PROGRAMME STRUCTURE

AND

SYLLABI OF

DIPLOMA PROGRAMME IN

ELECTRONICS ENGINEERING

UNDER RATIONALISED SEMESTER SYSTEM

(IMPLEMENTED FROM ACADEMIC YEAR 2019-20)

BOARD OF TECHNICAL EDUCATION, GOA STATE

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FOREWORD

I take this opportunity to putforth before you the Revised Curriculum for Diploma Programme in Electronics Engineering under Rationalised Semester System to be implemented from academic year 2019-20.

Shri Vivek B. Kamat, Director, Directorate of Technical Education triggered the idea of revision in Curriculum for various Diploma Programmes under 03/04 years Diploma Programmes. Director was instrumental in motivating the teaching faculties, offering technical guidance on continual basis for timely completion of said endeavour.

Dr. Krupashankara M.S. Chairman, BTE inspired the members of various Committees with NBA guidelines, January 2019. As per directives of Chairman BTE, Committees could execute CO-PO mapping, define the various levels as per Bloom's technology and thus can generate balanced question papers for internal/Board Examination.

I would like to appreciate Chairman of Courses committees alongwith sub-committee members, for having carried out the work, within the given schedule. I take this opportunity to thank Dr. V.N. Shet, Ex-Chairman, Board of Technical Education- Goa, Ms. Anjali Sardessai, Ms. Seema Naik, Mr. Rama Subhaji and all others who have directly/indirectly helped Board in achieving the goal.

This improvised Curriculum shall be beneficial to students Community at large, with updated knowledge database and can offer them better opportunities to seek employment in their relevant fields.

Thanking you,

(Shri.N.V.T. Pednekar)
Secretary
Board of Technical Education,Goa

Syllabus Drafting Committee for Diploma in Electronics Engineering

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DIPLOMA IN ELECTRONICS ENGINEERING - CURRICULUM STRUCTURE											
Semester	**Code**	**Subjects**	**L**	**T**	**P**	**C**	**TH**	**TM**	**PR**	**TW**	**TOT**
FIRST	GC102	Engineering Mathematics I	4	2	0	6	75	25	-	-	100
	GC103	Applied Physics I	4	0	2	6	75	25	-	25	125
	GC106	Basic Engineering Practice (Electronics & Computers)	0	0	4	4	-	-	50	75	125
	GC104	Applied Chemistry	3	0	2	5	75	25	-	25	125
	GC204	Engineering Drawing	2	0	4	6	-	-	50	50	100
			13	2	12	27	225	75	100	175	575
SECOND	GC201	Engineering Mathematics II	4	2	0	6	75	25	-	-	100
	GC202	Applied Physics II	3	0	2	5	75	25	-	25	125
	GC101	Communications Skills	0	0	2	2	-	-	25	25	50
	GC203	Environmental Science	3	0	0	3	75	25	-	-	100
	GC107	Basic Engineering Practice (Electrical & Mechanical)	0	0	6	6	-	-	50	100	150
	GC205	Engineering Materials	3	0	0	3	75	25	-	-	100
			13	2	10	25	300	100	75	150	625
THIRD	CC304	Basic Electrical Engineering	3	0	2	5	75	25	-	25	125
	EX302	Programming Constructs for Electronic Devices	0	0	4	4	-	-	50	25	75
	CC308	Basic Electronics Engineering	3	0	2	5	75	25	50	25	175
	CC309	Digital Electronics	3	0	2	5	75	25	50	25	175
	EX301	Communication Engineering	3	0	2	5	75	25	-	25	125
	CC303	Circuits & Networks	3	0	2	5	75	25	-	25	125
			15	0	14	29	375	125	150	150	800
FOURTH	EX401	Electronic Circuits	3	0	2	5	75	25	25	25	150
	EX602	Power Electronics	3	0	2	5	75	25	-	25	125
	EX403	8051 Microcontroller	3	0	2	5	75	25	25	25	150
	EX404	Maintenance and Circuit simulation using CADD	0	0	4	4	-	-	50	50	100
	EX405	Linear Integrated Circuits	3	0	2	5	75	25	25	25	150
	EX406	Electronic Measurements & Instrumentation	3	0	2	5	75	25	-	25	125
			15	0	14	29	375	125	125	175	800
FIFTH	TR501	Industrial Training	0	0	0	0	-	-	-	-	GRADE
	CC501	Entrepreneurship Development	0	0	2	2	-	-	-	25	25
	EX501	Programmable logic Controllers	3	0	2	5	75	25	-	25	125
	CC601	Industrial Organization & Management	3	0	0	3	75	25	-	-	100
		Elective 1	3	0	2	5	75	25	25	25	150
			9	0	6	15	225	75	25	75	400

	DIPLOMA IN ENGINEERING CURRICULUM STRUCTURE										
	Code	**Subjects**	**L**	**T**	**P**	**C**	**TH**	**TM**	**PR**	**TW**	**TOT**
SIXTH	EX601	Audio and Video Engineering	3	0	2	5	75	25	-	25	125
	CC602	Business Communication	0	0	2	2	-	--	50	50	100
	EX402	Industrial Electronics	3	0	2	5	75	25	-	25	125
		Elective 2	3	0	2	5	75	25	25	25	150
		Elective 3	3	0	2	5	75	25	25	25	150
	EX603	Project	0	0	8	8	-	-	50	100	150
			12	0	18	30	300	100	150	250	800
L- Lecturers T – Tutorial P – Practical C-Credits TH – Theory Marks TM – Test Marks PR – Practical Marks TW- Term Work Marks											

ELECTIVE GROUPS E1, E2, & E3

ELECTRONIC ENGG.
Elective 1: General (SEM V)
Biomedical Instrumentation
Autonomous Robots
Renewable energy
Electrical Machines
Web designing technologies
VHDL
Advanced microcontrollers
Data structures

ELECTRONIC ENGG.
Elective 2 & 3 (SEM VI)
Data Communication
Mobile communication
Digital Signal Processing
Consumer Electronics
Robotics
Image Processing
Smart Grid Technology
VLSI design and applications
Smart Sensor Networks

SEMESTER I

(GC102) Engineering Mathematics I

1. **AIM**

2. Developing the mathematical approach for solving engineering and technological problems.
3. The use of knowledge and understanding of mathematics in engineering context.
4. The selection of method of manipulation at appropriate place and time

2. COURSE OBJECTIVES:

The students will able to:

1. Acquire knowledge of Mathematical terms, concepts, principles and different methods.
2. Develop the ability to apply mathematical methods to solve technical problems, to execute management, plans with precision.
3. Acquire sufficient mathematical techniques necessary for daily and practical problems.

4. PRE-REQUISITES:

Students should know

1. Awareness of Co-ordinate Geometry.
2. The fundamentals of maths.

5.TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Tutorial Marks**	**Total Marks**
GC102		**L**	**T**	**P**	**C**	**TH**	**TM**	**Tutorials Test**	
Engineering Mathematics I		**4**	**2**	**-**	**6**	**75**	**20**	**05**	**100**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Apply formulae of algebra, geometry, trigonometry and calculus

2. Understand the concepts of calculus to solve the problems

3 Identify and apply the formulae of algebra and mensuration for solving practical engineering problems

4. Develop their lateral thinking abilities in solving mathematical problems

6. Mapping Course Outcomes with Program Outcomes

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**
	Basic & Discipline Specific Knowledge	**Problem Analysis**	**Design and Devlopment of Solutions**	**Engg. Tools, Experimentatn & Testing**	**Engg. Practices for Society,Sustain ability& Environment**	**Project Management**	**Life -long Learning**
CO1	**3**	**2**		**1**		**2**	
CO2	**3**	**2**			**1**		**1**
CO3	**3**	**2**				**2**	**1**
CO4	**3**			**2**		**2**	

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**	**Levels**
1 MATHEMATICS FUNDAMENTAL			**CO-1,3**	
1.1 **Polynomials: Types** of polynomials, addition subtraction, multiplication and division of polynomials (no question to be asked),Factorization of polynomials,Multiplication and division of polynomials	2	2		
1.2 **: Algebraic equations:**Different types of equations and their geometric meaning, Equations with one, two and three variables and solving equations with two and three variables Quadratic equations and nature of their solutions	2	2		
1.3: Logarithm: Definition of log, log with base 'e' and base'10' Properties of log, log and antilog using log table sums based on log	4	2		
2.STRAIGHT LINES AND CIRCLES			**CO-1 CO-4**	
2.1: Straight line: Intercept, slope, intersection of lines Equations of line: 1. Slope intercept form, slope point form, two points form, parallel and perpendicular lines, angle between lines Perpendicular distance of a point from line	8	7		
2.2: Circle:circle as a locus, centre, diameter, chord of a circle Equations of circle: Centre radius form, diameter form, general form and sums	7	7		
3. TRIGONOMETRY			**CO-1, CO-4**	
3.1: Angle and measurement, degree and radians and conversion and related sums, arc length and area of sector and sums **3.2:** Trigonometric ratios and identities 3.3: Trigonometric ratios of compound and allied angles 3.4: T.R.s of (A$\pm$ B) and sums 3.5: Product formulae sinA$\pm$sinB, cosA$\pm$cosB **3.6:** Sum and difference formulae **3.7:** Multiple angle 2A, and their trigonometric ratios, Multiple angle 3A (only sine, cos tan,ratios, no questions) **3.8**: Properties of Triangle sine rule, cosine rule in triangle, area of triangle	15	15		

4 :MENSURATION	10	8		
4.1: Areas of 2D figures like quadrilaterals, circle triangle etc (no questions to be asked) **4.2:** Area and volumes of cube, sphere, cylinder, cone, prism, pyramid **4.3**: frustum of cone, pyramid, sphere and their areas and volumes. **4.4:** Simpson's 1/3rd rule for area and volume			**CO-3**	
5 :CALCULUS			**CO-1, CO-2, CO-4**	
5.1:Limits 5.1.1 : Pre requisite : Sets , intervals relation, function (no questions to be asked) 5.1.2 : Limit of a function , algebraic properties of limit 5.1.3: limit of algebraic, trigonometric, exponential, logarithmic functions 5.1.4: Trigonometric limit formulae in sine and tan, exponential & logarithmic limit formulae	7	4		
5.2 : Derivatives 5.2 .1: Derivative definition by first principle (no question to be asked) 5.2.2: Algebraic properties of derivative, standard formulae 5.2.3: Derivatives of algebraic, trigonometric, exponential, logarithmic functions 5.2.4: Derivatives of sum , difference (u $\pm$ v) 5.2.5: Derivative of product of functions uv, uvw rule. 5.2.6: Derivative of u/v rule 5.2.7: Derivative of composite function 5.2.8: Derivative of parametric function 5.2.9: Derivative of implicit function 5.2.10 : Logarithmic differentiation 5.2.11: Second order derivatives (no question to be asked)	15	12		
5.3 : Applications of derivatives 5.3.1: Application to the geometry: i) derivative as a slope of a tangent ii) to find equations of tangent and normal at given point on the curve 5.3.2:Application to the Linear motion:i) displacement, velocity,acceleration 5.3.3: Application to the rate measure i) to find rate change in area and volume etc 5.3.4 : Maxima and minima	5	5		
Total	**75**	**64**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Mathematics Fundamental**	06	08
2	**Straight line and circle**	14	15
3	**Trigonometry**	15	15
4	**Mensuration**	08	10
5	**Calculus**	21	27
	Total	**64**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

Sr. No.	Unit	Sums per topic (minimum)	Tutorial test (marks)
1.	**Mathematics Fundamental**	20	
2.	**Straight line and circle**	20	
3.	**Trigonometry**	20	
4.	**Mensuration**	20	
5.	**Calculus**	30	
	Two Tutorial Tests should be conducted on topics which are not covered in the PA test, (each test of 5 marks and average to be taken)		
	Total		05

NOTE:

- Tutorial books should be maintained by students
- Teacher needs to sign for each topic in the index as well as inside on the last page of each topic where students solve sums.

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Mathematics for Polytechnic Students(Basic Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	Mathematics for Polytechnic Students(Engineering Mathematics)	S.P. Deshpande	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	S.B. Gore, M.B.Patil, S.P. Pawar	Applied Mathematics	Vrinda Publications

Note :Any XI and XII science mathematics books can be referred to as reference books.

Reference Books for further study

S. No.	**Author**	**Title of Books**	**Publishers**
1	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Applied Mathematics I	Nandu Printers& Publishers pvt. Ltd. Mumbai
2	H.K. Dass	Applied Mathematics for Polytechnics	CBS Publishers and distributers Pvt.Ltd. ,Pune
3	Seymour Lipschutz	Set Theory and related topics	McGraw-Hill

(GC103) APPLIED PHYSICS I

1. AIM

1.To provide the students with the applied knowledge in physics aimed at topics in higher semesters.

2. COURSE OBJECTIVES / RATIONALE:

On successful completion of the course, the student will be able to:

1.Comprehend the various topics in the course and apply them to engineering applications.

3. PRE-REQUISITES:

Students should know

1.Various units and their conversions into other units.

2.Use of basic mathematical calculations.

3. TEACHING AND EXAMINATION SCHEME

Semester I									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(GC103) APPLIED PHYSICS I	03	0	02	05	75	25	25	-	125

4.COURSE OUTCOMES:

The students will able to:

1.Understand the Fundamental concepts and principles of measurements of physical quantities used in engineering applications.

2. Apply the knowledge of statics and dynamics to determine the Work, Power and Energy used in different engineering applications.

3.Understand the different properties of matter and their significance in different engineering applications

4. Analyze the mechanism in solving simple problems of heat transfer taking place through different states of matter.

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5. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic and discipline specific Dknowledge	**Problrm analysis**	**Design/ Developments of sloutions**	**Engineering tools/Experimentation and testing**	**Engineering practice for society sustainability and environment**	**Project Management**	**Life Long Learning**
CO 1	3	1		1			3
CO 2	3	1	2	2			1
CO 3	3	2	2	2			1
CO 4	3	3		2			3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | Thr = Teaching hours | CO = Course Objectives			
Unit	**M**	**Thr**	**CO**
1 UNIT NAME: UNITS AND DIMENSIONS	**08**	**12**	**CO1**
1.1 Fundamental and Derived units ,			
1.2 Different system of units, SI unit conversion from one system to other,			
1.3 Principle of Homogeneity,			
1.4 Dimensions,dimensional formula,			
1.5 dimensonal correctness of given equation using dimensions			
1.6 least count of vernier calliper and screw gauge			
1.7 zero errors-- in case of vernier calliper and screw gauge			
1.8 Types of error.			
2. UNIT NAME: MOTION IN ONE DIMENSION, FORCE, WORK AND ENERGY	12	19	**CO2**
2.1 distance and displacement,			
2.2 scalar and vectors			
2.3,speed and velocity, uniform velocity, ,			
2.4 uniform acceleration,acceleration due to gravity			
2.5 equation of motion ($v=u+at$, $v^2=u^2+2as$, $s=ut+1/2at^2$)(no derivation)			
2.6 motion under gravity. Force and its unit.			
2.7 Work and its unit. Energy, law of conservation of energy,			
2.8. Kinetic and potential energy equation and examples.			
3. UNIT NAME: Uniform Circular Motion and Gravitation	10	16	**CO2**
3.1 unifrom circular motion,			
3.2 definition angular displacement,angular velocity, ,			
3.3conversion from rpm to rad/sec,$v=r\omega$, tangential velocity, radial acceleration			-
3.4 centripetal force and centrifugal force, examples,			

3.5 banking of roads,superelevation, expression for angle of banking			
3.6 Newtons law of gravitation, acceleration due to gravity ,			
3.7 Expression for acceleration due to gravity. Escape velocity, Critical velocity, and periodic time definition and expression (no derivation)			
3.8. sattellite, types(geosattionary,communication remote sensing)			
4. UNIT NAME: PROPERTIES OF MATTER	**10**	**16**	**CO3**
4.1 Elasticity ,			
4.2 stress, strain,hooke's law,			
4.3youngs modulus,			
4.4 bulk modulus, rigidity modulus,			
4.5 stress v/s strain graph			
4.6 yield point, breaking stress,factor of safety, ,			
4.7 surface tension definition and example			
4.8. adhesive and cohesive force, application,			
4.9 liquid miniscus and angle of contact, capillarity,			
4.10expression for surface tension (no derivation), applications. viscocity,			
4.11 definition velocity gradient, newtons law of viscocity, terminal velocity,stokes law,			
4.12 streamline flow and turbulent flow,critical velocity, application of viscocity.			
5. UNIT NAME: HEAT	**08**	**12**	**CO4**
5.1 statements of boyles law,charles law,gay lussacs law			
5.2 general gas equation,specific heat definition and unit, Latent heat definition and unit			
5.3Modes of transfer of heat, conduction, convection and radiation,			
5.4 Conduction of heat through a metall rod,			
5.5 variable and steady state			
5.6 law of thermal conductivity (With Derivation)			
5.7 applications of thermal conductivity			
5.8. thermal expansion of solids			
5.9 linear expansion,superficial expansion			
5.10Cubical Expansion			
5.11 Realtion betwenn α,β,γ (no derivation)			
5.12 Engineering applications of expansion of solids.			

7. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	UNITS AND DIMENSIONS	8	12
2	MOTION IN ONE DIMENSION, FORCE, WORK AND ENERGY	12	19
3	UNIFORM CIRCULAR MOTION AND GRAVITATION	10	16
4	PROPERTIES OF MATTER	10	16
5	HEAT	8	12
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Basic Conversion Techniques from one system of units to the other	
2.	Use Of Vernier callipers to find the Volume of Hollow cylinder, Block	
3.	Use of Screw gauge to find the cross sectional area of a wire and thickness of a clip	
4.	To find the Coefficient of Viscosity of a given liquid by stokes method	
5.	To Find the coefficient of Thermal Conductivity by Searle's Method	
6	To Find the Surface Tension of a given liquid by capillary rise method	
7	To Find Young's Modulus by Searles Method	
8	To Find acceleration due to gravity by simple pendulum method.	
	Total	25

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	
2	Bhandarkar	Applied Physics of Polytechnics	
3	R K Gaur and S L Gupta	Engineering Physics	
4	B L Thereja	Engineering Technology	
5	Dr. Vasudev R. Bhagwat	A Text Book of Applied Physics for polytechnic students.	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	
2		ABC of Physics I=II	
3	Saxena HC and Singh Prabhakaer	Applied Physics Vol I & II	

(GC106) Basic Engineering Practice (Mechanical & Electrical)

1. AIM:

To develop basic workshop skills and safety aspects necessary for a technician.

Rationale: A technician is expected to work on the shop floor. It therefore becomes essential for him/ her to have a thorough exposure to safety aspects, firefighting, and first-aid as he/she is the guide for the skilled and unskilled personnel working under him/ her. From technical knowledge and skills point of view he is also expected to have knowledge on proper ways of using various hand tools, measuring devices and drawings/circuit diagrams, in addition to other engineering skills

The course on Basic Engineering Skills will be providing him/ her the knowledge and skills in all those areas through shop floor instructions, demonstrations and skill development exercises.

2. PRE-REQUISITES:

1. Basic knowledge of Drawing.

2. Basic knowledge of Mathematics and Geometrical measurements.

3. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC 106)	L	T	P	C	TH	TM	PR/OR	TW	
Basic Engineering Practice	0	0	6	6	-	-	50	100	150

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand safety procedures to be followed while using various tools and equipment.
2. Demonstrate basic working skills for marking, measuring, holding, striking and cutting tools & equipment.
3. Plan a job/activity using job drawing/circuit diagrams.
4. Identify various electrical components and their working

5. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting& Testing	Engg. Practices for Society Sustainability & Environment	Project Management	Life -long Learning
CO1	3	1	1	2	2	0	3
CO2	3	2	1	2	2	0	3
CO3	3	1	2	2	2	0	3
CO4	3	2	2	2	2	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	2	2
CO4	1	1

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Pr**	**CO**	**Levels**
1 General Safety, Housekeeping, Fire Fighting & First Aid	10	10		
1.1.Introduction to General Safety aspects of engineering workshop 1.2.Meaning and importance of housekeeping 1.3.Fire hazards, fire triangle, types of fire extinguishers – selection and use 1.4.Basic knowledge of first aid with specific inputs on cuts, burns, electric shocks, artificial respiration, handling emergencies			CO1	1,2
2 Fitting Workshop Practice	30	24		
2.1 Introduction to the trade 2.2 Introduction to various hand Tools, Measuring and Marking Tools, cutting tools, Holding tools, Striking tools 2.3 Types of files and filing methods. 2.4 Drill bits and drilling Processes, using portable and pillar drilling machine. 2.5 Operations performed in fitting shop such as measuring, marking, chipping, filing, grinding, sawing, drilling 2.6 Threading using taps and dies.			CO1, CO2, CO3	1,3,4
3 Carpentry Workshop Practice	20	20		
3.1 Introduction to carpentry			CO1,	1,3,4

3.2 Types of wood and its characteristics, forms of wood, defects in timber and its identification, wood working hand tools 3.3 Wood working processes. 3.4 Different types of joints and their usage. 3.5 Introduction to wood working machines: a. Lathe b. Circular saw c. Band saw d. Wood planner e. Universal wood working machine			CO2, CO3	
4 Electrical Workshop Practice	30	32		
4.1 Brief introduction to power distribution and Electrical Safety. 4.2 Use of different hand tools used in electrical trade 4.3 Collection of details of motors and transformers. 4.4 Introduction to Control Panel and its various sections/components. 4.5 Making of wire joints. 4.6Measurement of current, voltage, frequency and Power Consumption. 4.7 Connecting and starting of Induction Motor & Measurement of its speed. Changing of Direction of rotation of induction motor. 4.8 Introduction to commonly used electrical Fittings (Domestic & Industrial). 4.9Wiring of Simple Electric Circuit (Bulb & plug point and switches) on wooden board 4.10 Study, connection & use of Energy Meter 4.11Testing of components using Series test lamp & Multimeter 4.12Study of Fuses & practice replacement of Fuse 4.13 Study & Troubleshooting of Tube Light			CO1, CO3, CO4	1,3,4
5 Plumbing	10	10		
5.1 Plumbing tools, pipe fittings and method of joining pvc pipes. 5.2 Use of spirit level and plumb bob. 5.3 Minor repairs and replacement of fittings. 5.4 Reading of plumbing drawings. *[Note: Plumbing restricted to domestic plumbing and pvc piping.]*			CO1, CO2, CO3	1,3,4
Total	100	96		

7. COURSE DELIVERY:

The course will be delivered through workshop practical sessions in mechanical and electrical workshops.

8. SPECIFICATION TABLE FOR PRACTICALS/ MACRO-LESSON PLAN

Unit No	Unit	Number of hrs.	Marks
1	General Safety, Housekeeping, Fire Fighting & First Aid	10	10
2	Fitting Workshop Practice	24	30
3	Carpentry Workshop Practice	20	20
4	Electrical Workshop Practice	32	30
5	Plumbing	10	10
	Total	96	100

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL MARKS.

No	Practical	Marks
1	Training on fire and emergency services (using video presentation /fire and safety expert talk/ training at fire and safety department)	10
2	Job involving filing, drilling on MS block	30
3	Job involving sawing, planning, joint preparation, and assembly. Wood working exercise on turning.	20
4	Exercise involving contents of Unit 4	30
5	Exercise involving contents of Unit 5	10
	Total	100

10. LEARNING RESOURCES

TEXT BOOKS

S. No.	Author	Title of Books	Publishers
1	N. Sesha Prakash	Manual Of Fire Safety	CBS Publishers and Distributers
2	S.K. Hajara-Chaudhary	Workshop Technology	Media Promoters
3	B.S. Raghuwanshi	Workshop Technology-	Dhanpat Rai and sons, New Delhi
4	R K Jain-	Production Technology	Khanna Publishers, New Delhi
5	H. S .Bawa	Workshop Technology	Tata McGraw Hill Publishers, New Delhi
6	Kent	Mechanical Engineering Hand book	John Wiley and Sons, New York
7	B.L. Theraja	Fundamentals of Electrical Engineering and Electronics	S. Chand – New Delhi

REFERENCE BOOKS FOR FURTHER STUDY

S. No.	Author	Title of Books	Publishers
1	CIMI- Central Instructional Media Institute Madras	Turner – Trade Theory – Ist and IInd Year	Wiley Eastern Ltd. New Delhi
2	CIMI- Central Instructional Media Institute Madras	Turner – Trade Practicals- Ist and IInd Year	Wiley Eastern Ltd. New Delhi
3	CIMI- Central Instructional Media Institute Madras	Fitter – Trade Theory- Ist and IInd Year	Wiley Eastern Ltd. New Delhi
4	CIMI- Central Instructional Media Institute Madras	Fitter – Trade Practicals- Ist and IInd Year	Wiley Eastern Ltd. New Delhi

INDIAN AND INTERNATIONAL CODES NEEDED

S. No.	Author	Title of Books	Publishers
1	Bureau Of Indian Standards New-Delhi	IS 2065 - 1983 : Code of practice for water supply to buildings	Bureau Of Indian Standards New-Delhi
2	Bureau Of Indian Standards New-Delhi	IS 732: Indian Standard code of practice for electrical wiring & installation.	Bureau Of Indian Standards New-Delhi
3	Bureau Of Indian Standards New-Delhi	IS 2274 - 1963: Indian Standard code of practice for electrical wiring & installation.	Bureau Of Indian Standards New-Delhi

INTERNET AND WEB RESOURCES

S. No.	Author	Link	Publishers
1	Vikas Rathore	Mortise & tenon joint prepared in carpentry shop(mec-108) of lovely professional university	You tube Lovely Professional University
2	Wood and Shop	How to Make Mortise and Tenon Joints with Hand Tools	You tube Wood and Shop
3	Debabrata DD	ITI - Fitter Hand Tools Name	You Tube

VIDEOS AND MULTIMEDIA TUTORIALS

S. No.	Author	Title of Media	Publishers
1	Directorate of Fire and Emergency Services , Government of Goa St. Inez Panaji Goa	CD developed by Basic Fire Safety and Evacuation Drill Procedure for Educational Institutions	Directorate of Fire and Emergency Services , Government of Goa St. Inez Panaji Goa

Notes:

1] The Workshop diary shall be maintained by each student duly signed by instructor of respective shop

2] While conducting Practical/Oral Exam, it should be borne in mind that the examiners either internal or external should be from mechanical and electrical discipline.

