ransformation , Examples of the formulation of Network equation	01	1-6
b	Loop & Node Variable analysis, Determinants-Minors & Gauss Metho	01	1-6
c	Duality, State Variable analysis	01	1-6
d	Impedance functions & Network Theorems –The concept of complex frequency	01	1-6
e	Transform Impedance & Transform Circuits, Series & parallel combination of elements	01	1-6
f	Superposition & Reciprocity, Thevenin's Theorem. Norton's Theorem	01	1-6
g	Reduction of complicated networks	01	1-6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory, construction part and working principal.			

Reference Books:

1. A. Mottershead , "Electronic Devices & Circuits", Prentice Hall of India.
2. A. P. Malvino, "Electronic Principles", Tata McGraw-Hill Publishing Company Limited India.
3. J. Millman & C. Halkis, "Electronic Devices and Circuits", Tata McGraw Hill Publication Company Limited India.
4. Donald A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw-Hill.
5. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Eighth edition, PHI publishers, 2004.
6. N. C. Goyal and R. K. Khetan, "A Monograph on Electronic Design Principles", Khanna Publishers.
7. http://nptel.iitm.ac.in

Measurement Fundamentals

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of measurements, errors and standards.

	Unit-I	Lecture required	References
a	Definition of instrumentation, Static &dynamic characteristics of instruments, types of error & their remedies.	02	1, 2
b	Data types. Statistical treatment of experimental data, system accuracy calculation	02	1, 2
c	Comparison of analog & digital instruments, instrument specifications	01	1, 2
d	Terminology as per ISA standards	01	1, 2
e	Standards for time, current, voltage, frequency etc.	01	1, 2
f	ANSI, ASME, ASA, BS, DIN, FCI, API, ISI, BIS, NEMA standards	02	1, 2
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on statistical treatment of experimental data should be asked.			

Unit - II

Teacher should facilitate learning of measuring instruments and their responses

	Unit-II	Lecture required	References
a	DC instruments- Galvanometer, ammeter, voltmeter, ohmmeter, multimeter.	02	1, 2
b	Design and operation of multi-range ammeter, voltmeter & ohmmeter	02	1, 2
c	Megger, design & operation	01	1, 2
d	Shunt meters & multipliers, design & operation. Calibration of meters	02	1, 2
e	AC instruments: ammeter, voltmeter, electrodynamometer	02	1,2
f	Phase & line frequency meter, energy meter, testing & calibration of meters.	01	1, 2
Guidelines for the examiner and paper setter. 1) Question should be asked on introductory part and working principal. 2) Numerical should be asked on design of instruments for given range.			

Unit - III

Teacher should facilitate learning of AC and DC Bridges.

	Unit-III	Lecture required	References
a	Wheatstone bridge design. Bridge sensitivity.	01	1, 2, 3
b	Analysis of thevenin's theorem, Errors in measurement, null type & deflection type-their comparison.	01	1, 2, 3
c	Current & voltage sensitive bridge, Kelvin bridge	01	1, 2, 3
d	Maxwell bridge, Hay bridge.	02	1, 2, 3
e	Wein bridge, Anderson bridge	02	1, 2, 3
f	Schering bridge	01	1, 2, 3
g	Storage factor, dissipation factor, their measurement. Phaser diagram.	01	1, 2 ,3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical are expected on each method.			

Unit - IV

Teacher should facilitate learning of Sequential Logic Design.

	Unit-IV	Lecture required	References
a	Potentiometers: principle, calibration, sensitivity of potentiometer	01	1, 2, 3
b	Self balancing potentiometer	01	1, 2, 3
c	Multi-range potentiometer	01	1, 2, 3
d	Recorders: Rectilinear recorder, inject, ink pen	02	1, 2, 3
e	Thermal galvanometric recording, magnetic, paperless, oscillo-graphic, hybrid recording	02	1, 2, 3
f	Y-T, X-T single, multichannel recorders	01	1, 2, 3
g	Driving systems for pen & chart, chart speed & their applications	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should be asked on construction part and working principal.			

Unit - V

Teacher should facilitate learning of Cathode Ray Oscilloscope.

	Unit - V	Lecture required	References
a	General purpose CRO, CRT block diagram, Controls on CRO panel	01	1, 4
b	Measurement of amplitude, phase, frequency, time, duration, rise & fall time	01	1, 4
c	Z-modulation, X-Y mode	01	1, 4
d	Dual trace oscilloscope	02	1, 4
e	Dual beam CRO	01	1, 4
f	Sampling oscilloscope.	01	1, 4
g	Details of DSO, Per-trigger, CRO probe,	01	1, 4
h	Analog storage oscilloscope.	01	1, 4
Guidelines for the examiner and paper setter. 1) Questions should be asked on types of CRO and its applications.			

Reference Books:

1. A.K. Sawhney, "A course in Electrical & Electronic Measurements & Instrumentation", Publication Dhanpat Rai & Sons.
2. Helfrick and Cooper, "Modern Electronic Instrumentation & Measurement Techniques", Publisher- Pearson.
3. V. Popov, "Electrical Measurements", Publication – Mir, Moscow.
4. Jones and Chin, "Electronics Instruments & Measurements", Tata McGraw Hill.
5. http://nptel.iitm.ac.in

Computational Methods and Programming

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of Computer Arithmatic.

	Unit-I	Lecture required	References
a	Floating point representation.	01	1, 2, 4
b	Arithmetic operation with normalized floating point numbers	01	1, 2, 4
c	Inherent error. absolute & relative error solution of simultaneous algebraic equation	01	1, 2, 4
d	Gauss elimination method	02	1, 2, 4
e	Iterative methods their convergence. Three Conditions equation	02	1, 2, 4
f	Decompositions methods	02	1, 2, 4
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on all methods are expected.			

Unit - II

Teacher should facilitate learning of Interpolation techniques and solutions of nonlinear equations.

