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MARATHWADA UNIVERSITY,  
AURANGABAD**



**Revised Structure and Syllabus of  
Second Year Engineering of**

**INSTRUMENTATION**

**EFFECTIVE FROM - 2012-13 & ONWARDS**

**FACULTY OF ENGINEERING AND  
TECHNOLOGY**  
Revised Structure for Second Year  
Instrumentation & Control  
Engineering/Instrumentation Engineering,

SUB NO.	SEMESTER -I	CONTACT HRS. /WEEK				EXAMINATION SCHEME				DURATION OF THEORY EXAMINATION
	SUBJECT	L	P	TOTAL	CT	TH.	TW.	P	TOTAL	
BSH201	Engineering Mathematics-III	4	--	4	20	80	-	-	100	3 Hrs
ICE202	Sensor technology -I	4	-	4	20	80	-	-	100	3 Hrs
ICE203	Electronic Devices & Circuits	4	-	4	20	80	-	-	100	3 Hrs
ICE204	Basic Instrumentation	4	-	4	20	80	-	-	100	3 Hrs
ICE205	Network Theory	4	-	4	20	80	-	-	100	3 Hrs
ICE 221	LAB I: Sensor technology -I	-	2	2	-	-	25	25	50	-
ICE 222	LAB II: Electronic Devices & Circuits	-	2	2	-	-	25	25	50	-
ICE 223	LAB III: Basic Instrumentation	-	2	2	-	-	25	25	50	-
ICE 224	LAB IV: Network Theory	-	2	2	-	-	25	25	50	-
ICE 225	LAB V: Matlab	-	2	2	-	-	50	-	50	-
	Total	20	10	30	100	400	150	100	750	-

SUB NO.	SEMESTER -II	CONTACT HRS. /WEEK				EXAMINATION SCHEME				DURATION OF THEORY EXAMINATION
	SUBJECT	L	P	TOTAL	CT	TH.	TW.	P	TOTAL	
BSH252	Engineering Mathematics-IV	4	-	4	20	80	-	-	100	3 Hrs
ICE 253	Sensor Technology – II	4	-	4	20	80	-	-	100	3 Hrs
ICE 254	Electrical Machines	4	-	4	20	80	-	-	100	3 Hrs
ICE 255	Linear Integrated Circuits & application	4	-	4	20	80	-	-	100	3 Hrs
ICE 256	Digital Electronics & Microprocessor	4	-	4	20	80	-	-	100	3 Hrs
ICE 271	LABVI: Sensor Technology – II	-	2	2	-	-	25	25	50	-
ICE 272	LAB VII: Electrical Machines	-	2	2	-	-	25	25	50	-
ICE 273	LAB VIII: Linear Integrated Circuits & application	-	2	2	-	-	25	25	50	-
ICE 274	LAB IX: Digital Electronics & Microprocessor	-	2	2	-	-	25	25	50	-
BSH275	LAB X: Communication Skill	-	2	2	-	-	50	-	50	-
	Total	20	10	30	100	400	150	100	750	-



**RULES AND REGULATIONS**  
**FOR**  
**SECOND YEAR DEGREE COURSE IN ENGINEERING (REVISED)**  
**(Applicable from the Academic Year 2012- 2013)**

**Note:**

All the Rules and Regulations, hereinafter specified shall be read as a whole for the purpose of interpretation.

**ADMISSION**

1. Admission to second year engineering shall be carried out as per the rules and regulations prescribed by the competent authority as appointed by the Government of Maharashtra and Dr. Babasaheb Ambedkar Marathwada University, Aurangabad, from time to time.

**DURATION AND COURSES OF STUDY**

1. The duration of the course is four years. Each of the four academic years shall be divided into two semesters herein after referred to as the semester I and semester II in chronological order. Each semester shall comprise

Instructions ..... 15 weeks

Preparation holiday ..... 2 weeks or 15 days

(Includes practical exams)

2. Candidate who fails to fulfill all the requirements for the award of the degree as specified hereinafter within eight academic years from the time of admission, will forfeit his/her seat in the course and his/her admission will stand cancelled.

**RULES AND REGULATION OF ATTENDANCE**

1. Candidates admitted to a particular course of study are required to pursue a "Regular course of study" as prescribed by the University before they are permitted to appear for the University Examination.
2. "A regular course of study" means putting in attendance not less than 75%.
3. a) In special cases and for sufficient causes shown, the Principal of the institute may, on the specific recommendation the Head of the Department, condone the deficiency in attendance to the extent of 15 % on medical ground subject to submission of medical certificate.

b) However, in respect of women candidates who seek condonation of attendance due to pregnancy, the Principal may condone the deficiency in attendance to the extent of 25 % (as against 15 % Condonation for other) on medical grounds subject to submission of medical

- certificate to this effect. Such condonation shall not be availed twice during the entire course of study leading to degree in Engineering and Technology.
4. "Active Participation in N.C.C/N.S.S. Camps or Inter collegiate or Inter University or Inter State or International matches or debates of Educational Excursions or such other Inter University activities as approved by the authorities involving journeys outside the city in which the college is situated will not be counted as absence. However, such 'absence shall not exceed (4) weeks per semester of the total period of instructions. Such leave should not be availed more than twice during the entire course of study.
  5. The attendance shall be calculated on the aggregate of the papers/subjects from the date of commencement of the semester.
  6. In case of the candidates who fail to put in the required attendance in a course of study, he/she shall be detained in the same class and will not be recommended to appear for the University examination.
  7. A candidate detained in semester I should take readmission in next academic year as a regular student and shall have to complete all the theory and practicals as a regular student.
  8. In case a candidate is detained in semester II, he/she should take admission to Semester II of next academic year and complete all the theory and practicals as a regular student of semester II
  9. In case of change of syllabus the candidate even if detained in semester II should take readmission in next academic year for Semester I and II as a regular student and complete all the theory and practicals as a regular student.