(GN104) Applied Chemistry

1. AIM: - 1. To Understand the general chemical principles and chemical properties of materials for their applications in the Engineering field.

2. To develop in students scientific temper, ability to investigate the cause and effect relationship and the ability to interpret and analyze the result under given conditions.

2. COURSE OBJECTIVES:

The students will able to:

1. Apply the knowledge of Chemistry in the field of Engineering.

2. Appreciate the importance of chemistry in day to day life.

3. PRE-REQUISITES:

Basic knowledge of General Science.

4. TEACHING AND EXAMINATION SCHEME

Semester	**I**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
GN 104 Applied Chemistry		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**50**	**-**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the fundamental concepts and principles of chemistry in various engineering applications.

2. Apply the knowledge of Electrochemistry and Corrosion in everyday life and Industrial applications

3. Compare the properties of materials and their significance in various engineering fields.

4. Examine the suitability of chemical processes to be used for domestic and industrial applications.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimenting& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	-	-	2	1	3
CO2	3	3	1	-	3	1	3
CO3	3	2	1	1	3	1	2
CO4	3	1	-	-	2	-	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**Mks**	**Thr**	**CO**	**Levels**
UNIT 1.0 : ATOMIC STRUCTURE AND CHEMICAL BONDING	**15**	**10**		
1.1 Atomic Structure 1.1.1 Fundamental particles and their characteristics. 1.1.2 Energy levels - Definition & designation 1.1.3 Sub Energy levels- Definition & designation 1.1.4 Orbital – Concept & shape (s and p only) **1.2**Quantum numbers 1.2.1 Designation, definition, values.	05	3	1	1,2
1.3 Electronic distribution (Elements from atomic Number 1-20) 1.3.1 Bohr – Bury's laws for distribution of electrons in shells (1st three laws only) 1.3.2 Aufbau Principle. for distribution of electrons in sub-shells 1.3.3 Pauli's Exclusion Principle.	06	03	1	1,2,3

1.3.4 Hund's Rule of maximum multiplicity 1.3.5 Orbital Electronic Configuration of elements (from atomic numbers 1 to 20 only).				
1.4 Chemical Bonding 1.4.1 Lewis and Longmuir concept of stable configuration. 1.4.2 Electrovalent – Bond - Concept Formation of Electrovalent Compound (NaCl & MgO) 1.4.3 Covalent Bond- Concept Formation of Covalent Compounds (Cl_2, O_2, N_2) 1.4.4 Co-ordinate Bond- Concept Formation of Co-ordinate Compounds (O_3) 1.4.5 Properties of Electrovalent , Covalent & Co-ordinate compounds	04	04	1,3	1,2 ,3
UNIT 2.0 : WATER	**15**	**10**		
2.1 Hardness of Water 2.1.1 Soft and Hard Water - Concept Soap Test (Chemical Equation not expected) 2.1.2 Causes of Hardness 2.1.3 Types of Hardness 2.1.4 Degree of Hardness & Units of Hardness (mg/L & ppm)	03	02	1	1,2
2.2 Disadvantages of Hard Water 2.2.1 Domestic Purpose Drinking, cooking, Washing & Bathing. 2.2.2 Industrial Purpose (Paper Industry, Textile & Dyeing Industry, Sugar Industry, Bakery & Concrete Making) 2.2.3 Boilers- Steam Generation Purpose. Sludge formation – causes & Disadvantages (No chemical equation expected)	04	03	1,4	1,2
2.3 Water Softening 2.3.1 Zeolite and Ion Exchange process of water softening	04	03	4	3
2.4 Desalination of water 2.4.1 Electrodialysis & Reverse Osmosis process. 2.4.2 pH- Concept, pH scale & Importance of pH	04	02	1,2 ,3	1,2
UNIT 3.0 : <u>ELECTROCHEMISTRY</u>	**12**	**08**		
3.1 Electrolytic dissociation 3.1.1 Arrhenius theory of Electrolytic dissociation 3.1.2 Factors affecting degree of Ionization- nature of solute, nature of solvent, concentration of solution and temperature.	04	03	1	1,2
3.2 Electrolysis 3.2.1 Mechanism of Electrolysis. Ionization Reactions	04	03	2,3	2,3

Reactions at cathode, Activity series of Cations. Reactions at Anode, Activity series of Anions. 3.2.2 Electrolysis of Molten NaCl using Carbon Electrodes. Aqueous NaCl using Platinum Electrodes. Aqueous $CuSO_4$ using Platinum Electrodes. Aqueous CuSO4using copper Electrodes.				
3.3 Electrochemical series – Definition and Significance	04	02	2	2,3
UNIT 4.0 : CORROSION AND ITS CONTROL	**25**	**14**		
4.1 Dry /Direct Chemical corrosion 4.1.1 Definition 4.1.2 Oxidation corrosion 4.1.3 Corrosion due to other gases.	06	03	1,2	1,2 ,3
4.2 Wet/Electrochemical Corrosion 4.2.1 Definition 4.2.2 Factors necessary for Electrochemical corrosion. 4.2.3Mechanism of Electrochemical corrosion(reactions at cathode and anode only) Hydrogen Evolution mechanism. Oxygen absorption mechanism.	05	03	1,2	1,2 ,3
4.3 Types of Electrochemical corrosion. 4.3.1 Galvanic Cell corrosion 4.3.2 Concentration cell corrosion(Metal ion concentration & differential Aeration)	04	02	2,4	2,3
4.4 Corrosion Control Protection of metals by: 4.4.1. Using Pure Metals & Metal alloys 4.4.2 Proper designing 4.4.3 Modifying the environment (De- aeration, Deactivation, Dehumidification, Alkaline neutralization) 4.4.4 Cathodic protection (Sacrificial anode and Impressed current cathodic protection) 4.4.5 Metal Coating (Galvanizing, Tinning, Metal-Spraying, Electroplating & powder coating)	10	06	2,4	2,3
UNIT 5: POLYMERS	**08**	**06**		
5.1 Concept of Monomers & Polymers **5.2**Polymerization- Definition.	04	04	3,4	2,3

5. 2.1 Addition polymerization-Definition. 5.2.2 General equation of polymerization of :- Ethylene to Polyethylene. Vinyl chloride to Polyvinylchloride Tetra fluoro ethylene to Poly tetra fluoroethylene(PTFE) 5.2.3 Condensation Polymerization-Definition 5.2.4 General Equation for formation of Phenol formaldehyde Resin. **5.3** Plastics. 5.3.1 Types of plastic (Thermosetting and Thermo softening), Examples 5.3.2Properties and applications of Poly-ethylene, PVC, polystyrene, Nylons, Bakelite & silicones.				
5.4 Rubber 5.4.1 Natural Rubber 5.4.2 Drawbacks of Crude rubber. 5.4.3 Vulcanization of Rubber (General Equation) 5.4.4 Rubber examples. 5.4.5 Properties of b Synthetic Rubber & related applications.	04	02	3,4	2,3

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**ATOMIC STRUCTURE AND CHEMICAL BONDING**	10	15
2	**WATER**	10	15
3	**ELECTROCHEMISTRY**	08	12
4	**CORROSION & IT'S CONTROL**	14	25
5	**POLYMERS**	06	08
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Practical Title	
1.	Double Acid-Base Titration using Phenolphthalein.	
2.	Acid- Base titration using Methyl orange.	
3.	Redox Titration of $KMnO_4$ soln., $FeSO_4$ soln. and Oxalic acid	
4.	Determination of degree of Hardness by E.D.T.A method.	
5.	Determination of Total Alkalinity of water sample.	
6.	Determination of Chloride content of water sample by Mohr's method.	
7.	pH- Metric titration.	
8.	Conduct metric Titration.	
9.	Determination of Conductivity of water samples from different water body sources.	
10.	Corrosion Susceptibility of Aluminum to Acid or Base.	
11.	Determination of pH of different food items.	
	Total	**50**
No	**Class room Assignments**	**Marks**
	TOTAL MARKS	**50**
...		

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	M.M. Uppal	Text book of Engg. Chemistry	Khanna Publisher
2	V.P.Mehta	Text book of Engg. Chemistry	Jain Bros. Delhi
3	S.N Narkhede	Textbook of Engg. Chemistry	Niraj Prakashan
5	S S Dara	A Textbook of Engg. Chemistry	S Chand & Co
4	P.C. Jain and M.Jain	Engg. Chemistry.	Dhanpat Rai Publishing Co.

(GC204) ENGINEERING DRAWING

1. Aim: This course is aimed at developing basic knowledge and skills of engineering drawing.

2. Rationale: Drawing is a graphical language of engineering field. Engineering technician irrespective of his/her field of operation in an industry is expected to possess a thorough understanding of drawing, which includes visualization of objects and the proficiency in reading and interpreting a wide variety of engineering drawings. It is the skill, which translates an engineering idea into lines and dimensions. Besides this he/she is also expected to possess a certain degree of drafting skills- depending upon his/her job.

3.Pre-Requisite:

NIL

4. **TEACHING AND EXAMINATION SCHEME:**

Course Code & Course Title	Periods/ Week (In Hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
GC204	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Engineering Drawing	2	-	4	6	-	-	50	50	**100**

5. Course Outcomes:

On successful completion of the course the student will be able to:

CO1: Recognize different engineering curves and shapes and their applications

CO2: Understand different methods of projection.

CO3: Draw Isometric views and orthographic projection

CO4: Select the relevant techniques for Engineering Drawing.

6. Mapping Course Outcomes with Program Outcomes

Relationship-1:Slight (low) 2:Moderate(Medium) 3: Substantial(High)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
	Basic and discipline specific knowledge	Problem analysis	Design and development of solution	Engg tools exptn and & testing	Engg Practice for society ,sustainability and environment	Project management	Lifelong learning
CO1	3	1	2	1	0	0	0
CO2	3	1	2	1	0	0	0
CO3	3	1	2	1	0	0	0
CO4	3	1	2	1	0	0	0

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	1	1
CO4	1	1

7. Detailed course Contents/ Micro lesson plan

M=Marks Thr= Teaching Hrs CO=Course Outcomes

Unit	Mark	Thr	CO	Levels
1. Introduction 1.1 Importance of engineering drawing as a means of communication. 1.2 Planning of drawing sheet as per SP 46:1988 1.3 Indian standard practices of laying out and folding of drawing 1.4 Different types of lines used in engineering drawing. 1.5 Importance of scale in Engineering Drawings. 1.6 Lettering 1.7 Methods of dimensioning, Dimensioning terms and notation (use of SP 46:1988), General rules for dimensioning, Dimensioning of cylinder, holes, arcs of circle, narrow space, angles, countersunk hole, taper.	02	04	-	1
2. Geometrical construction &Engineering Curves 2.1Construction of an Equilateral and Isosceles triangle, Square, Regular pentagon & Regular hexagon given distance across the corners/ flats and given length of a side using general method of construction 2.2 Construction of Engineering curves like: ellipse- by focus & directrix method and arcs of circles method parabola- by focus & directrix method and rectangle method hyperbola- Focus and directrix method 2.3 Cycloid- by generating circle rolling on a straight line 2.4 Involutes of a circle. 2.5Draw normal & tangents to the above curves from given point on the curve rves to be explained with the help of applications.	10	06	CO1	1
3. Orthographic projection 3.1 Definitions of various terms associated with orthographic projections. Planes of projections. Concept of Quadrants. 3.2 First and third angle method of projection.	18	13	CO2, CO3	2,3

3.3 Projection of points 3.4Projection of lines Parallel to both Principal planes Parallel to one and Perpendicular to other Principal plane. Inclined to one plane and parallel to other plane. 3.5 Projection of planes:Triangle, Square, circle when inclined to one principal plane & perpendicular to other plane. 3.6 Projection of solids: Cylinder, cone. Right regular solids such as (i) Prism: Square& Pentagonal (ii) Pyramid: Triangular & Square. Projections of above mentioned solids when axis is inclined to one principal plane & Parallel to other principal plane. 3.7 Conversion of simple pictorial views into orthographic views. *Problems where one end of the line is in one quadrant & other end in other quadrant and traces are to be excluded.* *Problems where apparent shape of plane are given, true shape & slope angle are to be drawn are excluded.*				
4. Section of solids Development of lateral surfaces **4.1** Concept of sectioning planes, Auxiliary planes and true shape of section. 4.2 Drawing section of solids like square prism, square pyramid, cylinder and cone with sectioning plane inclined to one principal plane and Perpendicular to the other principal plane (Axis of solid perpendicular to one principal plane and parallel to the other) 4.3Concept and importance of surface development in the engineering field. Methods of development of surfaces-Radial & Parallel line method. Development of surfaces for solids like square prism, square pyramid, cylinder and cone. *Development of solids standing on its base & cut by a plane inclined to either VP/HP and perpendicular to the other is also included.*	10	05	CO4	4
5. Isometric Views	10	04	CO3	3

5.1Difference between Isometric projection & Isometric view. 5.2Isometric view of geometrical planes and solids. 5.3Conversion of orthographic views into isometric views. 5.4Construction of Isometric view for any real object.				
Total	50	32		

8. Course Delivery:

The course will be delivered through lectures class room interaction and exercises.

9. Specification table for Theory/Macro Lesson Plan

Unit No.	**Unit**	**No. Of Lectures**	**Marks**
1	Introduction	04	02
2	Geometrical construction & Engineering Curves	06	10
3	Orthographic projection	13	18
4	Section of solids Development of lateral surfaces	05	10
5	Isometric Views	04	10
	Total	**32**	**50**

10. Specification table for Practical/ Termwork:

No.	Practical	Marks
1	TYPES OF LINES, LETTERING, DIMENSIONING.	5
2	GEOMETRICAL CONSTRUCTIONS	5
3	ENGINEERING CURVES	5
4	PROJECTION OF POINTS & LINES	5
5	PROJECTION OF PLANES	5

6	PROJECTIONS OF SOLIDS	5
7	ORTHOGRAPHIC PROJECTIONS (First angle)	5
8	ORTHOGRAPHIC PROJECTIONS(Third angle)	5
9	SECTIONS AND DEVELOPMENT OF SOLIDS	5
10	ISOMETRIC VIEWS	5
	Total	50

11. Learning Resources:

Text Books

S.No.	Author	Title	Publisher
1	N.D. Bhatt	Engineering Drawing & Machine Drawing	Charoter Publisher,Anand
2.	R. K. Dhawan	Engineering Drawing & Machine Drawing	S. Chand Publishing
3.	R.B. Gupta	Engineering Drawing	Satya Prakashan, Delhi

Reference Books only for further study

S.No.	Author	Title	Publisher
1	P.S. Gill	Geometrical Drawing	Ketson & Sons
2	P.S. Gill	Machine Drawing	Ketson & Sons
3	N.D. Bhatt	MachineDrawing	Charoter Publisher,Anand
4	TTTI, Bhopal	Work Book in Mechanical Drafting	TTTI, Bhopal

Indian and International codes needed

S.No.	Author	Title	Publisher
1.	BIS, India	IS. 696. (Latest revision).	BIS, India

SEMESTER II

(GC201) Engineering Mathematics II

AIM

1. Acquire knowledge of mathematical terms, concepts, principles and different methods.
2. Develop the ability to apply mathematical methods to solve technical problems, to execute management, plans with precision.
3. Acquire sufficient mathematical techniques necessary for daily and practical problems.

2. COURSE OBJECTIVES:

The students will able to:
1. Acquire knowledge of Mathematical terms, concepts, principles and different methods.
2. Develop the ability to apply mathematical methods to solve technical problems, to execute management,plans with precision.
3. Acquire sufficient mathematical techniques necessary for daily and practical problems.

3. PRE-REQUISITES: --

4. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(GC201) Engineering Mathematics II		**L**	**T**	**P**	**C**	**TH**	**TEST**	**Tutorial**	**PR/OR**
		4	**2**	**-**	**6**	**75**	**20**	**5**	**-**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
1. Use Determinants and Matrices to solve linear equations in engineering problems.
2. Recall formulae of integral calculus and use them in various applications.
3. Apply statistics formulae to compute various measures of central tendency and dispersion with the help of calculator.
4.Apply knowledge of vectors and complex numbers to be used in various areas of Engineering.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability& Environment	Project Management	Life -long Learning
CO1	3			2			1
CO2	3	1				1	
CO3	3			3			1
CO4	3				1		

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**	**Levels**
1 .DETERMINANTS AND MATRICES			**CO1**	
1.1 **Determinants**: Definition & order of determinant, value of determinant, properties of determinants(no question), Cramer's rule for solving equations with two & three variables	7	4		
1.2 Matrices: - Definition & order of matrix, types of matrices, Equality of matrices, addition & subtraction, multiplication of matrices, Adjoint &Inverse of a matrix, solution of linear equations with two & three variables using matrices	8	8		
2 .INTEGRATION	20	22	**CO2**	

Definition, standard formulae,algebraic properties of Integration for sum, difference and scalar multiplication, integration of algebraic, trigonometric, inverse trigonometric, exponential, logarithmic, composite function, Integration by substitution,integration by partial fraction, Integration by parts				
3 .DEFINITE INTEGRALS	10	08	**CO2**	
Definition of definite integral and Properties of definite integral ,sums , substitution and integral by parts method with simple sums Applications:Area under the curves & lines and area between the curves and Volumes (simple sums)				
4 .VECTORS	15	12	**CO4**	
Definition of scalars & vectors, equality of vectors, Addition & subtraction of vectors, triangle, parallelogram laws for addition, position vector, dot product & cross product and their properties and applications, relation between dot and cross product and scalar triple product and applications				
5 .STATISTICS / COMPLEX NUMBERS	15	10	**CO3,** **CO4**	
5.1 Statistics : 5.1.1:Measures of central Tendency -mean, median, mode for ungrouped & grouped data 5.1.2:Measures of dispersion –Range, mean deviation, standard deviation, variance, coefficient of variation 5.1.3: Corrected mean and relation between standard deviation and mean.				
5.2 Complex Numbers 5.2.1:Definition of complex number and argand diagram, equality of complex numbers, 5.2.2:powers of 'i' ,complex conjugates, 5.2.3:Addition& subtraction of complex nos. Multiplication& division of complex nos. 5.2.4: Modulus and argument of a complex number 5.2.5:Polar form & exponential form of complex no. 5.2.6: De Moivre's theorem., nth root of complex nos. 5.2.7:Hyperbolic, exponential, circular functions				
Total	**75**	**64**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Determinants & Matrices	12	15
2	Integration	22	20
3	Definite Integrals	08	10
4	Vectors	12	15
5	Statistics /Complex Number	10	15
	Total	64	75

10. SPECIFICATION TABLE FOR TUTORIALS HOURS-(N.A)

Sr. No.	**Unit**	**Sums per topic (minimum)**	**Tutorial test**
1.	Determinants & Matrices	20	
2.	Integration	30	
3.	Definite Integrals	20	
4.	Vectors	20	
5.	Statistics / Complex Number	20	
	(Two Tutorial Tests should be conducted on topics which are not covered in the PA test, each of 5 marks and average to be taken)		
...	Total		05

- Tutorial books should be maintained by students
- Teacher needs to sign for each topic in the index as well as inside on the last page of each topic where students solve sums.

11. LEARNING RESOURCES

Text Books /reference books

S. No.	Author	Title of Books	Publishers
1	S.P. Deshpande	Mathematics for Polytechnic Students(Basic Mathematics)	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
2	S.P. Deshpande	Mathematics for Polytechnic Students(Engineering Mathematics)	Pune VidyarthiGrihaPrakashan 1786, Sadashiv Peth, Pune
3	S.B. Gore, M.B.Patil, S.P. Pawar	Applied Mathematics	Vrinda Publications

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Dr. U.B.Jangam, K.P. Patil, Nalini Kumthekar	Applied Mathematics I	Nandu Printers& Publishers Pvt. Ltd. Mumbai
2	H.K. Dass	Applied Mathematics for Polytechnics	CBS Publishers & Distributers Pvt. Ltd. Pune
3	H.K. Dass	Advanced Engineering mathematics	S. Chand

Note : Any XI and XII science mathematics books can be referred to as reference books.

(GC202) APPLIED PHYSICS II

1. AIM

1.To provide the students with the applied knowledge in physics aimed at topics in higher semesters.

2. COURSE OBJECTIVES / RATIONALE:

On successful completion of the course, the student will be able to:

1.Comprehend the various topics in the course and apply them to engineering applications.

3. PRE-REQUISITES:

Students should know:

1.Basic principles of charges, electricity and magnetism

2. Use of basic mathematical calculations.

3. TEACHING AND EXAMINATION SCHEME

Semester II									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC202) Applied Physics II	L	T	P	C	TH	TM	TW	PR/OR	
	03	0	02	05	75	25	25	--	125

4.COURSE OUTCOMES:

1.Understand the basic concepts in Electrostatics and Electricity apply them to solve basic problems.

2.Understand and apply various concepts of Electro Magnetism and Magnetic Induction and apply them in simple engineering applications

3. Analyze various principles of Optics in understanding the behaviour of light and understand its applications in laser etc.

4.Understand the basic concepts of production and application of X-rays and ultrasonic waves and analyse their applications for non-destructive testing

5. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic and discipline specific Dknowledge	**Problrm analysis**	**Design/Devel opments of sloutions**	**Engineering tools/Experiment ation and testing**	**Engineering practice for society sustainability and environment**	**Project Management**	**Life Long Learning**
CO 1	3	3	1	1			2
CO 2	2	3	1	2			2
CO 3	3	1	1	1			2
CO 4	3	1	1	2			3

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**			
Unit	**M**	**Thr**	**CO**
1 UNIT NAME: ELECTROSTATICS	**12**	**8**	**CO1**
1.1Coulomb's law, electric field			
1.2 Electric field Intensity, electric lines of force and properties			
1.3 Electric potential, definition of absolute potential			
1.4, Potential difference, potential of sphere			
1.5 Potential of earth.			
1.6Capacitance			
1.7 Capacitors in parallel derivation of expression			
1.8. Capacitor in series derivation of expression			
2. UNIT NAME: CURRENT ELECTRICITY	20	12	**CO1**
2.1Definition of Electric Current and its Unit, Ohm's Law, Resistance,			
2.2 Factors on which resistance depends, Specific resistance. Effect of temperature on resistance Temperature coefficient of resistance,			
2.3Resistances in Series and parallel			
2.4EMF and Internal resistance of cell			
2.5 General Equation of ohm's law.			
2.6. Wheatstone's Network and Principle of Meter Bridge			
2.7 Principle of Potentiometer (Vα L) and Applications to compare EMF of given cells by single cell method and sum difference method			

2.8 Determination of Internal resistance of a cell using potentiometer.			
2.9 Electric Power and Electric Energy, KWh			
2.10 Calculation of Energy bills			
2.11 Heating Effect of Electric current. Joule's law.			
2.12 Applications in house hold appliances			
3.O**. UNIT NAME: ELECTROMAGNETISM AND EM INDUCTION**	**16**	**10**	**CO2**
3.1Magnet, Magnetic field, Magnetic flux, and magnetic flux density and its unit			
3.2 Magnetic effect of Current, Oersted's Experiment, Right hand Thumb Rule, Biot Savart law			
3.3Magnetic field at the center of the coil (no derivation), Magnetic field due to coil (Qualitative discussion only			
3.4Electromagnet. Force acting on a current carrying conductor placed in magnetic field and expression (no derivation)			
3.5 Fleming's left-hand rule. Electromagnetic Induction. Faraday's Experiment			
3.6. Faraday's laws Lenz's law. Self-Induction and Mutual Induction.			
3.7 Transformer Principle.			
3.8 Step up and Step-down transformer.			
3.9 Induction Heating			
3.10 Induction heater and uses			
4.O**. UNIT NAME: Light and Optics**	**16**	**10**	**CO3**
4.1Frequency Range of Infrared, ultraviolet and visible light and their uses			
4.2 Reflection, Refraction, snell's law, refractive index.			
4.3Refraction through glass slab and prism.			
4.4Total Internal reflection applications in optical fibers.			
4.5 Advantages of optical fibers. LASER, sources and applications.			
4.6. Luminous Intensity, Intensity of Illumination			
4.7 Inverse square law of Illumination (No derivation)			
4.8 Principle of Photometr, X rays,			
4.9 Production of X Rays by Coolidge tube			
4.10 Properties and applications			
5**. UNIT NAME: SOUND**	**11**	**08**	**CO4**
5.1 sound as longitudinal wave,wavelength,frequency,time period, amplitude,			

5.2 free vibration force vibration,resonance, examples,			
5.3echo reverberation ,pitch loudeness,intensity of sound,			
5.4Ultrasonic waves, Piezo electric effect, Principle of Production of ultra-sonics waves			
5.5 Application of Ultra sonics in finding depth of sea,			
5.6. Detection of flaws in metal, soldering, Drilling,			
5.7 Ultrasonic Cleaning			
5.8Ultrasound for medical purposes.(Just Uses)			

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**ELECTROSTATICS**	8	12
2	**CURRENT ELECTRICITY**	12	20
3	**ELECTROMAGNETISM AND EM INDUCTION**	10	16
4	**LIGHT AND OPTICS**	10	16
5	**SOUND**	8	12
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Specific Resistance by Ammeter Voltmeter Method	
2	Specific Resistance by Meter Bridge Method	
3	To Verify the Series Law of Resistance by Meter Bridge Method	
4	To Verify the Parallel Law of Resistance by Meter Bridge Method	
5	To Compare the emf of two cells by single cell method	
6	To find the internal resistance of a cell by Potentiometer Method	
7	To find the velocity of sound by Resonance Tube method	
8	To find the Refractive index	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B G Dhande	Applied Physics of Polytechnics	
2	Bhandarkar	Applied Physics of Polytechnics	
3	R K Gaur and S L Gupta	Engineering Physics	
4	Dr. Vasudev R Bhagwat	A Text Book of Applied Physics for Polytechnics	
5	B L Thereja	Engineering Technology	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Halliday D and Resnick	Physics Part I-II	
2		ABC of Physics I-II	
3	Saxena HC and Singh Prabhakar	Applied Physics Vol I & II	

