Sardar Patel Institute of Technology
Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

B. Tech. (Electronics Engineering) and B. Tech. (Electronics & Telecommunication Engineering) Syllabus (Semester I-IV)

2020 Iteration (w.e.f. 2020-21)

Sardar Patel Institute of Technology

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2020 ITERATION: ELECTRONICS DOMAIN

Nomenclature of the Courses

BSC	Basic Science Course	**PC**	Program Core
BSE	Basic Science Elective	**PE**	Program Elective
ESC	Engineering Science Core	**MLC**	Mandatory Learning Course
ESE	Engineering Science Elective	**SCOPE**	Skill Certification for Outcome based Professional Education
SBC	Skilled Based Course	**OE**	Open Elective
ABL-SATVA	Self- Accomplishment Through Various Activities	**HSSE**	Humanities and Social Science Elective
ABL-SEVA	Social Empowerment Through Various Activities		

Abbreviations

L	Lecture Hour	O	Other Work (Self Study)
T	Tutorial Hour	E	Total Engagement in Hours
P	Laboratory Hour	C	Credit Assigned

Semester I

No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA101	Engineering Calculus	3	1	0	8	12	4
2	BSC	AS101	Engineering Physics	2	1	2	5	10	4
3	ESC	AS104	Engineering Graphics	1	0	4	2	07	3
4	ESC	ET101	Basic Electrical Engineering	3	0	2	6	11	4
5	ESC	CS101	Problem Solving using Imperative Programming	2	0	2	3	07	3
6	SBC	AS106	Skill Shop	0	0	2	0	02	1
7	ABL	SVXX/ STXX	SEVA-I or SATVA-I	0	0	0	2	02	1
			TOTAL	**11**	**2**	**12**	**26**	**51**	**20**

Semester II

No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA102	Differential Equations and Complex Analysis	3	1	0	8	12	4
2	BSC	AS102	Engineering Chemistry	2	0	2	3	07	3
3	BSC	AS103	Biology for Engineers	2	0	0	3	05	2
4	ESC	AS105	Engineering Mechanics	2	0	2	4	08	3
5	ESC	CS102	Problem Solving using OOPs	2	0	2	4	08	3
6	ESC	EC101	Digital Systems and Microprocessors	3	0	2	5	10	4
7	SBC	AS107	Writing Skills	1	0	2	2	05	2
			TOTAL	**15**	**1**	**10**	**29**	**55**	**21**

FIRST SUMMER

No	Type	Code	Course	L	T	P	O	E	C
1	SBC	AS108	ENGINEERING EXPLORATION (Project to solve social problem)	0	0	0	0	12	2

Semester III									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC*	MA202	Foundation of Mathematics-I*	3	0	0	6	09	3
2	PC	ET201	Computer Architecture & Organization	3	0	2	4	09	4
3	PC	ET202	Electronic Devices	3	0	2	4	09	4
4	PC	ET203	Network Theory	3	0	2	4	09	4
5	SBC	ET204	Electronic Instruments and Measurement Lab	0	1	2	2	05	2
6	SBC	AS201	Communication Skills	1	0	2	2	05	2
7	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	0	03	1
8	HSSE	HSEXX	HSS-I	2	0	0	3	05	2
			TOTAL	**14**	**1**	**12**	**24**	**54**	**22**

**Only for Lateral Entry Students*

Semester IV									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA203	Probability and Stochastic Processes	3	0	0	5	08	3
1	BSC*	MA204	Foundation of Mathematics-II	2	1	0	6	09	3
2	PC	ET205	Analog Circuits	3	0	2	6	11	4
3	PC	ET206	Microcontrollers	3	0	2	6	11	4
4	PC	ET207	Signals and Systems	3	0	2	6	11	4
5	SBC	ET208	Mini Project-I	0	0	0	4	04	2
6	ABL	SVXX/STXX	SEVA II or III /SATVA II or III	0	0	0	3	01	1
7	HSSE	HSEX2	HSS-II	2	0	0	3	05	2
8	S/M	SCX1/MNX1	SCOPE-I/Minor-I						3
			TOTAL	**14**	**0**	**6**	**33**	**51**	**20**

**Only for Lateral Entry Students*

Second Summer for HSC students									
No	Type	Code	Course	L	T	P	O	E	C
1	MLC	AS202	Constitution of India				06	06	NC

Second Summer (For Lateral Entry Students)									
No	Type	Code	Course	L	T	P	O	E	C
1	BSC	MA201	Linear Algebra	2	0	2	5	09	3
1	BSC	MA203	Probability and Stochastic Processes	3	0	0	5	08	3
2	MLC	AS202	Constitution of India				06	06	NC

Semester-I

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Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Engineering Calculus	3	1	0	8	12	3	1	0	4
MA101		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	100		100		200		400	

Pre-requisite Course Codes, if any.	HSC Mathematics
Course Objective: To develop mathematical skills for solving engineering problems.	
Course Outcomes (CO): ***At the End of the course students will be able to:-***	
MA101.1	Differentiate a function partially.
MA101.2	Find extreme values of a given function.
MA101.3	Find the nth order derivative of a given function.
MA101.4	Expand a given function as a power series.
MA101.5	Calculate the value of integrals in one variable using different techniques and solve multiple integrals in various coordinate systems.
MA101.6	Calculate Area using double integration.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
MA101.1												
MA101.2												
MA101.3												
MA101.4												
MA101.5												
MA101.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA101.1							
MA101.2							
MA101.3							
MA101.4							
MA101.5							
MA101.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Partial Differentiation**	1,2,3	**10**
	1.1	Partial derivatives of first and higher order. Partial derivatives of composite functions.		4
	1.2	Euler's theorem for homogeneous functions with two and three independent variables, deductions from Euler's theorem.		3
	1.3	Application of partial derivatives: i) Local Maxima and Minima of functions of two variables. ii) Lagrange's Method of undetermined multipliers.		3
2	**Title**	**Successive Differentiation and Series**	1,2,3	**10**
	2.1	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of De Moivre's theorem and partial fractions to calculate nth derivatives of given functions.		3
	2.2	Leibnitz's Theorem on nth derivative of product of two functions		2
	2.3	Infinite series: 1) Maclaurian's series (without proof) and derivation of series of some standard functions using Maclaurin series. Expansion of functions in powers of x by using i) Standard series method ii) Method of differentiation and integration. 2) Taylor's series and applications.		5
3	**Title**	**Integral Calculus (one variable)**	1,2,3	**8**
	3.1	Gamma functions: properties of gamma functions and integrals reducible to gamma functions.		2
	3.2	Beta functions: properties, relation between Beta and Gamma functions, integrals reducible to Beta functions, Duplication formula.		4
	3.3	Differentiation under Integral sign: differentiating integrals with constant limits of integration for one parameter.		2
4	**Title**	**Integral Calculus (multi variable)**	1,2,3	**14**

	4.1	Tracing of curves. Sketching standard solids (Spheres, Ellipsoids, Cylinders, Cones, Tetrahedrons, planes)		2
	4.2	Double Integration: definition and evaluation. Evaluate by changing the order of integration and by changing to polar form.		7
	4.3	Application of double integral to finding area of given regions.		2
	4.4	Triple integration: definition and evaluation (Cartesian and cylindrical coordinates).		3
5	**Self Study**	1.1 Partial differentiation of implicit functions. 2.3 Series by method of Substitution 3.2 Proof of Duplication Formula 3.3 Differentiation under Integral sign using two parameters and variable limits 4.1 Finding lengths of curves in Cartesian and polar form	1,2,3	**08**
Total				**42***

***Total of 42 hours does not include self study hours.**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	**Higher Engineering Mathematics**	**44th**	**Dr. B. S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	**Advanced Engineering Mathematics**	**28th**	**H.K Das**	**S. Chand**	**2014**
2.	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
3.	**Advanced Engineering Mathematics**	**4th**	**Jain and Iyengar**	**Narosa Publications**	**2014**

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Engineering Physics	2	1	2	6	11	2	1	1	4
		Examination Scheme								
AS101		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	HSC level physics
Course Objective: To provide the knowledge and methodology necessary for solving problems in the field of engineering	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS101.1	Illustrate the knowledge of basic concepts of semiconductor physics, lasers and quantum mechanics.
AS101.2	Solve the problems by applying the basics concepts of physics.
AS101.3	Use the Schrodinger equation to realize the concept of discreteness and quantum tunneling.
AS101.4	Explain the working of various LASERs and its practical applications.
AS101.5	To develop experimental skills and the practical abilities.
AS101.6	To develop an ability of understanding of concepts and principles of physics.
AS101.7	To comprehend importance of precision, accuracy of the experimental data.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS101.1												
AS101.2												
AS101.3												
AS101.4												
AS101.5												
AS101.6												
AS101.7												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS101.1							
AS101.2							
AS101.3							
AS101.4							
AS101.5							
AS101.6							
AS101.7							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Quantum Mechanics**		**09**
	1.1	de-Broglie hypothesis; experimental verification of de Broglie hypothesis; wave packet, group velocity and phase velocity; Wave function, Physical interpretation of wave function; Heisenberg's uncertainty principle; Electron diffraction experiment; Applications of uncertainty principle	1,2,3	
	1.2	Schrodinger's time dependent wave equation, time independent wave equation; Application of time-independent Schrodinger equation - Particle trapped in one dimensional box and Potential barrier (Tunnelling), Harmonic oscillator (qualitative)	1,2,3	
2	**Title**	**Physics of Semiconductors and Semiconductor devices**		**13**
	2.1	Conduction in metals and semiconductors; Fermi-Dirac distribution function and Fermi level in a conductor, insulator and semiconductor	5	
	2.2	Intrinsic and extrinsic semiconductors; intrinsic conductivity and extrinsic conductivity; Law of mass action, charge neutrality condition; intrinsic carrier concentration, electron and hole concentration; Extrinsic carrier concentration as a function of temperature; Effect of impurity concentration and temperature on the Fermi Level; Hall Effect and its applications. Drift and Diffusion current density	5	
	2.3	Formation of a P-N junction, depletion region and barrier potential; Energy band structure of P-N Junction (unbiased, forward-bias, reverse-bias); concept of carrier current densities in p-n junction in equilibrium, forward bias and reverse bias; Breakdown mechanism - Zener effect and avalanche	5,6	
	2.4	P-N junction devices: LED, Zener diode, photoconductors, photovoltaic solar cells and Bipolar Junction Transistors	5,6	
3	**Title**	**LASERS**		**06**
	3.1	Processes - Absorption of light, spontaneous emission, stimulated emission; Einstein's equations, Population inversion; metastable states; pumping and pumping schemes; optical resonance cavity	3,4	
	3.2	Ruby and Helium Neon laser, semiconductor laser; Applications of laser in industry, medicine and holography. (construction & reconstruction of holograms)	3,4	
4	**Self Study**	Interference of light in thin films having uniform thickness, Newton's rings, Applications of interference in anti-reflecting and highly		**05***

		reflecting thin films. Diffraction of light, Diffraction due to single slit, double slit and diffraction grating.		
			Total (*Not included)	**28**

Laboratory Component

Sr. No	Title of the Experiment*
1	Determination of energy band gap of a semiconductor
2	Study of I-V characteristics of a Zener diode
3	Determination of the type of semiconductor sample, concentration of charge carriers and its mobility using Hall Effect
4	Determination of Planck's constant using photo vacuum tube
5	Measurement of ultrasonic velocity in liquid medium using ultrasonic interferometer
6	Determination of radius of curvature using Newton's Rings
7	Determination of thickness of a thin foil or wire using the interference pattern of a wedge-shaped film
8	Determination of wavelengths of a mercury source and resolving power of a plane diffraction grating
9	Study of single slit diffraction
10	Determination of grating element of a diffraction grating using a laser source
11	Determination of the numerical aperture of an optical fibre
12	Uses of a Cathode-Ray Oscilloscope

*Students will perform any 10 of the above experiments

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	A Textbook of Engineering Physics	11	Dr. M.N. Avadhanulu & Dr. P. G. Kshirsagar	S. Chand	2018
2.	Engineering Physics	1	D. K. Bhttacharya & Poonam Tandon	Oxford University Press	2015

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	Concepts of Modern Physics	6	Arthur Beiser	McGraw Hill Education	2009
2.	Modern Physics	3	Serway, Moses and Moyer	Thomson Learning	2005
3.	Fundamentals of Physics	10	Halliday and Resnick	Wiley	2013
4.	Solid State Physics	8	S. O. Pillai	New Age International Publishers	2018
5.	Solid State Electronic Devices	7	Ben G. Streetman and Sanjay Kumar Banerjee	Pearson Education	2016
6.	Lasers: Fundamentals and Applications	2	Ghatak and Thyagarajan	Springer	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Engineering Graphics	1	0	2+2	4	08	1	0	2	3
		Examination Scheme								
		Component		ISE		MSE		ESE		Total
AS104		Theory		25		25		50		100
		Laboratory		100		--		100		200