	Unit-II	Lecture required	References
a	Lagrange's interpolation.	01	1, 2, 4, 5
b	Difference table.	01	1, 2, 4, 5
c	Newton's interpolation	01	1, 2, 4, 5
d	Interpolation, iterated linear interpolation technique.	01	1, 2, 4, 5
e	Solution of non linear equations	01	1, 2, 4, 5
f	Bisection method	01	1, 2, 4, 5
g	False position method	01	1, 2, 4, 5
h	Newton Raphson method	01	1, 2, 4, 5
I	Method of successive approximation	01	1, 2, 4, 5
Guidelines for the examiner and paper setter.) Question should not be asked on introductory part. 2) Numerical on all methods are expected.			

Unit - III

Teacher should facilitate learning of Numerical Integration.

	Unit-III	Lecture required	References
a	Trapezoidal mile.	01	1, 2, 4, 5
b	Simpson's 1/3& 3/8 rule	02	1, 2, 4, 5
c	Romberg integration	01	1, 2, 4, 5
d	Newton's cote's integration formula, error in these formulae	02	1, 2, 4, 5
e	Simplex Method (Graphical & Numerical)	03	1, 2, 4, 5
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical are expected on each method.			

Unit - IV

Teacher should facilitate learning of solution of ordinary differential equations.

	Unit-IV	Lecture required	References
a	Taylor series method.	01	1, 2, 3
b	Picard's method	01	1, 2, 3
c	Euler method	01	1, 2, 3
d	Runga-Kutta second order method	01	1, 2, 3
e	Runga-Kutta fourth order method	01	1, 2, 3
f	Predictor Corrector method Numerical solution of partial differential equation	01	1, 2, 3
g	Finite difference, approximation to derivative	01	1, 2, 3
h	Laplace equation	01	1, 2, 3
i	Iterative methods for the solution of equation	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expected Numerical are expected on each method.			

Unit - V

Teacher should facilitate learning of least square approximation of function and numerical solution of integral equation.

	Unit - V	Lecture required	References
a	Linear regression, polynomial regression.	01	1, 3, 4
b	Fitting exponential& trigonometric function	01	1, 3, 4
c	Data fitting with cubic splines	01	1, 3, 4
	Approximation of function	01	1, 3, 4
	Finite difference methods	01	1, 3, 4
	Chebyshev series method	01	1, 3, 4
	Method using Generalized Quadrature	01	1, 3, 4
	Method for degenerate kernels.	01	1, 3, 4
	Method of Invariant embedding	01	1, 3, 4
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expected Numerical are expected on each method.			

Reference Books:

1. V. Rajaraman, "Computer Oriented Numerical Method"- Prentice Hall of India.
2. S.S. Shastry, "Introductory Methods of Numerical Analysis"., Prentice Hall of India
3. Thomas Richard Mecalla "Introduction to Numerical Methods and FORTRAN programming", Willey International Edition.
4. Steven C. Chapra and Raymond P. Canale, "Numerical Methods for Engineers", Mc-Graw-Hill Publications.
5. B.S. Grewal, "Numerical Methods in Engineering & Science", Khanna Publishers.

Soft Skills – III

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate the learning basic foundation of mathematics.

1.	**Arithmetic-1**		**Lecture required**	**Reference No**
	a	Number Systems: Basic Formulae, Divisibility Rules, Speed Maths, Remainder Theorem, Different Types of Numbers, Applications	01	01
	b	HCF, LCM and Linear Equations HCF – Successive Division and Prime Factorization Methods, LCM – Successive Division and Prime Factorization Methods, Applications, Linear Equations –Elimination Method, Substitution Method, Applications	01	01
	c	Averages and Mixtures Concept of Average, Faster Ways of Finding It, The Allegation Method, Applications	01	01

Unit II

Teacher should facilitate the learning basic foundation of mathematics.

2.	**Arithmetic-2**		**Lecture required**	**Reference No**
	a	**Percentages** Concept of Percentage, Working with Percentages Applications	01	01
	b	**Profit and Loss** Difference between Cost and Selling Price, Concept of Profit Percentage and Loss Percentage, Applications	01	01
	c	**Time and Work** Basic Time and Work Formula, Relation between Time and Work, Applications	01	01

Unit III

Teacher should facilitate the learning basic foundation of mathematics.

3.	Arithmetic-3		Lecture required	Reference No
	a	**Permutations and Combinations** Sum Rule of Disjoint Counting, Product Rule of Counting Concept of Factorial, Permutations, Linear Permutations, Combinations, Circular Permutations, Applications	01	01
	b	**Probability** Definition and Laws of Probability, Mutually Exclusive Events, Independent Events, Equally Likely Events, Exhaustive Events, Cards, Dice, Applications	01	01
	c	**Time and Distance** Speed, Conversion Factors for Speed, Average Speed, Moving Bodies – Passing, Crossing and Overtaking, Relative Speed, Boats and Streams, Applications	01	01

Unit IV

Teacher should facilitate learning of critical thinking.

4.	Non-Verbal Reasoning		Lecture required	Reference No
	a	**Analogies** Different type of examples of analogies and its Applications	01	02
	b	**Classification** Different type of examples of analogies and its Applications	01	02
	c	**Sequences** Different type of examples of analogies and its Applications		02

Unit V

Teacher should facilitate the learning of a deep sense of analysis towards solving a problem

5.	Analytical Reasoning		Lecture required	Reference No
	a	**Analytical Puzzles** Classification Puzzles, Ordering Puzzles, Assignment puzzles, Applications	01	03
	b	**Letter and Number Series** Different Types of Letter Series, different types of Number Series, mixed Series	01	03
	c	**Coding and Decoding** Letter Coding, Number Coding, Mixed Coding, Odd Man Out, Applications	01	03

Reference Books:

1. R. S. Aggarwal, "Quantitative Aptitude", S. Chand Publication, New Delhi, 2012.
2. R. S. Aggarwal, "A Modern Approach to Verbal Reasoning", S. Chand Publication, New Delhi, 2012.
3. R. S. Aggarwal, "A Modern Approach to Non-Verbal Reasoning", S. Chand Publication, New Delhi, 2012.

Electrical Circuits and Machine Lab

Teacher should facilitate learning following lab experiments:

(Note: Minimum FOUR Experiments from each group.)

