DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY LONERE.

Structure and syllabus

Of

Second Year B. Tech. (Instrumentation Engineering)

With effect from Academic Year 2018-19

Approved in the 11 Academic Council held on 8 June 2018

TEACHING AND EVALUATION SCHEME OF SECOND YEAR B.TECH INSTRUMENTATION ENGINEERING

III SEMESTER.									
S.No	Course Code	Course Title	Teaching Scheme			Evaluation Scheme			Credits
			L	T	P	MSE	CA	ESE	
1	BTBSC301	Engineering Mathematics-III	3	1	0	20	20	60	4
2	BTEEC302	Network Analysis and Synthesis	2	1	0	20	20	60	3
3	BTINC303	Sensor and Transducer	2	1	0	20	20	60	3
4	BTINC304	Analog Electronics	2	1	0	20	20	60	3
5	BTEEE305A BTEEE305B BTINE305C	Elective –I (A) Engineering Materials (B) Applied Physics (C) Production Process Metrology	3	0	0	20	20	60	3
6	BTHM3401	Basic Human Rights	2	0	0	-	20	-	Audit
	BTBSC306	Applied Biology	2	0	0		20	60	2
7	BTEEL307	Network Analysis and Synthesis Lab	-	0	2	-	60	40	1
8	BTINL307	Sensor and Transducer Lab	0	0	2	-	60	40	1
9	BTINL308	Analog Electronics Lab	-	-	2	-	60	40	1
10	BTINL309	Computational Technic Lab	-	-	2	-	60	40	1
11	BTINF310	Field Training/ Internship/ Industrial Training Evaluation						50	1
		TOTAL	16	04	08	120	380	570	23
IV SEMESTER.									
1	BTINC401	Digital electronics	3	1	0	20	20	60	4
2	BTINC402	Feedback Control System	2	1	0	20	20	60	3
3	BTINC403	Electrical and Electronics measurement	2	1	0	20	20	60	3
4	BTINE404A BTINE404B BTINE404C	Elective –II (A) Microprocessor Based Systems (B) Analytical Sensor (C) Signals and systems	2	1	0	20	20	60	3
5	BTEEOE406A BTINOE406B BTINOE406C	Elective –III (A). Industrial safety (B). Engineering Economics (C). Professional Communication	3	0	0	20	20	60	3
6	BTID405	Product Design Engineering	1	0	2	30	30	40	2
7	BTINL407	Feedback Control System Lab	0	0	2	-	60	40	1
8	BTINL408	Digital electronics Lab	0	0	2	-	60	40	1
9	BTINL409	Electrical and Electronics measurement lab	-	0	2	-	60	40	1
10	BTINM410	Mini Project	0	0	2	-	60	40	1
11		Field Training / Internship/Industrial Training (minimum 4 weeks which can be completed partially in Third semester and Fourth Semester or in at one time.)							Credits to be evaluated in V Sem
	TOTAL		14	04	10	120	360	520	22

Semester III

Engineering Mathematics III

Teaching Scheme	**Examination Scheme**
Theory : 03 Hrs/Week	Mid-term Test : 20 Marks
Tutorial : 01 Hr/Week	Internal Assessment: 20 Marks
	End Semester Exam: 60 Marks
	Duration: 03 Hrs.

Course Contents:

Unit 1: Laplace Transform

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

[07 Hours]

Unit 2: Inverse Laplace Transform

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

[07 Hours]

Unit 3: Fourier Transform

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

[07 Hours]

Unit 4: Partial Differential Equations and Their Applications

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).

[07 Hours]

Unit 5: Functions of Complex Variables (Differential calculus)

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

[07 Hours]

Unit 6: Functions of Complex Variables (Integral calculus)

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without roofs).

[07 Hours]

Text Books

1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

Reference Books

1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.
5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

General Instructions:

1. The tutorial classes in Engineering Mathematics-III are to be conducted batchwise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

BTINC 302. Sensors and Transducers

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To familiarize the students with Sensors and transducer	
Course Outcome	1. To expose the students to various sensors and transducers for measuring mechanical quantities. 2. To understand the specifications of sensors and transducers. 3. To learn the basic conditioning circuits for various sensors and transducers. 4. To introduce advances in sensor technology.	
Unit	Contents	Contact Hrs
1	General concepts and terminology of measurement systems, transducer classification, general input-output configuration, static and dynamic characteristics of a measurement system, Statistical analysis of measurement data.	4
2	Resistive transducers: Potentiometers, metal and semiconductor strain gauges and signal conditioning circuits, strain gauge applications: Load and torque measurement. Self and mutual inductive transducers: capacitive transducers, eddy current transducers, proximity sensors, tacho generators and stroboscope.	5
3	Piezoelectric transducers and their signal conditioning, Seismic transducer and its dynamic response, photoelectric transducers, hall effect sensors, magnetostrictive transducers, Basics of Gyroscope.	6
4	Resistive (potentiometric type): Forms, material, resolution, accuracy, sensitivity, Strain gauge: Theory, type, materials, design consideration, sensitivity, gauge factor, variation with temperature, adhesive, rosettes, Inductive sensor: common types- Reluctance change type, Mutual inductance change type, transformer action type, Magnetostrictive type, brief discussion with respect to material, construction and input output variable, Ferromagnetic plunger type, short analysis,	6
5	Piezoelectric element: piezoelectric effect, charge and voltage co-efficient, crystal model, materials, natural & synthetic type, their comparison, force & stress sensing, ultrasonic sensors. Thermal sensors: Material expansion type: solid, liquid, gas & vapor, Resistance change type: RTD materials, tip sensitive & stem sensitive type, Thermistor material, shape, ranges and accuracy specification, Thermo-emf sensor: types, thermoelectric power, general consideration, Junction semiconductor type IC and PTAT type.	6
6	Radiation sensors: types, characteristics and comparison. Pyroelectric type Magnetic sensors: Sensor based on Villani effect for assessment of force, torque, proximity, Weidman effect for yoke coil sensors, Thomson effect, Hall effect, and Hall drive, performance characteristics, Radiation sensors: LDR, Photovoltaic cells, photodiodes, photo emissive cell-types, materials, construction, response, Geiger counters, Scintillation detectors. Digital displacement sensors, fiber optic sensor, Semiconductor sensor and Smart sensors	7
	REFERENCES: 1. D. Patranabis, Sensor & transducers, 2nd edition, PHI 2. H.K.P. Neubert, Instrument transducers, Oxford University press. 3. John P. Bentley, Principles of measurement Systems, Pearson Education. 4. E. A. Doebelin, Measurement systems: application & design, Mc Graw Hill. 5. S. M. Sze, Semiconductor sensors, John Wiley & Sons Inc.	

BTEEC 302. NETWORK ANALYSIS AND SYNTHESIS.

