DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY

CIRCULAR NO. ACAD / NP /S.Y. B.Tech. /Syllabi/87/2012

It is hereby notified for the information of all concerned that, the Academic Council at its meeting held on 06-07-2012 has accepted the following syllabi in all Braches of S. Y. B.TECH. under the Faculty of Engineering & Technology as appended herewith :-

Sr. No.	Revised Syllabi
[1]	Second Year B.Tech. [CIVIL ENGINEERING],
[2]	Second Year B.Tech. [MECHANICAL / PRODUCTION ENGINEERING],
[3]	Second Year B.Tech. [ELECTRONICS & TELECOMMUNICATION ENGINEERING],
[4]	Second Year B.Tech. [COMPUTER SCIENCE & ENGINEERING],
[5]	Second Year B.Tech. [AGRICULTURAL ENGINEERING],
[6]	Second Year B.Tech. [PLASTICS AND POLYMER ENGINEERING],
[7]	Second Year B.Tech. [INSTRUMENTATION & CONTROL ENGINEERING],

This is effective from the academic year 2012-2013 and onwards.

All concerned are requested to note the contents of this circular for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO. ACAD/ NP/ S.Y.B.TECH./
2012/19011-33
A.C.S.S. I.No.82

Date:- 31-07-2012.

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Director,
Board of College and
University Development.

Copy forwarded with compliments to :-

1] The Principals, affiliated concerned Colleges,
Dr. Babasaheb Ambedkar Marathwada University.

Copy to :-

1] The Controller of Examinations,
2] The Superintendent, [Engineering Unit],
3] The Superintendent, [Eligibility Unit] ,
4] The Record Keeper,
Dr. Babasaheb Ambedkar Marathwada University.

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Dr BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

Revised Syllabus of Second Year

B.TECH.

INSTRUMENTATION & CONTROL ENGINEERING

EFECTIVE FROM - 2012-13 & ONWARDS

Faculty of Engineering and Technology
Revised Syllabus
S.Y. B. Tech (Instrumentation and Control Engineering)

Sub No.	Semester-III	Contact Hrs/Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TA	PR	Total	Credits	Duration of Theory Exam
BSH201	Engineering Mathematics- III	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE202	Measurement Fundamentals	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE203	Sensors and Transducers- I	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE204	Analog Electronics	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE205	Digital Electronics	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE206	Values and Ethics in Profession	2	-	-	2	10	40	-	-	50	2	2 Hrs
ICE221	Lab I: Sensors and Transducers- I	-	-	2	2	-	-	25	25	50	1	-
ICE222	Lab II: Analog Electronics	-	-	2	2	-	-	25	25	50	1	-
ICE223	Lab III: Digital Electronics	-	-	2	2	-	-	25	25	50	1	-
ICE224	Lab IV: Communication Laboratory	-	-	2	2	-	-	50	-	50	1	-
BSH225	Lab V:Development of Skills-II	-	-	2	2	-	-	50	-	50	1	-
	Total of Semester-III	**17**	**5**	**10**	**32**	**110**	**440**	**175**	**75**	**800**	**27**	

Sub No.	Semester-IV	Contact Hrs/Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TA	PR	Total	Credits	Duration of Theory Exam
BSH251	Engineering Mathematics- IV	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE252	Control System Components	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE253	Sensors and Transducers- II	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE254	Basic Control Theory	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE255	Circuit Theory and Networks	3	1	-	4	20	80	-	-	100	4	3 Hrs
ICE256	Unit Operations	2	-	-	2	10	40	-	-	50	2	2 Hrs
ICE271	Lab VI:Sensors and Transducers- II	-	-	2	2	-	-	25	25	50	1	-
ICE272	Lab VII:Basic Control Theory	-	-	2	2	-	-	25	25	50	1	-
ICE273	Lab VIII:Circuit Theory and Networks	-	-	2	2	-	-	25	25	50	1	-
ICE274	Lab IX:Pneumatic and Hydraulic Instrumentation Laboratory	-	-	2	2	-	-	50	-	50	1	-
ICE275	Lab X:Development of Skills-III	-	-	2	2	-	-	50	-	50	1	-
	Total of Semester-IV	**17**	**5**	**10**	**32**	**110**	**440**	**175**	**75**	**800**	**27**	
	Grand Total of III & IV	**34**	**10**	**20**	**64**	**220**	**880**	**350**	**150**	**1600**	**54**	

L: Lecture hours per week
T: Tutorial hours per week
P: Practical hours per week
TH:Theory Examination
TA: Teachers Assessment
CT: Class Test
PR: Practical/Oral Examination

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester-III

Code No: BSH201	Title: **Engineering Mathematics –III**
Teaching Scheme: 04Hrs/week	Class **Test: 20**
Theory: 03Hrs/week	Theory **Examination (Duration): 03 Hrs**
Tutorial: 01Hr/week	Theory **Examination (Marks): 80**
Credits:04	

Objectives	:	The contents aims to develop the knowledge of the student in the direction of solving the practical problem in the engineering and technology related to differential equation, Fourier Transforms, Statistical techniques Vectors and Probability.
Unit-I	:	**Linear Differential Equation**: Solution of linear differential equation of order n with constant coefficients: The complementary function, Method of finding particular integral: Short method, General method, Method of variation of parameters Equations reducible to linear form: i) The Cauchy's linear equation. ii) The Legendre's linear equation. Simultaneous differential equations. Application of linear differential equations to: i)Mechanical system. ii) Electrical System iii) Beam and Shafts **(12+3 Hrs)** **Tutorials**: Additional Practice Problems on each type of Application
Unit-II	:	**Vector Differentiation:** Differentiation of vectors, Radial, Transverse, Normal And tangential components of velocity and acceleration, Scalar and vector point function , Gradient of scalar point function , Divergence and curl of vector point function , Second order differentiation operator , Irrotational and solenoid fields. **Tutorial**: Additional Practice Problems on Irrotational and solenoid fields. **(7+3 Hrs)**
Unit-III	:	**Statistics:** Measures of central tendency: Mean Median, Quartiles and Mode. Measures of dispersion: Quartile deviation, Mean deviation, Standard deviation, coefficient of variation, Moments, Skewness, Kurtosis. **Tutorial**: Additional Practice Problems on coefficient of variation, Moments **(3+2 Hrs)**
Unit-IV	:	**Laplace Transform:** Definition, Laplace Transform of elementary function and its table, Theorem and properties of Laplace Transform: First shifting theorem, Second Shifting Theorem, Multiplication by t^n, Division by t, Change of scale property, Laplace Transform of integral, Laplace Transform of Derivative. Laplace Transform of some special functions: Bessel's function, Periodic function, Error Function, Heaviside Unit Step Function, Displaced Heaviside Unit Step Function Laplace Transform using Heaviside Unit function, Dirac delta function. Method to find inverse Laplace Transform: i. Use of Laplace Transform table ii. Use of Theorem and properties of Laplace iii. Use of partial fraction iv. Convolution theorem v. Use of development of Heaviside Unit Step Function Application of Laplace Transform to solve linear differential equation , Simultaneous differential

		equation. **Tutorial:** Additional Practice Problems on Solution of Linear Differential Equation, Simultaneous differential equation. (13+2 Hrs)
Unit-V	:	**Fourier Transform:** Fourier integral: Complex form of Fourier integral, sine and cosine integral, Fourier transform and inverse transform. D.U.I.S. rule (only statement), Fourier transform and inverse transform for even and odd function, Fourier sine and cosine transform and inverse transform. Tutorials: Additional Practice Problems Fourier sine and cosine transform. (7+3 Hrs)
Unit-VI	:	**Probability:** Introduction, Probability Distribution: Binomial Distribution, Poisson Distribution, Normal Distribution (3+2 Hrs) Tutorials: Additional Practice Problems on each type of Distribution
Reference Books:	:	1. A Text Book Of Applied Mathematics Volume-III BY P.N. Wartikar J.N.Wartikar, Pune Vidyaryhi Griha Prakashan, Ninth edition. 2. Advanced Engineering Mathematics BY H.K.Dass, S.Chand and Co.Ltd, Eighteenth edition. 3. Higher Engineering Mathematics BY Dr.B.S.Grewal, Khanna Publishers, 46th edition. 4. Higher Engineering Mathematics BY B.V.Ramana, Tata McGraw-Hill Publishing Co.Ltd., First edition. 5. Solution to Higher Engineering Mathematics Volume –III BY C.P.Gandhi