#### **SCHEME OF INSTRUCTIONS AND EXAMINATION**

1. Instructions about the curriculum in the various subjects in each semester of all the four years shall be provided by the University.
2. The details of instruction period, examination schedule, vacations etc. shall be notified by the Principal of the College as per the University academic calendar
3. The medium of instruction and examination shall be English.

4. At the end of each semester, University examinations shall be held as prescribed in the respective schemes of examination.
5. The examinations prescribed may include written papers, practical and oral, tests, inspection of certified sessional work in Drawing and Laboratories and work done by students in each practical examination, along with other materials prepared or collected as part of Lab work/Project.
6. All the rules for examinations prescribed by the University from time to time shall be adhered to.
7. A candidate shall be deemed to have fully passed the Examination of a semester, if he/she secures not less than the minimum marks/grade as prescribed.
8. Institutions will be encouraged to adopt modern tools in classroom/labs to deliver the course contents.
9. Institutions will be encouraged to conduct online class tests.

**O.874**

The Second Year Examination in Engineering will be held in two parts S.E. semester-I and S. E. semester-II. No candidate will be admitted to S.E. semester-I examination unless he/she produce testimonials of having kept one term, for the subject under F.E. semester-I and II satisfactorily in a college of engineering affiliated to this University after passing the First year examination of engineering other examination recognized as equivalent thereto as per the admission rules to second year engineering prescribed by the Government of Maharashtra and Dr. B.A.M.University from time to time.

**Note:** Following rules are to be follow strictly where ever applicable.

**1. Term Work:** Term work shall consist of at least eight experiments based the syllabus. Some of them may be from the list given. Student should submit a journal consisting of the record of experiments performed as list provided in each subject.

**2. Practical Examination:** The practical examination shall consist of performing the experiments based on the practical work done during the course, the record of experiments submitted by the candidate and viva-voce based on the syllabus.

**3. Theory Examination:**

**Pattern of Question Paper:**

The units in the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. . Question paper should cover the entire syllabus.

**For Theory paper 80 marks:**

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 and 6 be made compulsory and should have at least ten bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weight age of 15 marks

## ICE202: Sensors Technology - I

**Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit 1:****Displacement Measurement - I**

Resistive: Potentiometers, Strain gauge - classification. (Metallic, semiconductor), gauge factor, properties-of gauge wire, rosettes, measurement circuits, compensation, Piezoelectric: Electrostatic, Piezoresistive, Equivalent circuits, Charge and voltage sensitivity.

Inductive: LVDT - source frequency dependence and signal conditioning, RVDT, Variable reluctance, Self-inductance, Mutual inductance, Capacitive: Single plate, Differential capacitance -cell, and Measurement circuits (06)

**Unit 2:****Displacement Measurement - II**

Magnetostrictive, Laser dimensional gauge, Fiber optic, Moire's grating Digital Transducers: Encoders - Types of Translational and Rotary, Inductosyn Proximity Sensors - Inductive, Capacitive, Optical Flapper Nozzle: Sensitivity, Graph, Its application in air gauging

**Weight Measurement Load Cells** - Electronic, Pneumatic, Hydraulic and their comparison

**C) Force Measurement:**

Magnetic material, hysteresis, soft and hard magnetic materials, diamagnetism, paramagnetism and ferromagnetism, ferrites, effect of temperature on ferromagnetism, magnetic alloys and its characteristics. Selection of materials for LVDT, and in general for

Electromagnetic sensors. Materials for magnetic shielding. Basic methods of force measurement Strain gauges, LVDT, Piezoelectric, Vibrating Wire (10)

**Unit 3:****Pressure Measurement**

Materials for capacitive, ultrasonic and elastic transducers: Dielectric materials, dielectric polarization, dielectric constant and loss measurement, temperature and frequency effect, electric breakdown, ferroelectric materials. Elastic materials: Properties and selection of elastic materials for elastic transducers like spring, diaphragm, bellows, strain gauges, Piezoelectric and magnetostrictive materials.

Pressure scales, Units and relations Manometers. - U tube, Well type, inclined tube, Ring balance, Micromanometer, Elastic -Bourdon, Diaphragm, Bellows and their types-. Electronic - LVDT, Strain gauge, Capacitive, Piezoelectric, Thin film, Variable reluctance, Vibrating element (Diaphragm and Wire) High " Pressure Measurement - Bulk modulus cell, Bridgeman type Differential Pressure Measurement: Force balance, Motion balance, Capacitance delta cell, Ring balance DP cell, Diffused semiconductor strain gauges (08)

**Unit 4:****Vacuum measurement**

Units and, relations McLeod gauge, Thermal Conductivity (Pirani, Thermocouple), Hot cathode ionization gauge, Molecular momentum (Knudsen) gauge, Cold Cathode ionization (Penning) gauge Calibrating Instruments - Dead-Weight Tester (Pressure, Vacuum), Digital-.Manoinoter

**Temperature Measurement -I**



Engineering Materials for Temperature and Conductive, Resistive sensors: Properties of materials: Thermal properties, specific heat, expansion, conductivity and selection criteria for transducer design e.g. mercury filled thermometer, solid expansion bimetallic thermometer. Thermoelectric properties of materials: Properties and selection of materials for thermocouples, thermistor and RTD. Electric properties: Properties of resistors, conductors, semi conductors, conductive plastics and super conducting materials