	Group-A	**Lab hours required**
1	Two Wattmeter method of power measurement in three phase balanced load.	02
2	Speed control of D.C. shunt motor by armature voltage and flux control method.	02
3	Load test on three phase induction motor.	02
4	O.C. and S.C. test of single phase transformer to determine regulation and efficiency.	02
5	Load test on D.C. series motor	02
	Group-B	**Lab hours required**
6	Study of specification & application single phase motors.	02
7	Study of specification & application of stepper motor.	02
8	Study of specification & application of servo motor.	02
9	Study of specification & application of universal motors.	02
10	Study of starter of three-point starter.	02
11	Study of starter of star-delta starter.	02
12	Study of starter of DOL starter.	02

Reference Books:

1. B. Theraja, A. Theraja, "A Text book of Electrical Technology- Vol-I",S. Chand, 1st Edition, 2010.
2. B. Theraja, A. Theraja, "A Text book of Electrical Technology- Vol-II", S. Chand, 1st Edition, 2010.
3. P. S Bimbhra, "Electrical Machinery"2/E, Khanna Publishers
4. Ashfaq Husain, "Electrical Machines", Dhanpat Rai & Co.

Guide lines for ICA:

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Analog Circuits and Analysis Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	To study characteristics of JFET and MOSFET Draw the graph of Input Vs Output	2
2	To study clipping circuits. Draw the graph for clipped wave for sinusoidal input	2
3	To study clamping circuits. Draw the graph for clamped wave for sinusoidal input	2
4	To study voltage multiplier circuits Draw the graph of Input Vs Output	2
5	To study half wave rectifier Draw the graph of Input Vs Output with and without filter	2
6	To study full wave rectifier. Draw the graph of Input Vs Output with and without filter	2
7	To study bridge rectifier. Draw the graph of Input Vs Output with and without filter	2
8	To study frequency response of two-stage RC coupled amplifier Draw the frequency response	2
9	To study RC phase shift oscillator Draw the graph.	2
10	To study Hartley oscillator. Draw the graph.	2
11	To study Colpitt's oscillator. Draw the graph	2
12	Design and implementation of Astable multivibrator Design the circuit and plot the response	2
13	Design and implementation of Monostable multivibrator Design the circuit and plot the response	2
14	To study class AB push-pull power amplifier Plot the response	2
15	To study performance of emitter follower/Darlington emitter follower Plot the response	2
16	To study Thevenin's Theorem	2

Note: Lab file should consist of minimum **EIGHT** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. A. Mottershead , "Electronic Devices & Circuits", Prentice Hall of India.
2. A. P. Malvino, "Electronic Principles", Tata McGraw-Hill Publishing Company Limited India.
3. J. Millman & C. Halkis, "Electronic Devices and Circuits", Tata McGraw Hill Publication Company Limited India.
4. Donald A. Neamen, "Electronic Circuit Analysis and Design", Tata McGraw-Hill.
5. Robert L. Boylestad, Louis Nashelsky, "Electronic Devices and Circuit Theory", Eighth edition, PHI publishers, 2004.
6. N. C. Goyal and R. K. Khetan, "A Monograph on Electronic Design Principles", Khanna

Measurement Fundamentals Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	Design of multi-range ammeter Plot graph of current vs voltage	2
2	Design of multi-range voltmeter. Plot graph of voltage vs current	2
3	Design of series type ohmmeter. Plot graph of unknown resistance vs load resistance	2
4	Design of shunt type ohmmeter. Plot graph of unknown resistance vs load resistance	2
5	Design of Wheatstone bridge Plot graph of resistance vs voltage	2
6	Design and calibration of energy meter.	2
7	Design and calibration of wattmeter.	2
8	Voltage and frequency measurement on CRO using Lissajous pattern	2
9	Study of digital voltmeter, digital multi-meter.	2
10	Study of recorders.	2
11	Digital measurement of phase and frequency.	2
12	Study of AC and DC meters	2

Note: Lab file should consist of minimum **EIGHT** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. A.K. Sawhney, "A course in Electrical & Electronic Measurements & Instrumentation", Publication Dhanpat Rai & Sons.
2. Helfrick and Cooper, "Modern Electronic Instrumentation & Measurement Techniques", Publisher- Pearson.
3. V. Popov, "Electrical Measurements, Publication" – Mir, Moscow.
4. Jones and Chin, "Electronics Instruments & Measurements", Tata McGraw Hill.

Computational Methods And Programming Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	To find out the roots of the given polynomial by using Bisection method.	2
2	To find out the roots of the given polynomial by using false position method.	2
3	To find out the integration by using Trapezoidal method.	2
4	To solve the differential equation by using Runga kutta second order and forth order method.	2
5	To solve the differential equation by using Euler's method.	2
6	To find out the roots by using Newton-Raphson method.	2
7	To find out the integral by using Simpson's 1/3 rule and 3/8 rule.	2
8	To plot the straight line to the given data by using Simplex method.	2
9	To find out the optimal solution by using Least squares method.	2
10	To solve the differential equation by using Adam's Bashforth predictor and corrector method.	2
11	To find out the roots of the given polynomial by using Bisection method.	2
12	To find out the roots of the given polynomial by using false position method.	2

Note: Lab file should consist of minimum EIGHT experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Reference Books:

1. V. Rajaraman , "Computer Oriented Numerical Method" Prentice Hall of India.
2. S.S. Shastry " Introductory Methods of Numerical Analysis"., Prentice Hall of India

3. Thomas Richard Mecalla “Introduction to Numerical Methods and FORTRAN Programming”,Willey International Edition.
4. Steven C. Chapra and Raymond P. Canale, “Numerical Methods for Engineers”, Mc-Graw-Hill Publication, 2007.
5. B.S. Grewal, “Numerical Methods in Engineering & Science”, Khanna Publishers.
6. Steve Otto and James P. Denier “An Introduction to Programming and Numerical Methods in MATLAB” Springer
7. Rudra Pratap - Getting Started With Matlab 7 - Oxford University publications

NORTH MAHARASHTRA UNIVERSITY,

JALGAON (M.S.)

Teacher, Paper Setter & Examiner Manual

for

Second Year Instrumentation Engineering

Faculty of Engineering and Technology

SEMESTER –IV

W.E.F 2013 – 2014

Electronics Instrumentation

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of Introduction to Operational Amplifiers.