Section A: Includes Unit I, II and III; Section **B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE202	Title: Measurement Fundamentals
Teaching Scheme: 04Hrs/week	Class Test: 20
Theory: 03Hrs/week	Theory Examination (Duration): 03 Hrs
Tutorial: 01Hr/week	Theory Examination (Marks): 80
Credits:04	

Objectives	:	1. Exposing the students to the art and science of measurement with a view to impress. 2. Knowledge of the physical world depends on observation and measurement adds quantitative meaning to our knowledge 3. Observation, monitoring, analysis towards the instruments form the basis of measurement. 4. The method of measurement is a comparison. 5. The aids of measurement are standard.
Unit-I	:	**Introduction to measurements:** Physical measurement, Forms and methods of measurements, Fundamental SI Units, Derived Units, Definition of standards, International standards, Primary standards, Secondary standards, Working standards, Current standard, Voltage standard, Resistance standard, Capacitance standard, Time and frequency standards **(10Hrs)**
Unit-II	:	**Measurement Errors:** Human Error, Systematic Error, Limiting and Random Errors, Statistical analysis of measurement data, Introduction to uncertainty, Analysis of Uncertainty, Probability of Errors, Conditional probability, Mean, median, mode and standard deviation, Random variables, Discrete and continuous distributions, Poisson, Normal and Binomial distribution, Curve Fitting-Method of Least Squares. Chi-Square test. **(10Hrs)**
Unit-III	:	**Static characteristics of measurement system:** Range, Span, Linearity, Non-linearity, Sensitivity, Dependence on environmental effects, Hysteresis, Resolution, Wear and ageing, Accuracy, Precision, Repeatability, Reproducibility, Tolerance, Bias, Threshold and Loading Effect, **Dynamic characteristics of measurement system:** Step-response – rise time, etc. Frequency response – bandwidth. Time lag (dead-time). **(10 Hrs)**
Unit-IV	:	**Testing and calibration:** Traceability, Measurement reliability, Calibration experiment and evaluation of results, Calibration program required by regulatory authorities, Maintenance frequencies and procedures, Primary calibration, Secondary calibration, Direct calibration, Indirect calibration, Routine calibration, Out-of-tolerance calibration, Calibration and maintenance records, Calibration of a voltmeter, ammeter and an oscilloscope **(10Hrs)**
Unit-V	:	**Reliability of measurement systems:** Fundamental principles of reliability, practical reliability definitions, hazard rate, failure rate function and bath tube curve, Series and parallel reliability systems, design and maintenance for reliability, selection od Measurement systems, total lifetime operating cost, solution of problems based on reliability. **(10Hrs)**

Unit-VI	:	Product standards: Reasons for product standards. Standards setting Organizations. Bureau of Indian Standards. Example of a product standard. Conformance testing of products. Process quality standard: ISO 9000, family of standards. Relationship between product standard and process quality standard. **(10 Hrs)**

Reference Books:

Sr. No	Title	Author	Publication
1	Introduction to Instrumentation and Control	A K Ghosh	Prentice Hall of India, New Delhi 2004
2	A course on electrical and electronic measurements and instrumentation	A K Sawhney	Dhanpat Raj & Co, 2005
3	Principle of Industrial Instrumentation	D Patranabis	Tata McGraw-Hill, New Delhi 2004
4	Principles of measurement systems	John P.Bentley	3rd edition, Addison Wesley Longman, 2000
5	Electronic Instrumentation and measurement	David A Bell	Prentice Hall of India, New Delhi

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions.
2. Five questions in each section.
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE203	Title: Sensors and Transducers-I
Teaching Scheme: 04Hrs/week	Class Test: 20
Theory: 03Hrs/week	Theory Examination (Duration): 03 Hrs
Tutorial: 01Hr/week	Theory Examination (Marks): 80
Credits:04	

Objectives	:	Exposing the students to the art and science of measurement with a view to impress: 1. Knowledge of different types of measuring elements and circuits for displacement, pressure and temperature measurements. 2. Observation, monitoring, and analysis of these sensors form the basis of measurement.
Unit-I	:	**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. **(10 Hrs)**
Unit-II	:	**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, **Weight Measurement:** Load Cells - Electronic, Pneumatic, Hydraulic and their comparison, **Force Measurement:** Basic methods of force measurement Strain gauges, LVDT, Piezoelectric, Vibrating Wire. **(10 hrs)**
Unit-III	:	**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, Jerkmeter, Vibrometer. Vibration exciters (for Simulaflon) Calibration of accelerometers. **(10 Hrs)**
Unit-IV	:	**Temperature Measurement** - Temperature Scales, Units and relations, Classification of temperature Sensors, Mechanical: Bimetallic, Thermometer - Working Principle, Various types, Filled system thermometers, Electrical: RTD - Types and comparison, Circuits for lead wire, compensation, Sources of errors and their remedies, Thermistor: Types (NTC, PTC), Thermocouple: Terminology, Types (B, E, J, K, R, S, T), Characteristics, Laws of thermoelectricity, Lead wire compensation, Cold junction compensation, thermopiles, Non-contact Types: Quartz crystal, Pyrometers (Total and Optical), Fiber Optic, Infrared **(10 Hrs)**

Unit-V	:	Pressure **Measurement:** Pressure scales, Units and relations, Manometers.- U tube, Well type, Inclined tube, **Elastic:** Bourdon, Diaphragm, Bellows and their types, **Electronic** - LVDT, Strain gauge, Capacitive, Piezoelectric, High **Pressure Measurement** - Bulk modulus cell, Bridgeman type, **Differential Pressure** Measurement: Force balance, Motion balance, Capacitance delta cell, **Vacuum measurement:** Units and, relations, McLeod gauge, Thermal Conductivity (Pirani, Thermocouple), Hot cathode ionization gauge, Molecular momentum (Knudsen) gauge, Calibrating Instruments - Dead-Weight Tester (Pressure, Vacuum). (10 Hrs)
Unit-VI	:	Level **Measurement:** Liquid: Float, Displacer (Torque tube unit), Bubbler, Diaphragm box, DP cell, 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), Hydrostatic Head (Air bubbler, DP Cell), Oscillating Coriolis, Radiation Gas: Gow -Mac, Electromagnetic suspension, Displacement. (10 Hrs)

Reference Books:

Sr. No	Title	Author	Publication
1	Instrumentation Devices and Systems	Rangan C.S, Sarma G.R., Mani V S V	Tata McGraw-Hill Publication Ltd
2	Measurement Systems	Doebelin, E.O.,	McGraw Hill Book Co., 1998
3	A course on electrical and electronic measurements and instrumentation	A K Sawhney	Dhanpat Raj & Co, 2005
4	Principle of Industrial Instrumentation	D Patranabis	Tata McGraw-Hill, New Delhi 2004
5	Principles of measurement systems	John P.Bentley	Addison Wesley Longman, 3rd edition, 2000
6	Instrumentation Measurement and Analysis	Nakra B.C., Chaudhary K.K	McGraw-Hill Publication Ltd. 2001.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

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Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE204
Teaching Scheme: 04Hrs/week
Theory: 03Hrs/week
Tutorial: 01Hr/week
Credits:04

Title: **Analog Electronics**
Class Test: 20
Theory Examination (Duration): 03 Hrs
Theory Examination (Marks): 80