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Outcome	To review basic components of electric network. To design and develop network equations and their solutions. To apply Laplace theorem for electric network analyses To analyze AC circuit.	
Unit	Contents	Contact Hrs
1	Active & Passive Circuit Element: Independent & dependent voltage & current sources, R, L, C & mutual inductance circuit parameters, Their mathematical modes, Voltage current power relations. Classification of element: Lumped distributed, Linear & non-linear, Unilateral, Bilateral, Time invariant & variant, Pace invariant & variant, Super position, Thevenin's, Norton's Reciprocity, Maximum power transfer, Substitution, Tellegen's theorem.	6
2	Network Equations: Network topology, Graph, Tree, Branches, Chords, Equilibrium equation on loop basis & node basis Number of network equation required, Choice between nodal & loop analysis, Source transformation, Network mutual inductance, Dot conventions, Concept of super mesh, Super node Concept of duality & dual networks.	6
3	Solution of Network Equations: Classification solution of first, Second order differential equations of series & parallel R-L, R-C, R-L-C circuits, General & particular solutions, Particular integral & complimentary functions, Time constant, Mathematical analysis of circuit transients, initial conditions in network, Procedure of evaluality, Conditions in network problems, Solution of D.C. resistive network & A. C. sinusoidal steady state networks, Writing loop equations, Node equations directly in matrices form. Numericals	6
4	Application of Laplace's Transform: Solution of differential equation using Laplace transform, Unit step, Impulse & ramp functions, Laplace transform of singular & shifted function, Convolution integral, Concept of complex frequency, Transform impedance & transform admittance, Series & parallel combination of these transform networks.	6
5	Two port network: Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets.	6
6	Sinusoidal Steady State A. C. Circuit: R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC & VL, Magnification, Bandwidth, Q factor. Parallel Resonance: Resonance frequency for tank circuit frequency, Locus diagram of series R-L, R-C with variable R & X. Filter: Introduction classification, Low pass, High pass, Band pass & band reject filter, active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms.	6
	Ref Books: 1. Mac.E Van Valkenburg, "Network Analysis", 2. Franklin Fa-Kun. Kuo, "Network Analysis & Synthesis", John Wiley & Sons. 3. M. L. Soni, J. C. Gupta, "A Course in Electrical Circuits and Analysis", 4. Mac.E Van Valkenburg, "Network Synthesiss", 5. Joseph A. Edminister, Mahmood Maqvi, "Theory and Problems of Electric Circuits", Schaum's Outline Series,	

BTINC 304. ANALOG ELECTRONICS

Teaching scheme:
Theory: 2 hrs
Tutorial:1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electronics engineering	
Course Objective	To understand operational and performance characteristics of analog electronic devices To design and analyze transistor circuits	
Course Outcome	At the end of the course, students will able to: 1. Analyze transistor circuit using h parameter model. 2. Design and analyze different op-amp circuits for various applications. 3. Describe characteristics of various power devices and power converters.	
Unit	Contents	Contact Hrs
1	**Transistor:** Transistor biasing , Hybrid h parameter model and two port model applied to BJT, Analysis of common emitter, common collector and common base configurations- voltage and current gain, input and output impedance, comparison of properties; Current Mirrors Circuit, Class A, B and AB amplifiers, Class C amplifier, Power amplifiers, Servo amplifiers, Applications of Amplifiers .	7
2	**Operational Amplifiers:** Op-Amp parameters, frequency response, effect of temperature on Op-Amp parameters, differential versus single input amplifiers, instrumentation amplifier, bridge amplifier, adding versatility to the bridge amplifier, differentiator, integrator, Comparators, V to I and I to V Converters, Miller circuits, Voltage controlled oscillators, PLL and its applications, Signal conditioning circuits for temperature transmitter using OP amps	7
3	**Signal Generators and filters**: Multi vibrators, triangular wave generator, saw tooth wave generator, square wave generator, sine wave generator, Bootstrap Sweep generator, basic low pass filters, low pass and high pass Butterworth filters, band pass, band reject filters, applications of filters.	6
4	**Power devices and Applications:** SCR, Triac, DIAC, UJT, MOSFET, IGBT – Characteristics and principal of operation, Switching Characteristics, triggering requirement, protections, and applications	6
5	**Regulators:** Line and load regulation, characteristics of regulators, voltage multipliers, three terminal regulators, current boosters, protection circuits for regulators, power supply design, battery charging circuits	5
6	**Power Converters**: SMPS, working principles, performance parameters, DC-DC converters: different types, working principles and analysis, applications	5
	Reference : 1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" PearsonEducation, Tenth ed., 2009. 2. RamakantGayakwad, "Op-Amp and Linear Integrated Circuits", PHI,Forth ed.,2000 3. M. Rashid, "Power Electronics Circuit, Devices and Applications "Pearson Education, Third ed.2004	

BTIEEE 305.A. ENGINEERING MATERIALS.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, Physics, Chemistry	
Course Objective	To familiarized with different engineering material structure and properties.	
Course Outcome	To study basic crystallography. To study different alloys and ophasor diagram To study different metal structure and properties.	
Unit	Contents	Contact Hrs
1	Basic Crystallography- Crystal structure – BCC, FCC and HCP structure – unt cell – crystallographic planes and directions, miller indices. Crystal imperfections, point, line, planar and volume defects – Grain size, ASTM grain size number. Frank Reed source of dislocation Elastic & plastic modes of deformation, slip & twinning, strain hardening, seasons cracking, Bauschinger‟s effect, yield point phenomenon, cold/hot working, recovery, re-crystallization, and grain growth, strengthening of metals.	8
2	Constitution of Alloys and Phase Diagrams- Constitution of alloys – Solid solutions - substitutional and interstitial. Phase diagrams, Isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions. Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application	6
3	Heat Treatment- Definition – Full annealing, stress relief, recrystallisation and spheroidizing – normalising, hardening and tempering of steel. Isothermal transformation diagrams –cooling curves superimposed on I.T. diagram CCR Hardenability, Jominy end quench test – Austempering, martempering.Case hardening, carburising, nitriding, cyaniding, carbonitriding – Flame and Induction hardening.	6
4	Ferrous and Non Ferrous Metals- Effect of alloying additions on steel (Mn, Si, Cr, Mo, V Ti & W) - stainless and tool steels – HSLA. Gray, White malleable, spheroidal -Graphite - alloy cast-iron. Copper and Copper alloys – Brass, Bronze and Cupronickel. Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys	6
5	Non-Metallic Materials- Polymers – types of polymer, commodity and engineering polymers – Properties and applications of PE, PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE Polymers. Urea and Phenol formaldehydes. Engineering Ceramics – Properties and applications of Al2O3, SiC, SiC, Si3, N4, PSZ etc. Fibre and particulate reinforced composites and resin plastics. Powder metallurgy, Manufacturing Process, Compacting, Sintering, Vacuum processing. Properties of Powder processed materials, high energy compaction. Metal matrix composites, preparation propertes and uses.	6
6	Mechanical Properties and Testing- Mechanism of plastic deformation, slip and twinning. Types of fracture – Testing of materials under tension, compression and shear loads – dness tests (Brinell, Vickers and Rockwell) Impact test, Izod and charpy, fatigue and creep test	
	Reference Books: 1. Kenneth G.Budinski and Michael K.Budinski, Engineering Materials, Prentice-Hall 2. William D Callister, Material Science and Engineering, John Wiley and Sons. 3. Raghavan.V. Materials Science and Engineering, Prentice Hall of India. 4. Lakhtin, Y., & Weinstein, N. Engineering Physical Metallurgy: University Press of the Pacific. 5. Avner, S. H. Introduction to physical metallurgy: McGraw-Hill. 6. Jacobs, J. A., & Kilduff, T. F. Engineering materials technology: structures, processing, properties, and selection: Pearson/Prentice Hall. 7. Bolton, W., Engineering materials technology: Butterworth-Heinemann. 8. Flinn, R. A., & Trojan, P. K., Engineering Materials and Their Applications: Wiley	