Temperature Scales, Units and relations, Classification of temperature. Sensors Mechanical: Bimetallic Thermometer - Working Principle, Various types Filled system thermometers SAMA classifications, Sources of errors and their remedies, Dip effect (06)

**Unit 5:**

**Temperature Measurement - II**

Electrical: Resistance Temperature Detectors - Types and comparison, Circuits for lead wire compensation, Sources of errors and their remedies. Thermistor: Types (NTC, PTC), Measuring Circuits Thermocouple: Terminology, Types (B, E, J, K, R, S, T), Characteristics, Laws of thermoelectricity, Study of thermocouple tables, Lead wire compensation, Cold junction compensation techniques, Protection (Thermo well), EMF Measurement methods, Thermopiles Non-contact Types: Quartz crystal, Pyrometers (Total and Optical), Fiber Optic, Infrared (05)

**Unit 6:**

**Sound Measurement**

Concept of SPL, Typical sound measuring system (Sound level meter), Microphones (Capacitive, Piezoelectric, Electrodynamics, Carbon granule types)

**Shaft Power Measurement**

Dynamometer (servo control, absorption), Instantaneous power measurements, Alternator power measurement

**Torque Measurement:** Strain gauge, Torsion Bar, Feedback torque sensor

**Miscellaneous :** Leak Detector, Flame detector, Smoke detector (05)

**Note:**

All the above transducers are to be studied with reference to the operating principle, construction and working, materials of construction, calibration procedure, and performance characteristics, Merits, Demerits and Applications.

**List of Experiments:**

1. Characterization of strain gauge indicator and weight measurement using Load Cell.
2. Measurement of Displacement using LVDT.
3. Study of Encoder as displacement sensor.
4. To plot the characteristics of
  - a) J/K/R/S/T Thermocouples (any two types)
  - b) Thermocouple simulator
5. To plot the characteristics of
  - a) RTD Pt100/Pt500/Pt1000 (any two)
  - b) RTD simulator
6. Measurement of Pressure using Bellows, Bourdon gauge, Diaphragm.
7. Study of different types of Proximity switches.
8. Study of Dead Weight Tester.
9. Study of Vacuum Gauge Tester.
10. Measurement of sound level.

**Text Books:**

1. Instrumentation Devices and Systems, Rangan C.S, Sarma G.R., Mani V S V, Tata McGraw-Hill Publication: Second Edition
2. Instrumentation Measurement and Analysis , Nakra B.C., Chaudhary K.K , Tata McGraw-Hill Publication
3. Measurement Systems, Doebelin, E.O., McGraw Hill Book Co Fourth Edition.
4. Transducers and Instrumentation, Murthy, D.V.S., Prentice Hall of India Pvt. Ltd PHI Second Reprint 1995.
5. Sensors and Transducers, Patranabis, D Tata McGrawhill-7th Reprint, 1986
6. Electrical and Electronics Measurements and Instrumentation, Sawhney A. K., Dhanpat Rai and Sons

**Reference Books:**

1. Applied Instrumentation in Process Industries (Vol.-I )- Andrew, Williams- Gulf Publications Company- Second Edition
2. Process Measurement and Analysis- B. G. Liptak-Butterworth Heinemann- Third Edition
3. Jone's Instrument Technology (Vol. 1 and Vol. 2) B.E. Noltingk EL / BS – Fourth Edition
4. Process Control Instrumentation Technology- C. D. Johnson- PHI-Seventh Edition

**ICE203: Electronic Devices and Circuits****Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**UNIT 1:****Diodes & its applications:**

A brief review of following types of diodes, their peculiarities & applications-rectifier, signal, switching, power, tunnel, Schokley diode, Gunn, PIN, P-N Junction Diode: V-I characteristics equation of diode (no derivation), Voltage equivalent of temperature, Temperature dependence of V-I characteristics, Diode data sheets & specifications. (06)

**UNIT 2:****Transistor Circuits:**

Transistor configurations and characteristics (CE, CB, CC). biasing circuits and their comparison, stability factor and thermal runaway Field Effect Transistor/ JFET, construction, transfer characteristics, biasing techniques. Introduction to MOSFET and IGBT & their Construction and working principle. (08)

**UNIT 3:****Amplifiers:**

Small signal amplifiers, its DC and AC analysis (hybrid parameters), types of coupling (direct, RC, transformer), frequency response of transistor amplifier and introduction to high frequency analysis Multistage amplifiers (Darlington pair, cascade). (06)

**UNIT 4:****Feedback Amplifier and Oscillators:**

Four types of feedback, effect of negative feedback on amplifier performance, wide band amplifier, Concept of positive feedback, Barkhausen criteria, oscillators using BJT and FET, frequency stabilization (LC, RC, crystal). (06)

**UNIT 5:****Power Amplifiers:**

Class A, Class B, -Class C, Class AB power amplifiers, power calculations, Class B push pull amplifier, direct coupled push pull amplifier, complementary symmetry push pull amplifier. (06)

**UNIT 6:****Power Devices & Regulators:**

Characteristics, working principle and applications of photo transistor, photo diode, LDR, Solar cell, Opto-coupler, SCR, Diac, Triac and UJT, Regulators, shunt regulator, series regulator using Zener diode and transistors. (08)

**List of Experiments -:**

1. V-I characteristics of diode
2. CE, CB input output characteristics of BJT.
3. Transistor biasing for CE configuration. Potential divider, emitter bias, Q point for cut-off and saturation.
4. FET biasing potential divider, fixed bias, Q point for cut-off and saturation.
5. Effect of coupling on RC coupled amplifier & Frequency response.
6. Differential amplifier & Measurement of CMRR, effect of constant current source.
7. Effect of negative feedback in CE amplifier
8. Class C power amplifier and efficiency calculations.
9. Characteristics and applications of photo transistor & Opto coupler.
10. Characteristics and applications of SCR.
11. Characteristics and applications of UJT.