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS104.1	Construct basic engineering curves.
AS104.2	Read the 3 dimensional view and draw the orthographic projections.
AS104.3	Draw projection of points and lines.
AS104.4	Draw projection of regular solids inclined to both the reference planes.
AS104.5	Read the orthographic projection and draw isometric views.
AS104.6	Draw the development of lateral surfaces of solids.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS104.1												
AS104.2												
AS104.3												
AS104.4												
AS104.5												
AS104.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS104.1							
AS104.2							
AS104.3							
AS104.4							
AS104.5							
AS104.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Unit1**	Introduction to Engineering Drawing	1,2	**3**
	1.1	Types of Lines, Dimensioning Systems as per IS conventions. First angle method of projection only		
	1.2	Basic construction of Cycloid and Involutes.		
2	**Unit2**	Orthographic Projection	1	**2**
	2.1	Orthographic views of a simple machine part as per the first angle method of projection recommended by I.S.		
	2.2	Full Sectional views of the Simple Machine parts.		
3	**Unit3**	**Projection of Points and Lines:-**	1,2	**4**
	3.1	Projection of points in all four quadrants		
	3.2	Projection of lines parallel to one principal reference plane.		
	3.3	Lines inclined to both the Reference Planes (Excluding Traces of lines).		
4	**Unit4**	**Projection of solid** (Regular solids like Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron and Cone only)	1,2	**5**
	4.1	Projection of solid resting on plane (Single step projection)		
	4.2	Projection of solid such that base inclined to one reference plane (Two step projection)		
	4.3	Projection of solid such that base inclined to both reference planes (Three step projection/problem) (Exclude Spheres, Composite, Hollow solids and frustum of solids)		
5	**Unit5**	**Isometric visualization and DLS**	2	**Lab session (2)**
	5.1	Isometric view (Natural scale only)		
	5.2	Development of lateral surface. (Exclude DLS of a solid with section or a hole in it and Reverse Development)		
6	**Self Study**	1.2 Construction of Engineering curves like ellipse, parabola, hyperbola, helix, other types of cycloid etc. by using different method of construction. 2.1 Solve more practice examples of orthographic views. Draw different views of a machine part/any object using third angle method of projection. (Axonometric view, oblique view, perspective etc.) 2.2 Half sectional orthographic views. 3.1 Projection of lines with traces, application based problems on Projection of lines 4.1 Projection of section of solid with cutting planes.	1,2,3	**6***

		5.1 Development of surfaces of frustum of solid, and retaining part of the solid after cutting plane, reverse development of solid.		
			Total (*Not included)	**14**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Engineering AutoCAD Laboratory
1	Introduction to AutoCAD:-Basic Drawing and Editing Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting and Printing. **Auto-Cad Practice sheets (Min. Two)**
2	**Orthographic views (Min Two Problems)**
3	**Sectional Orthographic views**
4	**Draw cycloid and involute**
5	**Draw Projection of lines**
6	**Projection of solid (Single step and two step)**
7	**Projection of solid (Three step)**
8	**Draw development of lateral surfaces with simple sections.**
9	**Isometric Views:-** Isometric View/Drawing of blocks of plain and cylindrical surfaces using plain/natural scale only. (Exclude Spherical surfaces).
..	

Text Books:

Sr. No	Title	Edition	Authors	Publisher	Year
1	Engineering Drawing	53rd	N D Bhatt	Charotar	2016
2	Engineering Drawing	3rd	Dhananjay A Jolhe	Tata McGraw Hill	2011

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
3	AutoCAD 2017	--	Sham Tickoo	DreamTech Press, Delhi	2017
4	Engineering Drawing and Graphics	5th	K Venugopal	New Age International	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Basic Electrical Engineering	3	0	2	5	10	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
ET101		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	Basic concepts of electric charge, current, voltage and power
Course Objective: To impart a basic knowledge of electrical quantities, Circuits and components.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
ET101.1	Compute various electrical quantities of given dc circuit using circuit simplification techniques and various network theorems.
ET101.2	To expose the students to different terms and concepts in AC Circuits at fundamental frequency and to expose them to basics of effects of harmonics in the waveforms
ET101.3	To study the working principles of electrical machines and their applications
ET101.4	To expose the students the fundamental concepts in Controllable Switch and Modulation based Power Conversion
ET101.5	To study Electrical Parameters of the Batteries and their selection and design criteria for a specific application

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
ET101.1												
ET101.2												
ET101.3												
ET101.4												
ET101.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
ET101.1							
ET101.2							
ET101.3							
ET101.4							
ET101.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs
1	**Title**	**DC Circuits**		10
	1.1	Electrical circuit elements (R, L and C), Voltage and current sources, Equivalent resistance of circuits, Simplification using delta-star and star-delta transformation.		
	1.2	Kirchhoff's current and voltage laws, Analysis of simple circuits with dc excitation. Mesh analysis, Superposition, Thevenin, Norton and Maximum Power Transfer Theorems		
	1.3	Time-domain analysis of first-order DC Transients in RL and RC circuits.		
2	**Title**	**AC Circuits**		12
	2.1	Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Harmonics, Total Harmonic Distortion, Power supplied by Harmonic voltages and currents, Power factor in case of non-sinusoidal waveforms.		
	2.2	AC Analysis of series and parallel RLC Circuits with Resonance, Concept of Bandwidth and Q-factor,		
	2.3	Three-phase balanced circuits, voltage and current relations in star and delta connections.		
3	**Title**	**Electromagnetic and Electro-Mechanical Energy Converters**		10
	3.1	Magnetically Coupled Coils, Self and Mutual Inductance and Dot Convention		
	3.2	Single Phase Transformer: Principle of Operation, Equivalent Circuits, Efficiency and Regulation.		
	3.3	Introduction to Three-phase Transformers and Applications		
	3.4	Fundamental Principles of Rotating Machines, Characteristics of Induction motor and DC motor		
4	**Title**	**Electric Power Converters**		05
	4.1	Fundamental Principles of Buck, Boost and buck-boost DC-DC converters and their Transfer Characteristics, Duty Ratio Control		
	4.2	Single-phase voltage source inverters and PWM		
5	**Title**	**Batteries: Electrical Characteristics and Applications**		05
	5.1	Introduction to type of Batteries, Generalized Battery parameters such as SoC, DoD, Energy and Power Densities, Battery C-rating, etc. Comparison		

		of Batteries, Charging and Discharging Characteristic		
	5.2	Selection and Sizing of Battery Packs for Specific Applications		
6	**Self Study**	Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption and power factor improvement.		**3***
			Total (*Not included)	**42**

Laboratory Component (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
01	Introduction to Electrical Measuring instruments, Lamp Loads, Inductor Loads and Capacitor Bank
02	Verification of Star-Delta and Delta-star Transformation with Kirchoff's Laws
03	Verification of Thevenin's Norton's and Maximum Power Transfer Theorem
04	Verification of DC Transient equations in RL and RC Circuits
05	Experimental study of single-phase AC circuit with R-L and R-C Load with Measurement of Power and Power factor
06	Experimental study of R-L-C series Resonance. To plot resonance curve, To compute Bandwidth and Q-factor
07	Experiment on Magnetic Circuit Fundamentals
08	Loading of a transformer: measurement of primary and secondary voltages and currents, and power. To compute efficiency and regulation.
09	Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
10	Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.
11	Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform.
12	Demonstration of V/F control of Induction motor
13	Experimental study of charge and Discharge characteristics of a Lead-acid Battery
14	Introduction to L.T. Switch gear

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Basic Electrical Engineering	**3rd**	D.P. Kothari and I. J.	Tata McGraw Hill	2010
2	Electrical Technology	23rd	B. L. Theraja	S. Chand Publications	2003

Reference Books

Sr. No	Title	Edition	Author	Publisher	Year
01	Basic Electrical Engineering	2nd	D.C. Kulshreshtha	McGraw Hill	2019
02	Fundamentals of Electrical Engineering	2nd	L.S. Bobrow	Oxford University Press	2011
03	Electrical and Electronics Technology	3rd	E. Hughes	Pearson	2010
04	Electrical Engineering Fundamentals	2nd	V.D. Toro	Prentice Hall India	1989
05	Elements of Power Electronics	2nd	P. T. Krein	New York and Oxford: Oxford University Press	2015
06	Power Electronics: Converters, Application and Design	2nd	Ned Mohan, T.M Undelands and W P Robbins	John Wiley and Sons. Inc.	1995
07	Electric Machinery	6th	A. E. Fitzgerald, C. Kingsley and S. D. Umans	McGraw-Hill	2003

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Problem Solving using Imperative Programming	2	0	2	4	8	2	0	1	3
		Examination Scheme								
CS101		Component	ISE		MSE		ESE		Total	
		Theory	-		-		-		-	
		Laboratory	200		--		100		300	

Pre-requisite Course Codes, if any.	
Course Objective: To develop problem solving skills using imperative programming	
Course Outcomes (CO):*At the End of the course students will be able to*	
CS101.1	Explain the problem solving aspects using various programming paradigms.
CS101.2	Solve real world problems using imperative programming approach.
CS101.3	Solve problems using control structures for real world problems.
CS101.4	Solve problems using Arrays and Text processing.
CS101.5	Develop modular code for a given problem.
CS101.6	Solve real world problems using Structures and Unions

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CS101.1												
CS101.2												
CS101.3												
CS101.4												
CS101.5												
CS101.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CS101.1							
CS101.2							
CS101.3							
CS101.4							
CS101.5							
CS101.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Introduction to Problem Solving and Programming Paradigms**		
	1.1	What is a Problem, Problem Solving Aspect, Top Down Design, Implementation of Algorithms, Characteristics of a good algorithm, what is a computer program, real life examples of programming, Computer based applications of programming, Steps followed in Program Development, Characteristics of good Program	3,4	2
	1.2	Overview of Programming Paradigms - Declarative and Imperative, Problem solving using Algorithm and Flowcharts,	3,4	2
2	**Title**	**Basic Elements of Computer Programming and Control flow**		
	2.1	Variables, keywords, Data types, Operators**:** Arithmetic, Relational and Logical, Assignment, Unary, Conditional, Bitwise, Expression, Statements.	1,2	1
	2.2	Branching Structures: if statement, if-else statement, multi-way decision, switch statement, continue statement, break statement Iterative Structures: while, do-while, for, nested loops	1,2	3
	2.3	Problem solving using Control Structures for real world problems	1,2,4	2
3	**Title**	**Problem Solving using Array Techniques**		
	3.1	Introduction to Arrays: Declaration, Definition, accessing array elements, one-dimensional array, two-dimensional array, array of characters, Strings	1,2	2
	3.2	Classical Problem Solving using Arrays like Array Order Reversal, Array Counting or Histogramming, Finding the maximum number in a set.	1,2,4	2
	3.3	Text Processing problems like finding length, keyword search, finding anagrams	1,2,4	2
4	**Title**	**Problem Solving using Modular Approach**		
	4.1	Defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, call by value, pointers and call by reference, Recursion	1,2	4
	4.2	Problem solving using Functions and Recursive applications	1,2,4	3
5	**Title**	**Structures and Unions**		
	5.1	Structures and Union: Declaration, Initialization, structure within structure, Array of Structure, Operation on structures, Concept of Union, Difference between structure and union,	1,2	3
	5.2	Real world problems using Structures and Unions	1,2,4	2
6	**Self Study**	File handling**:** Types of File, File operation- Opening, Closing, Creating, Reading, Processing File, Command line arguments, Dynamic Memory Allocation	1,2,4	**4***
			Total (*Not included)	**28**

Laboratory Component (Minimum 10 Laboratory experiments are expected)
Note: All problems should be implemented using C language.