Objectives	:	1. Exposing the students to the basic theory of transistors and other electronic devices with a view to impress: 2. Knowledge of different types amplifiers and their mathematical expression. 3. Use of these devices for building an application circuitry.
Unit-I	:	Amplifiers: Configuration of BJT amplifier in CB, CE, CC :Input and Output V –I characteristics , switching characteristics & their comparison, concept of AC and DC load line, of BJT ,cutoff, saturation and active region of operation. Need of biasing, types of biasing, stability factor, bias compensation for different types of biasing circuits for BJT, its mathematical derivation. Relationship between α, β and γ. **(10 hrs)**
Unit-II	:	**FET and MOSFET:** An overview of different types of FETs viz. JFET, MOSFET, MESFET, Peculiarities of these types and their application areas. **JFET:** JFET construction, Symbol, Basic operation, V-I Characteristics, Transfer Characteristics (Shockley's Equation), Cut-off & Pinch-off voltages, Transconductance, Input resistance & Capacitance. Drain to Source resistance, Universal JFET bias curve. Biasing arrangements for JFET – Biasing against device variation, biasing for zero current drift. JFET as voltage controlled current source. JFET data sheet specifications – IDSS. Vp, gm, rd, RDS or RD (ON). **JFET Amplifiers:** CS, CD, CG amplifiers, their analysis using small signal JFET model. Introduction to MOSFET C-MOS as a VLSI device. **(12 hrs)**
Unit-III	:	**Voltage Amplifiers:** Typical small signal Voltage amplifier, its ideal characteristics, single stage CE amplifier, frequency response, bandwidth. Effect of coupling capacitor & bypass capacitor, junction capacitance, temperature on performance of amplifier. Cascaded Amplifier: types of coupling: direct, RC coupling, transformer coupling its operation comparison, advantages disadvantages. **(08 hrs)**
Unit-IV	:	**Hybrid Parameters:** Low frequency hybrid parameters, derivation of voltage gain, current gain, input impedance and output impedance. Comparison of hybrid parameters of all configurations (CB, CE, CC). High Frequency hybrid Π parameters, equivalent circuits,

		relationship between hybrid and Π parameters 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. (12hrs)
Unit-V	:	Linear Wave shaping and time base generator Circuits: Application of diode as voltage doublers, Tripler and voltage quadruple configurations, Clipping and clamping circuits, biased clipper, their operation. Clamping circuits. Integrator and differentiator circuits: working and applications pulse transformer UJT saw tooth generator, miller and bootstrap saw tooth generator circuit, current time base generators. (08hrs)
Unit-VI	:	Feedback Amplifiers and Oscillators: Concept of feedback, Negative and positive feedback. Classification of amplifiers based on feedback topology, Transfer gain with feedback. Advantages and disadvantages of negative feedback, Oscillators: Oscillator startup mechanism, Barkausen criteria for oscillation. Study of following oscillator circuits (using FET and BJT) – (Derivations not expected). LC oscillators – General form of LC oscillator, Hartley oscillator, Colpitts oscillator, RC phase shift oscillator using BJT and FET. (10hrs)

Reference Books:

Sr no.	Title	Author	Publication
1	Integrated Electronics	Millman Halkies	Tata McGraw Hill
2	Pulse, Digital and Switching Waveforms	Jacob Millman and Hilbert Taub	Tata McGraw Hill
3	Electronic devices and circuits theory	Boylestad and Nashelsky	Prentice Hall, 2009
4	Linear Integrated Circuits	D. Roy Choudhary, Shailesh Jain	New Age International
5	Operational-Amplifier and Integrated Circuits	Ramakant Gaikwad	Prentice Hall India
6	Integrated Circuits	K. R. Botkar	Khanna Publishers

Section A: Includes Unit I, II and III; Section B: Includes Unit IV, V and VI.

Pattern of Question Paper:

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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE205	Title: Digital Electronics
Teaching Scheme: 04Hrs/week	Class Test: 20
Theory: 03Hrs/week	Theory Examination (Duration): 03 Hrs
Tutorial: 01Hr/week	Theory Examination (Marks): 80
Credits:04	

Objectives	:	The content aims to develop the knowledge of the student in the direction of acquiring the basic knowledge in the field of digital electronics. • Knowledge of different types digital electronic devices and circuits • Use of these devices for building an application circuitry
Unit-I	:	**Binary number system:** Binary arithmetic (Addition, subtraction, multiplication, division), octal number system, hexadecimal number system, 1's and 2's complement. Signed numbers, Ex-3, gray code, alphanumeric code, EBCDIC, ASCII, Hollirith codes, Error detection & correction, parity, 7- bit hamming. (08Hrs)
Unit-II	:	**Logic families:** Basic gates, Universal gates, and their truth tables, postulates of Boolean algebra, De-Morgan's theorem, Parameter definition: noise margin, power dissipation, voltage and current parameter, propagation delay, typical values for TTL, CMOS and ECL. Input/output profile for TTL & CMOS.TTL logic families-standard TTL, Totem-poll, open collector. **(10 Hrs.)**
Unit-III	:	**Combination circuit Design:** Min term and Max term representation of logical function, K-map minimization using K-map, Don't care condition, Quinn Mc-clusky method for minimization, example – Binary half and full adders, and subs tractor, BCD to Seven segment decoder, binary to gray and gray to binary conversion. **(12 Hrs)**
Unit-IV	:	**Combinational Logic Design Using MSI circuit:** Multiplexers, cascading of multiplexers, introduction to general purpose 74-series ICS, De-multiplexer / Decoders, Encoder, cascading of De-multiplexers, binary and BCD adder, Digital comparator, parity generation & checking (IC74180), Look ahead carry generator, ALU (74181). **(08Hrs)**
Unit-V	:	**Flip Flop and Counter:** 1-Bit memory cell, Clocked S-R FF, JKFF,MSJK FF, T –Type FF, D Type FF, Excitation table for all FF's, Application of all FF's, tri-state devices, buffers, example 8286, 74LS244,74LS245,

		Latches 8282. Counter: Ripple or asynchronous counter, modulus of counter, introduction to general purpose 74/54 series. Asynchronous ICS, cascading of ripple counter ICS, synchronous counter, Design principles, UP/Down counter, introduction to general purpose 54/74 series synchronous ICs. (12 Hrs)
Unit-VI	:	**Sequential Logic Design:** Introduction, registers, shift register, 4 bit bidirectional shift register, Universal register, application of shift register as ring counter, twisted ring counter, introduction to general purpose 74, series register ICS. **Semiconductor Memories:** Introduction, memory organization and operation, introduction to different types of memories such as RAM, EPROM, EEPROM, RAM (static and dynamic). **(10Hrs.)**

Reference Books:

Sr. No	Title	Author	Publication
1	Modern Digital Electronics	R.P. Jain	Tata McGrawHill publication
2	Digital Electronics Principles	Malvino Leach	Tata McGrawHill publication
3	Switching theory and logic design	Hill and Peterson	John Wiley
4	Digital circuits and system	Douglas Hall	Tata McGrawHill publication

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

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For 80 marks Paper:

1) Minimum ten questions.
2) Five questions in each section.
3) Question no 1 from section A and Question no 6 from section B be made compulsory and Should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4) Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE206
Teaching Scheme: 02Hrs/week
Theory: 2 hrs / week
Credits:02

Title: Values and Ethics in Profession
Class Test: 10
Theory Examination (Duration): 02 Hrs
Theory Examination (Marks): 40

Objectives	:	**The content aims to develop the value of engineer in the profession as well as his/her responsibility, duty and awareness of ethics while working in any organization**
Unit-I	:	Science, Technology and Engineering as knowledge and as social and professional activities, Effects of Technological Growth: Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development. **(05 hrs)**
Unit-II	:	Appropriate Technology Movement of Schumacher; later developments, Technology and developing notions. Problems of Technology transfer, Technology assessment, impact analysis. **(05 hrs)**
Unit-III	:	Human Operator in Engineering projects and industries: Problems of man, machine, interaction, Impact of assembly line and automation. Human centered technology. **(05 hrs)**
Unit-IV	:	Ethics of Profession: Engineering profession: Ethical issues in engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of technologists, Codes of professional ethics. Whistle blowing and beyond, Case studies. **(05hrs)**
Unit-V	:	Profession and Human Values: Values Crisis in contemporary society. Nature of values: Value, Spectrum of a good life. Psychological values: Integrated personality; mental health. Social values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitutio. **(05hrs)**
Unit-VI	:	**Aesthetic values:** Perception and enjoyment of beauty, simplicity, clarity **Moral and ethical values:** Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility **(05hrs)**

Reference Books:

Sr no.	Tittle	Author	Publication
1	Controlling Technology: Ethics and the Responsible Engineers	Stephen H Unger	John Wiley & Sons, New York, 1994 (2nd Ed)
2	Ethical Issues in Engineering	Deborah Johnson	Prentice Hall, Englewood Cliffs New Jersey, 1991

		3	Human values in the Engineering Profession	A N Tripathi	Monograph published by IIM, Calcutta, 1996

Section A: Includes Unit I, II and III; Section B: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 marks Paper:

1.Minimum eight questions.