**Textbooks -:**

1. Millman Halkies Electronic Devices and Circuits -
2. David Bell Electronic Devices and Circuits -
3. Malvino Electronic Principles -
4. R. S. Sedha Textbook of Basic Electronics -
5. Allan Mottershed Electronic Devices and Circuits
6. Deabashis De Pearson publication Basic Electrical and Electronic Engineering.
7. S.K. Bhattacharya Basic Electric

**References Books-:**

1. Operational Amplifiers - Tobey and Graceme
2. Microelectronics- Millman
3. Datasheet of National Semiconductor

**ICE204: Basic Instrumentation****Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit I**

**Introduction:** Definition of Instrumentation, SI units - basic and derived, Static characteristics of instruments-accuracy, precision and significant figures, Sensitivity, Linearity and Non-linearity, reproducibility, drift connected instruments. Introduction to Virtual Instrumentation, dead zone, hysteresis, threshold, resolution. Dynamic characteristics of instruments- transfer function, transient response, steady state response, speed response, measuring lag, fidelity, dynamic error. Input and output impedance, loading effects, loading effects due to series and -shunt. (08)

**Unit 2**

**Fundamentals of measurement-** Definition, Introduction to calibration, definition, traceability, Infrastructural requirements of Calibration. Laboratory Technical: system requirements of Calibration laboratory Quality system requirement& of Calibration laboratory (05)

**Unit 3**

**Electrical. Measuring instruments:** DC-Galvanometer, ammeter, voltmeter, ohmmeter, multimeter, shunts and-multipliers design of multimeter, calibration of meters. Potentiometers: Principles, Calibration and, sensitivity of potentiometers, self-Balancing potentiometers and multi range potentiometers. Power and energy measuring instruments. Introduction to Current transformer and Potential transformer, HV insulate testing (06)

**Unit 4**

**DC Bridges:** Whetstone's bridge-design, arrangement of ratio arms, bridge sensitivity, errors in bridge circuit, null type and deflection type bridges, current sensitive and voltage sensitive bridges. Null sensitivity and calibration adjustments of Whetstone's Bridge, Kelvin Bridge and current Balance Bridge, Applications of DC bridges.

**AC bridges:** Induction bridge (Maxwell's), capacitance bridge (Hay's), Wein's bridge, Schering's bridge, storage and dissipation factor, Applications of AC bridges. (07)

**Unit 5**

**Recorders:** Rectilinear recording, ink jet, ink pen, thermal, galvanometric recording, magnetic, ooiilogarphic, hybrid recording, y-t, X-Y, single, multi channel recorders, driving systems for pen and chart, chart speed and their applications.

**Potentiometers:**

DC Potentiometers, basic circuits, Multirange potentiometers, constructional details of potentiometers .Types of potentiometers, Application, C.T., P.T.

**Signal Generator:** Introduction, Basic standard signal generator, Basic wave analyzer, Specification analyzer, Frequency analyzer.

**General purpose CRO:** CRT block diagram, controls on CRO panel, measurement of amplitude, phase, frequency, time duration, rise and fall time. Z-modulation using CRO. X-Y oscilloscope, Dual trace oscilloscope. (09)

#### **Unit 6**

**Mechanical Measurements:** Study of Mechanical Measurements-Linear Measurements: - line graduated measuring instruments, Vernier Caliper, Micrometer Screw Gauge. Sine Bar, inclinometer Introduction to limits fits gauges. Testing and calibration of gauges and dynamic measurements. (05)

#### **List of Experiments:**

1. Design of multirange ammeter and voltmeter, conversion of ammeter into voltmeter.
2. Design of series and shunt type ohmmeter.
3. Design of Wheatons Bridge.
4. Design of AC Bridge.
5. Measurement of unknown voltage using D.C. potentiometer.
6. Measurement of power using wattmeter (Single phase)
7. Measurement of power using Energy meter (Single phase.)
8. Measurement of voltage, Frequency and phase using CRO, measurement of unknown Frequency by Z-Modulation.
9. Study of y-t, X-Y recorders, frequency response of y-t recorder

#### **Text Books:**

1. Stanley wolf, Richard I. M. Smith "Student reference manual", Prentice Hall of India.
2. Helfric A, D and Cooper W. D "Modern electronic instrumentation and measurement techniques", Prentice Hall of India.
3. A. K. Shawney "A course in electrical and electronic measurements and instrumentation", Dhanpat Rai and Sons, New Delhi.
4. Kantrowitz, Kousourou, and zucker "Electronic measurements", Prentice Hall, New Jersey
5. H. S. Kalsi "Electronic instrumentation", Tata McGraw- Hill, New Delhi.
6. Calibration- The foundation for ISO 9000 and TQM by R.Subburay, Allied Publishers (1998)
7. K Lal Kishore Pearson publication Electronic Measurement and Instrumentation

#### **Reference Books:**

1. Measurement Systems by E.O. Doebelin
2. Process Measurement by B. G. Liptak

**ICE205 Network Theory****Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit 1**

**Network Equations & Topology:** Kirchhoff's laws, loop variable analysis, node variable analysis, duality, formation of network equation in matrix form, network solution by Laplace Transformation technique. Use and study of initial conditions in various elements, a procedure for evaluating initial conditions, initial state of a network. Star- Delta networks and Transformation, Matrix Solution of steady state network equations, Phasors, AC steady state network equations. Concept of graph, tree & co-tree, cut set matrices (10)