BTEEE305.(B). APPLIED PHYSICS

Teaching scheme:
Theory: 3hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Physics-II	
Course Outcome	1.Understand concept of Electromagnetic theory and Magnetism 2. Understand concept od Dielectric and Super conductivity 3. Understand concept of nanomaterial	
Unit	Contents	Contact Hrs
1	Electromagnetic Theory covering, Coulomb‟s law for distribution of charges, Polarization Gauss‟s law, Electric current and equation of continuity, Magnetic induction and Lorentz force, Steady current and Biot- Savert law, Ampere‟s law, Magnetization and magnetic intensity, Faradays law of induction, Generalization of Ampere‟s law, Maxwell‟s equations	4
2	Dielectrics: Introduction to dielectrics, Concept of Polarization; Dipole and dipole moment, Electric field due to dipole (without derivation); Depolarization field, depolarization factors, Local electric field at an atom, Lorentz field, Lorentz relation; Dielectric constant and polarizability – ClausiusMossotti equation (with derivation); Types of polarization – electronic, ionic, dipolar, space charge; Temperature and frequency dependence of dielectric constant	5
3	Magnetism : Magnetic field and Magnetization; Magnetic susceptibility, Paramagnetism - Paramagnetism due to partially filled shells, transition elements (3d), rare earths (4f) and actinides, Magnetization and total angular momentum (definition and relationship); Concept of magnetic moment, gyromagnetic ratio, Lande‟s g-factor, Bohr Magneton, Curie‟s Law – derivation for „spin only‟ system (L = 0), expression for non-zero orbital angular momentum system (J = L + S); Ferromagnetism, antiferromagnetism, and ferrimagnetism; Exchange interaction between magnetic ions; Molecular field, Expression for Curie-Weiss law, concept of θP ;Ferromagnetism and Ferrimagnetism – Curie temperature, hysteresis, Hard ferromagnets, permanent magnets – SmCo5, Nd2Fe14B, Sintered Alnico, Sintered Ferrite – 3 etc. – Comparison and applications; Soft ferromagnets –Permalloys, Ferrites etc. – Comparison and applications; Neel temperature, Curie-Weiss law; Magnetic resonance, NMR and MRI, MASER;	5
4	Superconductivity :Zero resistance, Critical temperature Tc ,Perfect diamagnetism, Meissner effect, Critical field Hc, Type I and Type II superconductors, Cooper pairs and formation of superconducting gap at Fermi level, Electron-Phonon interaction and BCS theory, Isotope effect, Applications – Superconducting magnets, Transmission lines, Josephson effect (DC & AC, qualitative), SQUID; (7 Lectures)	4
5	Physics of Nanomaterials : Nanoscale; Properties of nanomaterials- Optical (SPR, luminescence, tuning band gap of semiconductor nanoparticles), Electrical (SET), Magnetic, Structural, Mechanical; Brief description of different methods of synthesis of nanomaterials (physical - laser ablation, ball milling; chemical - vapor deposition, sol gel); Reduction of dimensionality, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Density of states and energy spectrum for Zero dimensional solid, One dimensional quantum wire, Two dimensional potential well, Particle in a three dimensional box; Some special nanomaterials like, Aerogels – properties and applications, Carbon nanotubes - properties and applications, Core shell nanoparticles - properties and applications; Applications of nanomaterials: Electronics, Energy, Automobiles, Space, Medical, Textile, Cosmetics; Nanotechnology and Environment;	7
6	Quantum Computation and Communication covering, the idea of „qubit‟ and examples of single qubit logic gates- Classical bits, Qubit as a two level system; Bloch vector representation of state of qubit; Polarization states of photon and measurements; Pauli gates, Hadamard gate, Phase shift gate, Quantum gates as rotations in Bloch sphere; EPR paradox, concept of entanglement and Bell‟s inequality- The paradox, joint state of entangled particles; Proof of Bell‟s inequality; Two-qubit controlled gates; entanglement generation and the Bell basis- Generic twoqubit state, Controlled-NOT gate; Quantum circuit for transforming computational basis to	8

	Bell basis; Qualitative discussion on the „circuit" model of „quantum computation; An overview of classical cryptography: Vernam cypher; Public key cryptosystem; The „Rivest-Shamir-Adleman" or „RSA" protocol; Comments on No-cloning theorem and impossibility of faster-than-light transfer of information; The BB84 protocol in quantum cryptography- The protocol; its validity on the basis of Heisenberg"s uncertainty principle; Quantum Teleportation- Basic idea; measurement using Bell operator, need for classical communication channel; quantum circuit describing teleportation protocol;	

	Ref Books: 1. Kittel C., Introduction to Solid State Physics, Wiley Eastern 2. Callister W.C. Jr., Material Science and Engineering: An Introduction, 6th Edn., John Wiley & Sons 3. Kulkarni Sulabha K., Nanotechnology: Principles & Practices, Capitol Publishing Co. **4.** Charles P. Poole, Jr., Frank J. Owens, Introduction to Nanotechnology, Wiley Eastern **5.** Nielsen M. A., I. L. Chuang, Quantum Computation & Quantum Information, Cambridge Univ. Press