2.Four questions in each section.

3.Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.

4.Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No: ICE221
Teaching Scheme: 2 hr / week
Practical: 2 hr / week
Credits:01

Title: **Lab I: Sensors and Transducers- I**

Teacher's Assessment: 25 Marks
Practical Examination : 25 Marks

Course Objectives	:	**Exposing the students to the basic principles of sensors and transducers with a view to impress.** • Knowledge of different types of measuring elements and circuits for displacement, pressure and temperature measurements. • Observation, monitoring, and analysis of these sensors form the basis of measurement.

List of Practicals (Minimum ten experiments to be performed) :

1	To determine the LVDT characteristics.
2	To determine thermocouple characteristics
3	To determine thermister characteristics
4	To determine level transducer characteristics
5	To study velocity transducer
6	To determine the characteristics of capacitive displacement transducer
7	To study of different biomedical electrodes
8	To determine RTD characteristics .
9	To determine strain gauge characteristics .
10	To determine the characteristics of Bourdon Tube Pressure Transducer
11	To measure the weight using Load Cell.

List of Reference Books :

Sr. No	Title	Author	Publication
1	Instrumentation Devices and Systems	Rangan C.S, Sarma G.R., Mani V S V	Tata McGraw-Hill Publication Ltd
2	Measurement Systems	Doebelin, E.O.	McGraw Hill Book Co., 1998

		3	A course on electrical and electronic measurements and instrumentation	A K Sawhney	Dhanpat Raj & Co, 2005
		4	Principle of Industrial Instrumentation	D Patranabis	Tata McGraw-Hill, New Delhi 2004
		5	Principles of measurement systems	John P.Bentley	Addison Wesley Longman, 3rd edition, 2000
		6	Instrumentation Measurement and Analysis	Nakra B.C., Chaudhary K.K	McGraw-Hill Publication Ltd. 2001.

The assessment of term work shall be on the following criteria:

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report
4. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

1. Performing the assigned practical during examination.
2. Record of experiment submitted by candidate.
3. Viva- voce based on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Code No: ICE222
Teaching Scheme: 2 hr / week
Practical: 2 hr / week
Credits:01

Title:Lab II: Analog Electronics
Teacher's Assessment: 25 Marks
Practical Examination : 25 Marks

Course Objectives	:	**Exposing the students to the basic theory of transistors and other electronic devices with a view to impress:** • Knowledge of different types amplifiers and their mathematical expression • Use of these devices for building an application circuitry

List of Practicals (Minimum ten experiments to be performed) :

1	V-I characteristics of PN junction Diode
2	Input, output and transfer characteristics of CE configuration
3	Input , output characteristics of CB BJT configuration
4	Drain characteristics and transfer characteristics of JFET
5	BJT biasing and plotting DC load line
6	To plot frequency response of CE amplifier
7	Clipping circuits: positive, negative and biased clipper circuits
8	RC phase oscillator, LC oscillator design and calculation of output frequency
9	Regulation measurement of transistor series voltage regulator
10	Class B Push pull amplifier: operation and efficiency calculation

List of Reference Books :

Sr. No	Title	Author	Publication
1	Integrated Electronics	Millman Halkies	Tata McGraw Hill
2	Pulse, Digital and Switching Waveforms	Jacob Millman and Hilbert Taub	Tata McGraw Hill
3	Electronic devices and circuits theory	Boylestad and Nashelsky	Prentice Hall, 2009
4	Linear Integrated Circuits	D. Roy Choudhary, Shailesh Jain	New Age International

		5	Operational-Amplifier and Integrated Circuits	Ramakant Gaikwad	Prentice Hall India
		6	Integrated Circuits	K. R. Botkar	Khanna Publishers

The assessment of term work shall be on the following criteria:

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report
4. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

1. Performing the assigned practical during examination
2. Record of experiment submitted by candidate
3. Viva- voce based on the syllabus

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No ICE223
Teaching Scheme: 2 hr / week
Practical: 2 hr / week
Credits:01

Title: Lab III: Digital Electronics
Teacher's Assessment: 25 Marks
Practical Examination : 25 Marks

Course Objectives :

The content aims to develop the knowledge of the student in the direction of acquiring the basic knowledge in the field of digital electronics.
- Knowledge of different types digital electronic devices and circuits
- Use of these devices for building an application circuitry

List of Practicals (Minimum ten experiments to be performed) :

1	Study of logic gates, Verification by truth tables
2	Implementation of Boolean algebra
3	Realization of half and full adder using gates
4	Realization of Substractors using gates
5	BCD adder using binary adder
6	Design and realization of code converter
7	Study of multiplexer and de-multiplexers
8	Study of S-R J-K, T AND D Flip-flop
9	Design and Implementation of 4 bit up/down counter using MSJK FF AND STUDY OF 7490, 7492,7493,74193 and other related chips.
10	Study of BCD to seven segment decoder
11	Study of ALU IC 74181

List of Reference Books :

Sr. No	Title	Author	Publication
1	Modern Digital Electronics	R.P. Jain	Tata McGraw Hill
2	Digital Electronics Principles	Malvino Leach	Tata McGraw Hill
3	Switching theory and logic design	Hill and Peterson	John Wiley
4	Digital circuits and system	Douglas Hall	Tata McGraw Hill

The assessment of term work shall be on the following criteria:

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report
4. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

1. Performing the assigned practical during examination
2. Record of experiment submitted by candidate
3. Viva- voce based on the syllabus

Dr. Babasaheb **Ambedkar Marathwada University, Aurangabad**
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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- III

Code No ICE224
Teaching Scheme: 2 hr / week
Practical: 2 hr / week
Credits:01

Title: **Lab IV: Communication Laboratory**
Teacher's Assessment: 50 Marks

Course Objectives	:	1. To help the Instrumentation and Control engineering students to get familiar with the communication engineering devices and networks. 2. To provide hands on practical experience to understand communication technology.

Practicals:

Section		Contents
Basic	:	Elements of communication system, types, base band signals and base band transmission, modulation techniques, bandwidth requirements, types and sources noise.
		(04 Hrs.)
Amplitude Modulation:	:	Generation of AM : low level and high level modulation, AM transmitters, AM broadcast transmitters, AM Receivers: Types of receivers and their characteristics
		(04 Hrs.)
Frequency Modulation:	:	Characteristics of FM: modulation index, deviation ratio, frequency spectrum, bandwidth requirement, percentage modulation, FM modulators.
		(04 Hrs.)
Audio Communication	:	Microphone types, characteristics, response parameters, Loudspeaker: types, characteristics, hi-fi system, stereophony, tone control circuits, recent trends in sound recording.
		(04 Hrs.)
Wireless Communication	:	Elements of wireless communication system, Infrared, optical, transmitters and receivers, modems, antenna, interfacing, Satellite communication
		(04 Hrs.)

List of Reference Books	:	Sr. No	Title	Author	Publication
		1	Principle of communication Engineering	George Kennedy	McGraw Hill
		2	Principle of communication Engineering	Rooddy Coolen	Tata McGraw Hill
		3	Audio & Video Systems	R.G.Gupta.	
		4	Communication Systems	B. P Lathi	BP publications
		5	Digital and Analog Communication Systems	K. Shanmugam	John Wiley & Sons

The assessment of term work shall be on the following criteria:
Assessment: of term work shall be done on the ten experiments based on the topics mentioned above and Oral examination would be conducted internally on the syllabus mentioned above too.