Sr. No	Title of the Experiment
1	Use the formatted input/output statements, operators and expressions of C language
2	Apply various control structures to solve given problems.
3	Apply the concept of functions to incorporate modularity.
4	Demonstrate the use of one-dimensional arrays to solve a given problem.
5	Demonstrate the use of two-dimensional arrays to solve a given problem.
6	Apply the concept of recursion to solve a given problem.
7	Implement various text processing problems.
8	Apply the concepts of structures/union to solve a given problem.
9	Demonstrate the use of pointers to solve a given problem.
10	Implement various operations on files to solve a given problem.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Programming with C	Fourth	Byron Gottfried	McGraw Hill (Schaum's outline series)	2018
2	The C programming Language	Second	Kernighan , Ritchie	Pearson	2015
3	Foundations of Programming Languages	Second	Kent D. Lee	Springer	2017
4	How to Solve it by Computer	First	R.G. Dromey	Prentice Hall India	1998

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Let Us C	Sixteenth	Yashavant Kanetkar	BPB	2017
2	Programming Language Concepts	Third	Carlo Ghezi, Mehdi Jazayeri	John Wiley & Sons	2008
3	Computer Programming in C	Second	V. Rajaraman & Neeharika Adabala	PHI Learning, Eastern Economy Edition,	2014

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Skill Shop	0	0	2	0	02	0	0	1	1
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
AS106		Theory	--		--		--			--
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To equip the students with the fundamental skills involved in the creation of simulated and physical design.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS106.1	Operate basic electronic equipment and instruments.
AS106.2	Make PCB designs in simulations.
AS106.3	Assemble, disassemble and troubleshoot computer hardware and network peripherals.
AS106.4	Fabricate basic jobs in traditional trades.
AS106.5	Design a 3D model and translate it to a 3D printed component.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS106.1												
AS106.2												
AS106.3												
AS106.4												
AS106.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS106.1							
AS106.2							
AS106.3							
AS106.4							
AS106.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Lab Component

Trade No.	Unit No.	Topics	Ref.	Hrs.
1	Unit 1	**Electronic Components**	5	
	1.1	**Introduction to Electronic Components** Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, IC tester and Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, AC mains voltage/1 KHz Square wave/any small signal from function generator on Oscilloscope, Testing of sample digital ICs using IC tester. **OR** **Repairing of gadgets and appliances:** Elementary skills of repairing juicer, mixer, grinder, etc.		**4**
2	Unit 2	**PCB Laboratory Exercises**	6	
	2.1	Layout drawing, Positive and negative film making, PCB etching and drilling, Tinning and soldering technique.		**4**
3	Unit 3	**Hardware and Networking**	7, 8	**4**
	3.1	Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc.		
	3.2	Assembling of PC, Installation of Operating System and Device drivers, Boot-up sequence. Installation of application software (at least one).		
	3.3	Basic troubleshooting and maintenance.		
	3.4	Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping.		
4	Unit 4	**Traditional Trades***	1, 2	**4**
		Carpentry Use and setting of hard tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood turning and modern wood turning methods. One carpentry job involving a joint and report on demonstration of a job involving wood turning required for successful completion of module. OR **Electrical board wiring** House wiring, staircase wiring, and wiring diagram for fluorescent tube light, Godown wiring and three phase wiring for electrical motors. OR **Sheet Metal Practice** Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of		

		joints. Utility job in sheet metal required for successful completion of module.		
5	**Unit 5**	**3D Modeling and Printing**	3, 4	**4**
	5.1	Modeling approaches for ideation and creation. Developing a CAD file (.iges/.step/.dwg) of a 3D model and export it as an .stl file for the purpose of 3D printing. Importing the 3D .stl file to generate a .gcode file for 3D printing through slicing, using open source software.		
	5.2	Introduction to 3D printing: methodologies, best practices, material and model variation. Live printing sessions of generated .gcode files in real time with optimal parameters and troubleshooting.		
			Total	**20**

*** Students can opt for any one of the three trades from Unit 4.**

Text Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Workshop Manual	6th	Venkat Reddy	BS Publication	2008
2	Wiring Simplified: Based on 2017 National Electrical Code	45th	Frederic P Hartwell, Herbert P. Richter, W.C. Schwan	Park Publishing	2017

Reference Books:

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Autocad 2017	1st	Shyam Tikoo	Dreamtech Press	2016
4	Ultimaker 2+ reference manual	-	-	Ultimaker	2017
5	Encyclopedia of Electronic Components	1st	Charles Platt	O Reilly	2012
6	Printed Circuit Boards	1st	Khandpur R.S.	Tata McGraw Hill	2005
7	Troubleshooting Your PC For Dummies	2nd	Gookin Dan	For Dummies	2005
8	Networking For Dummies	8th	Lowe Doug	For Dummies	2007

Semester-II

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Differential Equations and Complex Analysis	3	1	0	8	12	3	1	0	4
MA102		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		75		75		150		400

Pre-requisite Course Codes, if any.	Semester-I Mathematics
Course Objective: To develop mathematical skills for solving engineering problems.	
Course Outcomes (CO): ***At the End of the course students will be able to:-***	
MA102.1	Solve differential equations of first order.
MA102.2	Solve differential equations of higher order using operators.
MA102.3	Solve differential equations in electrical engineering problems.
MA102.4	Find powers, roots & logarithm of a complex number and to separate the function of a complex number into real and imaginary.
MA102.5	Check whether a given function is analytic and construct analytic functions.
MA102.6	Compute integrals of complex valued functions.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA102.1												
MA102.2												
MA102.3												
MA102.4												
MA102.5												
MA102.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA102.1							
MA102.2							
MA102.3							
MA102.4							
MA102.5							
MA102.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Linear Differential Equations of first order**	1,2, 3	**11**
	1.1	Exact Differential Equations, Integrating Factors, equations reducible to exact form.		3
	1.2	Linear differential equations (Definition), equations reducible to linear form, Bernoulli's equation		2
	1.3	Simple application of differential equation of first and second order to electrical engineering problems.		2
	1.4	Numerical solution of ordinary differential equations of first order and first degree using (a)Taylor's series method (b)Euler's method (c) Modified Euler method (d) Runge-Kutta fourth order formula.		4
2	**Title**	**Linear Differential Equations of higher order**	1,2, 3	**11**
	2.1	Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is e^{ax} , sin(ax+b), cos(ax+b), x^m, e^{ax}V, xV, where V is a function of x.		7
	2.2	Cauchy's homogeneous linear differential equation and Method of variation of parameters for second order.		2
	2.3	System of Differential Equations.		2
3	**Title**	**Complex Numbers**	1,2, 3	**12**
	3.1	**Revision:** Complex Numbers as ordered pairs, Argand's diagram, Cartesian, Polar and Exponential form of Complex Numbers.		1
	3.2	De Moivre's Theorem and its application to determine powers of complex numbers. Roots of complex numbers by De Moivre's Theorem.		3
	3.3	Expansion of $\sin n\theta$ and $\cos n\theta$ in terms of powers of $\sin\theta$ and $\cos\theta$. Expansion of $sin^n\theta$ and $cos^n\theta$ in terms of sines and cosines of multiples of θ.		2
	3.4	Hyperbolic Functions: relation between circular and hyperbolic functions, Inverse hyperbolic functions. Separation into real and imaginary parts of complex functions.		4
	3.5	Logarithm of a complex number.		2
4	**Title**	**Analytic functions and Complex Integrals**	1,2, 3	**8**
	4.1	Analytic functions, Cauchy Reimann equations in cartesian and polar form, construction of analytic functions using Milne-Thompson's method, Harmonic functions, poles of f(z).		4
	4.2	Line Integral, Cauchy's Integral theorem for simply connected regions,		4

		Cauchy's Integral formula (for poles lying inside or outside the curve).		
5	**Self Study**	1.3 To form D.E. for given L-C-E-R circuit 1.4 Picard's method 2.1 Method of undetermined coefficients to solve differential equations. 2.2 Legendre's differential equation, Method of variation of parameters for third order differential equations. 3.2 Complex examples using De Moivre's Theorem. 4.1 Construction of analytic function f(z) =u+iv when u+v or u-v is given. Orthogonal trajectories		**08**
			Total	**42***

***Total of 42 hours does not include self study hours.**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	**Higher Engineering Mathematics**	**44th**	**Dr.B.S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	**Advanced Engineering Mathematics**	**28th**	**H.K Das**	**S.Chand**	**2014**
2.	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
3.	**Advanced Engineering Mathematic**	**4th**	**Jain and Iyengar**	**Narosa Publications**	**2014**

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Engineering Chemistry	2	0	2	4	8	2	0	1	3
AS102		Examination Scheme								
		Component		ISE		MSE		ESE		Total
		Theory		50		50		100		200
		Laboratory		50		--		50		100

Pre-requisite Course Codes, if any.	HSC level Chemistry
Course Objective: To provide necessary background of Chemistry suited for relevant areas of engineering	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS102.1	Relate thermodynamic principles and laws to crucial applications like heat engines (Understanding)
AS102.2	Summarize properties and applications of different materials like polymers, ceramics, alloys , nanomaterials, conductors and insulators (Understanding)
AS102.3	Identify methods for corrosion control based on knowledge of different types of corrosion and factors affecting rate of corrosion (Application)
AS102.4	Compare different sources of energy like conventional fossil fuels, alternative fuels, batteries and fuel cells with respect to availability, working principles, constitution, efficiency of performance and environmental impact (Understanding)
AS102.5	Apply knowledge of electrochemistry and green chemistry in the interest of public health and environment (Application)
AS102.6	Make use of analytical techniques (complexometric and iodometric titrations) and instruments (pH-meter, conductometer and Orsats's Apparatus) for various purposes like hardness parameters of water, composition of alloys etc.
AS102.7	Estimate key properties of lubricants like flash point, viscosity and acid value
AS102.8	Estimate molecular weight of polymer

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS102.1												
AS102.2												
AS102.3												
AS102.4												
AS102.5												
AS102.6												
AS102.7												
AS102.8												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS102.1							
AS102.2							
AS102.3							
AS102.4							
AS102.5							
AS102.6							
AS102.7							
AS102.8							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Thermodynamics**		4
	1.1	Introduction, Terminology, Concepts of Internal Energy and Thermodynamic equilibrium, Zeroth and First Law of Thermodynamics, Implications and Limitations of First law	1,3	
	1.2	Concept of Enthalpy, Joule Thomson Effect, Carnot's Cycle, Carnot's theorem and related numerical, Second Law of Thermodynamics	1,3	
	1.3	Applications of thermodynamic principles to the working of refrigerator and air conditioner	1,3	
2	Title	**Polymers**		3
	2.1	Introduction, Effect of heat on polymers : Glass transition temperature and melting with significance;	1, 2, 3	
	2.2	Conducting polymers, Liquid crystal polymers, Engineering Polymers	1, 2 ,3	
3	Title	**Corrosion**		5
	3.1	Introduction, Dry corrosion (i) Due to oxygen (ii) Due to other gases	1,2	
	3.2	Electrochemical corrosion and mechanism, Galvanic, differential aeration corrosion, Significance of galvanic series for corrosion phenomenon	1,2	
	3.3	Factors affecting rate of corrosion (i)Position in galvanic series, (ii) relative areas of anode and cathode, (iii) conductance of medium	1,2	
	3.4	Methods to decrease the rate of corrosion : Material selection, Proper designing, Cathodic protection- i) Sacrificial anodic protection ii) Impressed current method, Metallic coatings, Cathodic and anodic coatings (Galvanisation and Tinning : principle and application only)	1,2	
4	Title	**Energy Sciences**		5

	4.1	Definition and classification of fuels, Calorific value : Definition, Gross or Higher calorific value & Net or lower calorific value, Dulong's formula & numericals for calculations of Gross and Net calorific values.	1,2	
	4.2	Knocking, Octane number, Cetane number, Antiknock agents, unleaded petrol	1,2	
	4.3	Combustion- Calculations for requirement of only oxygen and air (by weight and by volume only) for given solid & gaseous fuels.	1,2	
	4.4	Disadvantages of fossil fuels, Alternative (Green) Fuels : Power alcohol , Biomass, Biogas, Biodiesel, Natural Gas and CNG (Description, Utility, advantages and disadvantages)	1,2	
5	**Title**	**Batteries and Battery Technology**		**4**
	5.1	Introduction, Important terms, Nickel-Hydrogen(metal hydride), Rechargeable Lithium ion batteries	1,2	
	5.2	Reserve Batteries, Fuel cells, characteristics, description, construction and working of Hydrogen-oxygen fuel cells, Types of fuel cells (in brief)	1,2	
	5.3	Electrochemical sensors : Working principle, construction and applications	1,2	
6	**Title**	**Green Chemistry**		
	6.1	12 principles of green chemistry with examples, numericals on Atom Economy, Green Solvents (Water, Supercritical Fluids),	1,2	**3**
7	**Title**	**Engineering Materials**		
	7.1	Eutectic mixtures and soft solders, Advanced Ceramic materials and cermets : magnetic, electronic and electrical applications Carbon nanomaterials : Fullerenes and Carbon nanotubes, Structure, Properties and applications	1,2,3	**4**
	7.2	Insulators, Semiconductors and Superconductors : Thermal and electrical insulating materials and important engineering applications, Stoichiometric, defect and controlled valency semi-conductors.	1,2,3	
	7.3	Superconductors, perovskite structure and 1:2:3 compound YBa2Cu3O7-y, properties and applications	1,2,3	
8	**Self Study**	1. Supramolecular polymers and their applications 2. Anodic Protection as a corrosion control strategy 3. Current research and advances in fuel cells 4. Commercial applications of superconducting materials 5. Tops down vs bottoms up approach to nanotechnology and applications of nanoparticles other than carbon		**4***
			Total (*Not included)	**28**

Laboratory Component

Sr. No	Title of the Experiment
1	Determination of total, temporary and permanent hardness of water sample
2	Removal of hardness using ion exchange column
3	Molecular weight determination of polymers by Oswald's Viscometer
4	To determine flash point of a lubricating oil
5	Determination of Viscosity of oil by Redwood Viscometer
6	Estimation of acid value of lubricant
7	Determination of amount of strong acid present in a solution using a conductometer
8	Determination of strength of acid using a pH meter
9	Estimation of Copper in brass by Iodometric Titration
10	Analysis of Flue gas for its composition (by Orsat's Apparatus)
11	Estimation of Iron in plain Carbon steel
12	Determination of COD of wastewater sample

Text Books

Sr No	Title	Edition	Authors	Publisher	Year
1	Engineering Chemistry	XI	P.C.Jain & M.Jain	Dhanpat Rai & Co. (Pvt) Ltd.	2014
2	A Textbook of Engineering Chemistry	XII	S.S.Dara & S.S.Umare	S. Chand & Co.	2014
3	A Textbook of Engineering Chemistry	III	S Chawla	Dhanpat Rai & Co. (Pvt) Ltd.	2015