**Unit 2**

**Network Synthesis:** Waveform Synthesis, Properties of driving point impedance, Amplitude, Phase, Phase Delay, Convolution integral, Network synthesis, Active Network synthesis, Reliability of one part network, Hurwitz Network synthesis polynomials. (08)

**Unit 3**

**Network Theorems:** Superposition Theorem, Thevenin's Theorem, Norton Theorem, Miller Theorem, Tellegen's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem, Substitution Theorem. (07)

**Unit 4:**

**Network Functions:** Network functions for one port and two port network, calculation of network functions. Ladder network, General network. Poles and zeros of network functions, restriction on poles and zeros locations for driving point functions and transfer functions, Time domain behavior from pole and zero plot. (05)

**Unit 5:**

**Two Port Networks:** Two port network parameters Z, Y, H and transmission parameters, Combinations of two ports, Analysis of common two ports. (06)

**Unit 6:**

**Analog Filters:** Analog Filter Design: Time domain, Frequency Domain approximation, Low pass filter, Butter worth Chebyshev Filter, Linear Phase Filters. (04)

**Text Books:**

1. Franklin F. Kuo. Network Analysis and Synthesis, 2nd edition, Wiley International, 1996
2. John D Ryder, Network Lines and Fields, Prentice Hall, 2<sup>nd</sup> edition 1999
3. A. Sudhalkar and Shyamohan S. Palli, Circuits and Networks-Analysis and Synthesis," 2<sup>nd</sup> edition, Tata McGraw Hill, 2002
4. V. K Atre, "Network Theory and Filter Design, 2nd edition, Wiley Eastern Ltd. 1990
5. D. Roy Chaudhary, "Network Analysis and Synthesis, Wiley Eastern Ltd., 1991
6. W. H. Hayt. Jr. and J. E. Kemmerly, Engineering Circuit Analysis, Fifth Edition, Tata-McGraw Hill Edition, 2000.
7. K.S. Sureshkumar ,Electric and Network Pearson Publication

**Reference Books:**

1. M. E. Van Valkenberg, Network analysis, Third Edition, Prentice Hall of India Publication, 1996.
2. C. P. Kuriakose, Circuit Theory: Continuous and Discrete Time Systems, Elements of Network Synthesis, Prentice Hall of India Publication, New Delhi, 2005.
3. L. P. Huelsman, Basic Circuit Theory, Third Edition, Prentice Hall of India, New Delhi, 2002.
4. W. H. Hayt. Jr. and J. E. Kemmerly, Engineering Circuit Analysis, Fifth Edition, Tata-McGraw Hill Edition, 2000.
5. Umesh Sinha, Network Analysis & Synthesis : Satyaprakashan Publications
6. T. S. K. V. Iyer, Theory and problems in circuit analysis

**List of Experiments:**

1. Verification of Super Position Theorem
2. Verification of Maximum power transfer Theorem.
3. Verification of Thevenin's Theorem.
4. Verification of Norton's Theorem.
5. Verification of Reciprocity Theorem.
6. Plotting of behavior of RC circuit for step input.
7. Determination of parameters of two port network.
8. To determine Poles & Zeros & Plotting the same.



**ICE221 MATLAB****Teaching Scheme**

Practical: 2 Hrs./week

**Examination Scheme**

Practical: 50 marks

**Unit.1**

Student should be able to understand various Basic Concepts & general commands, functions of MATLAB Software.

**Unit.2**

Identifying the different tool Boxes available along with the MATLAB software and introducing their utilities.

**Unit.3**

Matrices and Linear algebra and different operations

**Unit.4**

Differential equations. Plots, 2D, 3D, Pi chart.

**Unit.5**

MATLAB Programming with different loops and sample programs. Introduction to Simulink and simulation using simulink.

**Term Work:**

Students should submit a term work report in the form of a journal containing the programs executed during the laboratory. Also student should do one small simulation project using MATLAB related to Instrumentation Engineering.

**Recommended books:**

1. Chapman S.J, "MATLAB Programming for Engineers" Thomson Bookware Companion Series, second Edition
2. Rudrapratap, "Getting started with MATLAB", Oxford University Pres.
3. MATLAB 7.1 Version Manuals, Mathworks USA

**ICE253: Sensor Technology – II****Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit I****Flow Measurement - I**

Units, Newtonian and non-Newtonian Fluids , Reynolds's number, Laminar and turbulent flows, Velocity profile, Bernoulli's equation for incompressible flow, Density, Beta ratio, Reynolds's number correction, Square root relation Head type flow meters: Orifice Eccentric, Segmental, concentric), Different pressure taps, Venturi Flow nozzle, Dahl tube, Pitot tube, Annu bar, Characteristics of head type flow meters Open channel flow measurement: Notch, Weirs (08)

**Unit 2****Flow Measurement – II**

Variable area type: Rotameter Other Flow meters: Turbine, Target, Electromagnetic, Ultrasonic (Doppler, Transit time i.e. Cross correlation Vortex shedding, Positive displacement, Anemometers Hot wire, Laser) Mass flow meters: Coriolis, Angular momentum, Thermal Flow totalizer Solid flow meters (08)

**Unit 3****Level Measurement**

Liquid: Float, Displacer (Torque tube unit), Bubbler, Diaphragm box , DP ceil Ultrasonic, Capacitive, Radioactive, Radar (Contact, Non-contact - TDR / PDS) Resistance, Thermal, Fiber optic Solid level detectors

**Density Measurement Liquid:** Chain-balanced float type, Hydrometer (Buoyancy type Gravitrol. meter (U tube type ), Hydrostatic Head ( Air bubbler, DP Cell ), Oscillating Coriolis, Radiation Gas: Gow -Mac, Electromagnetic suspension, Displacement (6)