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Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester- IV

Code No.: BSH225
Teaching Scheme:(02) Hours per week
Practical: 02 Hours per week
Credits:01

Title: Lab V: Development Of Skills- II
Termwork :50 marks
Practical :--
Total Examination (Marks): 50 marks

Course Objectives	:	Students should adequately equip to face the highly competitive and very demanding corporate world of today.Soft skills encompass personal, social, communication, and self-management behaviors. They cover a wide spectrum of abilities and traits: being self-aware, trustworthiness, conscientiousness, adaptability, critical thinking, attitude, initiative, empathy, confidence, integrity, self-control, organizational awareness.
Unit-I		**Soft skills and Functional English.** Basic of soft skills Dimensions of soft skills, Misconception of soft skills. The changing business environment and its impact on soft skills, Presentation: Preparation, delivery, etc.Interview technique ,Group Discussion and Debate **5 hrs**
Unit-II		**Nonverbal Communication And Corporate etiquettes.** Body Language and its different aspects, Voice dynamics and voice modulation, Professional Appearance, Clothing etiquettes and Corporate dressing, Dinning table etiquettes. etc. **06 hrs**
Unit-III		**Business Correspondence** Official Drafting:Letter writing, Inquiry, Request, Complain, Sales, Follow-up. etc. Office documents like circulars, notices, minutes, agenda and memos. Report Writings: Types of reports, Data Interpretation: Compréhension of data, Analyses and Interprétations of data **06 hrs**
Unit-IV		**E-communication** Email communication and Email etiquettes ,Video Conferencing, and other e-communication **04 hrs**
Unit-V		**Team work and team building** The elements of teamwork. The changing nature of team .The basics of team intelligence, Diversity awareness, Gender issues, what is an effective team? Essential building blocks of essential team. **04hrs**
Unit-VI		**Problem-Solving and self confidence** Collaborative problem-solving, Benefits of collaboration, Effective Conflict Communication, Conflict resolution styles, Defusing conflict, Evaluating the conflict, How to build confidence, How confident are you? Thinking like a confident person. **5Hrs**

List of Reference Books	1. Gopalaswamy Ramesh, Mahadevan Ramesh, "The Ace of soft skills"Pearson publications. 2. Jerry Weissman ,"Presenting to Win", Prentice Hall publications. 3. William Sanborn Pfeiffer,T.V.S.Padmaja, "Technical communication" Pearson publications. 4. "Presentation Skills for Managers"Mcgraw Hills brief case books. 5 .Personality Development and soft skills,Oxferd University Press 6 Technical Report Writing Today: Daniel G. Riordan, Steven E. Pauley 7 Technical Writing: B. N. Basu 8 David Lawrence Preston,"365 steps of self confidence", Published by How To Books Ltd,

The term work shall be done on the ten assignments based on the topics mentioned above .And oral examination would be conducted internally on the syllabus mentioned.

The assessment of term work shall be done on the basis of the following.

- Continuous assessment
- Performing the experiments in the laboratory
- Oral examination conducted on the syllabus and term work mentioned above

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of S. Y. B. Tech (Instrumentation and Control Engineering) Semester – IV

Code No.: **BSH251**
Teaching **Scheme:**
Theory: **3 hrs / week**
Tutorial: **1 hr / week**
Credits: 4

Title: **Engineering Mathematics-IV**
Class Test : **20 Marks**
Theory **Examination (Duration)**: 3 Hrs
Theory **Examination (Marks)**: 80

Objectives	:	The contents aims to develop the knowledge of the student in the direction of solving the practical problem in the engineering and technology related to Function of complex variable transforms, Numerical Methods, Vectors.
Unit-I	:	**Function of complex variable :** Introduction , Analytic function ,Cauchy-Riemann equation in Cartesian and polar coordinates , Harmonic function, orthogonal system , Integration in complex plane: Line integral, Contour integral, Cauchy's integral theorem , Cauchy's integral formula, Extension of Cauchy's theorem on multiply connected region Taylor's and Laurent's series(without proof), Singularities, Residues, Cauchy's residue theorem **(15 Hrs.)**
Unit-II	:	**Application of Complex Variable:** Evaluation of real integrals: Integration along unit circle and along the upper half semi circle, Conformal Transformation, Bilinear transformation. **(05 Hrs.)**
Unit-III	:	**Vector Integration:** Line integral, Surface integral, Gauss divergent theorem, Stroke's theorem, Green's theorem, Curvilinear coordinates: Cylindrical and Spherical polar coordinates. **(10 Hrs.)**
Unit-IV	:	**Application of partial differential equation** Solution of partial differential equation by method of separation variable, Application of the method to i. Vibration of a string (The wave equation), ii. One dimensional heat flow (The diffusion equation) iii. Two dimensional heat flow. (The Laplace equation) **(10 Hrs.)**
Unit-V	:	**Z- transform :** Definition, Z-transform of elementary function , properties of Z-trasform , Inverse Z-transform :Power series method ,partial fraction method, inversion integral method(Residue method),Solution of Difference equation by using Z-trasform **(08 Hrs.)**
Unit-VI	:	**Numerical Method:** Solution of algebraic and transcendental equation, Newton Raphson method, Lagrange's interpolation, Solution of linear simulteneous equation; by Guass elimination method, The Guass-seidal method. Numerical Differentation, Solution of ordinary differential equations. Taylor series method, Euler's Method, Euler's modified method, Fourth order Runge-Kutta method. **(12 Hrs.)**

Reference Books :

Sr. No.	Title	Author	Publication
1	A Text Book Of Applied Mathematics Volume-II	P.N. Wartikar J.N.Wartikar.	Pune Vidyaryhi Griha Prakashan,

					Ninth.edition
		2	A Text Book Of Applied Mathematics Volume-III	P.N. Wartikar J.N.Wartikar.	Pune Vidyaryhi Griha Prakashan, First edition
		3	Advanced Engineering Mathematics	H.K.Dass.	S.Chand And Co.Ltd, Eighteenth edition
		4	Higher Engineering Mathematics	Dr.B.S.Grewal .	Khanna Publishers, 40 th edition
		5	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill Publishing Co.Ltd., First edition
		6	Solution to Higher Engineering Mathematics Volume -III	C.P.Gandhi	Laxmi publication, First edition

Digital Reference:

Sr. No.	Website / Links / e-Journals
1	www.sosmath.com
2	www.mathmadeeasy.com
3	www.mathworldwolframe.com
4	www.springer.com/application of mathematics
5	www.springer.com/applied mathematics and optimization
6	Bulletin of Indian Mathematical Society
7	Bulletin of Marathwada Mathematical Society

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1) Minimum ten questions.
2) Three questions in each section.
3) Question no 1 from section A and Question no 6 from section B be made compulsory and Should cover complete syllabus of the respective section and should be set for eight marks each. The Question no.1 and 4 should be of objective nature.
4) Two questions of 6 marks each from remaining questions from each section A and B be asked to solve.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
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Syllabus of S. Y. B. Tech (Instrumentation and Control Engineering) Semester – IV

Code No.: ICE252
Teaching Scheme:
Theory: 3 hrs / week
Tutorial: 1 hr / week
Credits: 4

Title: Control System Components

Class Test : 20 Marks
Theory Examination (Duration): 3 Hrs
Theory Examination (Marks): 80

Objectives	:	The contents aim to develop the knowledge of the student to the operation of various control components. They will be able to understand the various mechanical, hydraulic, pneumatic and electric components used in the control system.
Unit-I	:	**Mechanical components:** Introduction, springs, mass dash-pot and absorbers, mechanical equalizes and their transfer function, comparison of electrical and mechanical systems, gears and their types, use of gears in control system. Mechanical components: principal of operations and practical application of flywheel, tachometer, gyroscope. **(10 Hrs.)**
Unit-II	:	**Hydraulic components:** Introduction basic types of hydraulic transmission lines, servo motors, hydraulic power supply, Hydraulic circuits and transmission, applications like motor speed control, reciprocating, loading, unloading, sequencing of cylinders and direction control valves. **(10 Hrs.)**
Unit-III	:	**Pneumatic components:** Pneumatic power supply, introduction to pneumatic system, filters and pressure regulators, flapper nozzle system, pneumatic motors, Pneumatic circuits, applications, pneumatic control valves: Classification of valves. Valve actuators and accessories, control valve characteristics, valve selection and specifications. **(10 Hrs.)**
Unit-IV	:	**D.C Machines:** Operating principal and parts of DC Generator, EMF equation, Method of excitation, Concept of Armature reaction and Commutation, Characteristics of DC Generator, Losses, application, D.C Motor: Torque equation, Characteristics of DC Motor, Staring and Speed control of DC motor, DC servomotor, application, Problems. **(10 Hrs.)**
Unit-V	:	**AC Machines:** Single phase and three phase Induction Motor-Principal of operation, Construction, Squirrel cage and Slip ring motor, Torque equation, Torque-slip Characteristics, comparison and application. Synchronous Machines: Principal of operation, Phasor diagram, starting method, AC servomotor, Stepper motor

		and their types, applications (10 Hrs.)
Unit-VI	:	**Transformers:** Three phase Transformer- Various transformer connections(Y/Y, Y/Δ,Δ/Y, Δ/Δ), V and Scott connection. **Synchros:** Transmitter and receiver construction, principal, applications of Synchros as an error detector. **Relays:** Types of relays, cam timer relays and bulk timer relays, electromagnetic relays and contactors, applications in control system. (10 Hrs.)