Reference Books

Sr No	Title	Edition	Authors	Publisher	Year
1	Physical Chemistry	Eleventh	Peter Atkins	Oxford University Press	2017

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Biology for Engineers	2	0	0	3	5	2	0	0	2
AS103		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	-		--		-		-	

Pre-requisite Course Codes, if any.	HSC level Biology
Course Objective: To provide engineering perspective towards the biological principles and systems	
Course Outcomes (CO): *At the End of the course students will be able to*	
AS103.1	understand basic biological principles and organizational structure of living systems at molecular level.
AS103.2	comprehend basic biological principles and organizational structure of living systems at cellular level
AS103.3	know Energy transformation and information processing in biological systems
AS103.4	appreciate biological process with engineering perspective
AS103.5	identify significance of Gene, Blood and Skin in human health system.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS103.1												
AS103.2												
AS103.3												
AS103.4												
AS103.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS103.1							
AS103.2							
AS103.3							
AS103.4							
AS103.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Bio-molecules and bio-polymers:** Structure and Function	1,3	4
	1.1	Organic and inorganic molecules, Unique Properties of water		
	1.2	Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA)		
2	**Title**	**Levels of organization of life**	1,3	4
	2.1	Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Cell membrane.		
	2.2	**Levels of organization:** cells, tissues, organs, systems & organism		
3	**Title**	**Energy transformations**	1,3	5
	3.1	**Energy transformations in Chloroplast:** Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems		
	3.2	**Energy transformations in Mitochondria:** Cellular respiration (glycolysis and Kreb cycle) and ATP generation		
4	**Title**	**Transport and Defense mechanisms**	1,3	5
	5.1	**Transport Phenomena in Biological Systems:** Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide Heat Transport - Body temperature regulation.		
	5.2	**Defense mechanisms:** In plants: Herbivory, secondary metabolites In animals: Innate and Adaptive immune systems		
5	**Title**	**Engineering perspectives of biological sciences:**	1,3	
	6.1	Biology and engineering crosstalk – At cell level: Hybridoma technology At tissue level: Plant Tissue Culture, Animal Tissue Culture;		6
	6.2	Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Bio-mimicry, nano-biotechnology		
6	**Title**	**Role of Gene, Blood and Skin in human health system.**	2,4	4
	7.1	Introduction to Genetic Engineering. Blood Type, Complete Blood Count Test and Abnormalities.		
	7.2	Structure of Skin, Functions of Skin. Engineering methods for identification of Skin diseases.		
7	**Self Study**	Introduction to Biosensors, transducers, amplifiers; Introduction to medical imaging and different medical Imaging modalities; Review of Signals and system; Electro Physiological Signal Analysis.		**4***
			Total (* Not included)	**28**

Text Books

Sr. No.	Title	Edition	Authors	Publisher	Year
1	Molecular Cell Biology	IV	Lodish H, Berk A, Zipursky SL	W. H. Freeman	2000
2	Textbook of Anatomy and Physiology for Nurses and allied Health Sciences	I	Indu Khurana & Arushi	CBS Publsihers & Distributors Pvt Ltd	2019

Reference Books

Sr. No.	Title	Edition	Authors	Publisher	Year
3	Lehninger Principles of Biochemistry	IV	Nelson, D. L., & Cox, M. M.	Freeman	2004
4	Introduction to Biomedical Engineering.	III	Joseph D. Bronzino, John Enderle	Academic Press	2012

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Engineering Mechanics	2	0	2	5	09	2	0	1	3
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
AS105		Theory	50		50		100			200
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS105.1	Draw free body diagram and determine reactive forces using conditions of equilibrium and Lami's theorem
AS105.2	Determine coefficient of friction for various contact surfaces
AS105.3	Analyze the three-dimensional system of space forces.
AS105.4	Analyze the kinematics of particle and obtain the various parameters of motion.
AS105.5	Determine Instantaneous centre of rotation (ICR).
AS105.6	Design and conduct an experiment to demonstrate principles of statics and dynamics

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS105.1												
AS105.2												
AS105.3												
AS105.4												
AS105.5												
AS105.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS105.1							
AS105.2							
AS105.3							
AS105.4							
AS105.5							
AS105.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Equilibrium of forces**		8
	1.1	Equilibrant force, conditions of equilibrium for concurrent forces, parallel forces and general force system, equilibrium of connected bodies, Lami's theorem.	1,3	
	1.2	Types of supports, types of loads, Beams, Determination of reactions at supports for various types of loads on beams	3	
2	Title	**Friction**		4
	2.1	Introduction to Laws of friction, Cone of friction, Equilibrium of bodies on inclined plane, Application to problems involving wedges, ladders.	1,2	
3	Title	**Forces in space**		5
	3.1	Rectangular Components of Forces in Space, Resultant of Space forces, Moment of a Force about a point, axis and line. Equilibrium of a particle in space.	1	
4	Title	**Kinematics of Particle**		8
	4.1	Motion along straight and curved path, Rectangular component of velocity and acceleration, Tangential & Normal component of acceleration, Motion curves(a-t, v-t, s-t curves), Projectile motion,	2,3	
5	Title	**Kinematics of Rigid Bodies**		3
	5.1	Instantaneous center of rotation for the velocity of bodies in plane motion, (up to 2 linkage mechanism)	3	
6	Self Study	1. Applications of resultant of forces, concept of couple and moments, 2. Centroid and center of gravity, analysis of trusses. 3. Kinetics of rigid body, work energy principle. 4. Principle of Law of Conservation of momentum, Impact and collision.	1,2,3	6*
			Total (*Not Included)	28

Laboratory Component, if any

Sr. No	Title of the Experiment
1	Draw the force polygon and determine the equilibrant force for concurrent coplanar force system.
2	Use the conditions of equilibrium for parallel force system and determine the support reactions.
3	Apply the principle of moment for equilibrium of levers.
4	Determine the coefficient of friction for glass slab and a metal plate on an inclined plane.
5	Determine the axial forces using Lami's theorem for Jib crane apparatus.
6	Use the conditions of equilibrium for non-concurrent non-parallel force system and draw the force polygon.
7	Measure the acceleration due to gravity with the help of simple pendulum apparatus.
8	Determine the range of projectile and the time of flight for the projectile motion.
9	Verify the law of conservation of momentum and determine the coefficient of restitution for collision
10	(Plot the motion of projectile using air-cushion table apparatus.) A small project based on Engineering Mechanics concept.

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Vector Mechanics for Engineers statics and dynamics	9th	Beer and Johnston	McGraw Hill	2010
2	Engineering Mechanics	5th	Bhavikatti S S and Rajsekharappa	New Age International	2009
3	Engineering Mechanics Statics and Dynamics	14th	A K Tayal	Umesh Publication, Delhi	2012

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
3	Engineering Mechanic: Statics and Dynamics,	5th	E.W. Nelson, C.L. Best, W.G. McLean,	McGraw Hill	1998
4	Singer's Engineering Mechanics Statics and Dynamics	3rd	Vijaya Kumar Reddy. K. and Suresh Kumar. J	BS Publication	2012

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(ESC)	Problem Solving using OOP	2	0	2	3	7	2	0	1	3
		Examination Scheme								
CS102		Component	ISE		MSE		ESE		Total	
		Theory	--		--		--		--	
		Laboratory	200		--		100		300	

Pre-requisite Course Codes, if any.	Problem Solving using Imperative Programming
Course Objective: To learn problem solving using Object-Oriented programming paradigm	
Course Outcomes (CO):*At the End of the course students will be able to*	
CS102.1	Apply concepts of object oriented programming using classes and objects
CS102.2	Apply Inheritance for a given scenario
CS102.3	Apply polymorphism for solving a given problem
CS102.4	Apply abstraction and exception handling to create efficient program.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CS102.1												
CS102.2												
CS102.3												
CS102.4												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
CS102.1							
CS102.2							
CS102.3							
CS102.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory (This course content delivery will be in C++/Java. Course Contents to be taken care accordingly)

Module No.	Unit No.	Topics	Ref.	Hrs.
1		**Introduction and Encapsulation**		**8**
	1.1	Introduction to Object Oriented Programming, Procedural verses Object Oriented Programming, Principles, Benefits and applications of Object Oriented Programming.	1,2	
	1.2	Encapsulation: Problem solving with Objects and Classes		
	1.3	Static data member and methods, constructors and their types. Types of functions and keywords, Strings, Arrays		
2		**Inheritance**		**6**
	2.1	Concept of Inheritance, parent class, derived class, base class and derived class constructor	1,2	
	2.2	Types of inheritance: single, multiple, multilevel, hierarchical, hybrid		
	2.3	Aggregation and Composition		
3		**Polymorphism**		**6**
	3.1	Static Polymorphism: Method overloading and Constructor overloading	1,2	
	3.2	Dynamic Polymorphism: Method overriding		
	3.3	Data conversion		
4		**Abstraction**		**2**
	4.1	Abstraction: abstract class	1,2	
5		**Exception Handling**		**6**
	5.1	try, throw, and catch exceptions	1,2	
	5.2	Function exception declaration		
6	**Self Study**	File Handling, $STL, $pointers, $virtual functions @Multithreading, @Packages, @interface	1,2	**5***
			Total (*Not included)	**28+**

$ only for C++

@ only for Java

**** Language used: C++ for Etrx and Extc Branch**

**** Language used: C++ / Java for IT and CE Branch**

Laboratory Component

Sr. No	Title of the Experiment
1	Program on Encapsulation: Write a program to demonstrate classes and objects
2	Program on Encapsulation: Write a program to demonstrate constructor
3	Program on Polymorphism: Implement a Program to demonstrate method overloading,
4	Program on Polymorphism: Implement a Program to demonstrate constructor overloading
5	Program on Polymorphism: Implement a Program to demonstrate method overriding
6	Program on Inheritance: Implement a Program to demonstrate single, multilevel Inheritance
7	Program on Inheritance: Implement a Program to demonstrate multiple Inheritance
8	Program on Abstraction: Implement a Program to demonstrate Abstraction using abstract class
9	Program on Abstraction: Implement a Program to demonstrate multithreading/ STL
10	Program to demonstrate File Handling

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Object Oriented Programming with C++	Sixth	E Balagurusamy	Tata McGraw Hill	2017
2	Oriented Programming in Turbo C++	Fourth	Robert Lafore	Galgotia	2001
3	Java -The Complete Reference	Tenth	Herbert Schildt	Tata McGraw-Hill	2017
4	Java Programming From the Ground Up	First	Ralph Bravaco,Shai Simoson	Tata McGraw-Hill	2009

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	The Compete Reference C++	Fourth	Herbert Schlitz	Tata McGraw Hill	2017
2	An introduction to Programming and Object Oriented Design using Java	Third	Jaime Nino, Frederick A. Hosch	Wiley Student Edition	2010

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Digital Systems and Microprocessor	3	0	2	5	10	3	0	1	4
EC101		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	
Course Objective: To prepare students to perform the analysis and design of various digital electronic circuits and introduce them to the concept of microprocessors	
Course Outcomes (CO): ***At the End of the course students will be able to***	
EC101.1	Explain various logic gates, SOP, POS forms and their minimization with k- map for given combinational circuits.
EC101.2	Construct combinational circuits using given MSI devices.
EC101.3	Apply the knowledge of flip-flops and MSI to design sequential circuits
EC101.4	Compare the logic families based on their characteristics
EC101.5	Comprehend the architectural features of 8085 with basic assembly language programming