**Unit 4****Velocity Measurement**

Terminology , Mechanical revolution counters - timers , Hall effect proximity pickup Magnetic (toothed rotor ) , Photoelectric pulse counting method, Translational velocity transducers ( Moving coil , Moving Magnet) AC and DC tachometers , Capacitive, tachometer , Gyroscope (Integrated, Rate )

**Acceleration and Vibration Measurement**

Terminology, Seismic, Strain gauge, Piezoelectric, Servo, Digital , Solid cylinder, Jerk meter, Vibrometer. Vibration exciters (for Simulafon) Calibration of accelerometers (07)

**Unit 5****PH and Conductivity Measurement, pH measurement:**

Terminology , Nearest equation, Temperature compensation Buffer solutions , Electrode, Potentials, Reference electrodes , Measuring electrodes, Combined electrode , Measuring circuits, Maintenance and cleaners, Solid state reference electrode Conductivity measurement: Probes, Cell constant, Measuring circuits

**Viscosity Measurement**

Terminology, Units, Types -Capillary, Saybolt, Searle's rotating cylinder, Cone and plate, Falling and rolling ball, Rotameter (07)

**Unit 6****Humidity and Moisture Measurement**

Humidity measurement: Terminology, Psychrometer, Hygrometer (Hair wire Electrolysis) Dew point meter, Piezoelectric, Infrared absorption. Moisture measurement: Conductance and capacitance probes

**Thickness Measurement**

Magnetic, Dielectric, Ultrasonic, LVDT

(04)

**Note:**

- 1) All the above transducers are to be studied with reference to operating principle construction and working, materials of construction, calibration - procedure performance characteristics, merits, demerits and applications,
- 2) Tutorial: Information with reference to manufacturers (Indigenous, Foreign) Specifications, Cost, Standards.

**List of Experiments:**

1. Measurement of Flow Using. a) Orifice, b) Venturi
2. Measurement of Flow Using Rotameter
3. Measurement of Level Using Any Two, Techniques
4. Study and Characterization of pH Meter
5. Study and Characterization of Conductivity-meter
6. Measurement of Relative Humidity by Any One Technique
7. Measurement of Density by
  - a) Hydrostatic head or
  - b) Buoyancy type methods
8. Study and Calibration of Vibrometer and Accelerometer
9. Measurement of Velocity Using Contact Method.
10. Measurement of Velocity Using Non-contact (Magnetic - Toothed Rotor, Photoelectric) Methods
11. Measurement of Viscosity Using Any One Technique

**Text Books:**

1. Instrumentation Devices and Systems- Rangan, Sharma, Mani-Tata McGrawhill 2<sup>nd</sup> Edition
2. Instrumentation Measurement and Analysis- Nakra, Chaudhary Tata McGrawhill-21<sup>st</sup> Reprint
3. Measurement System Application and, Design- E. O. Doebelin McGrawhill International-4th Edition
4. Transducers and Instrumentation- D. V. S. Murthy- PHI-Second Reprint1995
5. Principles of Industrial Instrumentation- D. Patranabis-Tata McGrawhill-7th Reprint, 1986
6. Electrical and Electronic Measurements and Instrumentation- A. K. Sawhney- Dhanpat Rai and Sons, Delhi-2002print
7. Mechanical and - Industrial Measurement- R. K. Jain - Khanna Publications-9th print

**Reference Books:**

1. Applied Instrumentation in Process Industries (Vol. I)- Andrew, Williams- Gulf Publications Company- Second Edition
3. Process Measurement and Analysis- B. G. Liptak- Butterworth Heinemann- Third Edition
4. Jone's Instrument Technology (Vol. 1 and Vol. 2)- B. E. Noltingk EL / BS- Fourth Edition
5. Process Control Instrumentation Technology- C. D. Jonhson- PHI Seventh Edition

## ICE254 Electrical Machine

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**Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit 1****D. C. Machines:** Construction of DC Machine, Types Of Dc Machine, Emf Equation of Dc Machine.**D. C. Generator:** Armature Reaction in Dc Generator, Characteristics of Dc Generator, OCC, Load Characteristics, and Internal Characteristics.**D. C. Motor:** Operating Principle, Torque Equation, Types, Characteristics, Speed Control, Starting and Efficiency. (8)**Unit 2****Electromagnetism and Polyphase AC Circuit:**

Magnet And Magnetic Field, Electromagnet, Faradays Law of Electromagnetic Induction, Polyphase Ac Circuit, Concept of Three Phase Supply And Phase Sequence, Star And Delta Connection(Voltage &amp;Current Constraints).(Only Descriptive Treatment) . (4)

**Unit 3****Induction Motor:****Three phase induction motor:** Construction, Production of Rotating Field, Speed and Slip, Rotor Voltage and Current, Efficiency, Torque Speed Characteristics, Starting and Speed Control, Starters of Induction Motor (Star Delta, DOL, and Auto Transformer).**Single phase induction motor:** Production of Rotating Magnetic Field, Double Revolving Theory, Types of Single Phase Induction Motor. (8)**Unit 4****Synchronous Machines:**

Generator operation synchronous motor construction and theory of operation, synchronization, Hunting, Synchronous Capacitance. (4)

**Unit 5****Concept of Measurement and Measurement System:**

Introduction to measurement, methods of measurement, applications of measurement system, static characteristics of measuring instruments, errors in measurement, types of error, sources of error. (4)

**Unit 6****Measuring Instruments:**

Classification of Instruments, Electrical Instruments, D'arsonval Galvanometer, Moving Iron And Moving Coil Ammeters And Voltmeters, Megger and Wattmeter's (Dynamometer And Induction Type), Instrument Transformers (CT&amp; PT), Recording Instruments (Strip Chart Recorder, XY Recorder, Magnetic Recorder) (10)

**Unit 7****Measurement of resistance:** Potentiometer Method, Ammeter Voltmeter Method, (2)

**List of Experiments:**

1. O.C.C Characteristics of D. C. Generators.
2. Load Test On D.C. Shunt Motor
3. Speed Control of D.C. Shunt Motor
4. Load Test on D.C. Series Motor
5. Study of D.C. Motor Starters
6. Load Test on Slip Ring Induction Motor
7. Speed Control of Induction Motor By Rotor Resistance Method.
8. Study of A.C. Motor Starter (Any Two)
9. Measurement Of Resistance By Megger.