List of reference books:

Sr. No.	Title	Author	Publication
1	Control System engineering	I. J. Nagrath	New Age International, 2006
2	Control System Components	M. D. Desai	Prentice Hall Learning, 2008
3	Control System Components	Gibson and Tuteur	Mc-Graw Hill, 1958
4	Electrical Machines	Nagrath Kothari	Tata Mcgraw-Hill
5	Electrical Technology	B. L. Theraja Vol. I and II	S. Chand
6	Electrical measurements and measuring instruments	Golding & Widdis	A. H. Wheeler

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1) Minimum ten questions.
2) Three questions in each section.
3) Question no 1 from section A and Question no 6 from section B be made compulsory and Should cover complete syllabus of the respective section and should be set for eight marks each. The Question no.1 and 4 should be of objective nature.
4) Two questions of 6 marks each from remaining questions from each section A and B be asked to solve.

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Code No.: ICE253
Teaching Scheme:
Theory: 3 hrs / week
Tutorial: 1 hr / week
Credits: 4

Title: Sensors and Transducers-II

Class Test : 20 Marks
Theory Examination (Duration): 3 Hrs
Theory Examination (Marks): 80

Objectives	:	Exposing the students to the basic principles of sensors and transducers with a view to impress: • Knowledge of different types of measuring elements and circuits for flow, pH, conductivity, humidity, viscosity, sound, torque, etc measurements. • Observation, monitoring, and analysis of these sensors form the basis of measurement.
Unit-I	:	**Flow Measurement - I** Units, Newtonian and non-Newtonian Fluids , Reynold's number, Laminar and turbulent flows, Velocity profile, Bernoulli's equation for incompressible flow, Density, Beta ratio, Reynold'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. **(10 Hrs.)**
Unit-II	:	**Flow Measurement – II** Variable area type: Rotameter Other Flowmeters: Turbine, Target, Electromagnetic, Ultrasonic (Doppler, Transit time i.e. Cross correlation Vortex shedding, Positive displacement, Anemometers Hot wire, Laser) Mass flowmeters: Coriolis, Angular momentum, Thermal, Flow totalizer, Solid flow meters. **(10 Hrs.)**
Unit-III	:	**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 **(10 Hrs.)**
Unit-IV	:	**A) Humidity and Moisture Measurement:** Humidity measurement : Terminology, Psychrometer, Hygrometer (Hair wire Electrolysis), Dew point. meter, Piezoelectric, Infrared absorption. Moisture measurement: Conductance and capacitance probes **B) Viscoisity Measurement:** Terminology, Units, Types -Capillary, Saybolt, Searle's rotating cylinder, Cone and plate, Falling and rolling ball. **(10 Hrs.)**
Unit-V	:	**A) Sound Measurement:** Concept of SPL, Typical sound measuring system (Sound level meter), Microphones (Capacitive, Piezoelectric, Electrodynamic, Carbon granule types) **B) Shaft Power Measurement:** Dynamometer (servo control, absorption), Instantaneous power measurements, Alternator, power measurement **C) Torque Measurement:** Strain gauge, Torsion Bar, Feedback torque sensor **D) Miscellaneous:** Leak Detector, Flame detector, Smoke detector **(10 Hrs.)**
Unit-VI	:	**Display Devices and Systems:**

		Classification of displays- Storage CRTs, Flat CRTs, LEDs, LCD display, Gas discharge plasma displays, Incandescent display, Electrophoretic image displays(EPID), Liquid Vapor Display (LVD). **(10 Hrs.)**

Reference Books:

Sr. No.	Title	Author	Publication
1	Instrumentation Devices and Systems	Rangan C.S, Sarma G.R., Mani V S V	Tata McGraw-Hill Publication Ltd
2	Measurement Systems	Doebelin, E.O.,	McGraw Hill Book Co., 1998
3	A course on electrical and electronic measurements and instrumentation	A K Sawhney	Dhanpat Raj & Co, 2005
4	Principle of Industrial Instrumentation	D Patranabis	Tata McGraw-Hill, New Delhi 2004
5	Principles of measurement systems	John P.Bentley	3rd edition, Addison Wesley Longman, 2000
6	Instrumentation Measurement and Analysis	Nakra B.C., Chaudhary K.K	McGraw-Hill Publication Ltd. 2001.

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1) Minimum ten questions.
2) Three questions in each section.
3) Question no 1 from section A and Question no 6 from section B be made compulsory and Should cover complete syllabus of the respective section and should be set for eight marks each. The Question no.1 and 4 should be of objective nature.
4) Two questions of 6 marks each from remaining questions from each section A and B be asked to solve.

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Code No.: ICE254 — Title: Basic Control Theory
Teaching Scheme: — Class Test : 20 Marks
Theory: 3 hrs / week — Theory Examination (Duration): 3 Hrs
Tutorial: 1 hr / week — Theory Examination (Marks): 80
Credits: 4

Objectives	:	**Exposing the students to the basic control systems with a view to impress:** • To understand the elements of control systems. • To understand the time domain and frequency domain analysis of control systems. • To understand the various stability determination tools for linear control systems.
Unit-I	:	**Introduction to control systems:** Definition, History, elements of control systems, Open- loop (non feedback) and closed loop (Feedback) control systems, Examples of such control systems, Effect of feedback on overall gain, Parameter variations, External disturbances or noise and control over system dynamics, Regenerative feedback, Linear versus nonlinear control systems, Time-invariant versus Time- varying systems, SISO and MIMO systems. **(10 Hrs.)**
Unit-II	:	**Representation of Control Systems:** Derivation of transfer functions of simple electric and mechanical systems, Block diagram representation of physical systems, Block diagram reduction technique, Signal flow graph, Mason's gain formula, conversion of block diagram to signal flow graph **(10 Hrs.)**
Unit-III	:	**Time- domain Analysis of control systems:** Standard test signals, transient response, Steady state error and error constants, Dynamic error series, Time response of first and second order systems, Time domain specifications, **Concept of stability:** BIBO stability, condition, zero-input and asymptotic stability, Hurwitz stability criterion, Routh-Hurwitz criterion in detail, Relative stability analysis. **(10 Hrs.)**
Unit-IV	:	**The Root–Locus technique:** Introduction, Basic properties of the root loci, General rules for constructing root loci, stability analysis of systems using Root locus, determination of roots of the closed loop system, inverse root locus, concept of dominant poles, Root-contour plots, effect of adding zeros & poles. **(10 Hrs.)**
Unit-V	:	**Frequency domain analysis:** Frequency domain specifications of the prototype second order system, Correlation between time and frequency response, Polar plots, Bode plots, Phase and Gain margin, Stability analysis with Bode plot, Log magnitude versus Phase plots. Constant M and N circles, Nichols Chart, Gain adjustments, Sensitivity analysis in frequency domain, Nyquist stability criterion: Mathematical preliminaries, stability and relative stability analysis. **(12 Hrs.)**

Unit-VI	:	**Compensators:** Introduction, different types of compensators, design of lag, lead, lag-lead compensators using root locus and Bode diagrams, design of P, I and PID controllers by analytical method, frequency response method and root locus technique. (08 Hrs.)