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC101.1												
EC101.2												
EC101.3												
EC101.4												
EC101.5												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
EC101.1							
EC101.2							
EC101.3							
EC101.4							
EC101.5							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply ✓	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Combinational Circuits**		11
	1.1	**Logic Gates:** Basic gates, Universal gates, Sum of products and products of sum, minimization with Karnaugh Map (up to four variables), Quine Mc'Clusky method and realization.	1,4	
	1.2	**Combinational Circuits using basic gates as well as MSI devices:** Half adder, Full adder, Half Subtractor, Full Subtractor, Multiplexer, Demultiplexer, Decoder, Comparator	1,4	
2	Title	**Sequential Circuits**		11
	2.1	**Sequential Logic:** Latches and Flip-Flops. Conversions of Flip-Flops.	1,4	
	2.2	**Counters:** Asynchronous Counters, Synchronous Counters, Up Down Counters, Mod Counters, Ring and Twisted Ring Counters , Shift Registers, Universal Shift Register	1,4	
	2.3	MSI counters (IC 7490, IC 74160, IC 74163, IC 74169), MSI Shift registers (IC 74194) and their applications	2,5	
3	Title	**Clocked Synchronous Machines**		05
	3.1	Mealy and Moore Machines, Clocked synchronous state machine analysis, State reduction techniques.	2,5	
4	Title	**Logic Families**		05
	4.1	Types of logic families (TTL and CMOS), characteristic parameters (propagation delays, power dissipation, Noise Margin, Fan-out and Fan-in), transfer characteristics of TTL NAND.	1,4	
5	Title	**Introduction to Microprocessors**		10
	5.1	Evolution of computers and Microprocessors	3	
	5.2	Essential components of a conventional Central Processing Unit (CPU)	3	
	5.3	Architecture of 8-bit microprocessor 8085	3	
	5.4	Basic instruction set with its addressing modes and concepts of Instruction cycle, Machine cycle and T states. Elementary programming in assembly language.	3	
	5.5	Elements of I/O data transfer with the concept of interrupts	3	
6	Self Study	Concepts of PROM, PAL and PLA. Timing Considerations and Meta-stability in Flip-Flops. Clocked synchronous state machine design. Interfacing CMOS to TTL and TTL to CMOS. Concepts of peripherals and memory with its interfacing with 8085 microprocessor		5*
			Total (*Not included)	**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	To implement the combinational logic for given function using basic gates/MSI ICs. a. To study and verify the truth table of logic gates b. To study the universal NAND and NOR gate c. To study the working of half adder, full adder, half subtractor, Full subtractor along with truth table
2	To implement TTL and CMOS logic family a. To study TTL NAND gate (BJT implementation). b. To study CMOS NAND gate c. To study interfacing of the TTL /CMOS
3	To implement 4-bit, 5-bit and 8 bit comparator using given MSI
4	To design implement gate level multiplexers and MSI multiplexers
5	To design and implement gate level and MSI circuits of flip-flops
6	To design counters a. To design a MOD4 synchronous up/down counter b. To study IC 7490 – Asynchronous Decade Counter
7	To synchronous counters, synchronous counters and shift register using given MSI. a. To study IC 74160 as Synchronous Decade Counter and Mod 6 counter b. To study IC 74163 as Synchronous MOD 16 Counter and Mod 10 counter c. To verify the truth table of IC 74194 as Universal Shift Register and implement Ring and Twisted Ring Counter.
8	To perform basic arithmetic operations through assembly language program in 8085
9	To simulate COPY and PASTE operation through 8085 assembly program
10	To write a program to add N elements stored in an array of 8 bit numbers (8085)

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Modern Digital Electronics	Forth	R. P. Jain	Tata McGraw Hill	**2009**
2	Digital Design Principles And Practices	Third	John F. Wakerly	Pearson Education	**2001**
3	Microprocessor Architecture, Programming, and Applications with the 8085	Sixth	Ramesh S. Gaonkar	Penram International	**2013**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
4	Digital Design	Forth	Morris Mano	Pearson Education	**2008**
5	Fundamentals of digital logic design with VHDL	Second	Stephen Brown and Zvonko Vranesic	McGraw Hill	**2006**

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Communication Skills	1	0	2	3	3	1	0	1	2
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
AS107		Theory	--		50**		--		50	
		Laboratory	150*		--		--		150	

** MSE will be evaluated on the basis of written test based on module 1 and 2.

** ISE will be evaluated on the basis of marks scored in practicals, out of 150.

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the end of the course students will be able to***	
AS107.1	Apply the principles of business writing for professional documents.
AS107.2	Develop advance vocabulary and grammar for spoken and written communication.
AS107.3	Design the draft a formal speech.
AS107.4	Analyze received information by using active listening and reading skills.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
AS107.1												
AS107.2												
AS107.3												
AS107.4												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS107.1							
AS107.2							
AS107.3							
AS107.4							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	L Hrs.	P Hrs
1	**Title**	**Vocabulary Building & Grammar**		**2**	**4**
	1.1	Concept of word formation, the root words from foreign languages and their use in English	7,1		
	1.2	Common errors in writing, confused pair of words, redundancies, clichés	6, 2		
2	**Title**	**Writing Skills**		**7**	**14**
	2.1	Principles of Business Writing: 7Cs of communication, sentence structures, Organizing paragraph in direct and indirect style; Summarization	4		
	2.2	Practices in Writing: E-mail Etiquettes, e-mail for business purposes	3		
	2.3	Critical Reading: understanding the concept of critical reading and applying to analyze a given text.	5		
3	**Title**	**Oral Skills**		**5**	**10**
	3.1	Listening Comprehension(audio): Pronunciation, intonation, Stress and Rhythm	5		
	3.2	Speaking Practices: 1. Common everyday situation: Conversation and dialogues (group activity, ice-breaking session) 2. Public Speaking: Extempore, formal speech	3		
4	**Self Study**	1. Basic Rules Of Grammar 2. GRE Vocabulary 3. Reading a book(fiction/non-fiction) and preparing a review on it			**6***
			Total (*Not included)	**42 hrs**	

List of activities (Graded, Non-graded)

Sr. No	Title of the assignments	Marks
1	Skit based on a given situation	-
2	ISE 1 – Summary Writing	10
3	ISE 2 – Extempore	10
4	ISE 3 – Grammar	20
5	ISE 4 – Vocabulary	20
6	Reviewing a book (fiction/ non-fiction)	10
7	ISE 5 – Email Writing (Inquiry)	20
8	ISE 6 – Email Writing (Complaint)	20
9	ISE 6 – Speech	20
10	ISE 7 – Critical Reading	20
	Total	150

Text Books:

Sr. No	Title	Edition	Authors	Publisher	Year
1	Communication Skills	2013	Shirley Mathews	Technical Publication, Pune	2013
2	English Vocabulary in Use	1999	Michael McCarthy , Felicity O'Dell	Cambridge University Press, India	1999

Reference Books:

Sr. No	Title	Edition	Authors	Publisher	Year
1	Oxford Practice Grammar	1999	John Eastwood	Oxford, India	1999
2	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011
3	Communication Skills	2010	Dr. Meera Bharwani	Synergy Knowledgeware, India	2010
4	English Grammar for Today	2005	Geoffrey Leech	Palgrave, UK	2005
5	Word Power Made Easy	1978	Norman Lewis	Anchor Books, New York	1978

Semester-III

Sardar Patel Institute of Technology

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(Autonomous Institute Affiliated to University of Mumbai)

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Linear Algebra	2	0	2	5	9	2	0	1	3
MA201		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To develop mathematical skills for solving engineering problems.	
Course Outcomes (CO): ***At the End of the course students will be able to:***	
MA201.1	Solve a homogeneous and non-homogeneous system of linear equations using rank of a matrix.
MA201.2	Solve system of linear equations by Numerical Methods.
MA201.3	Solve equations in real life problems and to encode and decode messages using the concept of matrices.
MA201.4	Identify whether given structures are vector spaces and subspaces and construct a basis for them.
MA201.5	Show if a given matrix is diagonalizable or not.
MA201.6	Apply concepts of Eigen-values and eigenvectors to calculate functions of a square matrix, Google page rank vector and solve systems of differential equations using diagonalisation of matrices.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA201.1												
MA201.2												
MA201.3												
MA201.4												
MA201.5												
MA201.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA201.1							
MA201.2							
MA201.3							
MA201.4							
MA201.5							
MA201.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Basics of matrices**	**3,5**	**03**
	1.1	Revision of basic matrices and types of matrices.		01
	1.2	Row echelon form, Reduced Row Echelon form, Rank of a matrix.		02
2	**Title**	**Linear equations & its solutions**	**1,2,3,5**	**07**
	2.1	Consistency and solution of simultaneous linear homogeneous and non-homogeneous equations.		02
	2.2	Application of solving systems of equations in traffic control.		01
	2.3	Solution of system of linear algebraic equations, by (1) Gauss Elimination Method (2) Gauss Jordan method (3) Gauss Jacobi Iteration method (4) Gauss Seidel Method. (5) LU Decomposition -Crout's method		04
3	**Title**	**Vector spaces (over field of real numbers)**	**1,2,5**	**08**
	3.1	Vector space, subspace, span, linear dependence and independence of vectors, basis, dimension, orthogonal projection & gram-schmidt process. Null space, row space, column space, Rank-Nullity theorem (only statement). Least square method.		08
4	**Title**	**Encoding & decoding using Matrices.**	**4**	**02**
	4.1	Application of matrices to Coding and Decoding		02
5	**Title**	**Eigenvalues and Eigenvectors**	**1,2,3,5**	**08**
	5.1	Eigenvalues , Eigenvectors and its properties. Cayley Hamilton theorem and its applications. Diagonalisation of matrices. Derogatory and Non-derogatory matrices.		04
	5.2	Application to find google page rank. Functions of a square matrix. Solving system of differential equations using diagonalisation.		04
6	**Self Study**	1.2 Normal form. 2.2 Forming equations using KVL for circuits and solving them using matrices. 3.1 Singular Value Decomposition. 5.1 Additional properties with proofs of eigenvalues and eigenvectors.	**1,2,3,5**	05*
			Total (*Not included)	**28**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Introduction to Scilab(getting started) and its benefits to use as a mathematics tool.
2	Basic commands of scilab and vectors & matrix operations.
3	Conditional branching and iterations using scilab.
4	Solution of linear equations using row-echelon and inverse of a matrix.
5	Solutions of linear equations using Gauss Elimination method.
6	Solutions of linear equations using Gauss Jordan method.
7	Solutions of linear equations using Gauss-Jacobi method.
8	Solutions of linear equations using Gauss-Seidel method.
9	Solutions of linear equations using Crout's method.
10	To find Eigenvalues and Eigenvectors using Scilab

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Linear Algebra and its applications	4th	Gilbert Strang	Cengage	2014
2.	Higher Engineering Mathematics	44th	Dr.B.S. Grewal	Khanna Publications	2020

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1.	Linear Algebra and its applications	3rd	David.C.Lay	Pearson Education	2006
2.	Elementary Linear Algebra Application Version	6th	H Anton and Crorres	John Wiley & Sons	2010
3.	Advanced Engineering Mathematics	28th	H.K Das	S.Chand	2014
4.	Hill Ciphers	1st	Jonaki B Ghosh	At Right Angles	2015
5.	Advanced Engineering Mathematics	10th	Erwin Kreysizg	John Wiley & Sons	2011

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-I	2	1	0	0	3	2	1	0	3
MA202		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	

Pre-requisite Course Codes, if any.	-
Course Objective: To develop basic foundation of mathematical skills.	
Course Outcomes (CO): ***At the End of the course students will be able to:-***	
MA201.1	Differentiate a function of one variable and partially differentiate a function of more than one variable.
MA201.2	Apply the concept of partial differentiation to find extreme values of a given function.
MA201.3	Find nth order derivative of a given function.
MA201.4	Expand a given function as a power series.
MA201.5	Perform operations on matrices and find inverses and determinants of them.
MA201.6	Perform vector operations and compute dot products and cross products between them.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA201.1												
MA201.2												
MA201.3												
MA201.4												
MA201.5												
MA201.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA201.1							
MA201.2							
MA201.3							
MA201.4							
MA201.5							
MA201.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	Title	**Differential Calculus**	1,2	**18**
	1.1	Partial fractions. Derivatives of standard functions, product and quotient rule for differentiation.		04
	1.2	Partial derivatives of first and higher order, composite differentiation		03
	1.3	Application of partial derivatives: Local Maxima and Minima of functions of two variables.		02
	1.4	Successive Differentiation: Proofs of nth derivatives of standard functions. Use of partial fractions to calculate nth derivatives of given functions. Leibnitz theorem for nth derivative of product of two functions.		05
	1.5	Infinite series: expansion of functions in powers of x using maclaurin series. Taylor's series.		04
2	Title	**Matrices**	1,2	**07**
	2.1	Addition and scalar multiplication of matrices. Matrix multiplication, types of matrices.		03
	2.2	Elementary row transformations, finding inverses using matrices, determinants and its properties		04
3	Title	**Vectors**	1,2	**03**
	3.1	Vector definition, addition, scalar multiplication, dot product of two vectors, angle between two vectors, cross product.		03
			Total	**28**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Higher Engineering Mathematics**	**44th**	**Dr.B.S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
2	**Advanced Engineering Mathematics**	**28th**	**H.K.Dass**	**S.Chand Publications**	**2014**

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Computer Architecture & Organization	3	0	2	4	9	3	0	1	4
ET201/EC201		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	EC101, Any Programming Language
Course Objective: Imparting concepts of each component of computer architecture thoroughly with practical aspects including memory systems and I/O communications with interfacing	
Course Outcomes (CO): *At the End of the course students will be able to*	
XX201.1	Describe basic computer structure and compare computer architecture models
XX201.2	Design algorithms to solve ALU operations and memory mapping techniques
XX201.3	Comprehend processor architecture with various design methods of CPU with comparative analysis
XX201.4	Describe memory systems with design and analysis of mapping techniques for cache and virtual memory
XX201.5	Analyze different parallel processing and pipelining concepts with pipelining hazards
XX201.6	Comprehend different types of I/O buses , compare and contrast different types of data transfer methods and arbitration techniques