BTINE305C. PRODUCTION PROCESS AND METROLOGY.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering, Physics, Chemistry	
Course Objective	To familiarized with different production process and metrology	
Course Outcome	To study different production process. To understand metrology of different materials	
Unit	Contents	Contact Hrs
1	**Press working;** description and operation of process, process of shearing, punching, piercing, blanking trimming, perfecting notching, lancing, embossing, coining, bending, forging and drawing press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements, requirements of stock material	7
2	**Rolling:** General description of machines and process; rolling of structural sections plates and sheets; construction of halls, hot and cold rolling techniques Forging theory and application of forging processes description ; principle of toleration of drop and horizontal forging machines; general principle of design	5
3	**Metal Cutting:** Principles of metal cutting ,tool geometry, tool life plots, mach inability, tool wear, cutting force analysis, cutting tool materials &cutting fluids, economics of metal machining	7
4	**Pattern making;** pattern and patternmaking, pattern allowance; pattern design considerations, core boxes, types of patterns. Foundry, molding and core sands and their properties, molding machines, centrifugal casting, dye casting shell molding; cupola description and operation . lost wax molding; continuous casting	6
5	**Welding;** gas welding, electric arc welding, AC and DC welding machines and their characteristics. Flux, electrodes, pressure welding, electric resistance welding spot, seam and butt welding, submerged arc welding, thermit and tig & mig welding brazing, gas cutting	6
6	**Metrology:** standards of measurements, linear and angular instruments, slip gauges, comparators, sine bar, angle gauges, clinometers, tape gauge crew thread measurements limit gauging gauge design, fits and tolerance	5
	References: 1. Anderson and Tetro; shop theory TMH 2. KushikJ. P. :Manufacturing process PHI 3. Chapman: workshop technology TMH 4. RaoP.N.:Manufacturing Tech; foundry, forming welding TMH 5. Rao P.N. : Manufacturing Tech; metal cutting and machine toolsTMH	

BTHM3401. BASIC HUMAN RIGHTS

Teaching scheme:
Theory: 2 hrs
Total credit: P/NP (Audit course)

Examination Scheme:
Internal Assessment: 20 Marks

Pre requisite		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	The Basic Concepts: Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.	6
2	Human Rights and Human Duties: Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom	6
3	Society, Religion, Culture, and their Inter-Relationship: Impact of Social Structure on Human behaviour, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.	6
4	Social Structure and Social Problems: Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.	6
5	State, Individual Liberty, Freedom and Democracy: The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.	6
6	Human Rights in Indian Constitution and Law: The constitution of India: (i) Preamble (ii) Fundamental Rights (iii) Directive principles of state policy (iv) Fundamental Duties (v) Some other provisions Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission	6
	Reference Books: 1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005. 2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.	

BTBSCS306. APPLIED BIOLOGY

Teaching scheme:
Theory: 2 hrs
Total credit: 2

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Objective	To make students conversant with basic Biology regarding the life processes. To impart knowledge about the common corridors of biology and engineering as biologically inspired technologies like designs in nature, bioenergetics, bioprocesses, biomaterials, biomechanics, bio imaging, bioinformatics, bioinstrumentation etl	
Course Outcome	To introduce recent trends in biology viz. genetic& tissue engineering, stem cell engineering, bio and nanotechnology etc. with the objective of appreciating engineering principles in biological systems	
Unit		Contact Hrs
1	**Understanding Basics :** Engineering perspectives of biological sciences: Where engineering meets biology and where biology meets engineering. Biology as an integrated Science; Case studies on integrating biology with engineering. Biopolymers and macromolecules - Structure and Function: Organic and inorganic molecules; Unique Properties of Carbon; Carbohydrates, Amino Acids and proteins, Lipids, Nucleic Acids, Vitamins and Minerals; The Rise of Living Systems. Levels of organization of life : Cell as basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles - structure and function; Levels of organization of life tissues, organs, systems and organism.	5
2	**Biological Processes and Bioenergetics:** Energy Dynamics in Biology -Photosynthesis and energy assimilation: aerobic and anaerobic systems. Applications Respiration and Electron Transport Chain: Mitochondria and respiration, ATP generation.	4
3	**Bioenergetics:** Thermodynamic principles applied to biology, negative entropy changes in biological systems, Free Energy, Chemical Equilibrium; Optimization of biological functions: Metabolic networks; anabolism and catabolism; flux analysis (MATLAB).	4
4	**Living Systems:** Transport Phenomena in Biological Systems: Membrane channels and ion channels; Fluid flowand mass transfer a)In plants: Xylem and Phloem, b)In animals: Blood and Lymph c) Transport of molecules and gases (Oxygen and Carbon dioxide); Heat Transport - Body temperature regulation. **Communication:** Cell junctions, Cell-cell communications - cell signaling, Hormones, Pheromones; Chemotaxis. Communication in living systems by photo, bio, chemotactic methods. Defense mechanisms in plants and animals: In plants: Herbivory, secondary metabolites. In animals: Innate and Adaptive immune systems	5
5	**Techniques;** Genetic Code - Expression and Transmission of Genetic Information, The concept of DNA cloning; Mechanisms of Enzyme Action. Techniques for optimization: At molecular level: Genetic Code and protein synthesis, DNA replication, RDT, DNA hybridization, Colony Hybrids, PCR, DNA microarray, At cell level: Hybridoma technology, At tissue level: Plant Tissue Culture, Animal Tissue Culture and Microbial Culture techniques; Tissue Engineering	4
6	**Current trends and advances in cell and molecular biology Landmark Discoveries:** Landmark discoveries in the field of Molecular Biology, Cell Biology andGenetics. Nanobiotechnology: Micro-/Nanotechnologies for Interfacing Live Cells; Nanotechnology in Medicine - Diagnostics and Therapy; Biosensors; Nanotechnology in Agriculture; Biomemetics. Biomemetics: Nature inspired processes applicable to the field of Engineerin	4
	REFERENCES: 1. Lodish H, Berk A, Zipursky SL, et al. (2000) Molecular Cell Biology. W. H. Freeman. 2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000).Lehninger principles of biochemistry. NewYork: Worth Publishers. 3. Eggins BR. (1006) Biosensors: An Introduction. John Wiley & Sons Publishers.	