Reference Books :

Sr. No.	Title	Author	Publication
1	Modern Control Engineering	K. Ogata	Prentice-Hall of India Private Limited
2	Control System Engineering	I.J. Nagrath & M.Gopal	Wiley Eastern)
3	Digital Control Systems Principles & Design	M. Gopal	Tata McGraw Hill
4	Automatic Control System	D.Roddy and J.Cooien	Prentice-Hall of India Private Limited
5	Control System Engineering	Norman S Nise	Prentice-Hall of India Private Limited

Section A: Includes Unit I, II and III; **Section B**: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions.
2. Five questions in each section.
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

`Dr.Babasaheb Ambedkar Marathwada University, Aurangabad
(Faculty of Engineering & Technology)
Syllabus of S. Y. B. Tech. (Instrumentation and Control Engineering) Semester-IV

Code No.: ICE255
Title: Circuit Theory and Networks
Teaching Scheme: 04Hrs/week
Class Test: 20
Theory: 03Hrs/week
Theory Examination (Duration): 03 Hrs
Tutorial: 01Hr/week
Theory Examination (Marks): 80
Credits:04

Objectives	:	The contents aim to develop the knowledge of the student in the various types of electronic circuits and networks. They will be able to do analysis of these circuits and to apply different transforms and theorems to do so.
Unit-I	:	**Different types of systems & networks:** Concept of Charge, Current, Voltage, Energy, etc., Various types of systems like continuous & Discrete, Fixed and Time varying, Linear and Nonlinear, Lumped and distributed, Passive & Active Networks & Systems **(08Hrs)**
Unit-II	:	**Network Equation and its solution:** Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits. Transient analysis of different electrical circuits with and without initial conditions, Fourier Series and Fourier Transform, Kirchhoff's law's number of network equations, loop variable analysis, node variable analysis, duality, formation of network equation in matrix form, network solution by Laplace Transformation technique. **(12Hrs)**
Unit-III	:	**Network theorems and their applications in circuit analysis:** Formulation of network equations, Source transformations, Thevenin, Superposition, Millmans, Tellegen, substitution, reciprocity, Norton and maximum power transfer theorems. **(10 Hrs)**
Unit-IV	:	**Graph of network:** Concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials **(08 Hrs)**
Unit-V	:	**Two port networks:** Open circuit Impedance and Short circuit Admittance parameters, Transmission parameters, hybrid parameters, and their inter-relations, Ladder and general network, Indefinite admittance matrix- their applications to the analysis of active network, Active filter analysis and synthesis using operational amplifier. **(10 Hrs)**
Unit-VI	:	**SPICE:** How SPICE works. Model statement, models for passive and active device, D.C. circuits analysis, small signal analysis, capacitors and inductors in D.C. Circuits, steady state and transient, plotting and printing, input and output Impedance, D.C. sensitivity analysis, harmonic decomposition (Fourier Series), Harmonic re-composition, voltage controlled components **(12 Hrs)**

Reference Books: :

List of reference books:

Sr. No.	Title	Author	Publication
1	Circuits & Networks:Analysis & Synthesis	Sudhakar	2nd edition, TMH New Delhi
2	Network Analysis	Valkenburg M. E. Van	Prentice Hall.
3	Engineering circuit analysis with PSPICE and probe	Roger	
4	Engg Circuit Analysis	Hayt	6th edition, Tata Mcgraw-Hill
5	Networks, Filters & Transmission Lines	A. Chakravarty	Prentice Hall.
6	Electric Circuits Analysis	Sivandam	Vikas

Section A: Includes Unit I, II and III; Section B: Includes Unit IV, V and VI.

Pattern of Question Paper:

The six units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus..

For 80 marks Paper:

1. Minimum ten questions.
2. Five questions in each section.
3. Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for ten marks each. The Question no.1 and 6 should be of objective nature.
4. Two questions of 15 marks each from remaining questions from each section A and B be asked to solve.

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Code No.: ICE256
Teaching Scheme: 02Hrs/week
Theory: 2 hrs / week
Credits: 2

Title: Unit Operations
Class Test: 10
Theory Examination (Duration): 02Hrs
Theory Examination (Marks): 40

Objectives	:	1. To study different unit operations used in industry 2. To understand role of Instrumentation Engineer during such processes.
Unit-I	:	**Introduction:** Concepts of Unit Operation and Unit Processes, Material Balance and Energy Balance, Types of reactions, general idea of controlling operation **(05Hrs)**
Unit-II	:	**Size Reduction:** Different Crushers and Grinders, Working Principle. **Crystallization:** Principle and Operation, terminologies and equipment **(05Hrs)**
Unit-III	:	Blowers and Industrial Compressors, seperations, mixing **(05Hrs)**
Unit-IV	:	**Drying and Evaporation:** Liquid Characteristics, Types of Evaporators, Principle and Operation of Single and multiple effect Evaporators. Classification of Dryers, Principle and Operation of heat exchanger. **(05Hrs)**
Unit-V	:	**Distillation:** Equipment Setup, Flash Distillation, Batch Distillation, Continuous Distillation, Operational Features, Construction and Working Only **(05Hrs)**
Unit-VI	:	**Leaching and Extraction:** Principle, Working of Equipments **Humidification and Dehumidification:** Equipment Setup, Principle of working. **(05Hrs)**

Reference Books: :

Sr. No	Title	Author	Publication
1	"Elements of Discrete Mathematics"	McCabe W. L. Smith J. C., Peter Harriot	McGraw Hill Inc., 1993.
2	"Discrete Mathematics	Leverspel O.	Second Edition Willey Eastern Pvt. Ltd.

		3	"Discrete Mathematics with Graph Theory"	A N Tripathi	Robert H. Perry and Don Green
		4	Instrumentation Engineers Handbook: Process Measurement	B. G. Liptak	Chilton Book Company
		5	Instrumentation Engineers Handbook: Process control	B. G. Liptak	Chilton Book Company

Section A: Includes Unit I, II and III; **Section B:** Includes Unit IV, V and VI.

Pattern of Question Paper:

The six/four units in the syllabus shall be divided in two equal parts i.e. 3 units respectively. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 40 marks Paper:

1.Minimum eight questions.

2.Four questions in each section.

3.Question no 1 from section A and Question no 6 from section B be made compulsory and should cover complete syllabus of the respective section and should be set for six marks each. The Question no.1 and 6 should be of objective nature.

4.Two questions of 7 marks each from remaining questions from each section A and B be asked to solve.

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Code No.: ICE271
Teaching Scheme:
Practical: 2 hrs / week
Credits: 1

Title: Lab VI: Sensors and Transducers-II

Teacher's Assessment: 25 Marks
Practical Examination : 25 Marks

Objectives	:	Exposing the students to the basic principles of sensors and transducers with a view to impress. Knowledge of different types of measuring elements and circuits for flow, pH, conductivity, humidity, viscosity, sound, torque, etc measurements. Observation, monitoring, and analysis of these sensors form the basis of measurement.
Unit-I	:	**List of Practicals:** **1.** To measure flow using the head type flow meters. **2.** To measure flow using the rotameter. **3.** To measure flow using the electromagnetic flowmeter **4.** To measure flow using the ultrasonic flowmeter **5.** To determine pH using the electode type transducers. **6.** To determine humidity using the hygrometer transducer. **7.** To study sound level meter **8.** To study dynamometer characteristics **9.** To study smoke detector **10.** To study LED and LCD devices **11.** To study viscocity transducers.

Reference Books: :

Sr. No	Title	Author	Publication
1	Instrumentation Devices and Systems	Rangan C.S, Sarma G.R., Mani V S V	Tata McGraw-Hill Publication Ltd
2	Measurement Systems .	Doebelin, E.O.,	McGraw Hill Book Co., 1998

		3	A course on electrical and electronic measurements and instrumentation	A K Sawhney	
		4	Principle of Industrial Instrumentation	D Patranabis	Tata McGraw-Hill, New Delhi 2004
		5	Principles of measurement systems	John P.Bentley	3rd edition, Addison Wesley Longman, 2000
		6	Instrumentation Measurement and Analysis	Nakra B.C., Chaudhary K.K	McGraw-Hill Publication Ltd. 2001.

The assessment of term work shall be on the following criteria:

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report
4. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

1. Performing the assigned practical during examination
2. Record of experiment submitted by candidate
3. Viva- voce based on the syllabus

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Code No.: ICE272 — Title: Lab VII: **Basic Control Theory**
Teaching Scheme:
Practical: 2 hrs / week — Teacher's **Assessment:** 25 Marks
Credits: 01 — Practical **Examination** : 25 Marks

Objectives :

Exposing the students to the basic control systems with a view to impress:
- To understand the elements of control systems.
- To understand the time domain and frequency domain analysis of control systems
- To understand the various stability determination tools for linear control systems.