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX201.1												
XX201.2												
XX201.3												
XX201.4												
XX201.5												
XX201.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX201.1							
XX201.2							
XX201.3							
XX201.4							
XX201.5							
XX201.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Overview of Computer Architecture and Organization**		5
	1.1	Introduction of Computer Organization and Architecture, Basic organization of computer and block level description of the functional units, Evolution of x86 Computers, Von Neumann model, Harvard Model, Embedded system	1	
	1.2	Performance Issues: Designing for performance, Amdahl's Law, Multi-core, GPGPU	1	
2	Title	**Data Representation and Arithmetic Algorithms**		6
	2.1	Number representation: Floating-point representation, Floating point arithmetic, IEEE 754 floating point number representation	2,3	
	2.2	Integer Data computation: Addition, Subtraction. Multiplication: Signed multiplication, Booth's algorithm.	2,3	
	2.3	Division of integers: Restoring and non-restoring division	2,3	
3	Title	**Processor Organization and Control Unit**		9
	3.1	CPU Architecture, Register Organization Instruction formats, basic instruction cycle. Instruction interpretation and sequencing, Case Study of 8086 Architecture and Register Organization.	1,2,4	
	3.2	Control Unit: Soft wired (Micro-programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations	2,4	
	3.3	RISC and CISC: Introduction to RISC and CISC architectures and design issues.	2,4	
4	Title	**Memory Organization**		11
	4.1	Introduction to Memory and Memory parameters. Classifications of primary and secondary memories. Types of RAM and ROM, Allocation policies, Memory hierarchy and characteristics.	1,2	
	4.2	Cache memory: Concept, architecture (L1, L2, L3), mapping techniques. Cache Coherency, Interleaved and Associative memory.	1,2	
	4.3	Virtual Memory: Concept, Segmentation and Paging, Page replacement policies	1,2,4	
5	Title	**I/O Organization and Introduction to Parallel Processing**		11
	5.1	Buses: Types of Buses ,Bus Arbitration, BUS standards	2	
	5.2	I/O Interface, I/O channels, I/O modules and IO processor, Types of data transfer techniques: Programmed I/O, Interrupt driven I/O and DMA.	1,2	
	5,3	Introduction to parallel processing concepts, Flynn's classifications, pipeline processing, Pipeline stages, Pipeline Hazards	1,2,4	
6	Self Study	Comparative Study of microprocessors and micro architectures with respect to their important features. 8086 instructions and assembler directives with addressing modes with memory interfacing techniques. Cache memory protocol and virtual memory concepts in Pentium processors. Vector and Array Processors with VLIW architecture		4*
			Total (*Not included)	**42**

Laboratory Component, if any: (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Implementation of various Arithmetic Operations through Assembly Language Programming for microprocessor 8086 (MASM)
2	Simulate the operation of COPY and PASTE in 8086 (MASM)
3	Implement various String Operations in 8086 through the utilities provided by DOS interrupts (MASM)
4	Generation of alphabetic arrangement of a given string in 8086 (MASM)
5	Design password application (generation and detection)in 8086 (MASM)
6	Design of Carry Look Ahead Adder
7	Implementation and programming of Booth's Multiplication Algorithm
8	Implementation and programming of Division Algorithm (Non-Restoring and Restoring)
9	Implementation of Mapping techniques of Cache memory
10	Implementation of Page Replacement Policies

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Computer Organization	**Fifth**	Carl Hamacher, Zvonko Vranesic and Safwat Zaky	**Tata McGraw-Hill**	**2002**
2	Computer Organization and Architecture: Designing for Performance	**Eighth**	William Stallings	**Pearson**	**2010**
3	Computer System Architecture	**Third**	M, Morris Mano	**Pearson**	**1993 Reprinted 2007**
4	Computer Architecture & Organization	**Third**	John P. Hayes	**McGraw-Hill**	**1998**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Structured Computer Organization	**Sixth**	Andrew S. Tanenbaum	**Pearson**	**2013**
2	Microprocessor and Interfacing: Programming & Hardware	**Third**	Douglas V Hall	**Tata-McGraw Hill**	**2012**
3	Computer Architecture and Organization: Design Principles and Applications	**Second**	B. Govindarajulu	**McGraw Hill**	**Paperback-2017**

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Electronic Devices	3	0	2	4	9	3	0	1	4
ET202/EC202		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	ES13 (Basic Electrical Technology)
Course Objective: To teach fundamentals of electronic devices	
Course Outcomes (CO):*At the End of the course students will be able to*	
XX202.1	Discuss device physics and characteristics of semiconductor devices.
XX202.2	Discuss working principle and characteristics of BJT
XX202.3	Discuss working principle and characteristics of FET
XX202.4	Analyze single stage BJT and FET amplifier circuits
XX202.5	Discuss semiconductor device fabrication process
XX202.6	Discuss construction, working principle and characteristics of advance semiconductor devices HEMT, MESFET and HBT

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX202.1												
XX202.2												
XX202.3												
XX202.4												
XX202.5												
XX202.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX202.1							
XX202.2							
XX202.3							
XX202.4							
XX202.5							
XX202.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	**Understand√**	**Apply√**	**Analyze√**	**Evaluate**	**Create**

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	**Title**	**Diode**	1	**6**
	1.1	Review of PN Junction Analysis		
	1.2	Applications of Diode:Simple diode model, Limiter circuits, Rectifiers, Clamper Circuits, Peak Detector and Voltage Doubler		
	1.3	Zener diode and Schottky diode		
2	**Title**	**Bipolar Devices**	1,2	**11**
	2.1	BJT: The bipolar transistor action, minority carrier distribution, low-frequency common-base current gain, non-ideal effects, Ebers-Moll Model and Hybrid-Pi Model		
	2.2	Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Biasing schemes for BJT amplifiers, bias stability, various configurations (such as CE, CB, CC) and their features, small signal analysis, low frequency models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, frequency analysis of multistage amplifiers.		
3	**Title**	**Field Effect Devices: JFET**	1,2	**11**
	3.1	Construction, operation and device characteristics		
	3.2	Biasing schemes for FET amplifiers, bias stability, various configurations (such as CS, CG, CD) and their features, small signal analysis, low frequency models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular specifications, frequency analysis of multistage amplifiers.		
4	**Title**	**Field Effect Devices: MOSFET**	2	**10**
	4.1	Two terminal MOS structure, MOSFET construction, Band diagrams under equilibrium and external bias, Threshold Voltage		
	4.2	V-I and CV characteristics, Channel length modulation, Short Channel effects, MOSFET Model		
5	**Title**	**Integrated circuit fabrication process**	R-3	**4**
	5.1	Oxidation, diffusion, ion implantation, photolithography		
	5.2	Etching, chemical vapor deposition, sputtering, twin-tub CMOS process.		
6	**Self Study**	Device structure, principle of operation and V-I characteristics of MODFET (i.e. HEMT), MESFET and HBT		**4***
			Total (*Not included)	**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	To plot forward and reverse characteristics of semiconductor diode
2	Implement clipper and clamper circuits using diode
3	Implement half-wave and full-wave rectifier circuits
4	To plot characteristics of Zener diode and observe Zener as voltage regulator
5	Finding characteristics of BJT configurations (CE/CB/CC) using simulation and hardware implementation.
6	Obtain the operating point for different biasing circuits
7	Design and implement single stage BJT based amplifier for the required specifications.
8	Obtain frequency response of single stage BJT based amplifier
9	Finding characteristics of FET (CG/CS/CD) using Simulation and Hardware Implementation
10	Design and implement single stage FET based amplifier for the required specifications.
11	Obtain frequency response of single stage FET based amplifier
12	Obtain Input-Output Characteristics of MOSFET using circuit simulator

Text Books:

S. N.	Title	Edition	Authors	Publisher	Year
1	Electronic Devices and Circuits	Eleventh	R L Boylestad and Lous Nashelsky	Prentice Hall	2013
2	Electronic Circuit Analysis and Design	Third	Donald A. Neamen	Tata McGraw Hill	2006

Reference Books:

S. N.	Title	Edition	Authors	Publisher	Year
1	Semiconductor Physics and Devices	Fourth	Donald A. Neamen and Dhrubes Biswas	Tata McGraw Hill	2017
2	CMOS Digital Integrated Circuits	Fourth	Sung-Mo Kang,YusufLeblebici and Chulwoo Kim	Tata McGraw Hill	2019
R-3	Semiconductor Devices: Physics and Technology	Third	S. M. Sze and Ming-Kwei Lee	Wiley	2015

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Network Theory	3	0	2	4	09	3	0	1	4
ET203/EC203		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	ET101
Course Objective: To teach fundamental theorems for circuit analysis.	
Course Outcomes (CO): *At the End of the course students will be able to*	
XX203.1	Analyze the given circuits using theorems and transformation techniques
XX203.2	Analyze the given circuit using Graph Theory
XX203.3	Analyze the given RL, RC and RLC circuits in time domain
XX203.4	Analyze the given RL, RC and RLC circuits in frequency domain
XX203.5	Predict the circuits using Foster and Cauer realization methods
XX203.6	Explain the concept of two port network, relation between the parameters and their interconnection

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX203.1												
XX203.2												
XX203.3												
XX203.4												
XX203.5												
XX203.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX203.1							
XX203.2							
XX203.3							
XX203.4							
XX203.5							
XX203.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Analysis of DC circuits** and **coupled circuits:**		12
	1.1	Analysis of circuits with and without controlled sources using generalized loop, node matrix, Superposition, Thevenin, Norton, Maximum Power transfer.	3	
	1.2	Self and mutual inductances, coefficient of coupling, Dot convention, equivalent circuit, solution using loop analysis	1	
2	Title	**Graph Theory:**		4
	2.1	Concept of loop, tree, co-tree, incidence matrix, cut set matrix and tie set matrix	4	
	2.2	Duality principle and its application	4	
3	Title	**Transient Analysis:**		12
	3.1	**Time domain analysis of R-L and R-C circuits:** Forced and natural response, time constant, initial and final values	1,3	
	3.2	**Time domain analysis of R-L-C circuits:** Forced and natural response, effect of damping **Solution using second order equation for standard input signals:** Transient and steady state time response	1,3	
	3.3	**Frequency domain analysis of RLC circuits:** S-domain representation, applications of Laplace Transform in solving electrical networks	1,3	
4	Title	**Network Synthesis :**		6
	4.1	**Network Function:** driving point and transfer function, Poles and Zeros, calculation of residues by analytical and graphical method, frequency response	2	
	4.2	**Positive real functions:** Concept of positive real function, testing for Hurwitz polynomials, testing for necessary and sufficient conditions for positive real functions	2	
	4.3	**Synthesis of RC, RL, LC circuits:** Concepts of synthesis of RC, RL, LC driving point functions.	2	
	Title	**Two Port Network :**		8
	5.1	**Parameters:** Open Circuit, Short Circuit, Transmission and Hybrid parameters, relationships among parameters, reciprocity and symmetry conditions	1	
	5.2	**Series/parallel connection:** T and Pi representations, interconnection of Two-Port networks	1	
6	**Self Study**	**Millman's theorem, Tellegen's theorem, Non planar graphs, Solution using first order equation for standard input signals, Transient and steady state time response, solution using universal formula, Terminated Two-Port networks**		4*
			Total (*Not included)	42

Laboratory Component

Sr. No	Title of the Experiment
1	To measure and calculate currents and voltages for a given resistive circuit and verify KCL and KVL.
2	To verify superposition theorem experimentally for a given resistive circuit consisting two Independent sources.
3	To verify Thevenin's theorem experimentally for a given circuit.
4	To verify maximum power transfer theorem experimentally for a given circuit.
5	To verify reciprocity theorem experimentally for a given circuit.
6	To measure and calculate RC time constant for a given RC circuit.
7	To measure and calculate RC time constant for a given RL circuit.
8	To measure and analyze (settling time, overshoot, undershoot, etc.) step response of for a given series RLC circuit for following cases: (1) $\zeta = 1$ (critically damped system), (2) $\zeta > 1$(over damped system), (3) $\zeta < 1$ (under damped system). Choose appropriate values of R, L, and C to obtain each of above cases one at a time.
9	To measure and calculate Z-parameters for a given two-port system.
10	To measure and calculate Y-parameters for a given two-port system.
11	To measure and calculate h-parameters for a given two-port system.
12	To measure and calculate ABCD-parameters for a given two-port system.