	Unit-I	**Lecture required**	**References**
a	Dual input-balanced output ; single input-balanced output; their analysis,	02	1, 2, 3
c	Constant current bias, current mirror, level translators,	02	1, 2, 3
d	Basic Operational amplifier; equivalent circuit	01	1, 2, 3
e	IC Operational amplifiers-characteristics, specification, Parameter measurements	02	1, 2, 3
f	Frequency response, types (741,308,356,OP07) and their properties	02	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part.			

Unit - II

Teacher should facilitate learning about applications of operational amplifier.

	Unit-II	**Lecture required**	**References**
a	Negative feedback applications, Voltage amplifier, current amplifier	01	1, 2, 3
b	Voltage to current and current to voltage converter	02	1, 2, 3
c	Op-amp as integrator and differentiator	01	1, 2, 3
d	Instrumentation amplifier	01	1, 2, 3
e	Positive feedback applications, Crystal oscillator	01	1, 2, 3
f	Function generator.	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each part should be asked.			

Unit - III

Teacher should facilitate learning of Comparators, Converters and Multivibrators.

	Unit-III	**Lecture required**	**References**
a	Basic comparator, zero-crossing detector, Schmitt	01	1, 2, 3, 10

	trigger.		
b	Precision AC/DC converters, analog-to-digital and digital-to –analog converters.	02	1, 2, 3, 10
c	Logarithmic amplifier, Clippers and clampers using op-amp.	01	1, 2, 3, 10
d	Timer ICs.-Timer 555, its block diagram	01	1, 2, 3, 10
e	Applications- astable , monostable multivibrater	02	1, 2, 3, 10
f	Timers- 7555 and XR2240, their block diagram and applications	01	1, 2, 3, 10
g	Phase locked loop (PLL)- operating principle, IC 565 applications	01	1, 2, 3, 10
h	Voltage controlled oscillator (VCO) and its applications	01	1, 2, 3, 10
i	Voltage to time, voltage to frequency converter	01	1, 2, 3, 10
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each part should be asked.			

Unit - IV

Teacher should facilitate learning about signal sources.

	Unit-IV	**Lecture required**	**References**
a	Sinusoidal signal sources, pulse generators, frequency synthesis, square wave generators, function generators.	01	4 - 9
b	Analog switches and multiplexers,	01	4 - 9
c	Sample and hold circuits, programmable amplifiers, lock in amplifiers.	01	4 - 9
d	distortion analyzer, wave analyzer,	02	4 - 9
e	spectrum analyzer, FFT analyzer,	02	4 - 9
f	logic analyzer, network analyzer,	02	4 - 9
g	optical spectrum analyzer and optical time domain reflectometer (OTDR)	01	4 - 9
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each part should be asked.			

Unit - V

Teacher should facilitate learning of voltage regulators and power supplies.

	Unit - V	**Lecture required**	**References**
a	3 terminal positive and negative voltage regulators, variable voltage regulators (3085,723), tracking regulators.	1	1, 3, 4, 5, 6
b	Active filters: Butterworth & Chebychev filter, design and evaluation of second order filters-low pass, high pass filter.	1	1, 3, 4, 5, 6
c	band pass, band reject and all pass filter.	1	1, 3, 4, 5, 6
d	Introduction to the unregulated power supply, DC voltage regulation, AC Ripple voltage.	1	1, 3, 4, 5, 6
e	Design procedure for a full-Wave Bridge unregulated supply.	1	1, 3, 4, 5, 6
f	Bipolar and two valve unregulated power supply, Need for voltage regulation, Linear IC voltage regulators, +/- 15V power supplies.	1	1, 3, 4, 5, 6
g	Adjustable three terminal positive voltage regulators (LM 317 HV) and negative voltage regulator (LM 337 HV).	1	1, 3, 4, 5, 6
h	Introduction to UPS and SMPS.	1	1, 3, 4, 5, 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each part should be asked.			

Reference Books:

1. Ramakant A. Gayakwad, “Op-Amp and Linear Integrated Circuits’, Third edition, Prentice-Hall of India
2. Graeme,Tobey and Huelsman, “Operational Amplifiers: Design and Application”, McGraw-Hill International edition.
3. D.Roy Choudhury and Shail Jaon, “Linear Integrated Circuits” New Age International
4. Albert Paul Malvino, “Electronic Principles” 6th edition, Tata McGraw-Hill.
5. Cooper and Helfric, “Electronic Instrumentation and Measurement Techniques”, third edition, Prentice – Hall of India.
6. Chin and Jones, “Electronic Instrumentation and Measurement”, wiley.
7. J.J.Carr, “Elements of Electronic Instrumentation and Measurement”, second Edition, Reston.

8. Oliver and Cage, “Electronic Instrumentation and Measurement”, McGraw-Hill.
9. Rangan, Sarma, Mani, “Instrumentation Devices and Systems”, Tata Mcgraw Hill.
10. S.Soclof, “Application of Analog integrated circuits”, prentice Hall.
11. http://nptel.iitm.ac.in

Signals and Systems

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of concepts of signals and systems.

	Unit-I	**Lecture required**	**References**
a	Continuous Time and Discrete Time Signals: Various classifications; Mathematical representation; Signal Energy and Power.	01	1, 2, 3
b	Transformations of the Independent Variable; Periodic Signals; Even and Odd Signals	01	1, 2, 3
c	Arithmetic Operations on Sequences; Continuous-Time and Discrete-Time Complex Exponential. The continuous-Time Unit Step and Unit Impulse Functions	01	1, 2, 3
d	The Discrete-Time Unit Impulse and Unit Step Sequences	01	1, 2, 3
e	Representation of Direct-Time Signals in Terms of impulse	01	1, 2, 3
f	Continuous-Time and Discrete-Time Systems: Interconnections of Systems	01	1, 2, 3
g	Basic System Properties (Causality, Stability, Time-Invariance, Linearity, Invertibility, systems with and without, memory)	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each part can be asked.			

Unit - II

Teacher should facilitate learning of LTI systems and its properties.