(GC101) Communication Skills

1. AIM

To enable the students to develop proficiency in communicating in the work environment

2. COURSE OBJECTIVES:

The students will able to:

1. develop effective communication skills in written form
2. develop effective communication skills in oral form
3. develop a dynamic personality through knowledge of etiquettes and positive body language

3. PRE-REQUISITES:

A basic understanding of the principles and techniques of English language

4. TEACHING AND EXAMINATION SCHEME

Semester II									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(GC101) Communication Skills	L	T	P	C	TH	TM	TW	PR/OR	
	-	-	02	02	-	-	25	25	50

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. understand the concepts of spoken and written English
2. apply the principles of spoken and written English in groups and organizations
3. analyse and organize the information that is required to be presented in written and oral communication.
4. develop etiquettes in inter-personal communication while projecting a positive body language

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Developm ent of	Engg. Tools, Experime ntatn&	Engg. Practices for Society, Sustainabi &	Project Managem ent	Life -long Learning
CO1	01	01	01	01	02	01	03
CO2	02	01	02	01	02	02	03
CO3	02	02	02	01	02	02	02
CO4	01	01	01	01	01	02	03

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Phr**	**CO**	**Levels**
1 UNIT NAME: Fundamentals of communication Skills			**-**			**M,**
1.1 **Communication skills fundamentals** Definition, communication process, importance of communication skills, essentials of effective communication				01	**CO 01** **CO 02** **CO 03** **CO 04**	
1.2 **Types of communication**: verbal Communication and Non verbal communication (Body language, facial expressions, gestures, eye contact, posture , dress and grooming/personal appearance , deportment, personal hygiene) Paralinguistic (Volume, pace, pitch, pauses)				02		
1.3 **Barriers to communication:** physical barriers, psychological barriers and cultural barriers				01		

2 . Unit: PRESENTATION SKILLS				
2.1 Presentations: Methods and style of presentation, Importance, planning a presentation, venue selection, audience awareness(age, gender, profession background, educational and social background) time and duration, audio visual aids (OHP, LCD projector, flip charts, white/black/green board, computer, microphone)		**02**	**CO02 CO03 CO04**	
2.2 Public speaking: preparatory steps, tips for good beginning and end, delivery style, techniques for a good speech(repetition, signs, pictures, humor), body language		**02**		
3 UNIT: TECHNICAL Writing				
3.1 **Report writing** Functions and parts of a report, Qualities of a good report, and types: Report on any institute function, Accident report , Industrial visit Report		04		
3.**2 Business letters** Principles of effective letter writing, parts of a business letter, formats(Full block style, Semi block style, modified block style) Routine/ Generic letters(letter to the heads of the institute, letter to the heads of various departments/sections of the institute) Types of letters: Enquiry Letter, Quotation, Purchase Order, Letter of Complaint		06	**CO 01 CO 02**	
3.3 **Job application** Tips for a good C.V and a Resume		02		
4 UNIT GRAMMAR	-			
4.1 Fundamentals of English writing Subject verb agreement, homonyms, homophones, homographs, articles, Punctuation ,synonyms, fundamentals of sentence construction		**02**	**CO 01 CO 02**	
4.2 Paragraph Writing: Developing Topics (the main idea), body (supporting sentences), conclusion, proof reading		**02**		
UNIT V:LANGUAGE WORKSHOP **5.1 Reading Skills** strategies to use for building vocabulary and reading fluencies (read extensively, identify new words ,use of dictionary, online dictionary apps), reading comprehension, pronunciation, , debate, role play,	-	08	**CO 01 CO 02 CO 03**	
5.2 Listening Skills How to listen effectively, listening comprehension				
5.3 Speaking skills speech, group discussion				
5.4 Writing skills précis writing, comprehension				
Total		**32**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, videos, exercises

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Fundamental of Communications skills	04	-
2	Presentation Skills	04	-
3	Technical Writing	12	-
4	Grammar	04	-
5	Language workshop	08	-
	Total	32	25

10. SPECIFICATION TABLE

FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	**Practical Title: Fundamental of Communications skills**	
i.	Comprehension	
ii.	Précis writing	
iii.	Self Introduction	
2	**Practical Title: Presentation Skills**	
iv.	Extempore speech	
v.	Presentation on any given Topic	
3	**Practical Title: Technical Writing**	
vi.	Accident Report	
vii.	Report on Institute function	
viii.	Industrial visit report	
ix.	Generic letters to the heads of various department/ Sections of the institute	
x.	Inquiry letter	
xi.	Quotation	
xii.	Purchase or supply order	
xiii.	Complaint letter	
xiv.	Job application	
4	**Grammar**	
xv.	Exercises in subject – verb agreement	
xvi.	Exercises in use of preposition	
xvii.	Exercises in use of Homophones, homonyms, homographs	
xviii.	Exercises in use of punctuation	
xix.	Exercises relating to correcting the sentences	
xx.	Paragraph writing	
5	**Language workshop**	
xxi.	Exercises to improve Reading skills	
xxii.	Exercises to improve Writing skills	

xxiii.	Group discussion	
xxiv.	Listening comprehension	
	Total	25
No	**Class room Assignments**	**Marks**
1	As Above	-
2		
...		
No	**Tutorial Exercises**	**Marks**
1	Not Applicable	-
2		
...		

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R. C. Sharma & Krishna Mohan	Business correspondence and Technical Writing	Tata Mc Graw Hill
2	P. Prasad, Sharma, K. Rajendra	The functional aspects of communication skills	S.k. Kataria & sons
3	Raul R. Timm	How to make winning presentations	Sneha Printers
4	Dale Carnegie, Training CPI	Stand and Deliver, How to become a masterful communicator and public speaker	Cox & Wyman, UK
5	Wren & Martin	High School English Grammar & Composition	S. Chand, N. Delhi

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Lee Iacocca	Lee Iacocca- An autobiography	
2	Barrack Obama	Dreams of my father	
3	Chetan Bhagat	Two states,Half Girl friend	
4			

Autobiographies, self help books, Audio speeches given by famous personalities

Internet and Web Resources

https://www.grammarly.com/
https://www.bbc.co.uk/programmes/articles/5QFnVy3xzT5htTh13cmP2P8/teacher-resources
https://Ted.com

Videos and Multimedia Tutorials

https://you.tu.be/AykYRO5d_II

(GC203)Environmental Studies

1. AIM :- To Sensitize the students towards the need to protect and conserve Planets Natural resources and biological support systems & Strive to live in harmony with nature.

2. COURSE OBJECTIVES :

The students will able to:

1. Develop an attitude of concern for the environment.

2. Choose environmentally friendly options for sustainable development.

3. PRE-REQUISITES:

1. Awareness of Elementary Environmental Education.
2. Fundamentals of General Science.

4. TEACHING AND EXAMINATION SCHEME

Semester	**II**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
GC203 Environmental Studies		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		03	**-**	**-**	**03**	**75**	**25**	**-**	**-**	**50**

5. COURSE OUTCOMES:

On successful completion of the course, the students will be able to:

1. Understand the importance of Natural resources & Biological support systems and hence the need for their conservation.

2. Identify the sources and effects of various forms of pollution.

3. Examine the impact of human intervention on environment.

4. Choose environmentally friendly options for sustainable development.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimenta tn& Testing	Engg. Practices for Society,Sust ainability & Environment	Project Management	Life -long Learning
CO1	2	1	1	0	2	1	2
CO2	1	2	1	0	2	1	2
CO3	2	2	1	0	3	2	2
CO4	2	2	1	1	3	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**Mks**	**Thr**	**CO**	**Levels**
UNIT 1.0 : Multidisciplinary Nature of Environmental Studies			**09**	**05**	**1,4**	**1,2,3**
1.1 Environmental studies : Definition , Scope and Importance						
1.2 Need for Public Awareness						
1.3 Environment & Human Health						
1.4 Environmental Ethics						
1.5 Value Education						
1.6 From Unsustainable to Sustainable Development : Concept and Guidelines						

1.7 Concept of Environmental Audit (EA) Environment Impact Assessment (EIA)				
1.8 Ecological Foot Prints				
UNIT 2.0 : ECOSYSTEM AND BIODIVERSITY	**15**	**09**		
2.1 Ecosystem 2.1.1Concept, Structure & functions of ecosystem (Function of producer, consumer and decomposer) 2.1.2 Food chain & Food web- Concept & Examples 2.1.3 Energy flow in Ecosystem 2.1.4 Ecological Pyramids (Inverted & Upright) Pyramid of Number, Biomass & Energy. 2.1.5 Ecological Succession (Primary & Secondary Succession) 2.1.6 Study of Ecosystem: characteristic features structure and functions) Terrestrial(Forest, Grassland, Desert) Aquatic(Pond, River & Ocean)	06	04	1	1,2,3
2.2 Biodiversity 2.2.1 Definition of Biodiversity 2.2.2. Types of Diversity (Genetic, Species & Ecosystem) 2.2.3. Value of Biodiversity (Consumptive , Productive, Social ,Aesthetic Moral & Optional value) 2.2.4 India as a Mega- diversity Nation 2.2.5 Biogeographical classification of India 2.2.6 Extinct, Endangered, Threatened & Endemic Species -Examples (of India) 2.2.7 Threats to Biodiversity (Habitat loss, Poaching of Wild life & Man Wildlife Conflict) 2.2.8 Reasons for loss of Biodiversity 2.2.9 Conservation of Biodiversity (Insitu & Exsitu conservation)	09	05	1,2	1,2,3
UNIT 3.0 : NATURAL RESOURCES	**18**	**12**		
3.1 Forest Resource 3.1.1 Direct & Indirect value of Forest 3.1.2 Deforestation-causes & effects 3.1.3 Forest Management **3.2**Water Resource 3.2.1 Water as a scarce Resourc 3.2.2Use and over exploitation of surface and ground water 3.2.3 Need for Water Conservation 3.2.4 Construction of dams- Benefits and draw backs (Rehabilitation & Resettlement of people) 3.2.5 Rain water Harvesting. 3.2.6 Watershed Management	09	06	1,2,3	1,2,3

3.2.7 Conflicts over water in India **3.3**Energy Resource 3.3.1 Renewable & Non-Renewable sources of Energy 3.3.2 Growing Energy Needs. 3.3.3 Alternate Source of Energy (Solar ,Wind, Bio, Geothermal, Hydro & Nuclear Energy)				
3.4 Food Resource 3.4.1 Sources of Food 3.4.2 World Food Problems (Undernourishment & Malnourishment) 3.4.3 Changes caused by agriculture & overgrazing 3.4.5 Effects of modern agriculture on environment (use of synthetic fertilizers & synthetic pesticides in agriculture) **3.5**Mineral Resource 3.5.1 Types of Minerals 3.5.2 Use & Overexploitation of Minerals 3.5.3 Environmental Impact of Mining. **3.6**Land Resource 3.6.1 Pattern of Land Utilization (In India and World) 3.6.2 Land Degradation – Causes & Control Measures	09	06	1,2,3	1,2,3
UNIT 4.0 : ENVIRONMENTAL POLLUTION- Sources , Effects & Control Measures	**24**	**16**		
4.1 Air Pollution 4.1.1 Definition, sources of air pollution(Primary and Secondary air pollutants with examples) 4.1.2 Effects on human health, animals, plants & Materials 4.1.3 Control of Air Pollution. 4.1.4 Removal of Particulate matter 4.1.5 Principles & Application of Control Equipments (Gravity and Inertial Separators, Cyclones, Filters, Electrostatic precipitators, Wet scrubbers) 4.1.6 Removal of Gaseous Pollutants (Combustion, Adsorption, Absorption) 4.1.7 Global Issues Definition, Cause & effects of Green House effect & Global Warming. Ozone layer Depletion, Acid Rain.	06	04	1,2,3 ,4	1,2,3
4.6 Noise Pollution :- 4.6.1Definition. 4.6.2 Sources of Noise Pollution 4.6.3 Effects of Noise Pollution on Human health (Noise Induced hearing loss, Physiological & Psychological Effects)	06	04	1,2,3 ,4	1,2,3

4.6.4 Control of Noise Pollution.				
4.7. Nuclear Pollution / Radioactive Pollution:- 4.7.1 Definition 4.7.2. Sources of nuclear Pollution (Natural & Man made) 4.7.3. Effects of Nuclear Pollution 4.7.4. Control of Nuclear Pollution 4.7.5.Disposal of Nuclear waste (Low, Medium & High activity waste) 4.7.6 Nuclear Accidents & Holocaust – case study	06	04	1,2,3 ,4	1,2,3
4.8 Solid Waste Pollution. Definition: Refuse, Garbage Sources of Solid waste Types of solid waste (MSW, HW, BMW & EW) Effects of Consumerism Segregation of Solid waste at source Treatment of MSW (Open dumping, Land filling, incineration & composting) Waste Utilization (Reuse, Reclaim & Recycle) Solid waste Management System – Flow sheet diagram **4.9** Role of an Individual in Prevention of Pollution.	06	04	1,2,3 ,4	1,2,3
UNIT 5.0 : **SOCIAL ISSUES & ENVIRONMENT**	**09**	**06**		
5.1 Environmental Legislation Article 47 & Article 51-A(g)of the constitution on Environment. 5.1.1 Protection Functions of Ministry of Environment and Forest Govt. of India Objectives & Functions of Central & state pollution Control Boards Environmental Protection Act. Air (Prevention & Control of Pollution) Act. Water (Preventation & Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Motor vehicle Act.	06	03	**1**	**1,2**
5.2 Social Issues 5.2.1Women & Child Welfare 5.2.2 Role of IT in Environment & Human Health 5.2.3 AIDS 5.2.4 Population Growth & Variation among Nations 5.2.5 Human Rights	03	03	1,4	1,2

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**MULTI-DISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES**	05	09
2	**ECOSYSTEM AND BIODIVERSITY**	09	15
3	**NATURAL RESOURCES**	12	18
4	**ENVIRONMENTAL POLLUTION**	16	24
5	**SOCIAL ISSUES & ENVIRONMENT**	06	09
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02	
2		
...		
No	**Tutorial Exercise**	**Marks**
1		
2		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Erach Bharucha	Textbook of Environmental Studies	Universities Press (India) Private Ltd.
2	Dr. Suresh K. Dhameja	Environmental studies	S.K. Kataria & Sons
3	Y. Anjaneyulu	Introduction to Environmental Science	B.S Publications
4	S. Deswal & A. Deswal	A Basic Cource in Environmental Studies	Dhanpat Rai & Co.
5	P. Meenakshi	Elements of Environmental Science and Engineering	Prentice Hall of India (PHI)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Pandya and Camy	Environmental Engineering	Tata McGraw Hill
2	Asthana D.K. and Asthana Meera	Environmental Problems and Solutions	S. Chand & Co.
3	Gilbert M. Masters	Introduction to Environmental Engineering and Science.	Prentice Hall of India (PHI)
4.	M N Rao & HVN Rao	Air Pollution	Tata McGraw Hill

(GC107) BASIC ENGINEERING PRACTICE (ELECTRONICS& COMPUTERS)

1. AIM: To impart basic electronics and computer programming knowledge to the students.

2. COURSE OBJECTIVES: In this course the students will learn the following:

1. Basic electronic components, their functions and uses.
2. Use of basic electronic test and measuring equipment.
3. Basics of computer programming and problem solving techniques.
4. Writing algorithms and drawing flowcharts.

3. PRE-REQUISITES:NIL

4. TEACHING AND EXAMINATION SCHEME

First Year	Periods/Week (in hours)			Total Credits	Examination Scheme				
Course code & course title					Theory Marks		Practical Marks		Total Marks
GC107	L	T	P	C	TH	TM	TW	PR/OR	
Basic Engineering Practice (Electronics & Computers)	-	-	4	4	-	-	75	50	125

5. COURSE OUTCOMES: On successful completion of the course, the students will be able to:

CO1: Explain different electronic components.

CO2: Make use of various electronic equipment.

CO3: Explain and use programming concepts for computer programming.

CO4: Develop algorithms and draw flowcharts for problem solving.

6. MAPPING COURSE OUTCOMES WITH PROGRAM OUTCOMES

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	2	1	0	2	0	0
CO2	2	2	1	3	2	0	0
CO3	2	2	0	0	0	0	1
CO4	2	3	2	2	2	0	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS

M=Marks	**Thr= Teaching hours**	**CO = Course Outcomes**	**L=Level**			
UNIT			**M**	**Thr**	**CO**	**L**
UNIT I	**1 INTRODUCTION TO BASIC ELECTRONICS** 1.1 Basic Electronic components 1.1.1 Passive components: Identification,Functions and Applications 1.1.1.1 Resistor 1.1.1.1.1 Determining values using color codes 1.1.1.1.2 Variable resistor (Potentiometer) 1.1.1.1.3 LDR 1.1.1.2 Capacitor 1.1.1.2.1 Determining values of capacitors 1.1.1.3 Inductor 1.1.2 Active components: Identification & Functions 1.1.2.1 Semiconductor Diodes 1.1.2.2 Zener Diodes 1.1.2.3 LED 1.1.2.4 Transistor (BC 147) 1.1.2.5 IC 7404 1.1.2.6 IC 7805 (Voltage Regulator IC) 1.2 Power Electronic Devices: Identification & Functions		22	20	CO1	2

	1.2.1 SCR 1.2.2 DIAC 1.2.3 TRIAC 1.2.4 UJT 1.2.5 PUT 1.3 Breadboard 1.3.1 Brief Introduction 1.3.2 Continuity check on the Breadboard 1.3.3 Connection of the various components on the Breadboard				
UNIT II	**2 INTRODUCTION TO BASIC ELECTRONICS EQUIPMENTS** 2.1 Digital Multimeter 2.1.1 Brief Introduction 2.1.2 Various Knobs/functions 2.1.3 Applications 2.1.3.1 Measurement of resistance 2.1.3.2 Measurement of capacitance 2.1.3.3 Measurement of voltage and Current 2.1.3.4 Continuity check 2.1.3.5 Testing of relays 2.2 Power supply 2.2.1 Brief Introduction 2.2.2 Block diagram 2.3 Function Generators 2.3.1 Brief Introduction 2.3.2 Application 2.4 Cathode Ray Oscilloscope (CRO) 2.4.1 Brief Introduction 2.4.2 Application 2.5 Soldering and Desoldering 2.5.1 Definitions 2.5.2 Soldering iron 2.5.2.1 Types 2.5.2.2 Safety measures 2.5.3 Introduction to flux 2.5.4 Soldering wire 2.5.5 Solder paste 2.5.6 Soldering and Desoldering procedure	15	12	CO1, CO2	2, 3

UNIT III	**3. COMPUTER PROGRAMMING** 3.1 Computer Terminology 3.1.1 Instruction 3.1.2 Program 3.1.3 Software 3.1.3.1 Application Software 3.1.3.2 System Software 3.1.3.3 Utility Software 3.2 Programming Language 3.2.1 Definition of Computer Programming 3.2.2 Types of Programming Languages 3.2.2.1 Machine Language 3.2.2.2 Assembly Language 3.2.2.2.1 Assembler 3.2.2.3 High Level Language 3.2.2.3.1 Translators- Interpreters and Compilers 3.2.2.4 Comparison of Programming languages 3.2.2.5 Examples of Programming Languages- BASIC, C, C++, JAVA 3.3 Computer Programmer 3.3.1 Definition 3.3.2 Skills required to become a programmer 3.4 Generations of Programming Languages 3.4.1 First Generation Languages 3.4.2 Second Generation Languages 3.4.3 Third Generation Languages 3.4.4 Fourth Generation Languages 3.4.5 Fifth Generation Languages 3.5 Applicability of Programming Languages in the field of Engineering 3.6 Computer Program Development Life Cycle 3.6.1 Defining the Problem 3.6.2 Designing the Program 3.6.3 Coding the Program 3.6.4 Testing and Debugging the Program 3.6.5 Documenting the Program 3.6.6 Implementation and Maintaining the Program 3.7 Errors in Computer Programming 3.7.1 Definition 3.7.2 Types of Errors 3.7.2.1 Syntax errors	13	11	CO3	2

	3.7.2.2 Semantic errors 3.7.2.3 Logical errors 3.7.3 Error Handling Mechanisms				
UNIT IV	**4. ALGORITHMS** 4.1 Introduction 4.2 Characteristics of Algorithm 4.2.1 Input 4.2.2 Output 4.2.3 Definiteness 4.2.4 Finiteness 4.3 Control structures of Algorithm 4.3.1 Sequence 4.3.2 Branching (Selection) 4.3.3 Loop (Repetition) 4.4 Advantages of algorithm 4.5 How to write algorithms 4.5.1 Define your algorithms input 4.5.2 Define the variables 4.5.3 Outline the algorithms operation 4.5.4 Output the results of algorithms operation	13	10	CO3, CO4	2, 3
UNIT V	**5. FLOWCHARTS** 5.1 Definition 5.2 Advantages of flowchart 5.3 Standard symbols for drawing Flowchart 5.4 Assignment Symbol 5.5 Mathematical Operators 5.6 Relational Operators 5.7 Logical Operators 5.8 Selection control Statements 5.9 Loop control Statements 5.10 Goto	12	11	CO3, CO4	2, 3
		38	64		

8. COURSE DELIVERY:

The course will be delivered through laboratory instructions and exercises.

9. SPECIFICATION TABLE FOR PRACTICAL PLAN

Unit No	Unit	Number of Practical Hours	Marks
I	**1. INTRODUCTION TO BASIC ELECTRONICS** 1.1 Basic Electronic components 1.2 Power Electronic Devices: Identification & Functions 1.3 Breadboard	20	10
II	**2. INTRODUCTION TO BASIC ELECTRONICS EQUIPMENT'S** 2.1 Digital Multimeter 2.2 Power supply 2.3 Function Generators 2.4 Cathode Ray Oscilloscope (CRO) 2.5 Soldering and Desoldering	12	10
III	**3. COMPUTER PROGRAMMING** 3.1 Computer Terminology 3.2 Programming Language 3.3 Computer Programmer 3.4 Generations of Programming Languages 3.5 Applicability of Programming Languages in the field of Engineering 3.6 Computer Program Development Life Cycle 3.7 Errors in Computer Programming	11	10
IV	**4. ALGORITHMS** 4.1 Introduction 4.2 Characteristics of Algorithm 4.3 Control structures of Algorithm 4.4 Advantages of algorithm 4.5 How to write algorithms	10	10
V	**5. FLOWCHARTS** 5.1 Definition 5.2 Advantages of flowchart 5.3 Standard symbols for drawing Flowchart 5.4 Assignment Symbol 5.5 Mathematical Operators 5.6 Relational Operators 5.7 Logical Operators 5.8 Selection control Statements 5.9 Loop control Statements 5.10 Goto	11	10
	Total	64	50

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Electronics)
1	Identification of various passive components like Resistor, potentiometer, LDR. Capacitor& inductor. Calculate the value of standard resistors using colour codes. Calculate the values of capacitors.
2.	Identification of the terminals of Semiconductor Diode, Zener Diode, LED, PNP/NPN Transistor, IC 7404 & IC 7805.
3.	Identification of the terminals of power electronic devices such as SCR, DIAC, TRIAC, UJT and PUT.
4.	Measurement of resistance, Capacitance & Continuity Check using digital multimeter.
5.	Continuity check of Rows and Columns of the Breadboard and mounting of various components on the Breadboard.
6.	Measurement of voltage using digital multimeter.
7.	Measurement of current using digital multimeter.
8.	Testing of various terminals of Relays.
9.	Connecting the power supply to the given circuit and adjusting the voltage to a given value of DC voltage using the coarse and fine adjustment knobs.
10.	Identify Various sections of power supply.
11.	Observation of Sine wave, Square Wave, Triangular Waveforms on the CRO and measure amplitude and frequency of the waveforms.
12.	Practice of Soldering and Desoldering on old and available PCBs.

No	Practical (Comp.)
1	Algorithm & Flowchart to find the sum of two numbers
2.	Algorithm & Flowchart to convert temperature from: (i) Celsius to Fahrenheit (ii) Fahrenheit to Celsius
3.	Algorithm & Flowchart to find Area and Perimeter of: (i) Square (ii) Rectangle (iii) Circle (iv) Triangle
4.	Algorithm & Flowchart to find: (i) Simple Interest (ii) Compound Interest
5.	Algorithm & Flowchart to Swap Two Numbers: (i) using Temporary Variable (ii) without using temporary variable
6.	Algorithm & Flowchart to find the: (i) smallest of two numbers (ii) largest of two numbers (iii) largest of three numbers
7.	Algorithm & Flowchart to find Even number between: (i) 1 to 50 (ii) 1 to n where n is a positive integer.
8.	Algorithm & Flowchart to find Odd number between: (i) 1 to 50 (ii) 1 to n where n is a positive integer
9.	Algorithm & Flowchart to find sum of series: (i) 1+2+3+…..+n (ii) $1- X + X^2 – X^3 ….X^n$
10.	Algorithm & Flowchart to find sum and average of given series of numbers
11.	Algorithm & Flowchart to find Roots of Quadratic Equations $AX^2+BX+C=0$
12.	Algorithm & Flowchart to find Factorial of number n (n!=1 x 2 x 3 x …n)

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	N. N. Bhargava	Basic Electronics and Linear Circuits	Tata McGraw Hill
2	Chattopadhyay D.	Electronics Fundamentals and Applications	New Age International
3	Ajay Mittal, Stewart Venit et al,	Fundamentals of Programming Languages	Pearson
4	Anil Bikas Chaudhuri	The Art of Programming Through Flowcharts and Algorithms	Firewall Media

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	K. Lal Kishore	Electronic Measurements and Instrumentation	Pearson India
2	Dipali P. Baviskar,	Fundamentals of Programming Languages	Technical Publications Pune
3	Luciano Manelli	Understanding Algorithms and Flowcharts: Step by Step Explanations of Simple and Fundamentals of Modern Information Technology	CreateSpace Independent Publishing Platform

Internet and Web Resources

S. No.	Description
1	https://www.dummies.com/programming/electronics/basic-electronic-components-and-what-they-do/
2	https://www.electronicshub.org/basic-electronic-components/
3	https://www.tutorialspoint.com/programming_methodologies/programming_methodologies_flowchart_elements.htm

Videos and Multimedia Tutorials

S. No.	Description
1	https://www.tutorialspoint.com/data_structure/what_is_an_algorithm.asp

(GC205) ENGINEERING MATERIALS

1. AIM

To provide knowledge to students in the area of materials for engineering applications.