**Text Books:**

1. A.K.Sawhney; Electrical & Electronic Measurement
2. Cooper; Electronic Instrumentation & Measurement;
3. R.K.Rajput; Electrical measurements and measuring instruments.
4. H.S.Kalsi; Electronic Instrumentation:
5. V.N.Mittal; Basic Electrical Engineering;
6. Hussain; Electrical Machines: Pub: Dhanapat Rai & sons.
7. P.S.Bhimra ; Electrical Machines:

**Reference Books:**

1. R.A.Barapte; Electronics Instrumentation & Measurement;
2. S.K.Singh; Industrial Instrumentation & Control;
3. N.V.Suryanarayana; Electrical Measurements and Measuring Instruments;
4. Rajendra Prasad; Electrical Measurements and Measuring Instruments
5. A.J.Bouwens; Digital Instrumentation;
6. Theraja ; Electrical Technology: Vol.II-B.L.
7. M.V.Deshpande ; Elements of Electrical Machines : Pub: P.V.G. Prakashan, Pune-30
8. R.K.Rajput; A.C. & D.C. Machines: Pub: Laxmi Publication, New Dehli

### ICE255 Linear Integrated Circuits

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**Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit 1**

**Introduction to Operational Amplifiers:** Block diagram representation of a typical op amp. Analysis of typical op-amp equivalent ckt. Types of integrated circuits. Manufacturers designation for IC's . Development of IC's .Package types of IC's. Device identification , interpreting a typical set of data sheets. Ideal op-amp, ideal voltage transfer curve (06)

**Unit 2**

**An Op-amp with Negative Feedback:** Block diagram representation of feedback configurations. Voltage series feedback amplifier, Voltage shunts feedback amplifiers, Differential amplifiers. (04)

**Unit 3**

**The Practical Op-amp:** Input offset voltage , input bias current ,input offset current , total output offset voltage , thermal drift effect of variation in power supply voltages on offset voltage , change in input offset voltage & current with time , temperature & supply voltage. Sensitivity parameters, noise, CMRR. (05)

**Unit 4**

**Frequency Response of an Op-amp:** Frequency response , compensating networks , frequency response of internally compensated op-amp , frequency response of non-compensated op-amps , high frequency op-amp equivalent ckt , open loop voltage gain as a function of frequency , closed loop frequency response , circuit stability , slew rate . (05)

**Unit 5**

**General linear applications:** DC & AC Amplifiers, AC amplifiers with a single supply voltage, Peaking amplifier, Summing, Scaling, & averaging amplifiers, Instrumentation Amplifier, Differential input & differential output amplifier. Voltage to current converter, Current to voltage converter, The Integrator, the differentiator. (06)

**Unit 6**

**Active filters and oscillators :**Introduction , First order low pass Butterworth filter ,first order high pass Butterworth, filter second order Butterworth filter , band pass filter ,band reject filters , all pass filters .

Oscillators : principle types , frequency stability , phase shift , wein bridge quadrature oscillators ,square wave , triangular wave , saw tooth wave generators , voltage controlled oscillators . (08)

#### Unit 7

**Comparators & Converters :** Basic comparator & its characteristics types and applications , zero crossing detector ,schmitt trigger , v/f & f/v converters , window detectors , clippers & clampers , absolute value output ckt , peak detector ,sample and hold ckt . (04)

#### Unit 8

**Specialized IC Applications:** Phase lock loops , power amplifiers , voltage regulators , voltage inverters & its applications. (02)

#### List of Experiments:

1. Non Inverting amplifier with feedback.
2. Inverting amplifier with feedback.
3. Differential amplifier with feedback.
4. Measurement of opamp parameters.
5. AC Inverting amplifiers.
6. Instrumentation amplifier.
7. First or low pass and high pass filter.
8. Comparators and Schmitt trigger.
9. Precision rectification using IC 741
10. IC 555 timer as a monostable and astable multivibrator
11. IC 7805 or 7905 as voltage regulator.
12. Logarithmic amplifier.
13. Oscillators using op amp .
14. Application of divider circuit.

#### Text Books:

1. Ramakant Gaikwad ;Op-amp and integrated circuits technology: Prentice Hall of India 4<sup>th</sup> Ed.
2. Botkar ; Integrated ckts:
3. D.Roy Choudhary Shail Jain; linear integrated ckts : New age international (P) ltd.