BTINL 308. SENSOR AND TRANSDUCER LABORATORY

Teaching scheme:

Lab work : 2 hrs

Total credit: 1

Examination Scheme:

Continuous Assessment (T/W): 60 Marks

Pr/oral: 40 Marks

Pre requisite	Basic electrical and electronics engineering
Course Objective	
Course Outcome	Identify various elements required for characterization of given transducers/sensors. Design and conduct experiments for measurement, characterization, and ability to analyze and interpret data Communicate effectively in oral and written form while formulating experiments, reports and other related documents.
Expt No	Title of Expt
1	Characterization and calibration of temperature measurement system. (Thermocouple, RTD and Thermistor)
2	Calibration of pressure gauges
3	Calibration of vacuum gauges
4	Characterization and calibration of level measurement system. (Capacitive, resistive, and radarlevel gauge)
5	Characterization and calibration of flow measurement system, (orifice and venture)
6	Characterization and calibration of flow measurement system (turbine, electromagnetic and ultrasonic)
7	Characterization and calibration of chemical sensors (pH and conductivity).
8	Identification of a temperature sensor from the list, which has minimum response time
9	Select a pressure sensor for the application which needs highest accuracy

BT**EEL307. NETWORK ANALYSIS AND SYNTHESIS LABORATORY**

Teaching scheme: **Examination Scheme:**

Lab work : 2 hrs Continuous Assessment (T/W): 60 Marks

Total credit: 1 Pr/oral: 40 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To understand and apply various network theorems for solution of engineering problems	
Course Outcome	Understand and apply various network theorems for solution of engineering problems	
Expt No	Title of Expt	
1	Verification of Superposition Theorem	
2	Verification of Thevinins Theorem	
3	Verification of Nortons Theorem	
4	Verification of Maximum power transfer theorem	
5	Determination of transient response of current in RL & RC circuits with step voltage input	
6	Analysis of RL/ RC and RLC circuits	
7	Determination of transient response of current in RLC circuit with step voltage input for under damped, critically damped and over damped cases	
8	Determination of frequency response of current in RLC circuit with sinusoidal ac input	
9	Determination of driving point and transfer functions of a two port ladder network and verify with theoretical values	
10	Determine characters tics of filter	

BT**IN308. ANALOG ELECTRONICS LABORATORY**

Teaching scheme:

Lab work : 2 hrs

Total credit: 1

Examination Scheme:

Continuous Assessment (T/W): 60 Marks

Pr/oral: 40 Marks

Pre requisite	Basic Electronics engineering	
Course Objective	To understand characteristics of basic semiconductor devices	
Course Outcome	Understand characteristics of various semiconductor devices	
Expt No	Title of Expt	
1	Measurement of op Amp parameters	
2	Design and implementation of integrator, differentiator and comparator	
3	Design and implementation of phased locked loop and its applications	
4	Design and implementation of various signal generator	
5	Design and implementation of instrument amplifier	
6	Design and implementation of voltage multiplier	
7	Characteristics of SCR Diac and Triac	
8	Characteristics of UJT BJT and MoSFET	
9	Design and implantation of voltage regulator	
10	Performance verification of SMPS	
11	Performance verification of DC- DC converter	

BTINL309.COMPUTATIONAL TECHNIQUES LABORATORY

Teaching scheme:

Lab work : 2 hrs

Total credit: 1

Examination Scheme:

Continuous Assessment (T/W): 60 Marks

Pr/oral: 40 Marks

Pre requisite		
Course Objective		
Course Outcome		
Expt No		
1	Recent developments in sensor design and analysis software tools.	
2	Introduction to COMSOL Multiphysics	
3	Analysis of mechanical structures to static or dynamic loads	
4	frequency-response analysis	
5	AC/DC Module for simulating electric, magnetic and electromagnetic fields	
6	Design and simulation of sensors and actuators using COMSOL	
7	Introduction to conventorwave	
8	Design and simulation of sensors and using Conventorwave	
9	Introduction to MATLAB	
10	Control design problems using state space approach	
11	Control design and implementation for electrical/mechanical/electromechanical/chemical processes using d SPACE	
12	Control design and implementation for electrical/mechanical/electromechanical/chemical processes using LabVIEW	
13	Control design and implementation for electrical/mechanical/electromechanical/chemical processes using OPAL-RT	

Semester –IV

BTINC 401. DIGITAL ELECTRONICS.

Teaching scheme:
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical technology,	
Course Objective	To familiarize the students with Digital Electronics.	
Course Outcome	To Work with a variety of number systems and numeric representations, including signed and unsigned binary, hexadecimal, 2's complement. To introduce basic postulates of Boolean algebra and show the correlation between Boolean expression. To introduce the methods for simplifying Boolean expressions. To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits.	
Unit	Contents	Contact Hrs
1	Positional Number System: Binary, Octal, Decimal, Hexadecimal number system, Number base conversions, complements - signed magnitude binary numbers - Binary Arithmetic- addition, subtraction - Binary codes- Weighted, BCD, 8421, Gray code, Excess 3 code, ASCII, Error detecting and correcting code, parity, hamming code. Boolean postulates and laws with proof, De-Morgan's Theorems, Principle of Duality, Minimization of Boolean expressions, Sum of Products (SOP), Product of Sums (POS), Canonical forms, Karnaugh map Minimization, Don't care conditions	8
2	Digital Circuits: Positive and Negative logic, Transistor logic, TTL with totem pole, open collector and tri state output, Emitter coupled logic – basic ECL inverter, NMOS NOR gate, CMOS inverter, NAND and NOR, Gate performance parameters – fan in, fan out, propagation delay, noise margin, power dissipation for each logic, characteristics of TTL and CMOS, subfamilies of TTL and CMOS.	8
3	Introduction to Combinational Circuits: Basic logic gates, Universal gates, Realization of Boolean functions using universal gates, Realization of combinational functions: addition – half and full adder – n bit adder – carry look ahead adder, subtraction, comparison, code conversion, and decoder, encoder, multiplexer, de-multiplexer, parity checkers, and parity generator.	4
4	Use of Multiplexers in logic design Multiplexer, de- multiplexers, decoders, encoders, designing using multiplexer, de-multiplexers, decoders. ICs of MUX, DEMUX, Decoders. Hazards in combinational circuits.	4
5	Application of flip flops as bounce elimination switch, register, counter and RAM, Binary ripple counter, synchronous binary counter, Design of modulo 'n' synchronous counter, up/down counters, Shift registers – SISO, SIPO, PISO, PIPO, bidirectional shift register and universal register, counters based on shift registers. Analysis of clocked sequential circuits, Design with state equation, Moore and Mealy graphs, State reduction and assignment, sequence Detection, Hazards in combinational circuits: Static hazard, dynamic hazard, essential hazards, hazard free combinational circuits	10
6	Introduction to programmable logic devices: PLA- block diagram, PAL – block diagram, registered PAL, Configurable PAL, GAL - architecture, CPLD – classification internal architecture, FPGA - architecture, ASIC – categories , full custom and semi-custom.	5
	REFERENCES: 1. Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003. 2. Thomas L Floyd, Digital Fundamentals, Pearson Education, 8th edition, 2003. 3. Donald P Leach, Albert Paul Malvino, Digital Principles and Applications, TMH, 2006.	

BTINC 402. FEEDBACK CONTROL SYSTEM.