2. RATIONALE:

To know about the properties and applications of engineering materials like metals, non-metals, conductor, semi-conductor, Insulating, Magnetic and Construction Materials. This information will be useful in studying other subjects of engineering.

3. PRE-REQUISITES:

Knowledge of engineering chemistry.

4. TEACHING AND EXAMINATION SCHEME

Semester	II								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
(GC205)		L	T	P	C	TH	TM	TW	PR/OR	
ENGINEERING MATERIALS		3	--	--	3	75	25	--	--	100

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1: Understand different types of materials

CO2: Identify different types of materials

CO3: Explain the composition of materials and its properties

CO4: Classify material based on application

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CO1	3	2	0	0	0	0	1
CO2	3	2	1	0	0	0	1
CO3	2	3	2	1	1	0	0
CO4	2	2	3	2	1	0	1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	2
CO2	1	2
CO3	2	2
CO4	2	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1 INTRODUCTION TO ENGINEERING MATERIALS			**08**	**04**	**CO1 CO4**	
1.1 Classification of Materials: Metal and Non-metal, Ferrous Metal & Non-ferrous Metals, Differences between Metals & non-metals						
1.2 Properties of Materials:(Note: Properties to be explained with relevant examples.) 1.2.1 Physical properties – Melting point, Freezing point, Boiling point,						

Density, Linear co-efficient of expansion, Thermal conductivity, Electrical resistivity				
1.2.2 Mechanical properties – Strength, Elasticity, Plasticity, Ductility, Malleability, Toughness, Brittleness, Hardness, Fatigue, Creep.				
1.2.3 Electrical properties – Resistivity, conductivity, Temperature coefficient of resistance, dielectric strength, Thermo electricity, super conductivity				
1.2.4 Magnetic properties – permeability and coercive force				
1.2.5 Chemical properties - Corrosion resistance and chemical composition				
2 FERROUS & NON-FERROUS METALS & ITS ALLOYS	**18**	**12**	**CO1 CO2 CO3 CO4**	
2.1 FERROUS ALLOYS:				
2.1.1 Low carbon steel, medium carbon steel, High carbon steel, their carbon percentage, properties & uses. 2.1.2 Cast iron: Grey cast iron, white cast iron, their properties & uses 2.1.3 Alloy steels: Constituents of alloy steels such as Phosphorous, Sulphur, Silicon, Manganese and their effect on properties of materials. 2.1.4 Stainless steel, Nickel-chromium-molybdenum steel, its properties & uses. 2.1.5 Tool steel – composition, HSS, properties & uses				
2.2 NON-FERROUS METALS & ALLOYS: 2.2.1 Aluminium – Properties & uses 2.2.2 Aluminium alloys – constituents of alloy & their effect on properties of metal 2.2.3 Properties & uses of Duralumin, Y-alloy and Al-si alloy 2.2.4 Copper – Properties & uses. 2.2.5 Copper alloys – Constituents of alloy & their effect on properties of metal 2.2.6 Properties & uses of Copper – Zinc alloys such as Muntz metal, manganese, bronze, copper-Tin alloys such as Bronze, copper aluminium alloys such as aluminium bronzes. 2.2.7 Lead and its hazard to the environment				
3 NON-METALLIC MATERIALS	**18**	**10**	**CO1 CO2**	

			CO3 CO4	
3.1 CONSTRUCTION MATERIALS 3.1.1 Classification of rocks, common building stones and their applications. 3.1.2 Cement: Types of cement, composition and applications 3.1.3 Bricks: Composition, properties, Classification, Special bricks- Refractory and fly-ash bricks and uses 3.1.4 Clay: Types, products of clay- tiles and pipes 3.1.5 Sand- sources – river, crushed aggregates, applications				
3.2 ENGINEERING CERAMICS 3.2.1 Refractories: Desirable properties, Properties and Applications of Fire clay and Silica Refractory, Difference between acid, basic & neutral refractories 3.2.2 Glass: Properties & uses of soda glass, Borosilicate glass and fibre glass 3.2.3 Glass wool: Composition, properties & uses 3.2.4 Timber: Common varieties of timber, uses of wood products, veneer and plywood 3.2.5 Natural & Synthetic abrasive materials: Introduction, Properties & uses				
4 CONDUCTOR, SEMI CONDUCTOR, AND INSULATING MATERIALS	**16**	**12**	**CO1 CO2 CO3 CO4**	
4.1 Classification of Materials as conductor, Semiconductor and Insulating materials				
4.2 Conductor Material: 4.2.1 High conductivity materials: Copper, Aluminium, Carbon, Silver, Lead & Tungsten, their properties as conducting materials and applications. 4.2.2 High resistivity materials: Nichrome, constantan, manganin and their applications				
4.3 Insulating Materials: Introduction and Characteristics of Good Insulating materials 4.3.1 Solid Insulating materials- Wood, paper, rubber, mica, glass fibre, porcelain, PVC, Resins, their characteristics as insulating materials and applications				
4.4 Semiconductor Materials: Silicon & Germanium, their specifications as semiconductor material and uses.				
Unit 5 MAGNETIC & COMPOSITE MATERIALS	**15**	**10**	**CO1 CO2 CO3 CO4**	
5.1 Magnetic Materials: Classification as Diamagnetic, Paramagnetic, Ferromagnetic, List of these materials and their applications				
5.2 Composite Materials**:** Metal matrix, ceramic matrix and polymer matrix composites, types of reinforcement materials and their applications				
5.3 Paints & Lubricants: 5.3.1 Classification: oil based and polymer based paints 5.3.2 Constituents of Paints – resin, binder, pigment, additives, solvents 5.3.3 Lubricants – Functions of lubricants, Types of Lubricants**,** Composition and Applications				
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures and class room interactions.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit Name**	**Number of lectures (hrs)**	**Marks**
1	Introduction to Engineering Materials	04	08
2	Ferrous & Non-Ferrous Metals & its alloys	12	18
3	Non-Metallic Materials	10	18
4	**Conductor, Semiconductor, & Insulating Materials**	12	16
5	**Magnetic & Composite Materials**	10	15
		48	**75**

10. LEARNING RESOURCES

Text Books

S. No.	**Author**	**Title of Books**	**Publishers**
1	R.S. Khurmi	Material Science	S. Chand
2	R. Srinivasan	Engineering Materials & Metallurgy	Tata McGrow Hill
3	TTTI Madras	Electrical Engineering Materials	
4	S. K. Hajra Choudhury	Material Science and Processes	Indian book distribution
5	P. C. Varghese	Building Materials	PHI
6	J. B. Gupta	Electrical and Electronic Engineering Materials	Katson

SEMESTER III

(CC 304) Basic Electrical Engineering

1. AIM

This course will enable the students to understand the basic concepts and principles of AC Circuits, Transformers and Motors.

2. COURSE OBJECTIVES:

1.To understand basic concepts in Electrical Engineering
2. To understand working & use of Transformer, DC & AC motors
3. To understand importance of safety precautions and use of protective devices

3. PRE-REQUISITES:NIL

4. TEACHING AND EXAMINATION SCHEME

Semester III									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(CC 304)	L	T	P	C	TH	TM	TW	PR/OR	
BASIC ELECTRICAL ENGINEERING	3	-	2	5	75	25	25	-	125

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain terms related to ac waveform ,operating principle and functions of parts of transformer, motors, need for earthing and operation of protective devices
2. Describe the procedure for starting and speed control of different motors
3. Differentiate between types of motors, types of earthing,protective devices, star and delta connection
4. Test &compute parameters of transformers

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentat n& Testing	Engg. Practices for Society,Sustai nability & Environment	Project Management	Life -long Learning
CO1	3	2					1
CO2	3	2		3		3	1
CO3	2	2	3	3	2	3	1
CO4	2	2			2		1

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1 AC CIRCUITS			15	9	CO 1,3	L1, 3
1.1 Sinusoidal AC voltage waveform. Definition and numerical Values of, average value, RMS value, form factor, peak factor, frequency of Sinusoidal quantities. Principle of single phase alternator						
1.2 Three-phase circuits. Concept of phase sequence, balanced system and unbalanced system Relation between line and phase quantities for star and delta connections.						
1.3 Concept & definition of Real, reactive and apparent power in three-phase system.						
2 TRANSFORMER			15	10	CO 1,4	L1, 4

2.1 Principle of operation and basic construction (Core & Shell type) of a single phase transformer. EMF equation, Calculations of Rated Currents & Voltages & Turns using emf equation				
2.2 Losses in transformer (Hysteresis, Eddy Current & copper loss, their brief description), efficiency and voltage regulation. Rating of transformer ,Applications of transformer				
3 DC MOTORS	15	10	CO 1,2 ,3	L1, 2,3
3.1 Working principle of DC motors, main parts of DC motor and their functions(Yoke ,pole core ,pole shoe, armature core, armature winding ,Commutator& Brushes), classification of DC motors (shunt, series and compound and their applications).				
3.2 Necessity of starter, methods of reversal of direction of rotation of DC shunt and series motor.				
3.3 Speed Equation , Armature resistance control & Field resistance control method for DC shunt Motor				
4 AC MOTORS	15	10	CO 1,2 ,3	L1, 2,3
4.1 Principleof three phase induction motor, main parts, classification (squirrel cage & Slip ring), torque-slip characteristics and application (only diagram).				
4.2 Necessity of starter, Starters - Direct On Line starter, star delta starter(Manual) and autotransformer starter(Maual), (w.r.t. circuit diagram, working and application). Method of reversal of direction of rotation.				
4.3 Working principle and application of - Single phase induction motor (split phase only) - Universal motor -Stepper motor (Variable reluctance type & permanent Magnet type.)				
5 EARTHING & PROTECTIVE DEVICES	15	09	CO 1,3	L1, 3
5.1 Electric shock, precautions against shock. Necessity of earthing, types of earthing- equipment earthing& system earthing (definitions only).Types of earthing electrodes- Pipe and Plate. Methods of reducing earth resistance.				
5.2 Fuse- Definition, Types of Fuses- Rewirable fuse, HRC fuse & Cartridge fuse. Rating for fuse such as Voltage ratings, Current ratings, Breaking capacity (Rupture capacity) & Minimum fusing current. MCB- Principle of operation and application. ELCB- Current operated type. Principle of operation and application. .				
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**AC CIRCUITS**	09	15
2	**TRANSFORMER**	10	15
3	**DC MOTORS**	10	15
4	**AC MOTORS**	10	15
5	**EARTHING & PROTECTIVE DEVICES**	09	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Minimum 8)	Marks
1.	Connection of single transformer & Measure its Voltages, Currents, Voltage Regulation & Efficiency	
2.	Verify relationship between phase & line quantities in star connected load	
3.	Speed control of DC motor	
4.	Starting of DC shunt motor and reversal of direction of rotation	
5.	Starting of three phase induction motor using star delta starter	
6.	Verify relationship between phase & line quantities in Delta connected load	
7.	Study of MCB & ELCB (Current Operated)	
8.	Study of stepper motors	
9.	Study of servo motors	
10.	Study of universal motors	
11.	Study of rotor resistance starter for starting of Slip ring induction motor.	
12.	Checking of Ceiling fan using series test lamp	
13.	Measurement of voltages in a single phase system(between phase and neutral, phase and earth and neutral and earth)	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments.	
No	**Tutorial Exercise**	**Marks**
1	NIL	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	B.L.Theraja	Electrical Technology (Vol I and Vol II)	S. Chand
2	V.K Mehta	Principles of Electrical Engineering & Electronics	S. Chand
3	J.B.Gupta	Fundamentals of Electrical Engineering	S.K. Kataria& sons

(EX302) PROGRAMMING CONSTRUCTS FOR ELECTRONIC DEVICES

1. AIM

1. To introduce students to programming skills through C language.
2. To enable students to develop logical skills to write C program
3. To train students to compile, debug and execute C program.

2. COURSE OBJECTIVES:

The students will able to:

1. Understand programming of C language.
2. Develop logical skills to write C program
3. Use compiler software to compile, debug and execute C program.

3. PRE-REQUISITES:

Students should know

1. Simple basics of computer hardware
2. Operating of a computer.

4. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX302) Programming Constructs for Electronic Devices		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		-	**-**	**4**	**4**	**-**	**-**	**25**	**50**	**75**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the program statement and draw flow chart.
2. Develop basic programming skills and write programs using C.
3. Analyze the program statement and build programs using features of C.
4. Compile, debug and execute programs of C.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimenta tn& Testing	Engg. Practices for Society,Sust ainability & Environmen t	Project Managemen t	Life -long Learning
CO1	0	2	1	0	0	3	0
CO2	3	3	1	2	2	3	0
CO3	3	3	1	2	3	3	2
CO4	0	1	0	2	0	3	0

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	2	1
CO3	3	1
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	M	P	CO	Levels
1 Introduction to C	12	10	co1	**L1 L2**
1.1 Overview of C: Brief history of C language, Features of C language ,Application of C language in electronics, Structure of C language				
1.2 Flow chart: Definition and uses, symbol used in flow chart- flow line, terminal, input/output, processing, decision, on-page connector, off-page connector, predefined process/function, Simple examples of flow chart.				
2 Basic elements of C programming	18	14	co2 co4	**L1 L2**
2.1 Lexical elements of C: C character set, Variables, Constants, Data types, delimiters, reserved words				
2.2 Operators and Expressions in C: Arithmetic operators, expressions, relational operators, logical operators, increment/decrement operators, bitwise data operators				
2.3 C pre-processor:				

File inclusion (usage only)				
2.4 Input/Output in C Different types of input functions and output functions, conversion specification, formatted input/output function				
3 Control statements of C programming	18	14	co2 co4	**L3** **L4**
3.1 Decision control statements : if else, nested if				
3.2 Loops: for loop, break and continue statement, nested for loop, while loop, do-while loop				
3.3 Case control statement: switch-case-default				
3.4 Functions: Call by value, call by reference, recursive function				
4 Data types	21	18	co3 co4	**L3** **L4**
4.1 Arrays: Declaration of Arrays, one dimensional Array , two dimensional Array				
4.2 Strings: Declaration of String, string library functions				
4.3 Pointers: Declaration of Pointers, pointer operators, Basic pointer arithmetic				
5 Structures	06	08	co3 co4	**L3** **L4**
5.1 Declaration of structure, array of structure, structure within a structure.				
Total	**75**	64		

8. COURSE DELIVERY: The Course will be delivered through practicals, laboratory interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of Practicals**	**Marks**
1	Introduction to C	10	12
2	Basic elements of C programming	14	18
3	Control statements of C programming	14	18
4	Data types	18	21
5	Structures	08	06
	Total	64	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (any 8 to 10)

No	Practical	Marks
1.	Program on flow chart	
2.	program on input and output	
3.	program on calculations using operators and expressions	
4.	program on controls statements-if , switch	
5.	Program on loop	
6.	program on function	
7.	program on pointers	
8.	program on arrays	
9.	Program on strings	
10.	program on structures	
	Total	25
No	**Tutorial Exercise**	**Marks**
1	To be decided as per requirement by subject teacher.	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Yeshwant Kanetkar	Let Us C	Jones and Bartlett publishera, USA
2	J. Jayasri	The 'C' Language Trainer with C Graphics and C++	New Age International (P) LTD.
3	Anil Bikas Chaudhuri	The Art of Programming Through Flowcharts & Algorithms	FIREWALL MEDIA, New Delhi
4	Luciano Mandli	Understanding Algorithm and Flow Chart	Create Space Independent Pub

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	B. W. Kernigham, D. M. Ritchie	The C programming language	
2	Byron gottfried	Programming with c- Schaum's outlines	Tata McGraw Hill

(CC 308) BASIC ELECTRONICS ENGINEERING

1. AIM

To introduce students to semiconductor devices and their applications

2. COURSE OBJECTIVES :

The students will able to:

1. Explain the operation and characteristics of semiconductor devices
2. Build and test electronic circuits based on semiconductor devices

3. PRE-REQUISITES:

1. Students should have knowledge of basic principles and laws of physics.

4. TEACHING AND EXAMINATION SCHEME

Semester III									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC 308	L	T	P	C	TH	TM	TW	PR/OR	
Basic Electronics Engineering	3	-	2	5	75	25	25	50	175

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the operation and characteristics of semiconductor devices
2. Apply the knowledge of semiconductor devices to build electronic circuits
3. Analyze capacitor filter and semiconductor device based electronic circuits
4. Select an appropriate semiconductor device based circuit for a specific application

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	1	1	3	2	0	2
CO2	3	2	1	3	2	2	0
CO3	3	3	2	2	3	0	2
CO4	2	2	2	1	3	0	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	3
CO3	3	2
CO4	3	2

.

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**		
Unit	**M**	**Thr**	**CO**	**Levels**
1 Introduction to Semiconductors	**10**		**CO1**	**L1, L2**
1.1 Classification of solids as conductors , semiconductors and insulators		1		
1.2 Types of semiconductors-Intrinsic and Extrinsic semiconductors, structure of intrinsic semiconductor Extrinsic semiconductor- definition of doping, pentavalent and trivalent impurity. P-type and N-type, structure, majority and minority carriers		4		
2 Semiconductor diode	18		**CO1, CO2, CO3, CO4**	**L1, L2**
2.1 P-N junction and depletion region. forward bias , reverse bias, V-I characteristics, Important diode ratings,		4		
2.2 Rectifiers- Half wave rectifier, Centre tap Full wave rectifier,		4		**L3**

Full wave bridge rectifier, (working, input , output waveforms, Vdc,PIV) , comparison between rectifiers				
2.3 Filters- definition of ripple factor, Types of filters, C filter operation(ripple factor, waveforms), numerical on c filter		2		**L3**
3 Zener Diode	12		**CO1, CO2, CO3, CO4**	**L1, L2**
3.1 Construction, operation, forward and reverse characteristics, breakdown mechanism, Important zener diode ratings, comparison with semiconductor diode		4		
3.2 Zener diode as voltage regulator, numerical on variable supply and variable load.		3		**L3, L4**
4 Bipolar Junction Transistor	20		**CO1, CO2, CO3**	**L1, L2**
4.1 Schematic of NPN and PNP transistor, working of NPN transistor.		2		
4.2 Transistor configurations-CE, CB and CC configurations		2		
4.3 Transistor input and output characteristics in CB configuration, Transistor input and output characteristics in CE configuration ,Alpha, Beta and the relation between them		6		
4.4 leakage currents- concept of ICBO, ICEO, numerical on leakage currents		2		
4.5 Comparison between transistor configurations		1		
4.6 Transistor as a switch		1		
5 Field Effect Transistors	15		**CO1**	**L1, L2**
5.1 JFET: Structure, operation, characteristics of n and p- channel JFET,		3		
5.2 important JFET parameters (rd, μ and gm, no derivations), comparison with BJT		2		
5.3 MOSFET: Structure, operation and characteristics of n-channel and p- channel enhancement type MOSFET.		3		
5.4 Structure, operation and characteristics of n -channel and p-channel depletion type MOSFET		3		
5.5 Comparison between JFET and MOSFET		1		
Total	**75**	**48**	**-**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises & case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit	Unit	Number of lectures	Marks
1	Introduction to Semiconductors	5	10
2	Semiconductor diode	10	18
3	Zener Diode	7	12
4	Bipolar Junction Transistor	14	20
5	Field Effect Transistors	12	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
1	Plot VI characteristics of semiconductor diode	
2	Plot VI characteristics of zener diode	
3	Assemble and test zener diode as a voltage regulator	
4	Assemble and test half wave rectifier with and without capacitor filter	
5	Assemble and test bridge full wave rectifier with and without capacitor filter	
6	Plot input characteristics of transistor in CB configuration	
7	Plot output characteristics of transistor in CB configuration	
8	Plot input characteristics of transistor in CE configuration	
9	Plot output characteristics of transistor in CE configuration	
10	Assemble and test circuit of transistor as a switch	
11	Plot VI characteristics of JFET	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments.	
No	**Tutorial Exercise**	**Marks**
1	NIL	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Bhargava & others	Basic Electronics and Linear circuits	TATA McGRAW HILL
2	Robert L. Boylestad	Electronic Devices and Circuit Theory	Prentice – Hall India
3	V.K. Mehta	Principles of Electronics Engineering	S. CHAND

(CC 309) DIGITAL ELECTRONICS

1. AIM

1. The students should be able to explain about digital number systems and logic circuits.
2. The student should be able to solve logic function minimization.
3. The students should be able to differentiate between combinational and sequential circuits such as decoders, encoders, multiplexers, demultiplexers, flipflops, counters, registers

2. COURSE OBJECTIVES:

The students need to learn basic concepts of digital circuits and system which leads to design of complex digital system such as microprocessors.

The students need to know combinational and sequential circuits using digital logic fundamentals. This is the first course by which students get exposure to digital electronics world.

The students will able to:

1. To understand various number representations and conversion between different representation in digital electronic circuits.
2. To introduce the students to various logic gates, SOP,, POS and their minimization techniques.
3. To analyze logic processes and implementation of logical operations using combinational logic circuits.
4. To understand, analyze and design sequential circuits

3. PRE-REQUISITES:

Students should know

1. Decimal number systems
2. Knowledge of semiconductors

4. TEACHING AND EXAMINATION SCHEME

Semester	**III**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(CC 309) Digital Electronics		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		03	**-**	**02**	**05**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand and relate the knowledge of Number Systems in Digital Applications
2. Build different Sequential and Combinational Circuits
3 Simplify logical problems using digital circuits
4. Develop, test and troubleshoot basic digital electronics circuits

.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	3	2	3	3	0	0	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	0	3
CO4	3	3	3	3	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**	**Levels**
1 Number System	**14**	**09**	**CO1**	**L1,L2**
1.1 **Digital and Analog Signals**. Definition of digital and analog signals,Comparison between Analog and Digital signals				
1.**2 Number System**:- Decimal, Binary, Hexadecimal. Introduction to Decimal, Binary and Hexadecimal Number Systems. Counting in each system. Conversion from one system to other.				**L3**
1.3 Codes:- introduction and importance of Codes.BCD code, GRAY code conversion of Gray to Binary, Binary to Gray, BCD to binary and Binary to BCD. Represent				**L3**

Decimal Numbers in BCD and Gray codes. ASCII code and its importance.				
1.4 Binary Addition (upto 4 bits), 1's complement of a Binary number, 2's complement of a Binary number. Binary Subtraction using 2's complement method. Addition of signed decimal numbers.				**L3**
2 Combinational Circuits	**19**	**12**	**CO1,CO2,CO3**	**L1,L2**
2.1 Logic Gates:- Symbol, Expression and Truth Tables of Basic gates(AND,OR,NOT) and Combinational gates(NOR,NAND,EXOR,EXNOR).				
2.2 Boolean Algebra:- DeMorgan's Theorems, Laws of Boolean Algebra ,Duality Theorem,				
2.3Simplification of Boolean Expressions using Boolean Algebraic laws and by using K-Maps Techniques (upto 4 Variables in SOP Form),				**L3**
2.4 Universal Gates:- Implementation of NOT,OR,AND,EXOR gates using NOR and NAND Gates				
2.5 Adders:- Half Adder circuit using logic gates , Full Adder circuit using logic gates, block diagram of 4 bit parallel adder. Subtractors:- Half subtractor circuit using logic gates, Full Subtractor using logic gates				
2.6Combinational circuits:- Block diagram and Implementation using basic gates:- Multiplexers(4 to 1), Demultiplexer(1 to 4), Encoder (4 to 2), Decoder(2 to 4). BCD to 7 segment Decoder driver (Common Cathode).				
3 Flipflops	**12**	**08**	**CO1,CO2,**	**L1, L2**
3.1 Definition of FlipFlop. Applications. Symbol, Truth Tables, Operation and timing diagrams of RS F/F using NAND gates. ,				
3.2 Symbol, Truth Tables, Operation and timing diagrams of clocked RS F/F using NAND Gates, Concept of Asynchronous inputs(Preset and Clear)				
3.3 Symbol, Truth Tables, Operation of Clocked D F/F				
3.4 Symbol, Truth Tables, Operation of Clocked JK F/F, Excitation table of JK flip flop				
3.5 Race around condition in JK F/F. Symbol, Truth Tables, Operation of JK master slave F/F.				
3.6 Symbol, Truth Tables, Operation of T F/F,				
4 Registers And Counters	**19**	**12**	**CO1,CO2,CO4**	**L1,L2**
4.1 Registers: Definition of Shift Registers, Applications				

of Registers Symbols and Logic block diagram of SISO,SIPO,PISO and PIPO Registers,				
4.2 Serial IN Serial Out Register (size of the register 4 bits) Logic Diagram and Operation of SISO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams				
4.3 Serial IN Parallel Out Register (size of the register 4 bits) Logic Diagram and Operation of SIPO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams.				
4.4 Parallel IN Serial Out Register (size of the register 4 bits) Logic Diagram and Operation of PISO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams				
4.5 Parallel In Parallel Out Register (size of the register 4 bits) Logic Diagram and Operation of PISO Register using negative edge triggered D F/F along with the Truth Table and Timing diagrams . Concept of Shift right, Shift left, Ring Counter.				
4.6 Counters: Introduction to counters, Modulus of counters. Count sequence, No of Flip Flops required for Specified counters				
4.7 Asynchronous Counters:- 4 bit UP counter using JK Flip Flops only and 4 bit DOWN counter using JK Flip Flops only.				
4.8 Synchronous Counters:- 4 bit UP counter using JK Flip Flops only and 4 bit DOWN counter using JK Flip Flops only, Decade (Mod 10) using JK Flip Flops only.				
4.9 Design of Synchronous counters(upto 4 bit) using only JK Flip Flops				**L4**
5 DAC and ADC and Memories	**11**	**7**	**CO1,CO4**	**L1,L2**
5.1 Definitions, Types of DAC and ADC(no description) , Applications		1		
5.2 Binary Ladder Network for DAC:- Logic circuit and operation. Simple numerical problems Successive Approximation ADC .:- Logic circuit and operation. Simple numerical problems.		4		**L3**
5.3Memories: Introduction, Semiconductor memories and its types –ROM,RAM,PROM, EPROM,EEPROM(only definition and applications)		2		
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Number systems	09	14
2	Combinational circuits	12	19
3	Flipflops	08	12
4	Registers and counters	12	19
5	DAC and ADC	07	11
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Perform any 8)	Marks
1.	Verification of Logic gates and Demorgan's Theorems	
2.	Universal gates (NAND and NOR)	
3.	Verification of Boolean Expression	
4.	Half Adder and Full Adder using logic gates	
5.	Half Subtractor and Full Subtractor using logic gates	
6.	MUX and D-MUX	
7.	RS F/F, D F/F and JK F/F	
8.	Assemble and Test Binary Counter/Decade counter	
9.	Assemble and test DAC using DAC0808	
10.	Assemble and test ADC using ADC0808	
	Total	25
...		
No	Class room Assignments	
	Atleast 02 assignments	
No	**Tutorial Exercise**	**Marks**
1	As decided by subject teacher as per the requirement	
...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.P.Jain,	Modern Digital Electronics	Fourth Edition, Tata McGraw-Hill Education.
2	Malvino & Leach,	Digital Principles and Applications	Seventh Edition, McGraw-Hill Education

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Thomas L. Floyd,	Digital Fundamentals	10th Edition, Pearson Education Inc, 2011
2	. By A.K. Maini,	Digital Electronics: Principles and Integrated Circuits	Wiley India Publications

(EX301) Communication Engineering

1. AIM

i) To introduce students to the basics of communication systems
ii) To impart in depth knowledge about of AM& FM
iii) To enable the students to understand the operation of AM & FM receiver
iv) To introduce students to various wave propagation techniques.