	Unit-II	**Lecture required**	**References**
a	Linear Time Invariant systems: The Discrete–Time and Continuous-Time LTI Systems; Unit Impulse Response.	01	1, 2, 3
b	Convolution Sum and Convolution Integral Representation. Properties of LTI Systems (Commutative, Distributive, Associative Properties, Invertibility, Causality, Stability).	01	1, 2, 3

c	The Unit Step Response of an LTI System; LTI Systems Described by Differential and the Difference Equations.	01	1, 2, 3
d	Block Diagram Representations; Singularity Functions.	01	1, 2, 3
e	Fourier Series Representation of Periodic Signals: The Response of LTI Systems to Complex Exponential.	01	1, 2, 3
f	Fourier Series Representation of Continuous-Time and Discrete–Time periodic Signals; Convergence of the Fourier Series.	02	1, 2, 3
g	Properties of Discrete-Time and Continuous-Time Fourier Series; Fourier Series and LTI Systems.	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical based on each part should be asked.			

Unit - III

Teacher should facilitate learning of Fourier Transform.

	Unit-III	**Lecture required**	**References**
a	The Continuous-Time Fourier Transform: Representation of Continuous-Time Aperiodic Signals and Continuous-Time Fourier Transform.	01	1, 2, 3
b	Properties of Continuous-Time Fourier Transform; Fourier Transform and LTI Systems.	02	1, 2, 3
c	The Discrete- Time Fourier Transform: Representation of Discrete-Time Aperiodic signals and.	01	1, 2, 3
d	Discrete-Time Fourier Transform. Fourier Transform for Periodic Signals	01	1, 2, 3
e	Properties of the Discrete-Time Fourier Transform	01	1, 2, 3
f	Discrete-Time LTI Systems and Discrete-Time Fourier Transform	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expect on each part.			

Unit - IV

Teacher should facilitate learning of time, frequency analysis of signals and systems .

	Unit-IV	**Lecture required**	**References**
a	Time and Frequency Characterization of Signals and Systems: The Magnitude and Phase.	01	1, 2, 3
b	Representation of the Fourier Transform. The Magnitude and Phase Representation of the Frequency Response of LTI systems	01	1, 2, 3
c	Time Domain Properties of Frequency Selective Filters; First Order and Second Order Continuous-Time and Discrete Time Systems	01	1, 2, 3
d	Time and Frequency Domain Analysis of Systems	01	1, 2, 3
e	Sampling: Representation of a continuous–Time Signal by its Samples	01	1, 2, 3
f	The Sampling Theorem; Reconstruction of Signals form its Samples using Interpolation; Effect of Under Sampling (Frequency Domain Aliasing)	01	1, 2, 3
g	Discrete Time processing of Continuous–Time Signals	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expected on each part.			

Unit - V

Teacher should facilitate learning of other tools for analysis of signals and systems.

	Unit - V	**Lecture required**	**References**
a	The Laplace Transform: The Laplace Transform; Region of Convergence for Laplace Transform.	01	1, 2, 3
b	Properties of Laplace Transform; Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot	01	1, 2, 3
c	Analysis and Characterization of LTI Systems using the Laplace Transform	01	1, 2, 3
d	System Transfer Function; Block Diagram Representations; The Unilateral Laplace Transform; Solution of Differential Equations using the Unilateral Laplace Transform	01	1, 2, 3
e	The Z Transform; The Region of Convergence for the Z-	01	1, 2, 3

	Transform		
f	Geometric Evaluation of the Fourier Transform from the Pole-Zero Plot.	01	1, 2, 3
g	Properties of Z-Transform; Analysis and Characterization of Discrete-Time LTI Systems using Z-Transform	01	1, 2, 3
h	System Transfer Function; Block Diagram Representation; The Unilateral Z-Transform; Solution of Difference Equation using the Unilateral Z-Transform.	01	1, 2, 3
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expect on each part			

Reference Books:

1. A. V. Oppenheim, A. S. Willsky with S. H. Nawab, "Signals and Systems", Prentice-Hall of India Private Limited, Second Edition, 1997.
2. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, Inc., Second Edition, 1999.
3. M. J. Roberts, Signals and Systems: Analysis using , Transform Methods and MATLAB, Tata McGraw-Hill Publishing Company Limited, Second Edition, 2003.
4. http://nptel.iitm.ac.in

Automatic Control Systems

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate introduction to control systems and its representation mathematically and graphically.

	Unit-I	**Lecture required**	**References**
a	Introduction to Laplace transform & its inverse.	01	1, 3, 6
b	Open loop & closed loop control system. Types of feedback control systems-linear v/s non linear systems. Time invariant v/s time varying.	01	1, 3, 6
c	Effect of feedback on gain, sensitivity, noise	01	1, 3, 6
d	Continuous Data sampled & data control systems	01	1, 3, 6
e	MIMO & SISO writing differential equations electrical, mechanical systems & to determine Transfer function	01	1, 3, 6
f	Transfer function by block diagram reduction technique	02	1, 3, 6
g	Transfer function by signal flow graph analysis using mason's Gain formula	02	1, 3, 6
Guidelines for the examiner and paper setter. 1) Do not ask numerical on Laplace Transform. 2) Numerical based on Transfer Function should be included.			

Unit - II

Teacher should facilitate learning of time domain parameters of control systems.

	Unit-II	**Lecture required**	**References**
a	Different test signals-step, ramp & parabolic.	01	1, 3, 6
b	Steady state response of various types (0, 1, 2, 3) of systems. Steady state Performance specifications.	02	1, 3, 6
c	Time response of first order system.	01	1, 3, 6
d	Transient response of second order systems. Performance specifications.	01	1, 3, 6
e	Dominant poles of transfer function.	01	1, 3, 6
f	Stability of control systems. Absolute & relative	01	1, 3, 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical based on transient response and steady state response should be included.			

Unit - III

Teacher should facilitate learning about stability of control systems.

	Unit-III	**Lecture required**	**References**
a	Methods of determining stability of linear control systems.	01	1, 3, 4, 6
b	Hurwitz criterion.	01	1, 3, 4, 6
c	Routh-Hurwitz criterion.	01	1, 3, 4, 6
d	Root locus technique,	02	1, 3, 4, 6
e	Effect of adding pole zero on stability.	01	1, 3, 4, 6
f	Root sensitivity-robustness of system.	01	1, 3, 4, 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part and working principal. 2) Numerical are expect on each method of stability.			