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Objective	• To understand the use of transfer function models for analysis physical systems and introduce the control system components. • To provide adequate knowledge in the time response of systems and steady state error analysis. • To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems. • To introduce stability analysis and design of compensators • To introduce state variable representation of physical systems and study the effect of state feedback.	
Course Outcome	Develop TF models of physical systems	
Unit		Contact Hrs
1	Introduction: Concept of open & closed loop control system, Servomechanism, Multivariable control system, Applications in non-engineering field	7
2	Physical Systems and Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function	7
3	Block diagrams and Signal flow graphs: a) Block diagram algebra, Diagram reduction, Numerical examples.b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback	7
4	Control system components: Derivation of transfer functions of following components a)DC servomotors (Armature and field control) b) AC servomotors c) Amplidyne generators d), Synchros e) DC and AC tacho generators f) Potentiometer error detectors	6
5	Time domain analysis: Typical test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, (With different input), Numerical examples, transient response, Numericals, Concept of stability, Determination of stability by Routh - Hurwitz criterion	7
6	Frequency domain analysis: Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Numericals, Bode plots, Principle of argument, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. Definition of Root Locus, Construction of root locus, Stability from root locus plots, Root counters, Effect of addition of poles & zeros on root locus plots.	7
	REFERENCES: 1. Ogata – Modern Control Engineering (Prentice Hall Of India). 2. Kuo .B. C– Automatic Control System.(Prentice Hall Of India). 3. Nagarath&Gopal – Control System(Willey Earstern) 4. Gopal .M.– Control System.(Prentice Hall Of India).	

BTINC 403 ELECTRICAL AND ELECTRONICS MEASUREMENT.

Teaching scheme:
Theory: 2 hrs
Tutorial:1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To familiarize with different measurement and instrumentation devices.	
Course Outcome	To understand philosophy of measurement. To understand different methods analog and digital measurement. To study principle of construction and operation of different transducer and dismay methods.	
Unit	Contents	Contact Hrs
1	Philosophy Of Measurement- Methods of Measurement, Measurement System, Classification of instrument system, Characteristics of instruments & measurement system, Errors in measurement & its analysis, Standards.	5
2	Analog Measurement of Electrical Quantities – Electro dynamic, Thermocouple, Electrostatic & Rectifier type Ammeters & Voltmeters, Electro dynamic Wattmeter, Three Phase Wattmeter, Power in three phase system, errors & remedies in wattmeter and energymeter. Instrument Transformer and their applications in the extension of instrument range, Introduction to measurement of speed, frequency and power factor	6
3	Measurement of Parameters - Different methods of measuring low, medium and high resistances, measurement of inductance & capacitance with the help of AC Bridges, Q Meter	6
4	Digital Measurement of Electrical Quantities-Concept of digital measurement, block diagram Study of digital voltmeter, frequency meter Power Analyzer and Harmonics Analyzer; Electronic Multimeter.	6
5	Transducers: Definition - different types of transducers – criteria for selection –general characteristics–dynamic characteristics – transducers for measurement of displacement (RVDT &LVDT), speed, angular rotation, altitude, force, torque, humidity and moisture, pressure, strain and temperature (Thermocouple and RTD method), Hall Effect transducer and applications Instrumentation amplifiers – differential amplifiers) Data transmission and telemetry – methods of data transmission, General telemetry systems – Digital methods of frequency, phase, time and period measurements.	6
6	Display methods, recorders: Display methods and devices – different types of recorders – galvanometric recorders – pen driving system– magnetic recorders – digital recorders, digital storage oscilloscope (Block Diagram, theory and applications only)	7
	Reference Books: 1. A.K.Sawhney, A course in Elect. & Electronic Measurement and Instrumentation, Dhapat Rai & Co. 2. Golding & Widis, Electrical Measurement and Measurement instrument, Wheelar Books H.S. Kalsi, Electronic Instruments, Tata Mc-Graw hill 3.Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education. 4. D. Patranabis, Sensors & Transducers, PHI. 5. A.J. Bouwens, Digital Instrumentation, Tata Mc-Graw hill. 6. A.D. Heltric & W.C. Copper, Modern Electronic instrumentation & Measuring instruments, Wheeler Publication. 7. H.K.P. Neubert, Instrument transducers, Oxford University press.	

BTINE404A. MICROPROCESSOR BASED SYSTEM

Teaching scheme:
Theory: 2 hrs
Tuotorial:1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Digital electronics	
Course Objective	To introduce architecture of microprocessor and its programming skill	
Course Outcome	Understands principles of architecture of microprocessor. Apply programming skill to different day to day applications.	
Unit		Contact Hrs
1	**Architecture of 8085 Microprocessor:** Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles and timing diagrams	7
2	**Programming :**Instruction formats, Addressing modes, Instruction set, Need for Assembly language, Development of Assembly language programms	7
3	**Interfacing:** Memory Interfacing: Interface requirements, Address space partitioning, Buffering of Buses, timing constraints, Memory control signals, Read and write cycles, interfacing SRAM, EPROM and DRAM sections	7
4	**I/O Interfacing:** Memory mapped I/O Scheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports, Programmable peripheral interface (8255). Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes, Interfacing, Simple keyboards and LED displays	8
5	**Interrupts and DMA:** Interrupt feature, Need for interrupts, Characteristics of Interrupts, Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Development of Interrupt service subroutines, Multiple interrupt request and their handling, need for direct memory access, Devices for Handling DMA, Programmable DMA controller 8237.	6
6	**Applications:** Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809), Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and power factor-Traffic light controller, Stepper motor control	8
	REFERENCES: 1. Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997. 2. Singh. I.P., "Microprocessor Systems", Module 9 : Microcontrollers and their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997. 3. Douglas, V.Hall., "Microprocessor and Interfacing Programming and Hardware", 2ndEdition, McGraw Hill Inc., 1992. 4. Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987	