2. COURSE OBJECTIVES:

The students will able to:
i) Understand concept of modulation and demodulation of AM / FM.
ii) Understand the operation of AM/ FM transmitter and receiver.
iii) Understand the concept of radio wave propagation.

3. PRE-REQUISITES:

Basic Electronics Engineering.

4. TEACHING AND EXAMINATION SCHEME

Semester III									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX301) Communication Engineering	L	T	P	C	TH	TM	TW	PR/OR	
	03	-	02	05	75	25	25	-	125

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
1. Understand different modulation and demodulation techniques used in analog communication systems.
2. Classify types of noise and various frequency bands in communication system
3 Apply the concept of modulation and demodulation in AM and FM transmitters and receivers.
4. Compare various types of antennas & wave propagation techniques

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	2	1	1	-	1	2
CO2	3	-	2	-	-	2	2
CO3	3	2	2	2	1	2	3
CO4	2	-	2	-	1	-	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**	**Levels**
1 Basics of communication Engg			12	07	CO1 & CO2	**L1 & L2**
1.1 Block diagram of communication system						
1.2 Frequency bands used in communication system						
1.3 Noise : Definition & Classification of noise • External Noise: Atmospheric noise, Industrial Noise & Extraterrestrial noise • Internal Noise: Thermal Noise, Shot Noise & Transit time Noise • Definition of signal to noise ratio & noise figure.						
1.4 Need for modulation& types of modulation • Analog Modulation techniques: AM, FM, PM Definitions, • Pulse Modulation techniques: Definition & waveforms of PAM, PWM & PPM. • Digital Modulation techniques :Definition & waveforms of ASK,FSK & PSK						
2 Amplitude Modulation			21	14	CO1	**L1&**

			& CO2	**L2**
2.1 Amplitude Modulation: Waveforms, Derivation of mathematical expression of AM signal.				
2.2 Derivation of Modulation Index equation using AM waveform, Frequency Spectrum of AM, Power and current relations, Simple numericals				**L3**
2.3 Block diagram of AM Transmitter-Low level and high level				
2.4 Detection of AM Waves. Envelope detector				
2.5 Single sideband AM : • Advantages of SSB • Suppression of carrier using Balanced modulator(no derivation) • Suppression of unwanted sideband using filter method • Block diagram and operation of ISB				
3 Angle Modulation	18	12	**CO1 & CO3**	**L1 & L2**
3.1 Angle Modulation : Definition & types of Angle Modulation				
3.2 Frequency Modulation : • Waveforms , Mathematical expression of FM (no derivation) • Modulation index & maximum frequency deviation • Frequency spectrum of FM using expanded form of FM equation and important observations • Bandwidth of FM wave ,Carson's rule				**L3**
3.3 Narrow band & Wide band FM ,Pre-emphasis and De-emphasis				
3.4 Generation of FM using varactor diode modulator, Detection of FM wave using Balanced slope detector				
3.5 Phase Modulation : Definition and mathematical expression (No derivation)				
3.6 Comparison between AM,FM & PM				**L4**
4 Receivers	12	07	**CO1 &CO3**	**L1 & L2**
4.1 Characteristics of Receivers : Sensitivity, Selectivity & fidelity (definitions)				
4.2 AM Receivers : • TRF receiver : Block diagram, Operation & limitations • Superheterodyne Receiver: Block diagram & operation				
4.3 FM Receiver: • Block diagram & operation • Stereo FM multiplex transmitter and receiver: Block diagram, operation & frequency spectrum				
5 Antennas& Wave Propagation	12	08	**CO4**	**L1 & L2**
5.1 Antennas:				

• Antenna parameters:-definitions of antenna gain, antenna resistance, beam width and polarization. • Construction and radiation pattern of Yagi-Uda & parabolic reflector (horn feed) Antennas.				
5.2 Wave Propagation • Ground Wave propagation • Sky Wave Propagation: Ionosphere & its effect, definitions of virtual height, critical frequency, skip distance , fading, maximum usable frequency. • Space Wave propagation				**L4**
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Basics of communication Engg	07	12
2	Amplitude Modulation	14	21
3	Angle Modulation	12	18
4	Receivers	07	12
5	Antennas& Wave Propagation	08	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1.	Perform Amplitude Modulation on trainer kit. (Observe and draw the waveform of AM & calculate modulation index of AM)	
2.	Perform Amplitude Demodulation on trainer kit.(Observe and draw the input waveform and output waveform)	
3.	Test the performance of SSB SC AM Modulation on trainer kit.	
4.	Test the performance of SSB SC AM Demodulation on trainer kit	
5.	Test the performance of DSB-SC AM modulation on trainer kit.	
6.	Perform frequency modulation on trainer kit.(Observe and draw the waveform of FM)	
7.	Perform frequency demodulation on trainer kit.(Observe and draw the input waveform and output waveform)	

8.	Test the performance of superheterodyne receiver on trainer kit.(Observe the wave forms at various points in AM receiver)	
9.	Field visit to All India Radio Transmitter Station (**Optional**)	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments	
...		
No	**Tutorial Exercise**	**Marks**
1		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Kennedy, George and Bernard Davis	Electronic &Communication System	Tata McGraw Hill, India, ISBN:978-00-746-3682-4
2	Roddy Collen	Electronic communication	Pearson Education ISBN:81-297-746-0106-5
3	Mithal G.K	Radio Engineering	Khanna Publishers, NewDelhi ISBN:978-8174090140

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	R P Singh & S D Sapre	Communication Systems	Tata McGraw Hill, India ISBN:13-978-0-07-063454-1
2	Taub's, Herbert	Principles of Communication Systems	Tata McGraw Hill, India ISBN:0-07-462456-3

(CC303) Circuits & Networks

1. AIM

1 To enable the students understand the facts, concepts & principles of electrical & electronics engineering circuits.
2. To enable them to analyze the electrical & electronic circuits.
3 To help them build different RLC circuits with AC supply.
4 To introduce two port networks like filters

2. COURSE OBJECTIVES : The students will able to:
1 . Verify different basic laws & theorems.
2 . Analyze different DC &AC circuits.
3 Test electrical &electronic circuits.

1. **PRE-REQUISITES:** Students should know
   1 .Applied Physics
   2 . Engg Mathamatics

4. TEACHING AND EXAMINATION SCHEME

Semester **III**									
Course code & course title	**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**				
					Theory Marks		**Practical Marks**		**Total Marks**
	L	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Circuits &Networks (CC303)	**3**	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1.Understand. network concepts, theorems & resonance
2. Interpret the response of different RLC circuits to AC supply.
3 .Apply various theorems to simplify resistive circuits.
4. Design basic electrical filters . .

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6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society, Sustainability &	Project Management	Life - long Learning
CO1	3	3	2	2	0	2	2
CO2	3	3	3	3	0	2	3
CO3	3	3	3	3	0	3	3
CO4	3	3	3	3	0	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 BASIC TERMINOLOGY	**6**	**4**	**1**	**L1, L2**
1.1 Definitions of circuit, network, voltage, current , ,power, mesh, loop,,node &branch, port .				
1.2 Definition of network elements Active & passive, Unilateral & bilateral, Linear & non linear,lumped& Distributed.				
1.3 Energy Source Voltage & Current Sources Concept of Ideal & practical energy source				
1.4 Series & Parallel equivalent expressions of resistors, capacitors & inductors.(No derivations),Simple numerical on it.				
2 NETWORK THEOREMS (RESISTIVE ONLY WITH DC SOURCE)	30	22	**3**	**L1, L2, L3**
2.1 Voltage& Current Divider theorem—Statement of theorem, simple numerical on it. 2.2 Kirchhoff's voltage& current Laws-Stataement of laws & simple numerical on it. 2.3 Concept of Mesh & Node analysis-Explanation of method & simple numerical(maximum 3 loops ,3 nodes) 2.4 Superposition Theorem- Explanation of statement of theorem & simple numerical 2.5 Thevenin's Theorem- Explanation of statement of theorem & simple numerical 2.6 Maximum Power Transfer Theorem -- Explanation of statement of theorem & simple numerical, 2.7 Star Delta transformation - Explanation of conversion from star to delta & vice versa, simple numerical on it				**L4**

3 AC CIRCUITS	20	10	**2,1**	**L1, L2, L3**
3.1 Response of basic R,L,C ,RL , RC,RLC elements to AC signal. 3.2 Phasor diagrams of series RC & series RL circuits,Concept of impedance. 3.3 Simple problems to find impedance,VR,VC,VL ,Phase angle in above circuits 3.4 Concept of series resonance Circuit .Graphical representation of resonance curve ,bandwidth ,half power frequencies. Problems based on Fr,Imax,F1,F2,Z.(Note:Resonance problems are of **L4)** 3.5 Concept of Q factor, Problems to calculate Q factor. 3.6 RC Integrater & Differentiater for sine & square wave input.				
4 NETWORKS	10	6	**3**	**L1, L2**
4.1 Introduction & Applications: Two port networks: Symmetrical T & Pi networks				
4.2 Characteristics of two port network: Characteristic impedance, short circuit & open circuit impedance				
4.3 Derivations& Simple numerical on Zo, Zoc, Zsc (only for T type)				
5 FILTERS	9	6	**4**	**L1, L2, L3, L4**
5.1 Introduction of Filter circuits				
5.2 LPF, HPF,BPF, BRF (graphical interpretation), Constant k (LPF, HPF-T type only)				
5.3 Design formulae & numerical				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	BasicTerminology	4	6
2	Network Theorems(Resistive circuis with DC Source)	22	30
3	AC Circuits	10	20
4	Networks	6	10
5	Filters	6	9
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Verification of Ohms law and its application to series parallel Circuits	
2	Verification of KVL and KCL	
3	Verification of superposition theorem	
4	Verification of Thevenins theorem	
5	Verification of maximum power transfer theorem	
6	Study of RLC series resonance circuits	
7	RC Integrator and RC Differentiator	
8	Study of filters LPF &HPF ,T & PI Type	
No	**Class room Assignments**	**Marks**
1	At-least two assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	NIL	
2		
...	Total	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Sudhakar &shyammohan	Circuits & Networks	McGrawHill Education
2	B.L.Theraja	Basic electrical eng.Vol I	S.Chand
3	Royal Signals	Handbook of Line Communication	HMSO
4	B.R.Gupta &V.Singhal	Network filters & Transmission lines	S.K.Kataria & Sons
5	Schaum Series	Electrical Circuits	McGrawHill Education

SEMESTER IV

(EX 401) ELECTRONIC CIRCUITS

1. AIM

1. To introduce students to working of various types of electronic circuits using transistors.
2. To assemble and test the performance of such circuits.

2. COURSE OBJECTIVES:

The students will able to:

1. Analyze the working of a given transistor based circuits.
2. Develop simple circuits using transistors.
3. Understand different types of feedback systems.

3. PRE-REQUISITES:

Students should know

1. Knowledge of semiconductor theory and devices specially working of bipolar junction transistor.
2. Basic principles of electronic and electrical circuits.

4. TEACHING AND EXAMINATION SCHEME

Semester IV									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX401) ELECTRONIC CIRCUITS	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain working of different electronic circuits based on transistors and their applications.
2. Apply the knowledge of transistors to build transistor amplifier circuits and identify different power amplifiers.
3. Analyze different types of feedback systems.
4. Build and test transistor based electronic circuits.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustai nability & Environment	Project Management	Life -long Learning
CO1	3	1	1	2	0	0	1
CO2	3	1	2	2	1	1	2
CO3	1	2	0	1	0	0	0
CO4	3	2	3	3	1	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	1
CO2	3	2
CO3	1	1
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**	**Levels**
1 Transistor biasing techniques and amplifiers			**21**	**15**	**CO1/ CO2/ CO4**	**L1,L2**
1.1 Transistor biasing techniques: need and types (fixed & voltage divider biasing- comparison), Steps for selection of Q point for fixed and voltage divider biasing, simple numerical on finding Q point(fixed and voltage divider)						**L4**
1.2 Single stage transistor CE amplifier- working, frequency response						
1.3 General block diagram of multi-stage amplifier, necessity of multistage amplifiers						
1.4 Different coupling methods- working, frequency response, applications and comparison of:- ➢ RC coupled ➢ Direct-coupled ➢ Transformer Coupled						**L3**

2 Feedback Circuits	**21**	**12**	**CO1/ CO3/ CO4**	**L1,L2**
2.1 Concept of feedback, block diagram of feedback systems, types of feedback, merits and limitations of negative feedback				
2.2 feedback connections-Block diagram of voltage series, voltage-shunt, current-series, current –shunt				
2.3 Derivation of input impedance, output impedance, voltage gain, stability factor (for voltage series), simple numerical on feedback				**L3**
2.4 Bandwidth of a voltage series amplifier(block diagram only) Feedback with & without bypass capacitor in single stage CE amplifier				
2.5 Emitter follower circuit				
3 Power Amplifiers	**12**	**9**	**CO1/ CO2/ CO4**	**L1,L2**
3.1 Need for Power amplifier, Difference between Power and voltage amplifier				
3.2 single ended power amplifier				
3.3 Classification- A, B, AB; operation, comparison.				**L3**
3.4 Push pull, complimentary symmetry power amplifier (no analysis)				
4 Oscillators	**12**	**06**	**CO1/ CO3/ CO4**	**L1,L2**
4.1 Principle of oscillations; Barkhausens criteria				
4.2 Working of RC oscillators- phase shift and Wien Bridge. (numerical for frequency)				**L3**
4.3 Working of LC oscillators- Hartley, Colpitts and crystal oscillator (numerical for frequency)				**L3**
5 Multivibrators	**09**	**06**	**CO1/ CO4**	**L1,L2**
5.1 Multivibrator-operation of Astable (simple numerical on T_{on} and T_{off}), Bistable and Monostable (simple numerical on pulse width)type circuit, List of applications				**L3**
5.2 Schmitt trigger circuit				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises & practical.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Transistor biasing techniques and amplifiers**	15	21
2	**Feedback Circuits**	12	21
3	**Power Amplifiers**	9	12
4	**Oscillators**	6	12
5	**Multivibrators**	6	9
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (Any 8)

No	Practical	Marks
1.	Assemble and test fixed bias circuit to determine Q point	
2	Assemble and test voltage divider bias circuit to determine Q point	
3	Assemble & Test a single stage CE amplifier without feedback	
4	Assemble & Test a single stage CE amplifier with feedback	
5	Test the performance of RC coupled amplifier	
6	Assemble and test Emitter follower	
7	Assemble and test performance of class A power amplifier	
8	Assemble and test the performance of Hartley oscillator	
9	Assemble and test the performance of Colpitts oscillator	
10	Assemble and test RC phase shift oscillator	
11	Assmeble and test performance of Bistable multivibrator	
12	Assmeble and test performance of Astable multivibrator	
13	Assmeble and test performance of Schmitt trigger circuit	
	Total	**25**

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Bhargava & Gupta	Basic Electronics &Linear circuits	2nd edition, McGraw Hill Education
2	Boylestad, Robert and Nashelsky Louis	Electronic Devices and circuit theory	11th edition, Pearson India Education Services Pvt Ltd
3	Mottershead Allen	Electronic devices and circuits : introduction	1st edition, Prentice Hall India Learning Private Limited

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	S Salivahanan N Sreshkumar	Electronic devices and circuits	4thedition Tata McGraw-Hill
2	B.L.Theraja A.K.Theraja	A Textbook of Electrical Technology Volume IV,Electronic Devices and Circuits	Latest, S Chand

(EX 402) POWER ELECTRONICS

1. AIM

1. To understand basic concepts of Power Electronic devices.

2. To understand concepts of triggering circuits.

3. To understand the working of various converter circuits.

2. COURSE OBJECTIVES / RATIONALE:

This course will enable the students to understand the working of power electronic devices and converter circuits.

3. PRE-REQUISITES:

1. Basic knowledge of Electronic Devices.

2. Basic knowledge of Ac waveforms.

3. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks	Total Marks
(EX402) POWER ELECTRONICS		L	T	P	C	TH	TM	TW	PR/OR	
		03	-	02	05	75	25	25	-	125

4. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain working of various power electronics devices and circuits, SCR triggering methods etc.
2. Demonstrate operation and applications of various power electronics circuits
3. Distinguish between different types of rectifiers, converters, Choppers, Inverters etc.
4. Choose power electronic device for given industrial application

5. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentat n& Testing	Engg. Practices for Society,Sustai nability & Environment	Project Management	Life -long Learning
CO1							2
CO2	2		3		3	1	2
CO3	1					2	2
CO4	2	2		2		3	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	
CO2	3	
CO3	3	2
CO4	3	2

6. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Th**	**CO**	
1. POWER ELECTRONIC DEVICES	**21**	**16**	**CO1 CO2 CO3 CO4**	**L1,2 ,3**
1.1 Schematic, symbol, working and characteristic of SCR, DIAC, TRIAC, LASCR, UJT, PUT.				
1.2 Two transistor model of SCR, turn on-turn off characteristics of SCR,V-I characteristic of SCR Triggering methods: Voltage triggering, Gate triggering, dv/dt triggering, light triggering.				
1.3 Pulse triggering circuits using UJT & PUT				
1.4 Commutation: types & working of commutation(A ,B,C,D,E and F type) (no waveforms)				
1.5 Protection of Power Electronic Device: Snubber circuit, gate protection and over current protection				
2. PHASE CONTROLLED CONVERTERS	**15**	**06**	**CO1 CO2 CO3 CO4**	**L1,2 ,3,4**
2.1 Working of half wave controlled converters with R, RL & RL with freewheeling diode. (input and output voltage waveforms only)				
2.2 Working of full wave Bridge controlled converter with R and RL load, Three phase half wave controlled converter with R load (input and output voltage waveforms only)				
3. CHOPPERS AND SWITCHING MODE REGULATORS	**09**	**06**	**CO1 CO2**	**L1,2 ,3,4**
3.1 Operation of Single thyristor chopper and two thyristor chopper.			**CO3**	
3.2 Circuit diagram and working of Buck and Boost regulators.			**CO4**	
4. INVERTERS ,UPS AND SMPS	**15**	**08**	**CO1**	
4.1 Definition, classification of inverters, Single phase half and full bridge inverter with R load, Series and parallel inverter.			**CO2 CO3**	
4.2 Block diagram of UPS (on-line and off-line), Comparison between Online and Offline UPS, Block diagram of SMPS.			**CO4**	
5. AC CONTROLLERS AND CYCLOCONVERTERS	**15**	**12**	**CO1 CO2**	**L1,2 ,3,4**
5.1 Working of On-Off and Phase Controlled AC voltage controllers, single phase unidirectional and bidirectional AC Voltage controllers with R load (fully controlled).			**CO3 CO4**	
5.2 Principle of operation of cycloconverter, single phase to single phase ste cycloconverter (F/2) (mid-point &bridge configuration) (circuit with waveforms), Applications of Cycloconverters (to list).				
Total	**75**	**48**	**-**	

7. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**POWER ELECTRONIC DEVICES**	16	21
2	**PHASE CONTROLLED CONVERTORS**	06	15
3	**CHOPPERS AND SWITCHING MODE REGULATORS**	06	09
4	**INVERTERS ,UPS AND SMPS**	08	15
5	**AC CONTROLLERS AND CYCLOCONVERTERS**	12	15
	Total	**48**	**75**

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (MIN 8)

No	Practical	Marks
1.	To study V-I characteristic of SCR	
2.	To study V-I characteristic of UJT	
3.	To study V-I characteristic of DIAC and TRIAC	
4	To study V-I characteristic of PUT	
5.	To study the Resistance triggering and Resistance Capacitance triggering of SCR	
6.	To study pulse triggering using UJT and PUT firing circuits	
7.	To study of Half wave controlled rectifier using R load	
8.	To study of Full wave controlled rectifier using R load	
9.	To study of Series and Parallel inverter using SCR	
	Total	
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Mohammed H. Rashid	Power Electronics	Prentice Hall of India, New Delhi
2	Bhimbhra P.S	Power Electronics	Khanna Publishers New Delhi
3	PC Sen	Power Electronics	McGraw Hill Education Private Limited,India

(EX 403) 8051 Microcontroller

1. AIM:

To learn the architecture and features of the 8051 microcontroller and interface and program it for various applications.

2. COURSE OBJECTIVES:

Students will be able to:
1. Understand the architecture and features of 8051 microcontroller
2. Interface 8051 microcontroller systems to peripherals and I/O devices
3. Program 8051 microcontroller for various applications

3. PRE-REQUISITES:

Students should have the knowledge of:
1. Number systems
2. Digital electronics
3. Programming concepts

4. TEACHING AND EXAMINATION SCHEME

Semester	IV								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(EX403)		L	T	P	C	TH	TM	TW	PR/OR	
8051 Microcontroller		3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, students will be able to:
1. Recall and explain the features of 8051 microcontroller and contrast between microcontrollers & microprocessors
2. Classify and interpret 8051 assembly language instructions
3. Develop, execute and debug assembly language programs for various applications
4. Interface 8051 microcontroller with external hardware for various applications

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Developm ent of	Engg. Tools, Experime ntation &	Engg. Practices for Society, Sustainabi	Project Managem ent	Life -long Learning
CO1	2	2	3	0	0	0	3
CO2	0	0	3	0	0	0	3
CO3	0	3	3	3	3	3	3
CO4	2	3	3	2	3	3	3

Relationship : Low-1 Medium-2 High-3

Mapping Course Outcomes with Program Specific Outcomes

	PSO1	PSO2
CO1	3	0
CO2	2	0
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1 Introduction to microcontrollers and 8051 microcontroller			**15**	**09**	**CO1**	**L1, L2**
1.1 Definition of embedded system, use of microcontrollers in embedded systems						
1.2 Difference between Harvard and Von Neumann architecture, microcontroller and microprocessor						
1.3 Advantages of microcontroller-based systems						
1.4 Architecture of 8051, it's pin functions, clock and oscillator						
1.5 Memory organization of 8051 – RAM, ROM, SFRs, flags; connections to external memory						
1.6 Ports of 8051 – registers, I/O configuration, features						
2 8051 additional built-in hardware and control			**18**	**11**	**CO1**	**L1, L2**
2.1 Timers/Counters – registers, modes of operation, configuration						

2.2 Interrupts – types (external & internal), priority, registers, configuration, interrupt-handling, interrupt service routine, ISR vector addresses				
2.3 Serial I/O – registers, configuration, serial data transfer operation				
3 Assembly language instructions for 8051 microcontroller	**12**	**08**	**CO2**	**L1, L2**
3.1 Addressing modes				
3.2 Assembly language instructions – data move, arithmetic, logical, branching, bit-wise				
4 Assembly language programming for 8051 microcontroller	**18**	**12**	**CO3**	**L2, L3, L4**
4.1 Programs using assembly language for the following: Data transfer between internal memory locations, data transfer to/from external memory, writing data to and reading data from ports Binary arithmetic (binary addition, subtraction, multiplication, division), BCD addition Logical operations Bit-wise operations Branching operations Subroutines, time delay subroutines, interrupt subroutines **(Students to be examined on assembly language programs that can include a combination of any instructions.** **Minimum instruction set should be provided to students during the examination)**				
5 Interfacing external hardware to 8051 microcontroller	**12**	**08**	**CO4**	**L2, L3**
5.1 Hardware connections and programs to interface the following to the 8051 microcontroller: LED and seven-segment display, LCD (Only interface diagram, no program for LCD) Switch and matrix keyboard Stepper motor IR sensor				
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies, laboratory practical, etc.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to microcontrollers and basics of 8051 microcontroller	09	15
2	8051 additional built-in hardware and control	11	18
3	Assembly language instructions for 8051 microcontroller	08	12
4	Assembly language programming for 8051 microcontroller	12	18
5	Interfacing external hardware to 8051 microcontroller	08	12
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Minimum FIVE - List 1	
1.	Program to add, subtract, multiply and divide two numbers	
2.	Program to add N binary numbers	
3.	Program to add BCD numbers	
4.	Program to transfer N data bytes within memory	
5.	Programs to implement logical instructions AND, OR, XOR, NOT	
6.	Program to implement logical instructions to swap and rotate data	
7.	Program to determine the largest/smallest binary number	
	List 2	
8.	Hardware interface of 8051 board to LEDs and assembly language program for blinking LEDs using bitwise instructions and software time delay routines	
9.	Hardware interface of 8051 board to LEDs and assembly language program for blinking LEDs using timer	
10.	Hardware interface of 8051 board to stepper motor and assembly language program to drive stepper motor	
11.	Hardware interface of 8051 board to LCD and assembly language program to display data on LCD	
	Total	25
No	**Class room Assignments**	**Marks**
	Atleast 02 assignments	
No	**Tutorial Exercise**	**Marks**
	To be decided by the subject teacher	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Muhammad Mazidi, Janice Mazidi, Colin McKinlay	The 8051 Microcontroller and Embedded Systems	Pearson
2	Kenneth Ayala	The 8051 Microcontroller	Cengage Learning

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Myke Predko	Programming and customizing the 8051 Microcontroller	McGraw-Hill

(EX404) MAINTENANCE AND CIRCUIT SIMULATION USING COMPUTER AIDED DESIGN AND DRAFTING

1. AIM

The aim of this course is to develop required skills in the students so that they are able to:
1. Maintain the electronic circuits of various equipment
2. Design a Printed Circuit Board
3. Simulate a given circuit using EDA tools.