Unit - IV

Teacher should facilitate learning of frequency response analysis of control systems.

	Unit-IV	**Lecture required**	**References**
a	Mapping theorem.	01	1, 3, 4, 6
b	Stability analysis with Nyquist stability criterion.	01	1, 3, 4, 6
c	Frequency domain characteristics	01	1, 3, 4, 6
d	Peak overshoot & Resonant frequency & the bandwidth of second order system	01	1, 3, 4, 6
e	Relative stability-gain margin, phase margin & peak overshoot	01	1, 3, 4, 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical are expected on each method of frequency domain analysis.			

Unit - V

Teacher should facilitate learning of graphical methods of stability analysis.

	Unit - V	**Lecture required**	**References**
a	Bode plot	02	2, 3, 4, 5
b	Calculation of gain margin & phase margin	01	2, 3, 4, 5
c	Importance of control system using Lead, Lag & Lead-Lag compensators	02	2, 3, 4, 5

d	Constant M & N loci in magnitude v/s phase plane- Nichols chart	01	2, 3, 4, 5
e	Design of Lead, Lag, Lead-Lag Compensator using Root Locus and Bode Diagrams	02	2, 3, 4, 5
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numericals should be asked on each method			

Reference Books:

1. Benjamin C. Kuo, "Automatic Control Systems", Fifth Edition, Prentice-Hall of India.
2. M. Gopal, "Control Systems: Principles & Design". Tata MC-Graw-Hill.
3. K. Ogata, "Modern control Engineering".(1997 edition)
4. Norman S. Nise- "Control systems Engineering", Third Edition, John Wiley and Sons.Inc, Singapore, 2001.
5. R. C. Dorf and R.H. Bishop, "Modern Control Systems", Eighth edition, Addison-Wesley, 1999.
6. I.J. Nagrath and M. Gopal, "Control systems Engineering", Third Edition, New age International Publishers, India, 2001.
7. http://nptel.iitm.ac.in

Sensors and Transducers

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate learning of Introduction to sensors and transducers.

	Unit-I	**Lecture required**	**References**
a	Transducer: Definition, classification, selection criteria.	01	1 - 6
c	Errors, loading effects, basic configuration of control system	01	1 - 6
d	Transducer specifications	01	1 - 6
e	Displacement, force and torque transducers	02	1 - 6
f	Force measuring transducers, electrical load cell, LVDT	02	1 - 6
g	Piezoelectric, vibrating type	01	1 - 6
h	Torque-strain gauge and other suitable transducers	01	1 - 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each type of transducer should be asked.			

Unit - II

Teacher should facilitate learning of Speed, temperature transducers

	Unit-II	**Lecture required**	**References**
a	Tachometers, toothed rotor tachometers,	01	1 – 6
b	Photoelectric, stroboscopic principal	02	1 - 6
c	Theory of acceleration pick- ups, their calibration	01	1 – 6
d	Type of accelerometer, Jerkmeter	01	1 – 6
e	Temperature Transducers : fills system thermometers	01	1 – 6
f	semiconductor temperature detector(thermistor and p-n junction)	01	1 - 6
g	resistance thermometer, thermometer ultrasonic, crystal , infrared thermometer	02	1 - 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each type of transducer should be asked.			

Unit - III

Teacher should facilitate learning of Level and Flow Transducers.

	Unit-III	**Lecture required**	**References**
a	Level transducers for liquid and solids- float type displacer	01	1 - 6
b	Air plug method, diaphragm box level gauge	01	1 - 6
c	DP cell, Load cell, bicolor direct reading	01	1 - 6
d	Vibrating, Ultrasonic, radioactive transducers, Reed switches, microwave sensors	01	1 - 6
e	Flow transducer: Basic measurement principle, Bernoulli's theorem	01	1 - 6
f	Differential pressure type (orifice, venturi, pitot type)	01	1 - 6
g	Variable area type, target type, magnetic	01	1 - 6
h	Ultrasonic vortex shedding, cross co-relation, positive displacement type	01	1 - 6
i	Mass flow meter, anemometer, total flow meter	01	1 - 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each type of transducer should be asked.			

Unit - IV

Teacher should facilitate learning of Pressure and Viscosity Transducers.

	Unit-IV	**Lecture required**	**References**
a	Pressure transducer: Pressure scale and standards, manometer, elastic (Bellows, bourdon tube, diaphragm) type.	01	1 - 6
b	Dead weight and vaccum gauge, testers, electrical pressure sensors (LVDT, strain gauge, load cell, piezo-electric, capacitive)	02	1 - 6
c	Tuning fork type, differential sensors (capacitive, force balance and vibrating cylinder type).	01	1 - 6
d	Vacuum pressure measurement- McLeod gauge, thermal conducting and ionization type	01	1 - 6
e	Transducers for very high pressure measurement	01	1 - 6
f	Viscosity and density sensing and measurement: capillary type, Shearle's rotating cylinder, cone and	02	1 - 6

	plate, falling and rolling ball type viscometers		
g	Gravity meters, buoyancy type, DP cell type and electrical density sensors	01	1 - 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each type of transducer should be asked.			

Unit - V

Teacher should facilitate learning of P^H, Conductivity, Humidity Sensors and Transducers.

	Unit - V	**Lecture required**	**References**
a	PH and conductivity sensors: pH scale and standards, principle of pH measurement.	1	1 - 6
b	Different type of reference and measuring electrodes, ion selective electrodes	1	1 - 6
c	Principle of conductivity measurement, conductivity cells and bridges-their application	1	1 - 6
d	Effect of temperature on pH and conductivity sensors	1	1 - 6
e	Humidity and misc. transducers: Pyrometer, Hygrometer (Hair, wire and Electrolysis type).	1	1 - 6
f	Dew point meter, piezoelectric humidity meter	1	1 - 6
g	Infrared conductance and capacitive type probes for moisture measurement	1	1 - 6
h	Flow detectors, leak detectors	1	1 - 6
i	Acoustic transducers and sound level measurement	1	1 - 6
Guidelines for the examiner and paper setter. 1) Question should not be asked on introductory part. 2) Numerical on each type of transducer should be asked.			