BTINE404B. .ANALYTICAL SENSORS

Teaching scheme:
Theory: 2 hrs
Tuotorial:1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Objective	• To understand various techniques and methods of analysis which occur in the various regions of the spectrum. • To study important methods of analysis of industrial gases. . To understand the important radio chemical methods of analysis	
Course Outcome	Ability to understand and analyze Instrumentation systems and their applications to various industries.	
Unit		Contact Hrs
1	**Colorimetry and spectrophotometry:** Spectral methods of analysis- Beer-Lambert law - Colorimeters - UV-Visible spectrophotometers - Single and double beam instruments , Sources and detectors - IR Spectrophotometers - Types - Attenuated total reflectance flame photometers - Atomic absorption spectrophotometers - Sources and detectors - FTIR spectrophotometers - Flame emission photometers - Fluorescence spectrophotometer.	6
2	**Chromatography:** Different techniques - Techniques by chromatographic bed shape- Column chromatography-Planer Chromatography-Paper Chromatography-Thin layer Chromatography-Applications - Techniques by physical state of mobile phase- Gas chromatography - Sources- Detectors - Liquid chromatographs-sources- detectors-Applications - High-pressure liquid chromatographs – sources detectors-Applications-Techniques by separation mechanism-Ion exchange chromatography-size exclusion chromatography-Applications.	7
3	**Industrial gas analyzers and pollution monitoring instruments:** Types of gas analyzers- Oxygen, No2 and H2S types, IR analyzers, Thermal conductivity analyzers, and analysis based on ionization of gases.	5
4	**Dust and smoke measurements:** Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulpher dioxide estimation	4
5	**PH Meters and dissolved component analyzers:** Principles of pH measurement, glass electrodes, hydrogen electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer- Sodium analyzer, silicon analyzer	6
6	**Nuclear Magnetic Resonance and microscopic Techniques:** NMR Basic principles , NMR spectrometer and Applications - Electron spin Resonance spectroscopy: - Basic principles, Instrumentation and applications. Scanning Electron Microscope (SEM) :- Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM) Basic principles - Instrumentation and applications. Mass spectrometers Different types and Applications.	8
	REFERENCES: 1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill 2nd edition, 2006. 2. G.W. Ewing, Instrumental Methods of Analysis, McGraw Hill, 2004. 3. Liptak, B.G., Process Measurement and Analysis, CRC Press, 2005 1. Braun, R.D., Introduction to Instrumental Analysis, McGraw - Hill, Singapore, 2006. 4. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007	

BTINE404C. SIGNALS AND SYSTEMS

Teaching scheme:
Theory: 3 hrs
Tuotorial:1hr
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Basic electrical engineering	
Course Objective	To familiarize the students with elements of signals and systems.	
Course Outcome	Understand standard concepts and tools that will serve as building blocks towards signal and system analysis	
Unit		Contact Hrs
1	**Classification of signals:** Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random signals.	5
2	**Classification of systems:** CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties	5
3	**Analysis of continuous time signals:** Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis	7
4	**Linear time invariant –continuous time systems** Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response , Fourier and Laplace transforms in analysis, State variable equations and matrix representation of syst	7
5	**Analysis of discrete time signals** Sampling of CT signals and aliasing, DTFT and properties, Z-transform and properties of Z transform.	6
6	**Linear time invariant - discrete time systems** Difference equations, Block diagram representation, Impulse response, Convolution sum, LTI systems analysis using DTFT and Z-transforms , State variable equations and matrix representation of systems.	7
	REFERENCES: 1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007. 2. Edward W Kamen& Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007 3. H P Hsu, RakeshRanjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007 4. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007. 5. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc, 2004. 6. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Willy	

Product Design Engineering

Teaching Scheme:	Examination Scheme:
Lecture-cum-demonstration: 1 hr/week Design Studio: 2 hr/week	Continuous Assessment 1: 30 Marks Continuous Assessment 2: 30 Marks Final Assessment: 40 Marks

- Pre-requisites: Knowledge of Basic Sciences, Mathematics and Engineering Drawing
- Design Studio : 2 hr/week to develop design sketching and practical skills, learning digital tools
- Continuous Assessment: Progress through a product design and documentation of steps in the selected product design
- Final Assessment: Product Design in Studio with final product specifications

Course Outcomes: At the end of the course, students will be able to

1. Create simple mechanical or other designs
2. Create design documents for knowledge sharing
3. Manage own work to meet design requirements
4. Work effectively with colleagues

Course Contents:

Unit 1. Introduction to Engineering Product Design:

Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.

Unit 2. Ideation:

Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals, Sketching of products, Market research for need, competitions, scale and cost, Initial specifications of products

Unit 3. Conceptualisation:

Computer operation principles and image editing through a graphical Composition; Computer aided 2D drafting and 3D Modeling through simple exercises.

Designing of components, Drawings of parts and synthesis of a product from its component parts, Rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, Detail Engineering drawings of components

BTINOE 406. A. INDUSTRIAL SAFETY.

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Objective	To introduce exposure towards different aspects of industrial operational management.	
Course Outcome	Understands safety and health management issues like fire safety health safety Develop awareness about various standards and procedures of industrial health and safety	
Unit		Contact Hrs
1	**Safety and Health Management :** i. Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. ii. Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders. iii. Importance of Industrial safety, role of safety department, Safety committee and National safety council Function Understanding basic safety Terms , Hazard definition , classification , What is Risk , Hazzard –Risk-Accident matrix. Personal Protective Equipments: Need, selection, supply, use, care and maintenance, Personal protective devices for head, ear, face, eye, foot, knee and body protection, Respiratory personal protective devices	5
2	**Industrial Hazzards, Risk and Prevention: Industrial noise**: -Sources, and its control, Effects of noise on the auditory system and health, Measurement of noise , Different air pollutants in industries: Effect of different gases and particulate matter ,acid fumes ,smoke, fog on human health. Vibration : effects, measurement and control measures, Machine and Plant layouts , ii. Machine guards and its types, automation. High pressure hazards, emptying, inspecting, repairing, hydraulic and nondestructive testing, hazards and control in mines.	5
3	**Electrical Hazards :** i. Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Overload and Short circuit protection, Earthling standards and earth fault protection , Protection against voltage fluctuations, Effects of shock on human body , Hazards from Borrowed neutrals, Electrical equipment in hazardous atmosphere, Criteria in their selection, installation, maintenance and use, Control of hazards due to static electricity, Importance of Insulation ,Introduction to CEA Safety Regulation 2010 Static Electricity and associated hazards , Hazards in Electronics and Instrumentation manufacturing industry	7
4	**Fire Safety :** General causes and classification of fire, Detection of fire, extinguishing methods, fire fighting installations with and without water., Type of Fire extinguishers , Use , hands on experience , Evacuation procedures , Mock drills introduction to Maharashtra Fire Prevention & Life Safety Measure Act, 2006 , Maharashtra Fire Prevention and Life Safety Measures Rules, 2009	7
5	**Occupational Health and Safety Assessment:** OHSAS 18001, Introduction, Origin, Development, How the standard works, Case studies .	6
6	**First aid and Emergency Procedures :** Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and joints, Bleeding, Burns, Scalds and accidents caused by electricity, Respiratory problems, Rescue and Transport of Casualty. CPR, poisoning, wounds.	7
	REFERENCES: NPTEL course material	