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List of Practicals:

1. To study the performance of an open and closed loop control system
2. To obtain the transient response of first order system
3. To obtain the transient response of second order system
4. To determine the transfer function of D. C. motor.
5. To determine steady state error of a type- 0, 1 and 2 system
6. Determination of transfer function of D. C. generator
7. To plot the root locus of a typical system
8. To plot the bode plot of a typical system
9. To plot the polar plot of a typical system
10. To study the lead and lag network.

Reference Books: :

Sr. No	Title	Author	Publication
1	Modern Control Engineering	K. Ogata	Prentice-Hall of India Private Limited
2	Control System Engineering	I.J. Nagrath & M.Gopal	Wiley Eastern)
3	Digital Control Systems Principles & Design	M. Gopal	Tata McGraw Hill
4	Automatic Control System	D.Roddy and J.Cooien	Prentice-Hall of India Private Limited
5	Control System Engineering	Norman S Nise	Prentice-Hall of India Private Limited

The assessment of term work shall be on the following criteria:

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report
4. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

1. Performing the assigned practical during examination
2. Record of experiment submitted by candidate
3. Viva- voce based on the syllabus

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Code No.: ICE273
Teaching Scheme:
Practical: 2 hrs / week
Credits: 01

Title: **Lab VIII: Circuit Theory and Networks**

Teacher's Assessment: 25 Marks
Practical Examination : 25 Marks

Objectives	:	The contents aim to develop the knowledge of the student in the various types of electronic circuits and networks. They will be able to do analysis of these circuits and to apply different transforms and theorems to do so.
	:	**List of Practicals:** 1. Kirchhoff's law justification. 2. Maximum power transfer theorem practical justification. 3. Thevenin's theorem practical justification. 4. Norton's theorem practical justification. 5. Plotting of behavior of RC circuit for step input using PSPICE. 6. Plotting of behavior of RL circuit for step input using PSPICE. 7. Plotting of behavior of RLC circuit for step input using PSPICE. 8. Fourier series analysis of square wave using PSPICE. 9. Fourier series analysis of triangular wave using PSPICE. 10. To determine the hybrid and impedance parameters of a given network.

Reference Books:	:	Sr. No	Title	Author	Publication
		1	Circuits & Networks: Analysis & Synthesis	Sudhakar	2nd edition, TMH New Delhi
		2	Network Analysis	Valkenburg M. E. Van	Prentice Hall.
		3	Engineering circuit analysis with PSPICE and probe	Roger	
		4	Engg Circuit Analysis	Hayt	6th edition, Tata Mcgraw-Hill
		5	Networks, Filters & Transmission Lines	A. Chakravarty	Prentice Hall.
		6	Electric Circuits Analysis	Sivandam	Vikas

The assessment of term work shall be on the following criteria:

5. Continuous Assessment
6. Performing the experiments in the laboratory
7. Regular submission of practical report
8. Oral examination conducted internally on the practical work and assigned syllabus

The assessment of Practical Examination shall be on the following criteria:

4. Performing the assigned practical during examination
5. Record of experiment submitted by candidate
6. Viva- voce based on the syllabus

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Code No.: ICE274
Teaching Scheme:
Practical: 2 hrs / week

Title: Lab IX: **Pneumatic and Hydraulic Instrumentation Laboratory**
Teacher's Assessment: 50 Marks
Credit: 1

Objectives	:	1. To help the Instrumentation and Control engineering students to get familiar with the pneumatic and Hydraulic systems and circuits. 2. To provide hands on practical experience to understand the importance of these circuits in control and industrial automation.
		Practicals:
		Basic of Pneumatic Systems Elements of pneumatic system, power supply, Air compressor, FRL unit, piston cylinder assembly. (04 Hrs.)
		Pneumatic Circuits 1. Single Acting cylinder with three way valve 2. Controlling speed of piston 3. Double acting cylinder with five way valve 4. Controlling speed of pneumatic motor 5. Timing ang sequencing Circuits (04 Hrs.)
		Basic of Hydraulic Systems Elements of Hydrulic system, power supply, FRL unit, types of piston cylinder assembly. **(04 Hrs.)**
		Hydraulic Circuits 1. Single Acting cylinder with directional valve 2. Controlling speed of piston 3. Double acting cylinder with five way valve 4. Controlling speed of hydraulic motor 5. Timing ang sequencing Circuits **(04 Hrs.)**

Electro-Pneumatic and Hydraulic System

1. Electrical components in Pneumatic and Hydraulic system
2. P/I Converter
3. Electrical sensors and actuators for Pneumatic and Hydraulic circuits
4. Pneumatic Control Vlaves and their characteristics

(04 Hrs.)

Reference Books :

Sr. No.	Title	Author	Publication
1	Process Control Instrumentation Technology	C. D. Johnson	PHI, 2002
2	Computer based Industrial Control	Krishankant	PHI,2004
3	Pneumatic & Hydraulic	Andrew Parr	PHI, 1999.
4	Introduction to hydraulics and Pneumatics	S. Ilango and V. Soundararajan	PHI (EEE)
5	Process Industrial Instruments & Control Handbook	D.Considine	McGraw Hill ,1993.

The assessment of term work shall be on the following criteria:

Assessment: of term work shall be done on the ten experiments based on the topics mentioned above and Oral examination would be conducted internally on the syllabus mentioned above too.

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Code No.: ICE275
Teaching Scheme: 02Hrs/week
Theory: 2 hrs / week
Credits: 1

Title: Lab X :**Development of skill-III**
Teachers assessment:**50 marks**

Objectives	:	1. To help the engineering students acquire adequate importance of various soft skills useful in professional life. 2. To provide training to the students to enable them to communicate in the team in the activities like group discussions, meeting, handling administrative responsibilities, presenting the ideas and to share the information.
Unit-I	:	**Group discussions :** To understand different communication practices like Debating, elocution, group discussions, critical thinking, brainstorming and conflict management. **(05Hrs)**
Unit-II	:	**Presentation :** To make good presentation, preparation for and practice of presentation, narration of events, Effective presentations- To make effective use of modern presentation aids, presentation graphics. **(5 Hrs)**
Unit-III	:	**Self-representation in a meeting :** Representation/ convincing of self opinion in a meeting of colleagues/ senior managerial personnel through arguing, convincing, presenting views in a meeting. Conducting a meeting: A). To acquire knowledge about preparing agenda of the meeting, receptive towards new ideas, appreciation of colleagues and subordinates, preparing minutes of meeting. B) To acquire Leadership skills and Interpersonal Communication, Vision, empowering and delegation, motivating others, team building. **(04 Hrs.)**
Unit-IV	:	**Marketing Skills :** Adaptation to marketing/ sales techniques: To achieve good marketing/ sales skills, Time Management. **(05Hrs)**
Unit-V	:	**Official letter writing :** A) To understand the method of writing official letters to boss/ seniors/ colleagues/ subordinates to assign tasks, to submit/ study progress reports.

		B) To study the official/ business correspondence (04 Hrs.)
Unit-VI	:	**Report writing :** Report writing on a mini project / visit : To acquire technical writing skill including technical reports, proposals, brochures, newsletters, technical articles, technical manuals. (02 Hrs.)

Reference Books:

Sr. No	Title	Author	Publication
1	Writing communication in English	Sarah Freeman	Orient Longman Publications
2	Handbook of Communication skills	Bernice Hurst	2nd edition,
3	Human Organisational Behaviour at work	Keith Davis	Tata McGraw Hill
4	Essence of effective. Communication	Ludlow & Panton	Prentice-Hall India Pvt. Ltd
5	Technical writing, Process. & Product	Gerson & Gerson	Prentice-Hall India Pvt. Ltd
6	Organisational Behaviour	Robbins	Prentice-Hall India Pvt. Ltd
7	You can Win	Shiv Khera	Macmillan Books, 2003 revised edition
8	Effective Business Communication	Asha Kaul	Prentice-Hall India Pvt. Ltd

The assessment of term work shall be on the following criteria:

Assessment: of term work shall be done on the ten assignments/practicals based on the topics mentioned above

1. Continuous Assessment
2. Performing the experiments in the laboratory
3. Regular submission of practical report/ assignments
4. Oral examination conducted internally on the practical work and assigned syllabus