Reference Books:

1. Bentley J.P., "Principles of Measurement Systems", Third Edition, Pearson Education Asia pvt.ltd.
2. Doebelin, E.O., "Measurement Systems", McGraw Hill Book Co.
3. Patranabis D, "Sensors and Transducers", Wheeler Publishing Co., Ltd. New Delhi.
4. Murthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi.
5. Neubert, H.K.P., "Instrument Transducers", Clarenden Press, Oxford.
6. R. K. Jain, "Mechanical and Industrial Measurement".
7. http://nptel.iitm.ac.in

Programming in MATLAB

Teacher, Paper setter and Examiners should follow the guidelines as given below.

Unit - I

Teacher should facilitate Introduction to Matlab.

	Unit-I	**Lecture required**	**References**
a	Introduction, 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	01	1, 2, 3, 4
b	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	01	1, 2, 3, 4
c	Built in functions. Some basic programs e.g conversion to convert temperature from ^{0}C to ^{0}F and vice versa, sum of series.	01	1, 2, 3, 4

Unit - II

Teacher should facilitate learning of Vectors, Matrices and Polynomials

	Unit-II	**Lecture required**	**References**
a	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	01	1, 2, 3, 4
b	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.	01	1, 2, 3, 4
c	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.	01	1, 2, 3, 4

Unit - III

Teacher should facilitate learning of Input- Output Statements and Matlab Graphics.

	Unit-III	**Lecture required**	**References**
a	Data Input, Interactive Inputs, Reading and sorting file data, Output commands	01	1, 2, 3, 4
b	Low level input output functions, file opening and closing functions, formatted Input Output functions, Binary Input Output Functions.	01	1, 2, 3, 4
c	Matlab Graphics, Two dimensional Plots, Multiple Plots, Style Options, Legend Command Subplots, Specialized Two Dimensional Plots, Three Dimensional Plots	01	1, 2, 3, 4

Unit - IV

Teacher should facilitate learning of Control Structures, Writing Programs and Functions.

	Unit-IV	**Lecture required**	**References**
a	Loops, for loop, nested for loop, while loop	01	1, 2, 3, 4
b	Branches control structures, if control structure, switch statement, break statement, continue statement, error statement, try-catch structure	01	1, 2, 3, 4
c	Matlab editor, Matlab programming, function sub programs, some illustrative examples Types of functions, function handles, Errors and warnings, matlab debugger	01	1, 2, 3, 4

Unit - V

Teacher should facilitate learning of Ordinary differential Equations and Simulink basics.

	Unit - V	**Lecture required**	**References**
a	Ordinary differential equations solver, symbolic mathematics, study of ode solvers, study of commands.	01	1, 2, 3, 4
b	Starting simulink, opening simulink model, simulink modeling, collecting blocks to create model, modifying block parameters, labeling blocks, collecting blocks, labeling single lines, saving the model. Solvers, Fixed step solvers, variable step solvers	01	1, 2, 3, 4

c	Simulating a model, Using variables from matlab, Data Import/ Export, creating subsystem, creating masked subsystem Getting Help for Simulink.	01	1, 2, 3, 4

Reference Books:

1. R. P. Jain, "Modern Digital Elecronics", 2nd edition, TMH.
2. Hill and Peterson, "Digital Logic and Microprocessor", John Wiley and Sons.
3. Malvino and Leach, "Digital Principles and Applications",
4. Morris Mano, "Digital Logic and Computer Design", PHI.
5. http://nptel.iitm.ac.in

Programming in Matlab Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
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
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	2
3	Write a program to fit the polynomial of degree 2 and degree 3	2
4	Write a Matlab program to copy the data from one file to another file.	2
5	Write a program to illustrate hoe menu can be created using Matlab.	2
6	Write a program to plot the curve for equation.	2
7	Assume suitable data and draw the following 2-D plots: a. Semilogx b. Loglog c. Bar d. Stem	2
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	2
9	Obtain the solution of the following differential equation for the interval t=0 to 2 using Matlab. $\frac{dy}{dt} = y\,(e^t - 1)$ with y(0)=1.	2
10	Consider a third order system described by $\frac{d^3x}{dt^3} + 4\frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x = u(t)$ Draw the block diagram and obtain the system response using Simulink.	2
11	Write Matlab Program using While loop.	2
12	Write Matlab Program using nested for loop	2

Note: Lab file should consist of minimum EIGHT experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Reference Books:

1. K. V. Krishnamurthy and S. K. Sen, “Programming in MATLAB”, East West Press.
2. M. E. Herniter, “Programming in MATLAB”, Thomson Brooks.
3. R. Pratap, “Getting Started with MATLAB 7”, A quick introduction for scientists and engineers, Oxford University Press.
4. R. K. Bansal, A. K. Goel, M. K. Sharma, “Matlab and its Applications in Engineering”, Pearson Education

Electronics Instrumentation Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	Measurement of different Op-Amp parameters	2
2	Design and implement Instrumentation Amplifier	2
3	Design and implement Function Generator using Op-amp	2
4	Design and implement Half-wave precision rectifier	2
5	Design and implement Zero-crossing detector	2
6	Design and implement Schmitt trigger	2
7	Design and implement Clipper / Clamper circuits using op-amp	2
8	Design and implement A/D and D/A converter	2
9	Design and implement Butterworth second order low-pass / high-pass filter	2
10	Design and implement Astable multivibrator using IC555	2
11	Design and implement Monostable multivibrator using IC555	2
12	Design and implement application of Phase locked loop PLL-565	2
13	Design Wein bridge Oscillator as a sine wave generator	2
14	Design function generator using IC 8038 and study its outputs	2
15	Design Q-meter circuit	2
16	Study of RLC meter	2

Note: Lab file should consist of minimum **Ten** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Reference Books:

1. Ramakant A. Gayakwad, “Op-Amp and Linear Integrated Circuits’, Third edition, Prentice-Hall of India
2. Graeme,Tobey and Huelsman, “Operational Amplifiers: Design and Application”, McGraw-Hill International edition.
3. D.Roy Choudhury and Shail Jaon, “Linear Integrated Circuits” New Age International
4. Albert Paul Malvino, “Electronic Principles” 6th edition, Tata McGraw-Hill.
5. Cooper and Helfric, “Electronic Instrumentation and Measurement Techniques”, third edition, Prentice – Hall of India.