#### Reference Books:

1. Dricoll Conyhlin; Integrated ckts:
2. Clitin G.B.;Operational amplifier:

## ICE256 Digital Electronics and Microprocessor

**Teaching Scheme:**

Theory: 4 Hours/Week

Practical: 2 Hours/Week

**Examination Scheme:**

Theory: 80 Marks: Class Test: 20 Marks

Term Work: 25 Marks: Practical: 25 Marks

**Unit 1**

Introduction to digital system, comparison between analog & digital system. Logic gates, Boolean algebra, Binary addition/ Subtraction, 2's complement representation, Adders & Subtractors. Boolean Laws & Theorems, Sum of Product Methods, Truth table to K-map, K-map simplifications, don't care conditions, Product of sum methods & Product of sum simplifications. (08)

**Unit 2**

Multiplexers, Demultiplexers, Decoders, 7-segment decoders & encoders. (02)

**Unit 3**

Flip-Flops: S-R, J-K, Master-Slave JK, D & T flip flops & their conversion. Counters & their types, design of counters, Shift Registers & their types. (04)

**Unit 4**

Introduction to 8085: Architecture and operation, pin out diagram. (04)

**Unit 5**

Assembly language programming for 8085 microprocessor instruction classification, instruction set study in details, addressing modes, writing assembly language programs, stacks subroutines, floating point routines. (06)

**Unit 6**

Instruction set, timing diagrams. (5)

**Unit 7**

Interfacing memories, EPROM/ROM and RAM with 8085 with exhaustive and partial decoding techniques. (02)

**Unit 8**

Interrupt structure of 8085, internal interrupt circuit, and hardware and software interrupts, serial data transfer. (03)

**Unit 9**

Programmable peripheral devices 8255, 8253 (block diagram, software for their interfacing with 8085 (04)

**Unit 10**

Interfacing application: Interfacing of LED, Relay, seven segments displays, A to D and D to A converter. (02)



**List of Experiments:**

1. Study of Half/Full Adder & Half/Full Subtractor.
2. Study of Multiplexer/ Demultiplexer.
3. Study of Flip-flops.
4. Study of Asynchronous/Synchronous Counter
5. Study of Shift registers
6. Study of hardware configuration of the system (microprocessor) used in lab.
7. Program based on arithmetic, logical, string manipulation & code conversion operation.
8. Interfacing of L.E.D.s
9. Interfacing of 7 Segment Displays.
10. Interfacing of ADC.
11. Interfacing of DAC
12. Interfacing of 8253.

**Text Books:**

1. Digital Principles & Applications: Tata Mc Graw-Hill by Leach & Malvino
2. Modern Digital Electronics:Tata McGraw-Hill by R.P.Jain
3. Digital Electronics-PHI:Gothman
4. Microprocess,architecture,Programming & application with 8085/8080A:Wiley Eastern Limited by Gaonkar Ramesh
5. Microprocessor & Programmed Logic :Pearson Education,:Short.K.L
6. Fundamentals of microprocessors & microcomputers:Dhanpatarai Publications pvt Ltd by B.Ram

**Reference book:**

1. Intel Corporation Santa Clara: "Intel MCS-80/85 User's Manual"

**BSH275 LAB X: Communication Skill****Teaching Scheme**

Practical: 2 Hrs. /week

**Examination Scheme**

Practical: 50 marks

Note: Common as per university other branches ECT/EEP/CSE/IT etc.

~~BSH219~~ **Basics of Communication Skills**

*Teaching Scheme*  
*Practical: 2 Hrs/ Week*

*Examination Scheme*  
*Term Work: 50 Marks*

**Course Curriculum**

Unit I	<b><i>Grammar and Usage</i></b>	7 Hrs
	<ul style="list-style-type: none"> <li>• Overview of basic Mid-level English Grammar.</li> <li>• Parts of Speech</li> <li>• Prepositions and Conditionals.</li> <li>• Tense and concept of time.</li> <li>• Sentence Construction (Concord).</li> <li>• Vocabulary: Words, Idioms, Phrases, Antonyms and Synonyms.</li> </ul>	
Unit II	<b><i>Speaking Skills</i></b>	5 Hrs
	<ul style="list-style-type: none"> <li>• Training in Sound Recognition</li> <li>• Stress and Intonation pattern in spoken communication</li> <li>• Rhythm and effective English communication</li> <li>• Sound Recognition Exercise (Language Lab Exercise).</li> <li>• Common Errors in English.</li> </ul>	
Unit III	<b><i>Listening and Reading Skills</i></b>	3 Hrs
	<ul style="list-style-type: none"> <li>• Active and Passive Listening.</li> <li>• Note taking tips</li> <li>• Techniques of reading</li> <li>• Types and Techniques – skimming and scanning of reading</li> </ul>	
Unit IV	<b><i>Writing Skills</i></b>	5 Hrs
	<ul style="list-style-type: none"> <li>• Identification of different writing styles (Four Writing Styles).</li> <li>• Business Letters</li> <li>• E-mail Writing</li> <li>• Report Writing</li> <li>• Job Applications</li> <li>• Resume Preparation</li> <li>• Drafting: Memo, Circulars, Notices, Agendas etc.</li> </ul>	

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*6/11/20*

**Term Work:** The Term Work consists of 10 Experiments from the above said syllabus.

**Texts:**

1. Farhathullah, T. M. **Communication Skills for Technical Students**. Kolkata: Orient Blackswan (2008).
2. Bansal R.K. and J. B. Harrison. **Spoken English**. Chennai: Orient Longman Ltd. (1997).
3. A. V. Martinet and A. J. Thomson. **A Practical English Grammar**. Oxford: University Press (1986).

**References:**

- Murphy, Raymond. **Essential English Grammar**. Cambridge: University Press (2000).
- Hewings, Martin. **Advanced English Grammar**. Cambridge: University Press (2003).
- Apte, Madhavi. **A Course in English Communication**. New Delhi: Prentice Hall of India Pvt. (2008).

**Web Links:**

- <http://www.bmconsultantsindia.com/advanced-english-speaking.html>
- <http://englishtrainer.blogspot.in>
- <http://www.englishclub.com/learn-english/language-skills.htm>

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