2. COURSE OBJECTIVES

The students will able to:
1. Develop skills to maintain basic electronic circuitry used in consumer goods segments
2. Design a Printed Circuit Board
3. Simulate electronic circuits using EDA tools.

3. PRE-REQUISITES:
1. Basic electronic circuits and their expected operation and output.
2. Basic soldering skill

4. TEACHING AND EXAMINATION SCHEME

Semester IV									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX 404)	L	T	P	C	TH	TM	TW	PR/OR	
MAINTENANCE AND CIRCUIT SIMULATION USING CADD	-	-	4	4	-	-	50	50	100

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Test various electronic components
2. Use test & measurement equipment to find faults and maintain electronic circuits
3. Use EDA tools for designing a Printed Circuit Board
4. Use EDA tools for design, simulation and analysis of electronic circuits.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	2	2	1	2	0	0	0
CO2	3	3	1	3	0	0	0
CO3	2	0	3	1	2	0	2
CO4	2	2	2	0	0	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	0
CO2	3	1
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**	**Levels**
1. Testing of Electronic Components		**14**	**1,2**	**L1, 2,3**
1.1 Standard values and ratings of resistors and capacitors				
1.2 Reading of datasheets (IC 741, 555, 723)				
1.3 Testing of passive components- Cold testing of resistors, capacitors, switches, fuses, connectors, inductors, relays, transformers, crystals				
1.4 Testing of active components- Diodes, BJTs, JFETs, MOSFET's, SCR, DIAC,TRIAC, Displays using LED and Opto electronics components, ICs				
2. Testing and Maintenance of Electronic Circuits (Use multimeter)		**10**	**1,2**	**L1, 2,3**

2.1 Measurement of A.C. and D.C. voltage				
2.2 Continuity test of PCB track, wiring, switch etc.				
2.3 Inspection of solder joints, defects of soldered joints, defects of soldered joints, use of soldering gun, desoldering tools and rework station.				
2.4 Maintenance of any two home appliances				
3. PCB Design		**18**	**3,4**	**L1, 2,3 ,4**
3.1 Prepare components for soldering, soldering and de- soldering techniques.				
3.2 Exposure to computer aided PCB making (layout from given schematic)				
3.3 Design of PCB (any electronic circuit) using the automated layout.				
3.4 Concept of machine soldering, SMD soldering (could be imparted though online videos)				
4. Circuit building and debugging using EDA tools		**11**	**3,4**	**L1, 2,3**
4.1 Introduction to EDA tools and need for the same				
4.2 Simulation of simple R/RC/RLC networks				
4.3 Simulate a power supply circuit for specified I,V,P rating				
4.4 Simulation of summer/ averaging)/ comparator/ zero crossing detector/ Schmitt trigger/ integrator/differentiator using opamps				
5. Circuit simulation and documentation using EDA tools		**11**	**3,4**	**L1, 2,3**
5.1 Simulation of an astable multivibrator				
5.2 Simulation of a RC amplifier				
5.3 Simulation of an oscillator				
5.4 Simulation of a controller based circuit for specified application				
5.5 Prepare documentation i.e circuit diagram, bill of material, and specification table for any of the simulated circuit.				
5.6 Drafting and modification of piping and instrumentation diagrams. (AutoCAD 3D plant may be used)				
Total	**----**	**64**		

NOTE 1: For units 3,4 and 5, the student may use software tools like Orcad, Eagle ,TINA, Matlab, Labview, Autocad(P&ID), Automation Studio, Multisim, Proteus or any other suitable suite.

NOTE 2: The practical examination for CADD (50) will be based on the simulations carried out using EDA tools.
Term work marks (50) may be distributed for performance in testing electronic components and fabricating the PCB.

8. COURSE DELIVERY:
The course will be delivered through lab sessions, study videos, group interactions, exercises and case studies.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Testing of Electronic Components	14	--
2	Testing and Maintenance of Electronic Circuits	10	
3	PCB Design	18	
4	Circuit building and debugging using EDA tools	09	
5	Circuit simulation and documentation using EDA tools	13	
	Total	64	

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Hours
1.	Explore datasheet of any three electronics components/analog/ Digital IC's.	04
2	Testing of passive components- Cold testing of resistors, capacitors, switches, fuses, connectors, inductors, relays, transformers, crystal	04
3	Testing of active components- Diodes, BJTs, JFETs, MOSFET's, SCR, DIAC,TRIAC	04
4	Testing of Displays using LED and Opto electronics components, ICs	02
5	To test continuity of PCB tracks, identify solder defects and rectify faults where possible	02
6	Maintenance/repair (if possible) of any two home appliances	08
7	Study of soldering and de-soldering techniques	02
8	Study of any computer aided PCB making (layout from given schematic)	08
9	Design of a PCB of any electronic circuit	08
	The following circuits may be simulated using any suitable EDA tool	0
10	Introduction to EDA tools and need for simulation Simulation of simple R/RC/RLC networks	02
11	Simulate a power supply circuit for specified I,V,P rating	01
12	Simulation of a summer/ averaging/ comparator/ zero crossing detector/ Schmitt trigger / integrator/ differentiator using opamps	06
13	Simulation of an astable multivibrator	02
14	Simulation of a RC amplifier	02
15	Simulation of an oscillator	02
16	Simulation of a controller based circuit for specified application	03
17	Prepare documentation i.e circuit diagram, bill of material, and specification table for any of the simulated circuit.	02
18	Use AutoCAD 3D plant to draft and modify piping and instrumentation diagrams.	02
	TOTAL HOURS	64

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Singh K. Sudeep	Troubleshooting and Maintenance of Electronics Equipment	Katson Book, New Delhi, Reprint 2014
2	Khandpur R. S	Troubleshooting Electronic Equipment: Includes Repair and Maintenance	Tata McGraw-Hill Education, New Delhi, India

(EX 405) Linear Integrated Circuit

1. AIM: To introduce students to working and applications of different Linear ICs.

2. COURSE OBJECTIVES

The students will able to:

1. Analyse the working of a given OPAMP based circuits.
2. Develop simple circuits using Linear ICs.

PRE-REQUISITES

Students should have the knowledge of:

1. Working of basic electronic Circuits.
2. Use of electronic equipment like Multimeter, CRO and function generator.

4. TEACHING AND EXAMINATION SCHEME

Semester IV									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX 405) Linear Integrated Circuit	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the parameters of various IC's and working of application circuits.
2. Apply knowledge of IC's to build op-amp, 555 timer and regulator based circuits.
3. Analyze op-amp, 555 timer and regulator based circuits.
4. Compare and select appropriate IC based circuit for specific application.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	2	2	1	0	0	3
CO2	3	2	1	2	0	1	2
CO3	3	3	2	2	1	1	2
CO4	2	2	2	1	1	1	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1

Note:- IC Pin diagrams should not be asked in theory examination

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Level**
1Introduction to operational amplifiers			**12**	**8**	**CO1**	**L1,L 2**
1.1 Integrated circuit –List of IC Classification List of IC Packages.						
1.2Advantages of IC over discrete components						
1.3 Op-amp—Block diagram and function of each block						
1.4 Symbol and equivalent circuit of op-amp Pin configuration of IC741.						
1.5 Characteristics of ideal and practical Op-amp.						
1.6 Op-amp Parameters(only definition)- I/p offset voltage, I/p offset current, I/p bias current, o/p offset voltage, input impedance, output impedance, bandwidth, CMRR, slew rate.						
2 Op-amp configuration			**9**	**6**	**CO1 ,CO**	**L1,L 2**

			2	
2.1 Concept of Negative feedback				
2.2 Voltage series feedback amplifier- block diagram, circuit diagram , expression for voltage gain.(No derivation)				
2.3 Voltage shunt feedback amplifier- block diagram, circuit diagram, expression for voltage gain. (No derivation)				
2.4 Numerical problems based on voltage gain equation				**L3**
3 Applications of Op-Amp	**21**	**12**	**CO1 CO2**	**L1,L2**
3.1 Inverting Op-amp as summing, scaling , averaging amplifier			**CO3**	
3.2 Subtractor			**CO4**	
3.3 Voltage to current convertor (with grounded load only)				
3.4 Current to voltage convertor				
3.5 Integrator				
3.6 Differentiator				
3.7 Voltage comparators: Non-inverting with positive and negative reference				
3.8 Clippers: Positive with positive and negative reference				
3.9 Clampers : Non-inverting with positive reference				
4.0 Waveform generators and Filters	**15**	**10**	**CO1 CO2**	**L1,L2**
4.1 Op-amp Wein bridge oscillator			**CO3**	**L4**
4.2 Op-amp as Astablemultivibrator			**CO4**	
4.3 Triangular waveform generator.(Using 4.2)				
4.4 Concepts of active filters, comparison of active & passive filters				
4.5 Butter worth low pass filter (1st order only)				
4.6 Butter worth high pass filter (1st order only)				
4.7 Simple numerical problems on above filters.				**L3**
5 Special function ICs	**18**	**12**	**CO1 CO2**	**L1, L2**
5.1 Block diagram of IC 555 and its pin configuration/ functionality			**CO3**	
5.2 IC555 as Astablemultivibrator			**CO4**	**L4**
5.3 IC555 as Monostablemultivibrator				
5.4 Numerical problems (no derivations)				**L3**
5.5 Voltage regulators performance parameters of a regulator – load & line regulation and ripple rejection				
5.6 Salient features of three pin regulators, IC78XX series and IC79XX series fixed voltage regulators.				
5.7 Adjustable Positive voltage regulator using LM317: Circuit diagram, working, Output voltage equation (No derivation)				
5.8 VCO IC 566 block diagram and list of applications				
Total	**75**	**48**	**-**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to operational amplifiers	8	12
2	Op-amp configuration	6	9
3	Applications of Op-Amp	12	21
4	Waveform generators and Filters	10	15
5	Special function ICs	12	18
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Determine the op-amp parameters	
2.	Determine the gain of Inverting and Non-inverting amplifier using op-amp and compare it with theoretical gain.	
3.	Verify the operation of adder and subtractor circuit.	
4.	Verify the working of active integrator and differentiator circuits.	
5.	Assemble and test V to I converter.	
6.	Verify the working of Comparator	
7.	Assemble and test Clipper circuit.	
8.	Assemble and test Clamper circuit.	
9.	Assemble and test first order filter.	
10.	Assemble and test astablemultivibrator using OPAMP	
11.	Assemble and test a multivibrator circuit using IC 555.	
12.	Assemble and test a IC fixed voltage regulator	
13	Assemble and test an Adjustable positive voltage regulator	
14	Test a VCO.	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	RamakantGayakwad	Op-Amps and Linear Integrated Circuit	Pearson Education
2	K.R. Botkar	Integrated Circuit	Khanna

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	David A.Bell	Op-amp & Linear ICs	Prentice Hall of India
2	Dr.Y. Venkataramani	Linear Integrated Circuits & Applications	ISTE

(EX406) Electronic Measurement and Instrumentation

1. AIM:-Provide knowledge of measurements and measuring instruments and also to gain knowledge of various sensors for different physical parameters.

2. COURSE OBJECTIVES: To explain basic concepts and definitions in measurement systems and to identify various parameters measurable in electronics instrumentation.

The students will able to:

1. Employ appropriate instruments to measure a given set of parameters.

2. Deep understanding about blocks in various instruments used in practicals.

3. Identify various sensors that will be useful in measuring different parameters in industry

3. PRE-REQUISITES: --

4. TEACHING AND EXAMINATION SCHEME

Semester	**IV**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(EX 406) Electronic Measurement and Instrumentation		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**150**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the working of analog and digital instruments and transducers
2.Classify different types of errors in measurements
3.Use appropriate instrument/bridges for measurement and testing of electronic circuits
4. Compare and select appropriate transducer/ instrument for specific application

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit	Project Managem ent	Life -long Learning
CO1	3	2	3	0	0	2	3
CO2	3	2	2	2	0	2	3
CO3	3	2	2	2	0	2	3
CO4	2	3	3	3	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1 Basics of Measuring Instruments			**9**	**6**	**1,2**	**1,2**
1.1 Static Characteristics- Accuracy, Resolution (only Definitions)						
1.2 Dynamic characteristics- Speed of response, Lag, Fidelity						
1.3 Error: Systematic, Limiting Errors, numerical on error calculation,systematic and limiting errors.						
1.4 Construction and working of PMMC movement, Block Diagram of Analog Multimeter, Digital Multimeter.						
2 Generators, Bridges and Display			24	15	**3**	**1,2**
2.1 Oscilloscope – Block Diagram of CRT and CRO, Types of CRO- Dual trace , DSO						
2.2 Block Diagram of Function Generator						
2.3 Block Diagram of Basic Spectrum Analyzer						
2.4Bridges : Wheatstone, Maxwells, Schering, Weins Bridge,along with numerical for each type of bridge.						**3**
2.5 Digital Display- working of LED and LCD						
3 Instrumentation System and Transducers			18	12	**1**	**1,2**
3.1 Block Diagram of Instrumentation System and their functions						

3.2 Transducer – Characteristics, classification(Active and Passive, Analog and Digital)				
3.3Resistive Transducer – Potentiometer, Strain Gauge(Bonded and Semiconductor), RTD,Thermistor.				
3.4 Inductive Transducer : LVDT				
3.5 Capacitive Transducer – Varying of distance, area, permittivity				
3.6Piezoelectric Transducer – Principle and material used.				
3.7 Optical Transducer : Construction and characteristics of LDR, Photodiode, phototransistor				
3.8 Digital Transducer : construction and working of Shaft Encoders				
4 Applications of Transducers	15	8	**4**	**1,2 ,3**
4.1 Displacement Measurement – Linear and angular displacement using Resistive , Capacitive and Inductive Transducer				
4.2 Angular Speed Measurement – Photoelectric pickup, magnetic pick up				
4.3 Pressure Measurement – Diaphragm with strain gauge				
4.4 Level Measurement - Float operated resistive method				
4.5 Flow Measurement : Turbine Meter				
5 Application of Instrumentation Systems	9	8	**4**	**1,2 ,3**
5.1 signal conditioning – Need for Signal Conditioning, Block Diagram of AC and DC				
5.2 Block Diagram and applications of the following: • Data Acquisition System • Process Control • SCADA				
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Basics of Measuring Instruments	6	9
2	Instrumentation System and Transducers	15	24
3	Instrumentation System and Transducers	12	18
4	Applications of Transducers	9	15
5	Application of Instrumentation Systems	6	9
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Measurement of current, voltage and resistance using PMMC meter	
2	Measurement of current, voltage, frequency and time period using CRO	
3	Testing of Wheatstones Bridge	
4	Testing of Maxwells bridge	
5	Temperature measurement using RTD	
6	Displacement measurement using LVDT	
7	Weight measurement using strain gauge bridge	
8	speed measurement of motor using photo electric pickup	
9	Liquid level measurement	
10	study of light sensors, photo transducers, Piezo electric transducer	
	Total	25
	Class room Assignments	**Marks**
	At least 02 assignments to be given on relevant topics	
No	**Tutorial Exercise**	**Marks**
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Cooper	Electronic measurement and instrumentation	Prentice Hall
2	H. S. Kalsi,	Electronic measurement and instrumentation	McGraw Hill India
3	A.K. Sawhney,	Electrical & Electronic Measurement and Instrumentation	Khanna Publishers, Delhi

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Curtis Johnson,	Process Control Instrumentation technology	Pearson/Prentice Hall
2	Murty, D.V.S.,	Transducers and Instrumentation	Prentice Hall of India, New Delhi,
3	Doeblin,	measurement Systems: Application and Design	McGraw Hill India

SEMESTER V

(TR 501) Industrial Training

1. AIM

To expose & prepare the students for the Industrial work situation. This exposure and hands on experience will further enhance the prospects of student fraternity to be better placed on completion of their course.

2. COURSE OBJECTIVES:

The students will able to:

i. Understand functions of various departments of the industry while working in the industry.
ii. Observe & familiarize with features of raw materials, machines, tools,products & processes of the particular industry
iii. Work in the team to develop teamwork, leadership & communication skills
iv. Develop technical skills as well as soft skills

3. PRE-REQUISITES:

i) Basic Engineering Skills

4. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(TR 501) Industrial Training	L	T	P	C	TH	TM	TW	PR/OR	Grade
	-	-	0	0	-	-	-	-	

08 Weeks

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the organizational set up & functions of various departments in the industry
2. Apply the knowledge gained in the institute to correlate with the actual processes in the industry &Compile relevant data in the form of a report.
3. Develop leadership, teamwork & communication skills while having hands on experience in the industry

4. Demonstrate consciousness towards safety & environment by adapting to the rules & regulations of Industry

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	2	1	2	2	3	3	3
CO2	3	3	2	3	3	3	3
CO3	1	2	2	2	3	3	3
CO4	1	2	1	2	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

1.1 Students are required to study and have hands-on experience wherever possible in the following areas (depending on availability):

- Company Profile
- Organizational Structure
- Company Product Range
- Manufacturing Facilities Available /Services provided
- Plant / Facility Layout
- Operations / Production Processes
- Production Planning and Control
- Detail study of Latest Equipment/ Technologies Used
- Stores Functions
- Material Handling Systems/ Equipment
- Quality Management Systems / Functions
- Maintenance and Repair Practices
- Safety Practices / Safety Equipment
- Utilities
- Logistics
- Sales and Marketing

- Ethics, Statutory Rules and Regulations followed
- Product Design and Development
- Any other area specific to the Industry providing Training

8.TERM WORK & PRACTICALS

Evaluation Scheme					
TW				**PR/OR**	TOTAL Marks
Attendance Marks*	Industrial Mentor's assessment Marks	Institute Mentor's assessment Marks	Training Report	Report Assessment & Seminar/Viva	
10	**20**	**20**	**20**	**30**	**100**

* 01 mark shall be deducted for every Absence (with or without permission).

Daily Dairy:

The daily dairy should-be maintained in a book. It should reflect the day to day activities performed by the student (including task, men and materials involved). It should be counter signed by the Industry Mentor. It will become the basis for writing reports on the complete training.

Training Report

The training report should be submitted by the training students should include the following salient points- Certificate from institute, Certificate of training from company, detailed write up as per daily dairy, detailed drawings, working drawings, photographs, safety precautions, techniques for work minimization on site, organizational chart, Importance of project to the society, special methods/techniques/equipment should be separately high lightened, including environmental aspects. The report should be informative and technical, typed with double spacing on good quality bond paper and bound. Assessment of Training Report be based on Knowledge, Presentation, Quality of contents and Sketches.

Note:

a. Student/s undergoing Industrial Training shall follow Rules and Regulations of the Industry.

b. Industrial Training will generally be organized and conducted in accordance with Industrial Training Manual duly prescribed by the Board.

9. SUGGESTED SPECIFICATION TABLE WITH MARKS & HOURS

Unit No	Name of the Unit	Teaching Hours	Marks
1	**PR/OR**	**08 weeks**	**30**
2	**TW**		**70**
	Total	**08 weeks**	**100**

Note:

1. For Industrial training Grades will be awarded based on marks scored as follows:

80% and above Marks – Grade 'A'
60% to 79% Marks – Grade 'B'
40% to 59% Marks – Grade 'C'
Marks below 40% - Grade 'D'

2. TW and PR/OR shall be separate heads of passing. Student has to secure minimum Grade 'C' for passing.

(CC501) ENTREPRENEURSHIP DEVELOPMENT

1. **AIM:** Student will able to start his own venture with all fundamentals of business.
2. **Rationale:**

   Today Entrepreneurship is given importance by the government to bring the youth of our country to overcome the problem of unemployment and bring them in the main stream of global business to strengthen Indian economy by Make in India philosophy. Government has announced various financial schemes for young youth and women to support them for setting up an enterprise. To fulfill this, youth are to be prepared for setting an enterprise. The students undergoing this course will be develop entrepreneurial traits and confidence within themselves and choose entrepreneurship as a career to brighten their future.

3. **PRE-REQUISTES:** Maths

4. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Ttal Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CS501 Entrepreneurship Development	**L**	**T**	**P**	**C**	**-**	**-**	**PR/OR**	**TW**	25
	-	-	2	2	-	-	-	25	

Minimum passing % Practical 40%

4. COURSE OUTCOMES:

   1. CO1 Classify the type of entrepreneur and enterprises
   2. CO2 Understand basic financial terms and market research
   3. CO3 Identify legal formalities required for Business.
   4. CO4 Examine the project report for new enterprise.

5. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability& Environment	Project Management	Life -long Learning
CO1	0	1	2	0	2	3	3
CO2	3	2	2	0	3	0	0
CO3	0	1	2	0	0	0	2
CO4	3	2	2	0	2	0	2

Relationship : Low-1 Medium-2 High-3

Mapping Course Outcomes with Program specific Outcomes

	PSO1	PSO2
CO1	0	2
CO2	0	2
CO3	0	2
CO4	0	2

6. DETAILED COURSE CONTENTS

M=Marks	Thr= Teaching hours	CO – Course Outcomes				
Unit			M	Thr	CO	Level
1 Entrepreneurship Development			3	4	CO1	2
1.1 Introduction to Entrepreneurship Development (EDP): Need						
1.2 Entrepreneur definition , Types of Entrepreneur, Characteristics of entrepreneur and entrepreneurship						
1.3 Enterprises: Micro, Small and Medium Enterprises (MSME), Service industry, Manufacturing Industry, Franchises and Start up.						
2. Identification of business opportunity			5	6	CO2	3
2.1 business ideas- Exploring business ideas in terms of marketability, technical feasibility ,financing and authorities						
2.2 Business terms – Clients, vendors market description, demand, supply, banking, & non-banking, financing companies, Loans of various types, GST, peers Promoters, Lenders, Consortium.						
3. Market Research			3	4	CO2	3
3.1 Data Collection – Data collection of Business idea such as Number of players, Total demand, Total supply,						
3.2 Analysis of Data- Analysis of data and projection of data with respect to various factor (such as GDP, Climate etc through case studies).						
3.3 Questionnaire – Preparing a questionnaire for business idea to assess business opportunity.						
4. Legal Aspect			8	10	CO3	3
4.1 Legal Financial Term- Know the various terms such as Resources, Assets, Liabilities, Advances, Depreciations, Investments, Fixed Capital, Working Capital (cash credit), Employee Cost, Miscellaneous Expense, Other						

Income, Profit & Loss Statement, Cash Flow Analysis, and Balance Sheet.				
4.2 Legal Aspects- Procedure for Registration with various government agencies GST, PAN, Slabs of Income Tax.				
4.3 Business Analyses 1) Swot Analysis 2) Break – Even Analysis 3) Exit Plan				
5. Project Report	6	8	CO4	4
Need for project report, Importance of Project report, Scope of project report: Economic aspects, Technical aspects, Financial aspects, Managerial aspects, Production aspects. List the contents of a project report. Proforma of a project report which includes:-Introduction, Schemes, Profitability and Projections, Infrastructure, Break Even Point, Names and Addresses of suppliers, remarks.				
Project Profile. Project appraisal criteria:- Technical feasibility, Financial feasibility, Economic viability, Commercial viability, Managerial competency, Political and Labour considerations				
Total	25	32		

7. COURSE DELIVERY:

Videos / Lectures/ Practicals /Expert lectures / Industry visits

8. SPECIFICATION TABLE FOR PRACTICALS

Unit No.	Topic	Teaching Hours/ Semester	MARKS
1	**Entrepreneurship Development**	4	3
2	**Identification of business opportunity**	6	5
3	**Market Research**	4	3
4	**Legal Aspect**	10	8
5	**Project Report**	8	6
TOTAL		**32**	**25**

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICAL HOURS

No	**Classroom Assignments**	**Marks**
1.	Prepare a Case Study on leading enterprise	**3**
2.	Prepare a Case Study on small scale unit	**3**
3.	Prepare a report on various government schemes for startup.	**4**
4.	Prepare SWOT analysis for a new business idea.	**5**
5.	Prepare Project Report for a new business idea.	**10**

10. LEARNING RESOURCES

S.No.	Author	Title of Books	*Publisher*
1.	*Sharadjawadekar, shobhadodlani,*	*Business entrepreneurship*	*Suvicharprakashanmandalpune,*
2.	*S.S. Khanna*	*Entrepreneurship development*	*S. Chand & Co. Ltd, New Delhi,*
3.	*Vasant Desai*	*Management of small Scale Industry in India*	*Himalaya Publishing House*
4.	*DilipSarwate*	*Entrepreneurial development Concepts and practices*	*Everest Publication House, Pune*
5.	*CB Gupta and P Srinivasan*	*Entrepreneurship Development*	*S. Chand and Sons,* *New Delhi*

(EX 501) PROGRAMMABLE LOGIC CONTROLLERS (PLC)

1. AIM
1. To introduce students to PLC Hardware and programming concepts

2. COURSE OBJECTIVES / RATIONALE:
The students will able to:
1. To understand working of a PLC based System.
2. Write simple programs using ladder symbols and functional blocks.