BTINOE406B: ENGINEERING ECONOMICS

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite		
Course Outcome	To study concept of time value of money To study about demand in detail To understand Meaning of Production and factors of production, To understand dif. Concept about market	
Unit	Contents	Contact Hrs
1	Introduction to the subject: Micro and Macro Economics, Relationship between Science, Engineering, Technology and Economic Development. Production Possibility Curve, Nature of Economic Laws.	6
2	Time Value of Money: concepts and application. Capital budgeting; Traditional and modern methods, Payback period method, IRR, ARR, NPV, PI (with the help of case studies)	6
3	Meaning of Demand, Law of Demand, Elasticity of Demand; meaning, factors effecting it and its practical application and importance. Demand forecasting (a brief explanation)	6
4	Meaning of Production and factors of production, Law of variable proportions and returns to scale. Internal and external economies and diseconomies of scale. Concepts of cost of production, different types of costs; accounting cost, sunk cost, marginal cost, Opportunity cost. Break even analysis, Make or Buy decision (case study). Relevance of Depreciation towards industry.	7
5	Meaning of market, types of market, perfect competition, Monopoly, Monopolistic, Oligopoly. (Main features). Supply and law of supply, Role of demand and supply in price determination.	6
6	Indian Economy, nature and characteristics. Basic concepts; fiscal and monetary policy, LPG, Inflation, Sensex, GATT, WTO and IMF. Difference between Central bank and Commercial banks	6
	Reference Books: 1. Chopra P. N., Principle of Economics, Kalyani Publishers 2. Dewett K. K., Modern economic theory, S. Chand 3. H. L. Ahuja., Modern economic theory, S. Chand 4. Dutt Rudar & Sundhram K. P. M., Indian Economy 5. Mishra S. K., Modern Micro Economics, Pragati Publications	

BTINOE406C. PROFESSIONAL COMMUNICATION

Teaching scheme:
Theory: 3 hrs
Total credit: 3

Examination Scheme:
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

Pre requisite	Communication Skill	
Course Objective	To enhance professional communication and report writing and presentation skill	
Course Outcome	develop good communication, presentation and report writing skill	
Unit		Contact Hrs
1	Introduction: Meaning & Definition, Role, Classification – Purpose of communication – Communication Process – Characteristics of successful communication – Importance of communication in management – Communication structure in organization – Communication in conflict resolution - Communication in crisis. Communication and negotiation. Communication in a cross-cultural setting	8
2	Oral Communication: Meaning – Principles of successful oral communication – Barriers to communication – Conversation control – Reflection and Empathy: two sides of effective oral communication. Modes of Oral Communication. Listening as a Communication Skill, Nonverbal communication	6
3	Written Communication: Purpose of writing – Clarity in writing – Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features – Coherence – Electronic writing process.	6
4	Business Letters and Reports: Introduction to business letters – Types of Business Letters - Writing routine and persuasive letters – Positive and Negative messages Writing Reports: Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports Writing Proposals: Structure & preparation. Writing memos Media management: The press release – Press conference – Media interviews Group Communication: Meetings – Planning meetings – objectives – participants – timing – venue of meetings. Meeting Documentation: Notice, Agenda, and Resolution & Minutes	6
5	Presentation skills: What is a presentation – Elements of presentation – Designing & Delivering Business Presentations – Advanced Visual Support for Managers Negotiation skills: What is negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies	7
6	Employment communication: Introduction – Composing Application Messages - Writing CVs – Group discussions – Interview skills Impact of Technological Advancement on Business Communication – Technologyenabled Communication - Communication networks – Intranet – Internet – e mails – SMS – teleconferencing – videoconferencing	8
	References: 1. Effective Technical Communication - Ashraf Rizvi M, TMH, 2005. 2. Business Communication - Sehgal M. K & Khetrapal V, Excel BOOKS. 3. Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012. 4. Basic Business Communication – Raj Kumar, Excel BOOKS, 2010.	

BTINL407.FEEDBACK CONTROL SYSTEM LABORATORY

Teaching scheme:

Lab work : 2 hrs

Total credit: 1

Examination Scheme:

Continuous Assessment (T/W): 60Marks

Pr/oral: 40 Marks

Pre requisite	**Feedback control System**	
Course Objective	To understand characteristics of second order system, To understand behavior of different compensation networks	
Course Outcome	Design various compensation networks. Design feedback controller and observer	
Expt No		
1	Time response Characteristic of a second order system	
2	Frequency response Characteristic of a second order system	
3	Constant gain compensation in time domain circuits	
4	Constant gain compensation in frequency domain circuits	
5	Compensating network characteristics	
6	Design of lead compensation networks	
7	Design of lag compensation networks	
8	Design of compensation lead-lag networks	
9	Designing of state feedback controller	
10	Observer design	

BTINL408. DIGITAL ELECTRONICS LABORATORY

Teaching scheme:

Lab work : 2 hrs

Total credit: 1

Examination Scheme:

Continuous Assessment (T/W): 60 Marks

Pr/oral: 40 Marks

Pre requisite	**Digital electronics**	
Course Objective	Understands designing of various digital circuits	
Course Outcome	Design and verifies various digital circuits	
Expt No		
1	Measurement of IC's parameters like rise time, fall time, propagation delays, and current and voltage parameters	
2	Design and implementation of arithmetic circuits	
3	Design and implementation of various code converters and its applications.	
4	Design and implementation of multiplexer and demultiplexer and its applications.	
5	Design and implementation of encoders and decoders and its applications	
6	Design and implementation of synchronous and asynchronous counters and its applications	
7	Design and implementation of non-sequential counters.	
8	Design and implementation of shift registers and its applications.	
9	Implementation and verifications of Combinational circuits on programmable logic devices	
10	Implementation and verifications of sequential circuits on programmable logic devices.	

BTINL 409. ELECTRICAL AND ELECTRONICS MEASUREMENT LABORATORY

Teaching scheme: **Examination Scheme:**

Lab work : 2 hrs Continuous Assessment (T/W): 60 Marks

Total credit: 1 Pr/oral: 40Marks

Pre requisite	Basic electrical engineering	
Course Objective		
Course Outcome		
Expt No	Title of Expt	
1	Cal liberation and error measurement of ammeter and voltmeter	
2	Performance verification of Thermocouple	
3	Power measurement using two wattmeter	
4	Calibration of single phase energy meter	
5	Extension of range in instrument transformer	
6	Error measurement of power and power factor instrument	
7	Conversion and extension of PMMC type instruments.	
8	Design and implementation of resistance measurement using Wheatstone bridge	
9	Design and implementation of series and shunt ohmmeters and evaluate its performance.	
10	Design of Schering and Maxwell bridges for measurement of inductance and capacitance and validation using LCR - Q meter.	
11	Study of DSO control panel and its specifications. Implement applications of DSO, Function generator	

BTINM 410. MINI PROJECT

Teaching scheme:	**Examination Scheme:**
Lab work : 2 hrs	Continuous Assessment (T/W): 60 Marks
Total credit: 1	Pr/oral: 40 Marks

Objective	To provide platform to apply engineering knowledge
Outcome	Able to simulate hardware for verification of engineering principles
	Demonstration of sensor circuits, extraction of signals and signal conditioning, measurement of various parameters including electrical, thermal, Mechanical communication parameters etc