Design based Problems (DP)/Open Ended Problem:

1. Write a 'c' program to obtain RC time constant from a given step response of RC circuit.
2. Write a 'c' program to plot frequency response of RC circuit for different values of R and C.
3. Write a 'c' program to obtain 3-dB bandwidth and RC time constant from a given frequency response of RC circuit.
4. Write a 'c' program to plot impedance of a given series RLC circuit as a function of frequency. Also obtain minimum value of impedance and series resonance frequency using 'c' program.
5. Write a 'c' program to obtain following parameters from step response of series RLC circuit for different values of R, L and C.
    a. Propagation delay
    b. Overshoot
    c. Undershoot
    d. Damping factor
    e. Natural frequency
    f. Settling time

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Circuit Theory	Seventh Revised Edition	A. Chakrabarti	Dhanpat Rai and Co., New Delhi	**2018**
2	Network Analysis	Third Edition	M E Van Valkenburg	Prentice-Hall of India Pvt. Ltd.	**2018**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
3	Network Analysis and Synthesis	Second Edition	Franklin F Kuo	Wiley	**2006**
4	Networks and Systems	Second Edition	D. Roy Choudhury	New Age International Pvt. Ltd, Wiley	**2009**

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(SBC)	Electronics Instruments and Measurement Lab	0	1	2	2	5	0	1	1	2
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
ET204/EC204		Theory	--		--		--			--
		Laboratory	150		--		50			200

Pre-requisite Course Codes, if any.	ET101
Course Objective: To teach principle of working and application of various measuring instruments used in Electronics Laboratories	
Course Outcomes (CO):*At the End of the course students will be able to*	
XX204.1	Describe the working of measuring instruments available in the lab
XX204.2	Find out and verify the manufacturers, make, models, market cost and specifications of the given instrument
XX204.3	Select the suitable test and measuring instrument for the given circuit
XX204.4	Operate the instrument for observing and recording the given signal in time domain and frequency domain
XX204.5	Recognize the importance of calibration of instruments
XX204.6	Design signal conditioning circuit for measurement of various parameters

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX204.1												
XX204.2												
XX204.3												
XX204.4												
XX204.5												
XX204.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX204.1							
XX204.2							
XX204.3							
XX204.4							
XX204.5							
XX204.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	Understand√	Apply√	Analyze	Evaluate	Create

Sr. No	Title of the Experiment
1	Measurement of static parameters using analog ammeter, voltmeter and galvanometer.
2	Exploring controls of CRO/DSO and measurement of various parameters in the given circuit using CRO/DSO
3	Study of working principle and exploring controls of function generator, signal generator and arbitrary function generator
4	Study of working principle of tachometer, lux meter, clamp meter and thermal camera and demonstrate its use.
5	Study of working principle of multimeter, wattmeter & energy meter and demonstrate its use.
6	Designing DC bridge for Resistance Measurement (Quarter, Half and Full bridge)
7	Designing signal Conditioning circuit for Strain Measurement
8	Designing AC bridge Circuit for capacitance measurement and verification using Q-meter
9	Designing signal Conditioning circuit for Temperature Measurement
10	Designing signal Conditioning circuit for Distance Measurement

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
SBC	Professional Communication Skills	1	0	2	3	6	1	0	1	2
AS201		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory			--		--			
		Laboratory	200		--		--			200

Pre-requisite Course Codes, if any.	
Course Objective:	
Course Outcomes (CO): ***At the End of the course students will be able to***	
AS201.1	Demonstrate the spoken and written skills for job placements.
AS201.2	Draft professional documents.
AS201.3	Design written communication for social media.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
AS201.1												
AS201.2												
AS201.3												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
AS201.1							
AS201.2							
AS201.3							

BLOOM'S Levels Targeted (Pl. appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create
		√	√		

Theory Component

Module No.	Unit No.	Topics	Ref.	L Hrs.	P Hrs
1.	**Title**	**Placement Skills**		6	12
	1.1	Resume Writing & Cover Letter			
	1.2	Group Discussion			
	1.3	Case Studies/Pitching a startup			
	1.4	Team Building Skills/Work			
	1.5	Interview Skills			
2	**Title**	**Corporate Communication**		6	12
	2.1	Presentation Skills			
	2.2	Meeting: Notice, Agenda, Minutes			
	2.3	Proposal Writing			
	2.4	Report Writing: Informative, Analytical report			
3	**Title**	**Research Writing**		2	4
	3.1	Sourcing information through digital media			
	3.2	Written communication using social media: Blog			
4	**Self Study**	Research Paper, News Analysis			6*
			Total(*Not included)	**42 hrs**	

List of ISEs

Sr. No	Title of the Experiment	Marks
1	Resume	20
2	Cover Letter	20
3	GD	40
4	Mock Interview	20
5	Presentation	20
6	Blog Writing	20
7	Team Building Activity	--
8	Minutes of the Meeting/Notice & Agenda	20
9	Proposal Writing	20
10	Report Writing	20
	Total	200

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Interpersonal Skills at Work	2002	John Hayes	McGraw Hill Education	2002
2	Campus Placement: A Comprehensive Guide	2016	Ankur Malhotra	McGraw Hill Education	2016

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	If I Understood You, Would I Have This Look on My Face? My Adventures in the Art and Science of Relating and Communicating	2017	Alan Alda	Random House	2017
2	Handbook for Writing Proposals	2010	Robert J. Hamper, Sue Baugh	McGraw Hill Education	2010
3	Effective Communication Skills for Scientific and Technical Professionals	2000	Harry Chambers	Paperback Basic Books	2000
4	The Art Of Writing Together	2008	William Issac	Crown Business	2008
5	Communication Skills	2011	Meenakshi Raman, Sangeeta Sharma	Oxford, India	2011

Semester-IV

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Probability and Stochastic Processes	3	0	0	6	9	3	0	0	3
		Examination Scheme								
MA203		Component	ISE		MSE		ESE		Total	
		Theory	75		75		150		300	
		Laboratory	-		--		-		-	

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To provide the fundamentals and advanced concepts of probability theory and random process to support core courses in electronic and Electronic and communication engineering. The required mathematical foundations will be studied at a fairly rigorous level and the applications of the probability theory and random processes to engineering problems will be emphasized.	
Course Outcomes (CO): ***At the End of the course students will be able to***	
MA203.1	Apply concepts of mathematics to set operations and probability theory
MA203.2	Apply concepts of probability theory to single random variables
MA203.3	Apply theorems to multiple random variables and investigate significance of Central Limit Theorem.
MA203.4	Determine solutions to various characteristics of random variables/distributions/processes
MA203.5	Investigate characteristics of random processes
MA203.6	To interpret use of probability distributions in real world and illustrate Markov Theory application to Queuing theory.

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA203.1												
MA203.2												
MA203.3												
MA203.4												
MA203.5												
MA203.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA203.1							
MA203.2							
MA203.3							
MA203.4							
MA203.5							
MA203.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Probability**	1,2	**08**
	1.1	Sets and set operations; Probability space; Conditional probability and Bayes theorem		
2	Title	**Single Random Variable**	1,2	**08**
	2.1	Discrete random variables, probability mass function, probability distribution function, example random variables and distributions		
	2.2	Continuous random variables, probability density function, probability distribution function, example distributions		
3	Title	**Multiple Random Variables**	1,2	**10**
	3.1	Joint distributions, functions of one and two random variables, moments of random variables; Conditional distribution		
	3.2	densities and moments; Characteristic functions of a random variable		
	3.3	Markov, Chebyshev and Chernoff bounds		
4	Title	**Sequence of Random Variables**	1,2	**06**
	4.1	Random sequences and modes of convergence (everywhere, almost everywhere, probability, distribution and mean square)		
	4.2	Limit theorems; Strong and weak laws of large numbers, central limit theorem.		
5	Title	**Random Process**	1,2	**10**
	5.1	Random process. Stationary processes. Mean and covariance functions. Ergodicity.		
	5.2	Transmission of random process through LTI. Power spectral density.		
6	Self Study	**Application of different probability distributions(to any one field of interest but not limited to)** 1.Wireless Communication 2.Queuing theory 3. Networking 4. Digital Signal Processing. 5.VLSI	1,2	**06***
			Total	**42**

***Not included in the total**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Probability, Random Variables and Stochastic Processes	4th	A.Papoulis and S. Unnikrishnan Pillai	McGraw Hill	2002
2	Probability and Random Processes with Applications to Signal Processing	3rd	H. Stark and J. Woods	Pearson education	2002

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Probability And Random Processes For Electrical Engineering	3rd	Alberto Leon Garcia	Pearson education	2008
2	Probability, Statistics and Random Processes	3rd	T Veerarajan	McGraw Hill	2008

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(BSC)	Foundations of Mathematics-II	2	1	0	0	3	2	1	0	3
MA204		Examination Scheme								
		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300

Pre-requisite Course Codes, if any.	Foundations of Mathematics-I
Course Objective: To develop basic foundation of mathematical skills.	
Course Outcomes (CO): ***At the End of the course students will be able to:-***	
MA204.1	Integrate a function of one variable using various techniques
MA204.2	Sketch basic curves and solve double and triple integrals.
MA204.3	Solve basic problems using properties of complex numbers.
MA204.4	Solve differential equations of first order.
MA204.5	Apply the techniques of solving first order differential equations to electrical engineering problems.
MA204.6	Solve differential equations of higher order

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
MA204.1												
MA204.2												
MA204.3												
MA204.4												
MA204.5												
MA204.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
MA204.1							
MA204.2							
MA204.3							
MA204.4							
MA204.5							
MA204.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref	Hrs.
1	**Title**	**Integral Calculus**	1,2	**13**
	1.1	Formulae for integral of standard functions, integration by parts, integration by method of substitution.		04
	1.2	Gamma functions, Beta functions .Differentiation under Integral sign with constant limits and one parameter.		04
	1.3	Standard curves (lines, circles, parabolas, ellipses). Concept of double integration. Evaluation of double and triple integrals.		05
2	**Title**	**Complex Numbers**	1,2	**03**
	2.1	Operations on complex numbers, polar form of a complex number, properties of a complex number.		03
3	**Title**	**Differential Equations**	1,2	**12**
	3.1	Exact differential equations. Linear differential equations of the first order and equations reducible to linear.		04
	3.2	Solving differential equations of first order in electrical networks.		01
	3.3	Linear differential equations with constant coefficients: complementary function and particular integral.		07
			Total	**28**

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Higher Engineering Mathematics**	**44th**	**Dr.B.S. Grewal**	**Khanna Publications**	**2020**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	**Advanced Engineering Mathematics**	**10th**	**Erwin Kreysizg**	**John Wiley & Sons**	**2011**
2	**Advanced Engineering Mathematics**	**28th**	**H.K.Dass**	**S.Chand**	**2014**

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Analog Circuits	3	0	2	6	11	3	0	1	4
		Examination Scheme								
ET205/EC205		Component	ISE		MSE		ESE			Total
		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	ET101, ET202
Course Objective: To teach fundamentals of analog electronic circuits	
Course Outcomes (CO):*At the End of the course students will be able to*	
XX205.1	Apply the concept of negative and positive feedback
XX205.2	Discuss differential amplifier and power amplifier circuits
XX205.3	Discuss fundamentals of operational amplifier IC
XX205.4	Design linear and non-linear applications using operational amplifier IC
XX205.5	Discuss various data conversion techniques
XX205.6	Design applications with special purpose ICs

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX205.1												
XX205.2												
XX205.3												
XX205.4												
XX205.5												
XX205.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX205.1							
XX205.2							
XX205.3							
XX205.4							
XX205.5							
XX205.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember√	**Understand√**	**Apply√**	**Analyze√**	**Evaluate**	**Create**

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Feedback topologies and Oscillators**	1	8
	1.1	Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin.		
	1.2	**Oscillators:** Review of the basic concept, Barkhausen criterion, RC oscillators (phase shift, Wien bridge etc.) and LC oscillators (Hartley, Colpitt, Clapp etc.)		
2	Title	**Differential amplifier and Power Amplifier**	1	8
	2.1	**Current mirror:** Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load.		
	2.2	**Differential amplifier:** Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR.		
	2.3	**Power amplifiers:** Power BJTs, Power MOSFETs, Heat Sinks, Class A, Class B, Class C and Class AB operation, Power efficiency		
3	Title	**Operational Amplifier**	2	12
	3.1	Functional Block Diagram of op amp, DC and AC characteristics of an op-amp, Ideal op-amp		
	3.2	**Linear Applications of Operational Amplifier** Inverting and non-inverting amplifier, adder, subtractor, integrator, differentiator, difference amplifier, instrumentation amplifier **Active Filters:** First order filters, second order active finite and infinite gain low pass, high pass		
	3.3	**Non-Linear Applications of Operational Amplifier** **Comparators:** Inverting comparator, non-inverting comparator, zero crossing detector **Schmitt Triggers:** Inverting Schmitt trigger		
4	Title	**Data Converters**	2	6
	4.1	Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc.		
	4.2	Analog to-digital converters (ADC): Single slope, dual slope, successive approximation, flash etc.		
	4.3	Switched capacitor circuits: Basic concept, practical configurations, application in amplifier, integrator, ADC etc.		
5	Title	**Special Purpose Integrated Circuits**	2	8
	5.1	Timer 555 and its applications		
	5.2	Three-terminal fixed (78XX series) and general purpose 723 voltage regulators.		

6	**Self Study**	Multiplier IC's, Power Amplifier IC's, PLL and VCO. Design of applications using these IC's.	**6***
		Total (*Not included)	**42**

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Design and implement any one negative feedback amplifier
2	Design and implement any one oscillator circuit
3	Design and implement differential amplifier with and without current mirror circuit
4	Design and implement any one power amplifier circuit
5	To measure (a) Input bias current, (b) Input offset current,(c)Input offset voltage & (d) Slew rate of the given Op-Amp IC 741.
6	Design and Implement linear application using Op-Amp IC 741.
7	Design and Implement non-linear application using Op-Amp IC 741
8	Design and Implement active filter circuit using Op-Amp IC 741.
9	Design and implement data converter circuit
10	Design and Implement Multivibrator Circuits using IC 555
11	Design, Implement and analyze Voltage Regulator Circuit using IC 723.