3. PRE-REQUISITES:
Students should know
1. Working of Digital Circuits like Shift Registers, Counters, ADC and DAC.
2. Working of a Relay and Power electronic devices like Diac and Triac.

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX 501) PROGRAMMABLE LOGIC CONTROLLERS (PLC)		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

5. COURSE OUTCOMES:
On successful completion of the course, the student will be able to:
1. Describe the hardware and I/O interface of PLC system.
2. Describe the procedures to commission and test PLCs in Industrial Automation Systems.
3. Develop and troubleshoot ladder programs for PLCs.
4. Design a simple automated system using PLCs.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CO1	2	0	1	0	0	2	2
CO2	2	2	1	2	2	3	3
CO3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	2	1
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1. PLC HARDWARE	**18**	**12**	**CO 1**	**L1,L2**
1.1 Introduction: Definition, Features, Advantages, Applications				
1.2 Types of PLC : Single box & Modular, Small, Medium and Large PLC				
1.3 PLC system: General Block diagram, Internal architecture (block diagram): CPU, Buses & Memory.				
1.4 Input and output: Types of I/O signals – Analog, Digital and Discrete Types of I/O Connections – Sourcing and Sinking Input Units: DC input unit, AC input Unit and Analog input Unit. Output Units: Basic forms of Relay output unit, transistor output unit and Triac output unit. I/O Addressing: The general format of an I/O address.				
2. PLC Instructions and Functional Blocks	18	12	**CO 3** **CO 4**	**L2** **L3**
2.1 PLC ladder diagram conventions, rules, standard IEC 1131-3 symbols.				
2.2 Data handling instructions – Data movement (MOV), Data comparison (EQUAL, NOT EQUAL, LESS THAN, LESS THAN OR EQUAL, GREATER THAN, GREATER THAN OR EQUAL, MASKED COMPARISON FOR EQUAL, LIMIT TEST)				
2.3 Mathematical instructions(ADD, SUBTRACT, MULTIPLY,				

DIVIDE, SQUARE ROOT)				
2.4 SET and RESET Instructions				
2.5 Subroutine: call to subroutine, return to main program				
2.6 Shift registers: Introduction, function, (SHIFT LEFT, SHIFT RIGHT, SHIFT 1 BIT AND 4 BIT AT A TIME).				
2.7 Internal Relays: Function of internal relays, Addressing of internal relays, battery backed relays, master control relay.				
3. TIMERS & COUNTERS	12	8	**CO 3 CO 4**	**L2 L3**
3.1 Timers: Function and list of applications of On-delay timers, Off-delay timers, Retentive Timers, Non retentive Timers, Pulse timers, Cascaded timers.				
3.2 Timer Parameters: Preset value, Time base, Total time delay, Significance of Timer timing and Timer Out.				
3.3 Counters: Function and list of applications of Up and Down counters.				
3.4 Counter Parameters: Preset value, Accumulated Value, Clock Input and counter Overflow and Underflow indications				
4. PROGRAMMING a PLC	15	8	**CO 3 CO 4**	**L3 L4**
4.1 ladder programs to represent logic functions (AND, OR, NOT, NAND, NOR, XOR)				
4.2 ladder programs for switches, latching circuits, multiple outputs and sequenced outputs				
4.3 Ladder programs and functional block diagrams from boolean expressions(POS, SOP)				
4.4 Simple Ladder programs using data handling and mathematical instructions.				
4.5 Simple Ladder programs using internal relay, master control relay and shift register.				
4.6 Simple Ladder programs using timers and counters				
5. DESIGNING SYSTEMS	**12**	**8**	**CO 2**	**L1,L2**
5.1 Brief overview of steps in systematic designing of a PLC based System.				
5.2 Safety in PLCs – emergency stop relays.				
5.3 Commissioning a PLC – Testing of inputs & outputs, Testing Software, and Simulation.				
5.4 Fault finding: Fault detection techniques – timing checks, last output set, replication and expected value checks.				
5.5 Brief overview of System documentation.				

8. COURSE DELIVERY:
The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	PLC HARDWARE	12	18
2	PLC INSTRUCTIONS AND FUNCTIONAL BLOCKS	12	18
3	TIMERS & COUNTERS	08	12
4	PROGRAMMING A PLC	08	15
5	DESIGNING SYSTEMS	08	12
		48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Introduction to the PLC simulation software.	
2.	Compare Specifications of different PLCs	
3.	Ladder programming for logical functions	
4.	Ladder programming for latching functions	
5.	Ladder programming for data manipulation functions	
6.	Ladder programming for mathematical functions	
7.	Ladder programming for shift registers functions	
8.	Ladder programming for internal relay and master control relay functions.	
9.	Ladder programming for timer functions	
10.	Ladder programming for counter functions	
11.	Micro Project (simple Application)	
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments.	
...		
No	**Tutorial Exercise**	**Marks**
1	To be decided by the subject teacher as per requirements	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	William Bolton	Programmable Logic Controllers 5th Edition	ELSEVIER, Newnes. ISBN:978-93-80501-46-8
2	Frank D Petruzella	Programmable Logic Controllers 3rd Edition	McGraw Hill Higher Education or TMH

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Madhuchhanda Mitra, Samarjit Sen Gupta	PLC & Industrial Automation an introduction 5th Edition	PENRAM International publishing ISBN:9788187972297
2	John W. Webb, Ronald A. Reis	Programmable Logic Controllers: Principles and Applications 5th Edition	Prentice Hall of India ISBN :978-8120323087
3	George Batten	Programmable Logic Controllers.	Tata McGraw Hill

(CC601) INDUSTRIAL ORGANISATION AND MANAGEMENT

1. AIM : To acquaint the students with management and other related aspects in order to achieve the organisational goals.

2. RATIONALE

Management is the basic need of any organization. Organization consists of multiple activities which are to be systematically managed for effective output. The course covers various principles related to organization and management. The areas covered are finance, human resource, project management etc. After completion of the course, the student will be able to apply the knowledge in the world of work.

3.PRE-REQUISITES : Nil

4.TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
CC601 Industrial Organisation and Management	L	T	P	C	TH	TM	TW	PR/OR	100
	3	-	-	3	75	25	-	-	

5. COURSE OUTCOMES

On successful completion of the course,the student will be able to:
CO1: Understand the types of business organizations
CO2: Apply basic management principles in the industry
CO3:Explain the basics of finance and human resource
CO4: Analyse the basic problems of management

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn& Testing	Engg. Practices for Society,Sustainability& Environment	Project Management	Life -long Learning
CO1	0	0	0	0	0	3	3
CO2	1	3	0	0	3	3	3
CO3	3	0	0	0	0	3	3
CO4	3	3	0	0	3	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
	T0 use Knowledge of power & design engg. For solvingeng g. problems	To apply the principles of Mgmt. & Mfg. technology to effectively plan and control the industrial activities
CO1	0	3
CO2	0	3
CO3	0	3
CO4	0	3

7. DETAILED COURSE CONTENTS/ MICRO-LESSON PLAN

M=Marks | **Thr= Teaching hours** | **CO= Course Outcomes**				
Unit	**M**	**Thr**	**CO**	**Levels**
1.Business Organization **1.1** Types of business organizations: Individual proprietorship,Partnership, Joint Stock Companies : Private Ltd and Public Ltd , Co-operative societies, Public sector **1.2** Structure of business organization: Line organization, Functional organisation,Line and staff organization, Project organization	**10**	**6**	CO1	L1,L2
2.Business Management **2.1:** Concept of management and administration, management as an art and science, evolution and growth of scientific management- contribution of F.W Taylor. **2.2** Basic functions of management : planning, organizing, staffing, directing, controlling. Other functions: forecasting, coordinating and decision- making. **2.3** Functions in Industry: Basics of procuring, store- keeping, material handling, production, packing and forwarding, marketing and sales , supervision, research and development. **2.4**Supervisory skills required in industry	**16**	**9**	CO2	L1,L2
3.Basics of Finance **3.1** Sources of finance **3.2** Cost Concepts: Necessity of costing, elements of cost: material, labour and expense; prime cost, overhead cost, total cost, break- even analysis. **3.3** Materials management: Inventory control-standard order, reserve stock, reorder point, lead time. Economic order quantity, ABC Analysis. Introduction to Just in time (JIT) system	**18**	**13**	CO2, CO3	L1,L2, L3,L4

3.4 Depreciation: Definition and causes. Methods of calculating depreciation charges: Straight Line Method, Diminishing Balance Method, Sinking Fund method **3.5** Obsolescence- definitions and reasons. **3.6** Introduction to GST.				
4.Human Resource Management **4.1** Functions of Personnel Department**:** Human resource planning, selection and recruitment, training, promotion and transfer, welfare of employees. **4.2** Industrial Relations**:** Employer-employee relations, trade union, settlement of disputes of employees, collective bargaining, conciliation, arbitration, grievance handling mechanism. **4.3** Wages and Incentives**:** Factors influencing wages, types of wage plans – time rate and piece rate, Incentive – objectives and types, individual and group incentive plan, characteristics of a good wage or incentive plan, difference between incentive and wage. **4.4** Industrial Acts : Introduction to the following Industrial Acts: Industrial Disputes Act 1947/1956; The Indian Factories Act 1948 The Workmen's Compensation Act 1923	**21**	**14**	CO2, CO3	L1,L2
5.Project Management **5.1** Introduction to Project Management **5.2** Network Analysis (Introduction to basic concepts with simple problems) CPM- Critical Path Method: Definition, network diagrams, critical path, advantages PERT- Programme Evaluation and Review Technique: Definition, network diagrams, advantages. Comparison of PERT and CPM.	**10**	**6**	CO2, CO4	L1,L2, L3,L4, L5
Total	**75**	**48**		

8. COURSE DELIVERY :

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Business Organization**	**6**	**10**
2	**Business Management**	**9**	**16**
3	**Basics of Finance**	**13**	**18**
4	**Human Resource Management**	**14**	**21**
5	**Project Management**	**6**	**10**
	Total	**48**	**75**

10.LEARNING RESOURCES

Text Books

S.No	Author	Title of Book	Publisher
1	O.P. Khanna	Industrial Engineering and Management	DhanpatRai Publications
2	T.R.Banga ,S.C. Sharma	Industrial Organisation and Engineering Economics	Khanna Publishers
3	Awate,Chunawala, Patel,Bhandarkar, Sriniwasan	Industrial Organisation and Management	Vrinda Publication
4	MartandTelsang	Industrial Engineering and Production Management	S.Chand& Company Ltd

ELECTIVES – SEMESTER V

(EX611) Biomedical Instrumentation

1. AIM

Students of electronics engineering related branches opting for this course will be introduced to the basic concepts of biomedical instrumentation enabling them to pursue a career in the health care sector.

2. COURSE OBJECTIVES:

The students will able to:

1. Assist doctors in a hospital as biomedical engineers.

2. Work as service engineers for medical equipment maintenance.

3. PRE-REQUISITES:

1. Knowledge of basic principles of physics

2. Knowledge of basic electronics

3. Knowledge of sensors and transducers

4. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
	L	T	P	C	TH	TM	TW	PR/OR	
(EX611) Biomedical Instrumentation	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Demonstrate a knowledge of the working principles of clinical laboratory instruments

2. Perform various physiological measurements

3. Perform pulmonary function measurements

4. Demonstrate a knowledge of medical imaging equipment and nuclear medicine

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	2	0	1	3	2	0	0
CO2	3	0	1	3	3	0	2
CO3	2	0	1	2	3	0	0
CO4	2	0	1	1	3	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	0
CO2	2	1
CO3	2	1
CO4	2	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**TH= Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**T H**	**CO**	**Levels**
1 CLINICAL LABORATORY INSTRUMENTS			**12**	**08**	**CO1**	**L1,L2**
1.1 Medical diagnosis with chemical test, principles of spectrophotometry, colorimeters and clinical flame photometers						
1.2 Types of blood cells, methods of blood cell counting- microscopic method, automatic optical method, electrical conductivity method, coulter counter						
2 PHYSIOLOGICAL INSTRUMENTATION			18	12	**CO2**	**L2,L3**
2.1Origin of bioelectric signals, recording electrodes, electrode tissue interface, polarization, skin contact impedance, motion artifacts.Block diagram of a typical biopotential recording system						
2.2 Block diagram of Electrocardiogram system, ECG leads, effects of artefacts on ECG recordings						
2.3 Electroencephelogram (EEG)-Block diagram, electrode placement						
2.4 Electromyography(EMG)-generation of EMG signals						
2.5 Evoked response potentials						
2.6 Blood pressure , blood pressure measurement using korotkoff's method (sphygmomanometer), Invasive measurement of blood pressure						

2.7 Measurement of Oxygen in the Blood, working of Pulse Oximeter				
3 PULMONARY FUNCTION MEASUREMENTS	12	04	**CO3**	**L2,L3**
3.1 Respiratory volumes and capacities				
3.2 Spirometry and its applications, Working of water seal spirometer, wedge spirometer and Fleisch- pneumotachometer				
3.3Measurement of volume- flow volume curve				
4 MEDICAL IMAGING FUNDAMENTALS	21	12	**CO4**	**L2,L3**
4.1 Basics of Diagnostic Radiology, Nature and properties of x-rays, production of x-rays, stationary anode tube, Rotating Anode tube, x-ray machine, collimators & grids, x-ray films, x-ray Image intensifier				
4.2 Principle of computed tomography				
4.3 Principles of Magnetic resonance imaging (MRI) systems, Basic NMR components, Biological effects of NMR imaging, advantages of NMR imaging system.				
4.4 Diagnostic ultrasound-nature of ultrasound, ultrasound generators, interaction of ultrasound with matter,Pulse-Echo display modes in ultrasonic imaging(A-mode, B-mode and M-mode),Components of an ultrasound System (Block diagram level), Scanning probes (working of linear array and curved array transducer), Principle and Applications (listing only) of Doppler ultrasound, Principle of Echocardiography				
5NUCLEAR MEDICINE	12	12	**CO4**	**L2,L3**
5.1 Radioactivity, radioactive decay law, interaction of radiation with matter				
5.2 Working of Scintillation detectors and Gamma Camera				
5.3 Principles and applications of SPECT and PET				
5.4 Radiation hazards and prevention, biological effects of radiation exposure				
Total	**75**	**48**	**-**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Clinical laboratory instruments	08	12
2	Physiological instrumentation	12	18
3	Pulmonary function measurements	04	12
4	Medical imaging fundamentals	12	21
5	Nuclear medicine	12	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Blood pressure measurement using a sphygmomanometer	
2	Study of ECG signal measurement	
3.	Study of patient monitoring system	
4.	Study of x-ray machine	
5.	Study of CT-scanner	
6.	Study of MRI scanner	
7.	Study of Sonography machine	
8.	Field visit to a hospital to study hospital layout, patient monitoring system, x-ray machines, CT-scanners, MRI scanners, pathlab, etc.	
9.	Field visit to an occupational health centre to study pulmonary function measurements	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.S. Kandpur	Handbook of biomedical instrumentation	McGraw Hill
2	Leslie Cromwell	Biomedical instrumentation and measurements	
3	John webster	Medical Instrumentation	John Wiley and sons
4	Satish K Bhargava	Step by Step: Ultrasound	
5	Sandra L. Hagen-Ansert	Textbook of diagnostic sonography	

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	D. Jennings, A. Flint, B.C.H. Turton and L.D.M. Nokes	Introduction to Medical Electronics Applications	Edward Arnold,
2	Ramesh Chandra	Introductory Physics of Nuclear Medicine	Lea & Febiger
3	Harry E Thomas	Handbook of biomedical instrument and measurement	Prentice Hall

(EX612) Autonomous Robots

1. AIM

Robotics is a fast –Growing field whose definition has been evolving over time, along with the field itself. Other than industrial applications, Robots are increasingly being used in newer field of application like medicine, space, exploration, and hazardous environment, military and domestic use. There is huge demand for innovation in autonomous robots in new areas like virtual reality, cars, personal care for disabled people. Robots are likely to be common basic necessity as human try to survive in a harsher future with security treats, depleted natural recourses and global climatic changes

2. COURSE OBJECTIVES / RATIONALE:

- To introduce students to Arduino Interactive Development IDE
- To enable them to understand the working and various types of Arduino board
- To help them build innovative projects using Arduino and IOT
- To introduce students to Internet of Things

3. PRE-REQUISITES:

Students should know

- programming concepts
- processing unit

4. TEACHING AND EXAMINATION SCHEME

Course Code & Course Title	Periods/ Week (In Hours)			Total Credit	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX612) Autonomous Robots	**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	**150**
	3	-	2	5	75	25	25	25	

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the concept of Arduino processor and IOT
2. Apply the basic protocol and working principle of interfacing Modules.
3. Analyze various application program for wide range of Arduino processors
4. Design, debug and troubleshoot Arduino/IOT based project

6. Mapping Course Outcomes with Program Outcomes

Relationship : 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabi	Project Management	Life - long Learning
CO1	3	2	1	0	0	0	2
CO2	2	3	2	1	2	0	3
CO3	0	3	3	2	3	0	3
CO4	0	3	3	3	3	3	3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**

Unit	**M**	**Thr**	**CO**	**LEVEL**
1 Autonomous Robotics				
1.1 definition of Robot, industrial Robot, Autonomous Robot, Applications 1.2 Autonomous Robot Types: wheeled and Legged, types of Stability: dynamic and Static 1.3 Control Components of AR: wired control, IR control, Radio Control, ZigBee 1.4 Sensor Navigation: Bump Switch, IR Sensor, Ultrasonic Range Finder, Accelerometer, GPS module, GPRS module 1.5 Block Diagram and Working Principle of Servo Motor and DC motor	18	12	CO1 CO2	1

2 Introduction to Arduino Programming 2.1 Block diagram, input and output pins of Arduino Uno development Board 2.2 Basic Commands of Arduino Programming Void Setup (), Void Loop(), pinMode(), 2.3 basic Commands for Serial Communication, analog Input/Output, Digital Input/output, delay commands	14	8	**CO3**	**1**
3 Sensor module interfacing with Arduino Uno (interfacing diagram and Arduino sketch for the following) 3.1 motion detector: tilt sensor, PIR 3.2 light detector :LDR 3.3 Distance Measurement Ultrasonic Sensor,IR sensor 3.4 Vibration detector: Piezo sensor 3.5 sound detector: Microphone 3.6 Temperature Sensor: LM35 3.7 Rotary Encoder 3.8 GPS ***[Note: Knowledge of interfacing any of above Sensor module with Arduino is of LEVEL 2 and writing Arduino sketch for such interfacing is of LEVEL3]***	18	12	**CO2, CO3**	**2, 3**
4 Motor control with Arduino Uno (interfacing diagram and Arduino sketch for the following) 4.1 controlling position of servo motor 4.2 Controlling direction of DC motor using transistor H-bridge 4.3 Controlling direction of DC motor using IC: Movements for two wheeled Robot: move forward, move back ward, stop, move left, move righ ***(LEVEL 3)***	13	8	**CO2, CO3, CO4**	**2, 3**
5 Internet Of Things (IOT) 5.1 Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models, IOT Module ***(LEVEL 1)*** 5.2 interfacing IOT module to Arduino Board ***(LEVEL 2)*** 5.3 Arduino based IOT Applications***(LEVEL 4)***	12	8	CO1, CO2, CO3, CO4	**1, 2, 3, 4**
Total	**75**	**48**	**-**	

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Autonomous Robotics**	12	18
2	**Introduction to Arduino Programming**	8	14
3	**Sensor module interfacing with Arduino Uno**	12	18
4	**Motor control with Arduino Uno**	8	13
5	**Internet Of Things (IOT)**	8	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Interfacing and Programming of Arduino with motion detector: tilt sensor, PIR, Gyroscope, Accelerometer (any one)	2
2	Interfacing and Programming of Arduino with LDR	2
3	Interfacing and Programming of Arduino with ultrasonic Sensor/IR sensor	2
4	Interfacing and Programming of Arduino with Piezo Sensor	2
5	Interfacing and Programming of Arduino with microphone	2
6	Interfacing and Programming of Arduino with LM35	2
7	Interfacing and Programming of Arduino with servo motor	2
8	Interfacing and Programming of Arduino with DC motor	2
9	Programming Arduino for two wheeled Robot interfaced to Arduino for following movement like Move forward, Move back ward, stop, move left, move right	4
10	Mini Projects: Line Follower, obstacle Avoider, etc.	5
	Total	25 marks

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Massimo Banzi	Getting started with Arduino	Second Edition, O'reilly
2	Maja J. Mataric	Robotics Primer	Latest
3	Brian Evans	Beginning Arduino Programming	A Press Publishers, Recent Edition
4	Vijay Madisetti, Arshdeep Bahga,	"Internet of Things: A Hands-On Approach"	Recent edition

(EX613) Renewable Energy

1. AIM : To enable the student to understand various Renewable Energy Sources and their application

2. COURSE OBJECTIVES:

The students will able to:

1. Compare conventional energy sources with renewable energy sources

2. Develop applications using these energy sources

3. Prioritize energy sources

3. PRE-REQUISITES: Basic Electrical and Sciences

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX613) Renewable Energy		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Define and find different energy sources

2. Explain different components of solar, wind energy Tidal and biomass plant devices

3 Compare the conventional energy sources with renewable on the basis of availability, infrastructure requirements and future scope.

4. Analyze the conventional energy sources with renewable on the basis of cost. i.e Perform audit

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	2	1	2	1	3	3	3
CO2	2	3	3	2	3	2	3
CO3	2	2	3	2	2	2	3
CO4	3	3	3	3	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Level**
1 Introduction to energy sources	**12**	**9**	**1,2,3,4**	**1,2**
1.1 Major sources of energy: Renewable and Non-renewable				
1.2 Primary and secondary energy sources				
1.3 Principles of energy conservation , Methods of energy conservation				
1.4 Need and advantages of renewable energy and their limitations. Future of renewable energy, Energy Scenario in India				**3**
1.5 Energy audit : Types of energy Audit				**4**
2 Solar Energy	18	13	**1,2,3**	**1,2,3**
2.1 Principle of conversion of solar energy into heat and electricity				
2.2 Types of collectors : concentrating(focussing) and non-concentrating Concentrating: Different types: construction and working of any one concentrating collector Non- concentrating: types, construction and working of Flat plate collectors.				
2.3 Solar energy storage system: Need for storage, Different types : Thermal, mechanical and Electrical Electrical Storage : battery Storage type				

2.4 Applications : Enlist applications solar water heater :Concept, Advantages , disadvantages				
3 Wind Energy	16	09	**1,2,3**	**1,2,3**
3.1 Basic principle of wind energy, Environmental aspects of wind energy.Basic components of wind energy conversion system				
3.2 Wind power :available wind power formulation, power coefficient, maximum power (no numerical) Main considerations in selecting the site for wind mills Classification of wind mills: construction and working of horizontal axis wind mills				
3.2 Enlist applications of wind energy, Advantages and limitations of wind energy conversions,				
4 Energy from Biomass	16	09	**1,2,3**	**1,2,3**
4.1 Introduction :Biomass resources				
4.2 Biomass conversion technologies : direct combustion, thermo-chemical conversion, Bio chemical conversion, Biogas generation				
4.3 Types of biogas plants : floating drum type- construction and working, Factors affecting biogas generation				
4.4 Applications : Advantages, disadvantages				
5 Tidal Energy and Wave Energy	13	08	**1,2,3**	**1,2,3**
5.1 Tides as sources of energy, Fundamentals of tidal power,				
5.2 Use of tidal energy **,** Limitations of tidal energy conversion systems				
5.3 Sketch and Working of simple Tidal Power Plant.				
5.4 Waves as Sources of Energy				
5.5 Principle of conversion of Wave Energy into Power-Construction and working of any one wave energy converter				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Introduction to Energy Sources	7	12
2	Solar Energy	12	18
3	Biogas	10	15
4	Biomass cogeneration, Biomass resource development in India	10	15
5	Tidal Energy and Wave Energy	9	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Perform an experiment using a solar cooker.	
2	To perform an experiment on solar flat plate collector used for water heating.	
3	Setting up a photovoltaic cell for lighting with focus on orientation of panels and measuring output in terms of voltage & current.	
4	Visit to plant of solar heating system for hotel/hostel/railway stations etc and write a brief report on the visit.	
5	To visit biomass / biogas plant of Municipal waste or elsewhere and write a brief report on the visit.	
6	Demonstration of Video/animation on Tidal Energy Generation	
7	Demonstration of Video/animation on Wave Energy Plant	
8	Demonstration of Video/animation on Windmill.	
9	Perform energy audit for workshop / Office / SSI unit.	
10	Perform an experiment using a solar cooker.	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Dr. B. H. Khan	Non conventional energy Resources	Tata McGraw Hill
2	G. D. Rai	Non conventional energy sources	Khanna Publishers
3	S. P. Sukhatme	Solar energy Principles	Tata McGraw Hill
4	P. H. Henderson	India – The Energy sector	University Press

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	D.A. Ray	Industrial Energy Conservation	Pergaman Press
2	W. C. Turner	Energy management Handbook	Wiley Press
3	S. Rao, B. Parulekar	Energy Technology	Khanna Publishers

(EX614) Electrical Machines

1. AIM

This subject enables the student to understand the working principle, construction, performance, control and applications of electrical machines.