6. Chin and Jones, “Electronic Instrumentation and Measurement”, wiley.
7. J.J.Carr, “Elements of Electronic Instrumentation and Measurement”, second Edition, Reston.
8. Oliver and Cage, “Electronic Instrumentation and Measurement”, McGraw-Hill.
9. Rangan, Sarma, Mani, “Instrumentation Devices and Systems”, Tata Mcgraw Hill.
10. S.Soclof, “Application of Analog integrated circuits”, prentice Hall.

Automatic Control Systems Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	Determination of transfer function of an armature controlled d. c. motor	2
2	Time response of first order system e.g. RC Network, plot the response and obtain time constant	2
3	Transient response of second order system e.g. RLC Network, plot the response and obtain time domain parameters	2
4	Frequency response of first order system	2
5	Frequency response of second order system	2
6	Design of Lag Compensator	2
7	Design of Lead Compensator	2
8	Design of Lead-Lag Compensator	2
9	Compare and plot the unit-step responses of the unity-feedback closed loop systems with the given forward path transfer function. Assume zero initial conditions. Use any computer simulation program.	2
10	Study of effect of damping factor on system performance by obtaining unit step response and unit impulse response for a prototype standard second order system. Consider five different values for ξ = 0.1, 0.3, 0.5, 0.7 and 1.0. Also study the effect of varying undamped natural frequency by taking three different values. Comment on the simulations obtained.	2
11	Write a program that will compute the step response characteristics of a second order system i.e. percent overshoot, rise time, peak time and settling time. Generalize it for accepting different values of undamped natural frequency and damping factor.	2
12	Study and plot the unit step responses of addition of a pole and a zero to the forward path transfer function for a unity feedback system. Plot the responses for four different values of poles and zeros. Comment on the simulations obtained.	2
13	Program for compensator design using Bode plot.	2
14	Program for Compensator design using Root Locus Analysis.	2
15	Plot and comment on various properties of any three systems (Problems) using • Routh-Hurwitz criterion	2

	• Root locus technique • Bode plots • Nyquist plots.	

Note: Lab file should consist of minimum **EIGHT** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked questions on practical. Evaluation will be based on answers given by student in oral examination.

Reference Books:

1. Benjamin C. Kuo, "Automatic Control Systems", Fifth Edition, Prentice-Hall of India.
2. M. Gopal, "Control Systems: Principles & Design". Tata MC-Graw-Hill.
3. K. Ogata, "Modern control Engineering".(1997 edition)
4. Norman S. Nise- "Control systems Engineering", Third Edition, John Wiley and Sons.Inc, Singapore, 2001.
5. R. C. Dorf and R.H. Bishop, "Modern Control Systems", Eighth edition, Addison-Wesley, 1999.
6. I.J. Nagrath and M. Gopal, "Control systems Engineering", Third Edition, New age International Publishers, India, 2001.

Sensors And Transducers Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	To determine the LVDT characteristics. Plot the Graph	2
2	To determine the characteristics of capacitive displacement transducer Plot the Graph	2
3	To determine Strain gauge characteristics Plot the Graph	2
4	To determine Thermocouple characteristics Plot the Graph	2
5	To determine RTD characteristics Plot the Graph	2
6	To determine thermistor characteristics Plot the Graph	2
7	To determine Rotameter characteristics Plot the Graph	2
8	To determine level transducer characteristics Plot the Graph	2
9	To determine DP Cell characteristics Plot the Graph	2
10	To determine flow using orifice or venturimeter or rotameter and compare the accuracy Plot the Graph	2
11	Study of conductivity measurement Plot the Graph	2
12	Pressure measurement using dead weight tester Plot the Graph	2
13	Vacuum measurement using vacuum gauge Plot the Graph	2
14	Study of Humidity Measurement Plot the Graph	2
15	Study of Vibration Measurement Plot the Graph	2
16	Speed Measurement using Stroboscope and Tachometer Plot the Graph	2

Note: Lab file should consist of minimum Ten experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical. Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. Bentley J.P., "Principles of Measurement Systems", Third Edition, Pearson Education Asia pvt.ltd.
2. Doebelin, E.O., "Measurement Systems", McGraw Hill Book Co.
3. Patranabis D, "Sensors and Transducers", Wheeler Publishing Co., Ltd. New Delhi.
4. Murthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd., New Delhi.
5. Neubert, H.K.P., "Instrument Transducers", Clarenden Press, Oxford.
6. R. K. Jain, "Mechanical and Industrial Measurement".

Digital Circuits Design Lab

Teacher should facilitate learning following lab experiments:

Sr. No	Experiments	Lab Hour per Week
1	Verification of truth table of various TTL logic gates.	2
2	Verification of Boolean algebra laws.	2
3	Verification of given logical expression using universal gates.	2
4	To Design and test adder circuits (half and full adder) using K-map.	2
5	To Design and test binary to gray code converter circuits and test using IC7486.	2
6	To Design and test BCD to Exess-3 code converter circuit.	2
7	To Design and test one bit comparator circuit using K-map.	2
8	Verification of truth table of multiplexer using IC74153.	2
9	Verification of truth table of De-multiplexer using IC74155.	2
10	Verification of BCD to 7-segment display using IC7447.	2
11	Verification of ring counter using IC7493.	2
12	To study and test D/A converter (R/2R ladder network).	2

Note: Lab file should consist of minimum **EIGHT** experiments.

Guide lines for ICA :

ICA shall be based on continuous evaluation of student performance throughout semester and practical assignment submitted by the student in the form of journal.

Guide lines for ESE:-

ESE will be based on practical assignment submitted by the student in the form of journal. In ESE the student may be asked to perform any one practical . Evaluation will be based on paper work and performance in the practical.

Reference Books:

1. R. P. Jain, “Modern Digital Elecronics”, 2nd edition, TMH.
2. Hill and Peterson, “Digital Logic and Microprocessor”, John Wiley and Sons.
3. Malvino and Leach, “Digital Principles and Applications”,
4. Morris Mano, “Digital Logic and Computer Design”, PHI.