Text Books :

S. N.	Title	Edition	Authors	Publisher	Year
1	Electronic Circuit Analysis and Design	**Third**	Donald A. Neamen	Tata McGraw Hill	**2006**
2	Linear Integrated Circuits	**Fourth**	D. Roy Choudhury and S. B. Jain	New Age International Publishers	**2018**

Reference Books :

S. N.	Title	Edition	Authors	Publisher	Year
1	Millman's Electronic Devices and Circuits	**Third**	Jacob Millman,Christos C Halkias, and Satyabratata JIT	McGrawHill	**2014**
2	Design with operational amplifiers and analog integrated circuits	**Fourth**	Sergio Franco	Tata McGraw Hill	**2016**
3	Op-Amps and Linear Integrated Circuits	**Fourth**	Ramakant A. Gayakwad	Pearson Prentice Hall	**2015**

Sardar Patel Institute of Technology

Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai-400058-India
(Autonomous Institute Affiliated to University of Mumbai)

Course(Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Microcontrollers	3	0	2	6	11	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE		Total	
ET206/EC206		Theory	50		50		100		200	
		Laboratory	50		--		50		100	

Pre-requisite Course Codes, if any.	EC101, ET201
Course Objective: Imparting the detailed architectural features of various microcontrollers like 8051, PIC and ARM along with integrated peripherals and programming	
Course Outcomes (CO): *At the End of the course students will be able to*	
XX206.1	Compare and contrast traditional microprocessor with traditional microcontroller 8051
XX206.2	Understand and describe architectural features of microcontrollers like PIC and ARM
XX206.3	Comprehend ARM core model and classify different modes of operation with justification
XX206.4	Classify various instructions with addressing modes of microcontrollers like PIC and ARM
XX206.5	Analyze the given problem statement and apply the programming concepts to solve the problem through program in PIC and ARM
XX206.6	Illustrate and utilize the integrated peripherals of 16 and 32 bit microcontrollers

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX206.1												
XX206.2												
XX206.3												
XX206.4												
XX206.5												
XX206.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX206.1							
XX206.2							
XX206.3							
XX206.4							
XX206.5							
XX206.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	Apply	Analyze ✓	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Introduction of 8-bit Microcontroller - 8051**		4
	1.1	Overview of 8051 Family of Controllers	1	
	1.2	Architecture of 8051 with block diagram schematic	1	
	1.3	Brief description of integrated components of 8051	1	
2	Title	**PIC Microcontroller**		10
	2.1	Microcontroller architecture and Programming model	2	
	2.2	Instruction set with addressing modes	2	
	2.3	Programming and Problem solving approaches	2	
3	Title	**PIC Integrated Peripherals**		9
	3.1	I/O Ports with its interfacing	2	
	3.2	Interrupt Structure	2	
	3.3	Timers with its configuration	2	
	3.4	Data Converters (ADC and DAC)	2	
	3.5	Serial I/O (SPI and I^2C protocol)	2	
4	Title	**ARM7TDMI(ARMv4T) Architecture**		10
	4.1	Features and advantages, ARM versions	3,4	
	4.2	Processor operating states, ARM core data flow model, operating modes, registers, program status registers, exceptions and pipelined architecture advantage	3,4	
	4.3	Instruction set with addressing modes	3,4	
5	Title	**LPC2148 ARM7 Processor Programming and Interfacing**		9
	5.1	Processor state changing (ARM←→THUMB), Exceptions, interrupts and its handling.	3,4	
	5.2	Timer Programming, Watchdog Timer	3,4	
	5.3	ADC and Sensor Interfacing	3,4	
	5.4	SPI and I2C Peripheral Interface	3,4	
6	Self Study	ARM-v7-M (Cortex-M3), Comparison of ARM-v&-A (Cortex A8), ARM-v7-R (Cortex R4), ARM-v7-M (Cortex M3). Application Case Study for PIC and ARM controllers		6*
			Total (*Not included)	42

Laboratory Component, if any (Minimum 10 Laboratory experiments are expected)

Sr. No	Title of the Experiment
1	Programming the I/O Port of 8-bit 8051 Microcontroller and effectively interface the LED and switch.
2	Programming and Interfacing for utilization of on-chip resources like Timers and Serial Communication of 8-bit 8051 Microcontroller.
3	PIC assembly language programming and simulation
4	PIC LED/LCD interfacing and programming
5	PIC Timers and interrupts programming
6	PIC ADC Programming
7	ARM LEDs and Keyboard Interface
8	ARM Programming and Interfacing of sensors using on chip ADC
9	ARM Programming and Interfacing on chip Serial Port
10	ARM Programming and Interfacing on chip timer

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	The 8051 Microcontroller and Embedded Systems: Using Assembly and C	**Second**	Muhammad Ali Mazidi, Janice G. Mazidi and R. D. McKinlay	**Pearson**	**2006**
2	Fundamentals of Microcontrollers and Applications in Embedded Systems (with PIC18 microcontroller family)	**Fourth**	Ramesh Gaonkar	**Penram International Publishing Pvt. Ltd**	**2007**
3	ARM System Developer's Guide Designing and Optimizing System Software	**First**	Andrew N. Sloss, Dominic Sysmes and Chris Wright	**Elsevier Inc Morgan Kaufmann**	**2004**
4	ARM Architecture ,Reference Manual	**Second**	David Seal	**Addison Wesley**	**2001**

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	PIC Microntroller: An Introduction to Software & Hardware Interfacing	**Second**	Han- Way Huang	**Cengage Learning**	**2005**
2	ARM System-on-Chip Architecture	**Second**	Steve Furber	**Addison-Wesley**	**2000**

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned			
		L	T	P	O	E	L	T	P	Total
(PC)	Signals and Systems	3	0	2	6	11	3	0	1	4
		Examination Scheme								
		Component	ISE		MSE		ESE			Total
ET207/EC207		Theory	75		75		150			300
		Laboratory	50		--		50			100

Pre-requisite Course Codes, if any.	MA101, MA102
Course Objective: To develop strong foundation of continuous time signals and systems	
Course Outcomes (CO): ***At the End of the course students will be able to***	
XX207.1	Classify and illustrate various operations on signals and systems.
XX207.2	Analyze the properties of a continuous time signal in frequency domain and observe the spectrum.
XX207.3	Apply Laplace Transform on continuous time signals
XX207.4	Evaluate Linear Time Invariant system response using Laplace Transform
XX207.5	Design analog Butterworth and Chebyshev filter
XX207.6	Interpret system using state space model

CO-PO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
XX207.1												
XX207.2												
XX207.3												
XX207.4												
XX207.5												
XX207.6												

CO-PEO/PSO Correlation Matrix (3-Strong, 2-Moderate, 1-Weak Correlation)

	PEO1	PEO2	PEO3	PEO4	PSO1	PSO2	PSO3
XX207.1							
XX207.2							
XX207.3							
XX207.4							
XX207.5							
XX207.6							

BLOOM'S Levels Targeted (Pl. Tick appropriate)

Remember	Understand	✓ Apply	✓ Analyze	Evaluate	Create

Theory Component

Module No.	Unit No.	Topics	Ref.	Hrs.
1	Title	**Overview of Continuous Time Signals and Systems**	1,2	08
	1.1	**Introduction:** Signals, systems, elementary signals, exponential, sine, step, impulse, ramp, rectangular, triangular and operations on signals		
	1.2	**Classification of signals:** Continuous Signals, deterministic and non-deterministic, periodic and aperiodic, symmetric (even) and asymmetric (odd), energy and power, causal and anti-causal signals.		
	1.3	Operations of Signals: Shifting, Scaling, Time Reversal, Addition and Multiplication, Convolution, Correlation		
2	Title	**Fourier Series and Fourier Transform**	1,2	10
	2.1	**Fourier series**: Orthogonal representation of signals, Continuous Time Fourier Series (CTFS), magnitude and phase spectra, Gibbs phenomenon, Parsevel's relation,		
	2.2	**Fourier Transform**: Fourier Transform and Inverse Fourier Transform on periodic and non-periodic signals, Limitations of Fourier Transform and need for Laplace Transform, Properties of Fourier Transform, Parsevel's relation, Energy and Power Spectral Density and Bandwidth.		
3	Title	**Laplace Transform**	1,2	04
	3.1	Laplace Transform, Properties of Laplace Transform, Relation between Laplace Transform and Fourier Transform,		
	3.2	Inverse Laplace Transform using Partial Fraction method		
4	Title	**Linear Time Invariant (LTI) Systems**	1,2	08
	4.1	**Classification of systems:** Static and dynamic, time variant and time invariant, linear and nonlinear, causal and non-causal, stable and unstable systems.		

	4.2	Impulse Response, Transfer Function, Differential Equation, Stability of Systems, Frequency Response, Solution of Differential Equation using Laplace Transform		
5	**Title**	**Analog Filter Design**	1,2	**12**
	5.1	Design of Ideal Analog filter, Butterworth Low Pass Filter (LPF) design, Butterworth High Pass Filter (HPF) design, Butterworth Band Pass Filter (BPF) and Band Reject Filter design, Pole zero plot of Butterworth filters, Magnitude Spectrum		
	5.2	Equiripple Filters, Chebyshev Type-I LPF, HPF Design, Polezero plot of Chebyshev filter, magnitude spectrum.		
	5.3	Realization diagram (Form I and II)		
6	**Self Study**	**State Space Model:** Procedure to determine state equations, State equations from transfer function, Laplace transform solution of state equations		**6***
			Total (*Not included)	**42**

Laboratory Component

Sr. No	**Title of the Experiment**
1	Representation of Signals
2	Operations on Signals
3	Convolution on Continuous Time Signals
4	Synthesis of signals using Fourier Series
5	Synthesis of signals using Fourier Transform
6	Analysis of LTI system using Laplace Transform
7	Plotting of frequency spectrum
8	Butterworth filter design
9	Chebyshev filter design
10	Mini-project: Analysis of real world signals

Text Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Signals and Systems	3rd	Nagoor Kani	Tata McGraw Hill	2011
2	Digital Signal Processing	4th	Ramesh Babu	Scitech	2014

Reference Books

Sr. No	Title	Edition	Authors	Publisher	Year
1	Signals and Systems	2nd	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab	Pearson	2002
2	Signals and Systems	3rd	Simon Haykin and Barry Van Veen	John Wiley & Sons	2002
3	Linear Systems and Signals	4th	B. P. Lathi	Oxford University Press	2005
4	Signals and Systems	2nd	H. P Hsu, R. Ranjan	Schaum's outlines	2006

Course (Category) Code	Course Name	Teaching Scheme (Hrs/week)					Credits Assigned				
		L	T	P	O	E	L	T	P	O	Total
(SBC)	Mini Project-I	0	0	0	4	4	0	0	0	2	2
		Examination Scheme									
		Component			ISE		MSE		ESE		Total
ET208/EC208		Theory			--		--		--		--
		Laboratory			--		--		--		--
		Self Study			100		--		100		200

Pre-requisite Course Codes	All the Courses till third Semester

Mini-project is an opportunity to make a difference in the experience of education in its own way. It is an attempt of scientific study of the problem in surrounding in order to guide, correct and evaluate the actions and decisions about it. It is based on a small project correlating scientific knowledge and day to day experience which encourages development of scientific attitude to solve real life problems among students.

The Objectives of Action Research are:

- ✓ To make students sensitive towards societal issues
- ✓ To learn scientific principles from day-to-day experiences
- ✓ To develop psycho-technological skills through observation, classification, statement of hypothesis etc.
- ✓ Development of communication, organizational skills and maturity through discussion, presentation etc.
- ✓ To develop ability to correlate science, technology and society
- ✓ To apply engineering knowledge and propose innovative, sustainable solutions to the real life challenges

Steps for Implementation: (ISE: Through 2 Phases of Evaluation) and ESE

- ✓ Keen observation of the surrounding/society
- ✓ Identification of the problem
- ✓ Analysis of the problem
- ✓ Collection of relevant information by formulating research questions
- ✓ Suggesting plan of action
- ✓ Conducting experiments
- ✓ To draw conclusion
- ✓ To find the possible solution to rectify the problem
- ✓ To execute experiments and remedial measures wherever possible

Students can seek guidance from teachers, other experts and make effective use of other sources of information available around them. Students must ensure that problem to be solved in manageable in one semester.

Teachers must follow the below mentioned principles:

- ✓ Make student confront problem solving
- ✓ Develop methods and techniques of handling problems.
- ✓ Teach how to use the methods and not directly give solution to the problem.
- ✓ Lead the students to the peak of their powers for improvement of better learning.

The H/W and S/W resources required to complete the Mini-Project-I may be beyond the scope of curriculum of courses taken or may be based on the courses but thrust should be on

- Learning additional skills
- Development of ability to define and design the problem and lead to its accomplishment with proper planning
- Learn the behavioral discipline by working in a team. The team may be maximum three (03) students.

Evaluation:

Project report should contain project title, student details, certificate and acknowledgements. Other sections of the report shall be decided by the department based on projects. But it must have introduction, necessity of project, objectives, hypothesis, plan, observations, analysis of results, conclusion and references along with other sections related to technology. The ISE and ESE evaluation will be carried out based on the rubrics framed by the Department. The ESE marks will be based on final demonstration of the project and viva based on it and report/poster/technical paper of the project in the standard format provided by the Department.