2. COURSE OBJECTIVES:

The students will able to:

1. List parts of electrical machines
2. Classify different types of Electrical Machines
3. Understand concept of synchronous condenser

3. PRE-REQUISITES:

Students should know

1. Applied Physics

2. Basic Electrical Engg

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX614) Electrical Machines		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	-	2	5	75	25	25	-	**125**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain principle of operation and construction of Electrical Machines

2. Demonstrate various methods of starting and speed control of Motors, parallel operation of alternators

3. Perform different types of tests on Electrical machines

4. Compare and Recommend suitable machines for given application

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society,Sustainability & Environment	Project Management	Life -long Learning
CO1	2						1
CO2	2	1		3	2		1
CO3	2			3	2	2	1
CO4	2	1	3				2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1 TRANSFORMERS (NO NUMERICAL)			21	14	CO 1,3,4	L1, 3,4
1.1 Constructionand working principle of a transformer. Various types of insulation used in transformers- inter turn, winding to winding, winding to core. Cooling system- need of cooling & different types of cooling systems. Final Equivalent circuit of transformers			12	9	CO 1	L1
1.3 Procedure and diagram of Open Circuit & Short Circuit test. Salient features of a power & distribution transformer (three phase). Construction & principle of operation of an autotransformer, its advantages & disadvantages over two winding transformer			9	5	CO 3,4	L3, 4
2 DC MOTORS (NO NUMERICAL)			9	06	CO 1,2	L1, 2

2.1 Principle of operation & working, concept of back emf & its importance Classification of DC motors based on connection of field & armature winding and their voltage & power equations, speed equation. Methods of speed control and their comparison. Starting of DC motors – Necessity of a starter, three point & four point starters	9	6	CO 1,2	L1, 2
3 THREE PHASE INDUCTION MOTOR	18	11	CO 1,2	L 1,2
3.1 Working principle of 3 phase Induction motor, constructional details and its types:- slip ring and squirrel cage. Concept of rotor slip, rotor frequency, rotor emf, rotor current under standstill and running condition (numerical) Final Equivalent circuit diagram.	9	6	CO 1	L1
3.2Power flow and losses in induction motor. Different methods of speed control (brief description) Terminal marking for three phase induction motor	9	5	CO 2	L2
4 ALTERNATOR (NO NUMERICAL)	21	14	CO 1,2 ,3	L 1,2 ,3
4.1 Classification, construction, components and functions of salient pole & cylindrical pole type.	9	6	CO 1	L1
4.2 Operating parameters – armature resistance, leakage reactance, synchronous reactance and synchronous impedance. Significance of Voltage Regulation in alternator.	6	4	CO 3	L3
4.3 Necessity & desirable conditions for parallel operation of alternators. Methods of synchronizing of alternators (lamp method and synchroscope method)	6	4	CO 2	L2
5 SYNCHRONOUS MOTOR AND CONDENSER	06	03	CO 4	L4
5.1 Principle of operation and special features of synchronous motor. Concept of synchronous condenser.	6	3	CO 4	L4
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Transformers	14	21
2	Classification and starting of DC motors	6	9
3	Performance of Three phase induction motor	11	18
4	Alternator	14	21
5	Synchronous motor and condenser	03	06
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Minimum 8)	Marks
1.	To perform O.C & S.C test on a single phase transformer	
2.	To perform back to back test on a single phase transformer to determine losses and calculate efficiency and regulation	
3.	To study direct load test on a three phase transformer and measurement of its voltage regulation.	
4.	Speed control of a DC shunt motor above & below normal speed.	
5.	Starting a DC shunt motor using a starter and reversal of direction of rotation	
6.	To perform no load & blocked rotor test on a 3 phase induction motor and Determine its equivalent circuit parameters	
7.	To perform load test on induction motor	
8.	To perform O.C & S.C test on an alternator and determine its voltage regulation.	
9.	To determine the excitation required to maintain constant voltage in an alternator under varying voltages.	
10.	To study synchronization of alternators	
	Total	25
	Class room Assignments	**Marks**
	At least 02 assignments	
	Tutorial Exercise	**Marks**
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	BHEL	Transformers	Tata Mcgraw
2	S.K. Bhattacharya	Electrical machinery	Tata Mcgraw
3	J.B.Gupta.	Thoery & performance of Electrical Machines	S. K. Kataria & sons
4	B.L.Theraja.	Electrical Technology (Vol II)	S Chand
5	P.S. Bhimbra.	Elementary theory of electrical machines	Khanna Publishers

(EX615) WEB DESIGNING TECHNOLOGIES

1. AIM

1. To introduce students to various Web designing technologies used and protocols used in Internet
2. To enable students to design Web pages using HTML
3. To train students to develop and deploy Web sites implemented having a front-end, back-end processing and a database

2. COURSE OBJECTIVES :

The students will able to:

1. Understand the basic working of the Internet and be aware of various technologies used in Web designing
2. Design and develop simple websites by implementing suitable user interface and back-end processing

3. PRE-REQUISITES:

Students should know

1. Basics of computer hardware and simple softwares
2. Surfing the Internet

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX615)		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Web Designing Technologies		**3**	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain various technologies used in website designing and protocols used on the Internet
2. Build static and dynamic web pages using HTML and apply front-end validation using Javascript
3. Analyze simple web pages which include back-end processing using php
4. Evaluate a simple database and design Web pages to access the database

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y &	Project Managem ent	Life -long Learning
CO1	3	1	0	0	0	0	2
CO2	0	1	1	0	0	3	2
CO3	0	0	1	0	0	3	2
CO4	2	1	1	1	2	3	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	1
CO2	2	2
CO3	2	2
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 INTRODUCTION TO INTERNET, PROTOCOLS AND WEB TECHNOLOGIES	**21**	**14**	**CO1**	**L1**
1.1 INTRODUCTION TO THE INTERNET IP addresses, domain names, Working of Web browsers and Web servers, URLs				
1.2 INTERNET PROTOCOLS TCP/IP basics, Basic working and features of the following protocols - IP protocol (including IPV4 datagram format), address resolution protocol (ARP), reverse address resolution protocol (RARP), Internet control message protocol (ICMP), TCP, DNS, SMTP, POP, hypertext transfer protocol (http).				
1.3 WEB TECHNOLOGIES Web pages (types and issues), Concept of a tier, Comparison of Microsoft and Java technologies. Static web pages, plug-ins. Need for dynamic web pages, overview of dynamic web pages and technologies. Active web pages – Introduction and advantages. Different Web browsers, programming languages used in Web page development (front-end and back-end), databases, frameworks and data formats (LISTING ONLY)				

2 HTML	**18**	**10**	**CO2**	**L2**
2.1 HYPERTEXT MARKUP LANGUAGE Basic syntax, basic text formatting, images, hypertext links, lists, tables, frames, forms, creating simple HTML pages using these tags and their attributes				
3 BASICS OF JAVASCRIPT	**12**	**08**	**CO2**	**L2**
3.1 INTRODUCTION TO JAVASCRIPT Javascript uses, Javascript objects, reserved words.				
3.2 PROGRAMMING USING JAVASCRIPT Javascript syntax, primitives, operators, expressions, screen output, control statements, arrays, functions.				
3.3 JAVASCRIPT OBJECTS AND EVENT HANDLERS Core Javascript built-in objects and their methods and properties (Document object, Date object, Math object, String object, Array object), events and event handlers				
4 INTRODUCTION TO PHP	**12**	**08**	**CO3**	**L3**
4.1 PHP BASICS Overview of php, general syntax, primitives				
4.2 PROGRAMMING USING PHP Operations and expressions, output, control statements, arrays, functions, form handling, cookies, session tracking, simple programs				
5 WEB SERVERS AND DATABASE ACCESS	**12**	**08**	**CO4**	**L4**
5.1 WEB SERVERS Web server operation, general server characteristics.				
5.2 RELATIONAL DATABASE Introduction to relational databases, Introduction to Structured Query language (SQL) – CREATE,INSERT, UPDATE, DELETE commands, the MySQL database system, database access with PHP and MySQL, writing Web pages to process validated data from HTML forms using php and retrieve as well as store records in mysql database				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	INTRODUCTION TO INTERNET, PROTOCOLS AND WEB TECHNOLOGIES	14	21
2	HTML	10	18
3	BASICS OF JAVASCRIPT	8	12
4	INTRODUCTION TO PHP	8	12
5	WEB SERVERS AND DATABASE ACCESS	8	12
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study the various features available in a Web browser	
	Create a simple website (minimum 8 webpages) on the local server using HTML, PHP and MySQL which implements the following:	
2.	Write HTML codes for text formatting and images	
3.	Write HTML code to create lists and tables	
4.	Write HTML code using hyperlinks and frames	
5.	Write HTML code using forms	
6.	Write Javascript code to perform form validation	
7.	Write php code to process data from an HTML form	
8.	Configure apache Web server and php and create a simple MySQL database	
9.	Write HTML and PHP code to process data from a MySQL database	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Robert W. Sebesta	Programming the World Wide Web	Pearson Education
2	Achyut Godbole and Atul Kahate	Web Technologies	Tata McGraw-Hill Publishing Company Limited
3	C. Xavier	Web Technology and design	New Age
4	Laura Lemay	Mastering HTML,CSS & Javascript web publishing	BPB Publications
5	Danny Goodman	Javascript bible	Wiley
6	Mike McGrath	PHP and mysql	McGraw Hill Education

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Deven Shah	Advanced Internet technology	Dreamtech Press
2	Ivan Bayross	Web enabled commercial application development using HTML, Javascipt, DHTML and PHP	Paperback ISBN: 9788183330084
3	Kogent Learning SolutionsInc	Internet Technologies	Dreamtech Press

Website resources

https://differential.com/insights/14-technologies-every-web-developer-should-be-able-to-explain/
http://www.html.net
http://www.w3schools.com
http://www.tutorialpoint.com

(EX616) VHDL

1. AIM: To introduce hardware description languageVHDL and its application in designing digital circuits and hardware in FPGAs

2. COURSE OBJECTIVES: learn VHDL programming and use it to design and simulate different types of digital circuits and programmable logic devices and field programmable gate arrays..

The students will able to:

1. Learn VHDL programming.

2. Design and write codes for different digital circuits

3. Use VHDL for simulating the operation of digital hardware

3. PRE-REQUISITES: Students should know

1. Basic knowledge of c programming

2. Combinational and synchronous sequential circuits

3. Flip flops, registers and counters

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX616) VHDL		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Develop basic programming skills in VHDL
2. Write/Develop VHDL codes for combinational and sequential digital circuits
3. Compile, debug and simulate VHDL codes for combinational and sequential digital Circuits.
4. Design digital circuits and logic devices

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y &	Project Managem ent	Life -long Learning
CO1	2	2	3	1	0	2	3
CO2	2	3	3	2	0	2	3
CO3	2	3	1	3	0	2	3
CO4	2	3	3	2	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	2	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**				
Unit			**M**	**Thr**	**CO**	**Levels**
1.Overview of digital design with VHDL			**9**	**5**	**1**	**1,2**
1.1 1.1 VHDL:-What is VHDL • Hardware abstraction • Why use VHDL • Shortcomings of VHDL steps in using VHDL for design Synthesis						
1.2 Hierarchical Modeling techniques- Top down and bottom up design methodology, difference between modules and instances (only definition)						
2. VHDL reference			15	9	**1**	**1,2**
2.1 Documentation (comment line) • Data objects • Data object names • Data object values and numbers • Signal data objects • Bit and Bit vector types • STD_LOGIC and STD_LOGIC_VECTOR types						

• Signed and unsigned type • INTEGER type • CONSTANT data objects • VARIABLE data objects • Arrays Operators				
2.2 **VHDL design entity**-Entity declaration, Architecture, Package. writing simple VHDL code for a given logic function				
3 VHDL code for combinational circuits	21	14	**2,3**	**1,2 ,3**
3.1 selected signal assignment- 4-to-1 mux				
3.2 conditional signal assignment-priority encoder, 4 bit comparator				
3.3 process statement-2-to-1 mux using if-then-else statement				
3.4 case statement- 2-to-4 binary decoder,BCD to 7 segment				
3.55 **VHDL code for:** • And,,or,nand,nor gates • 4 bit arithmetic adder,4 bit arithmetic subtractor				
4 Flip Flops, Registers	12	8	**2,3**	**1,2 ,3**
4.1 **Circuit,timing diagram,graphical symbol and VHDL code of**:- gated D latch,D flip flop,T flip flop and JK flip flop				
4.2 **Circuit diagram and VHDL code of-** simple shift register and parallel-access shift register				
5 Synchronous Sequential circuits and logic devices	18	12	**3,4**	**1,2**
5.1 Circuit diagram and timing diagram of-4-bit up counter,4-bit down counter,2-digit BCD counter.				
5.2 Moore type finite state machine-state diagram and VHDL code				**3**
5.3 Mealy type finite state machine-state diagram and VHDL code.				**3**
5.4 Programmable logic devices-PAL,PLA,CPLD,FPGA, applications of CPLD and FPGA				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	No. of lectures	Marks
1	Overview of digital design with VHDL	5	9
2	VHDL reference	9	15
3	VHDL code for combinational circuits	14	21
4	Flip Flops, Registers	8	12
5	Synchronous Sequential circuits	12	18
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Design and simulate using -VHDL language	
1.	Design and implementation of Basic gates-AND,OR,NOT gates	
2	Design and implementation of 4-to-1 mux	
3	Design and implementation of 2-t0-4 Decoder	
4	Design and implementation of RS Flip Flop	
5	Design and implementation of JK Flip Flop	
6	Design and implementation of D Flip Flop	
7	Design and implementation of 4 bit up counter	
8	Design and implementation of shift register	
9	Design and implementation of logic devices	

11. LEARNING RESOURCES

Text Books

S. no.	Author	Title of Books	Publishers
1	Stephen Brown and Vranesic	Fundamentals of Digital Logic with VHDL design	Tata McGraw Hill,2008, India, ISBN 978–0–07–352953–0
2	Samir Palnitkar	Verilog HDL: A Guide to Digital Design&Synthesis,	Prentice Hall ISBN: 0-13-044911-3(downloadable)
3	Jayaram Bhaskar	A VHDL primer	PTR Prentice Hall

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Kevin Skahill and Cyress	VHDL for Programmable Logic	Pearson Education (downloadable)
2	Douglas Perry	VHDL:Programming by example	Tata McGraw Hill,2008, India, ISBN 978-0-07-049944-7

(EX617) Advanced Microcontroller

1. AIM:

To understand advanced microcontroller concepts, interface ARM microcontroller to external hardware and program ARM-based systems for various applications

2. COURSE OBJECTIVES / RATIONALE:

Students will be able to:

1. Understand advanced microcontroller concepts
2. Interface ARM microcontroller to external hardware
3. Program ARM-based systems using assembly and embedded C languages

3. PRE-REQUISITES:

Students should have the knowledge of:

1. Digital electronics and number systems
2. Basic microcontrollers
3. Computer programming and assembly language programming

4. TEACHING AND EXAMINATION SCHEME

Semester V									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX617) Advanced Microcontroller	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, students will be able to:

1. Recall and explain the features of ARM7TDMI microcontroller
2. Compare/contrast and select appropriate interface for a given application
3. Develop, execute and debug assembly language and embedded C programs for various applications
4. Interface ARM7TDMI microcontroller with hardware for various applications

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	2	3	3	0	0	0	3
CO2	0	3	3	0	0	0	3
CO3	0	3	3	3	3	3	3
CO4	2	3	3	3	3	3	3

Relationship : Low-1 Medium-2 High-3

Mapping Course Outcomes with Program Specific Outcomes

	PSO1	PSO2
CO1	3	0
CO2	3	0
CO3	3	3
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 Introduction to ARM7TDMI	**12**	**7**	**CO1**	**L1, L2**
1.1 ARM7TDMI architecture, block diagram, functional diagram				
1.2 ARM7TDMI register set, 32-bit CPU registers, CPSR and SPSR registers				
1.3 ARM7TDMI three-stage pipeline				
1.4 Memory map and memory interfacing, implementation of stack				
1.5 AMBA overview				
2 ARM7TDMI on-chip peripherals	**18**	**12**	**CO1**	**L1. L2**
2.1 Timer – features, pin and register description, timer-handling				
2.2 Serial port – configuration, interfacing PC with microcontroller, UART0 and UART1-handling				
2.3 Interrupt – IRQ, FIQ, ISR and interrupt-handling				

2.4 ADC – built-in ADC, interfacing external device to ADC				
2.5 PWM – register description, application				
2.6 Real time clock – RTC features, RTC register description, RTC interrupts				
2.7 Flash – flash memory system				
2.8 Watchdog timer				
3 Communication protocols for interfacing	**10**	**6**	**CO2**	**L1, L2**
3.1 I2C interface – features, architecture, pin and register description, applications				
3.2 SPI interface – features, architecture, pin and register description, applications				
3.3 Introduction to CAN interface				
4 ARM7TDMI instruction set and programming **(Students to be examined on assembly language programs that can include a combination of any instructions.** **Minimum instruction set should be provided to students during the examination)**	**20**	**13**	**CO3**	**L1 L2, L3, L4**
4.1 32-bit ARM instruction set				
4.2 16-bit THUMB instruction set				
4.3 Simple programs using different types of ARM instructions				
5 Interfacing ports to external devices	**15**	**10**	**CO4**	**L2, L3**
5.1 Hardware interfacing to output devices and programming - LED, seven-segment LED display, LCD, motor				
5.2 Hardware interfacing to input devices and programming - Switches, matrix keypad				
5.3 Hardware interfacing to sensors and programming - IR, temperature sensors				
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies, laboratory practical, etc.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to ARM7TDMI	7	12
2	ARM7TDMI on-chip peripherals	12	18
3	Communication protocols for interfacing	6	10
4	ARM7TDMI instruction set and programming	13	20
5	Interfacing ports to external devices	10	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
	Minimum eight to be performed	
1.	Program to add n binary numbers	
2.	Programming of timer for 8-bit PWM Generation	
3.	Programming of timer for variable frequency square wave generation	
4.	Programming of timer for frequency measurement and display on LCD	
5.	Programming of on-chip ADC	
6.	Programming of SPI port for interfacing with ADC MCP3304	
7.	Programming of SPI port for interfacing with DAC MCP4822	
8.	Programming of GPIO port for LED flashing	
9.	Programming of GPIO port for key interface	
10.	Programming of timer for accurate delays	
11.	Programming of UART for interfacing with PC	
	Total	25
No	**Class room Assignments**	**Marks**
	Atleast 2 assignments	
No	**Tutorial Exercise**	**Marks**
	To be decided by the subject teacher	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Andrew N.SLOSS, Dominic SYMES and Chris WRIGHT	ARM System Developers Guide, Designing and Optimizing System Software	ELSEVIER
2	Steve Furber	ARM System-on-Chip Architecture, Second Edition	PEARSON

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	William Stallings	Operating Systems	Pearson

(EX618) DATA STRUCTURES

1. AIM

1. To be aware of different types of data structures and their usages
2. To write simple programs implementing stacks, queues and linked lists
3. To be able to use different techniques for searching and sorting data

2. COURSE OBJECTIVES:

The students will able to:

1. List different types of data structures and understand their usage
2. Write programs to implement different types of data structures
3. Implement different methods to search and sort data

3. PRE-REQUISITES:

Students should know

1. To logically reason and write programs using C
2. Concepts of pointers in C and write simple programs using pointers

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX618) DATA STRUCTURES		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Define different types of data structures and show implementation of stacks and various types of queues
2. Develop programs for various types of linked lists
3. Evaluate programs which implement various kinds of searches and sorts
4. Discuss the various concepts in trees and graphs

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y &	Project Managem ent	Life -long Learning
CO1	3	2	1	1	2	3	0
CO2	2	2	1	1	2	3	3
CO3	2	0	0	1	0	2	3
CO4	2	1	0	0	0	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	1	2
CO2	3	2
CO3	3	2
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**					
Unit		**M**	**Thr**	**CO**	**Levels**
1 INTRODUCTION TO DATA STRUCTURES		**15**	**8**	**CO1**	**L1**
1.1 OVERVIEW OF DATA STRUCTURES AND ALGORITHMS Definition of data structures, types of data structures, data structure operations, algorithms –brute force, divide and conquer, Greedy, backtracking, space and time complexity, asymptotic notation					
2 STACKS AND QUEUES		**15**	**10**	**CO1**	**L1**
2.1 STACKS Introduction to stack, stack operations, stack implementation, applications of stack, programs using stacks.					
2.2 QUEUES Queue basics, queue implementation, basics concepts of circular queues, priority queues and double-ended queues, programs using queues.					
3 LINKED LISTS		**15**	**10**	**CO2**	**L2**
3.1 SINGLY-LINKED LISTS Basic concepts and implementation of linked lists, operations – node insertion, deletion of anode, searching a node, traversing through the list, programs.					
3.2 CIRCULAR-LINKED AND DOUBLY-LINKED LISTS Basic concepts of circular-linked lists and doubly- linked lists, programs					
4 SEARCHING AND SORTING		**15**	**10**	**CO3**	**L3**
4.1 SEARCHING TECHNIQUES Basic concepts of searching, linear search and binary search techniques, programs					
4.2 SORTING TECHNIQUES Basic concepts of bubble sort, selection sort, insertion sort and quick sort techniques, programs					

5 TREES AND GRAPHS		**15**	**10**	**CO4**	**L4**
5.1 TREES Basic concepts of trees (NO IMPLEMENTATION), binary tree, binary tree representation, traversal, search tree					
5.2 GRAPHS Basic concepts of graphs (NO IMPLEMENTATION), undirected and directed graphs, graph terminology – degree of vertex, indegree and outdegree of a vertex, connected graph, directed acyclic graph (DAG) and subgraph. Graph representation – adjacency matrix, adjacency list, adjacency matrix. Graph traversal- depth first search, breadth first search.					
Total		**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	INTRODUCTION TO DATA STRUCTURES	8	15
2	STACKS AND QUEUES	10	15
3	LINKED LISTS	10	15
4	SEARCHING AND SORTING	10	15
5	TREES AND GRAPHS	10	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks**
1	Program to implement stacks	
2	Program to implement queues	
3	Program to implement singly-linked lists	
4	Program to implement doubly-linked lists	
5	Program to implement circular-linked lists	
6	Program to implement linear search	
7	Program to implement binary search	
8	Program to implement bubble sorting technique	
9	Program to implement selection sorting technique	
10	Program to implement insertion sorting technique	
11	Program to implement quick sorting technique	
	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	E. Balagurusamy	Data structures through C	McGraw Hill Education
2	Yeshwant Kanetkar	Data structures through C	BPB Publications
3	Seymour Lipschutz	Data structures with C (Schaum's outline series)	McGraw Hill Education

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	S.K. Srivastava	Data structures through C in depth	BPB publications
2	Reema Thareja	Data structures using C	Oxford
3	Sahni Horowitz	Fundamentals of data structures in C	Universities Press

SEMESTER VI

(EX601) Audio & VideoEngineering

1. AIM

1. To enable the students to understand the concept of sound & video recording.
2. To enable them to analyze composite video signal B/W as well as colour & VSB modulation.
3. To enable them to understand performance of B/W & colour picture tube, TV transmitter & receiver.
4. To introduce LCD & LED TV block diagrams.
5. To understand theperformance of HDTV,CCTV.DTH etc.

2. COURSE OBJECTIVES :

The course will introduce the students with working principle,block diagrams of sound transducers,B/W &colour TV ,LCD,LED TV,CCTV,DTH,HDTV,cable TV so that they will be able to install,test & troubleshoot simple faults in audio & Video equipments.

2. PRE-REQUISITES:

Students should know
1 .Electronic Circuits
2. Analog Communication

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX-601)		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
Audio & Video Engineering		**3**	**-**	**2**	**5**	**75**	**25**	**25**	**-**	**125**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1.Understand various concepts and characteristics of Audio Transducers.
2 Describe applications of TV such as CCTV,CATV,HDTV,DTV,DTH,LCD & LED TV.
3.Differentiate between various audio & Video recorder formats.
4. Analyze and compare B/W & colour TV system

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	2	0	0	3	0	0	3
CO2	2	1	0	3	0	0	0
CO3	2	0	2	0	0	3	3
CO4	2	1	2	3	0	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 SOUND TRANSDUCERS	**15**	**9**	**1**	**L1, L2**
1.1 Characteristics: sensitivity, signal to noise ratio, directivity, output impedance, distortion and frequency response				
1.2 Requisites of a good microphone. Construction, functioning, features, and applications of microphones: Crystal, Moving coil. And Electret.				
1.3 LOUD SPEAKERS**:**Characteristics of loudspeaker Working principles of horn type and electrodynamic type loudspeaker Baffles(Finite,infinite ,bassreflex & acoustic labryinth) &Enclosure,Multiway speaker system (Woofers & Tweeters),surround sound system(block diagram)				
2 TV COMMUNICATION SYSTEM	18	12	**4**	**L1, L2**
2.1 TV PICTURE ANALYSIS: -Frequency range of various VHF/UHF band, Aspect ratio, Persistence of vision.				

2.2 Scanning: Need, Sequential scanning, flicker, interlaced scanning,interlace error,interlace error calculation, horizontal scanning, vertical scanning				**L4**
2.3 Composite Video Signal (CVS) .need for synchronization,Horizontal sync and blanking pulses, Vertical sync and blanking,(No equalizing pulses).				
2.4 TV Camera tube: Characteristics of camera tube, construction and working of vidicon				
2.5 VSB Modulation				
3 COLOUR TELEVISION	18	10	**4**	**L1, L2**
3.1Compatibility of color TV system with monochrome system.				
3.2 Additive and subtracting mixing of colors, luminance, Hue and Saturation				
3.3 Block diagram of video camera and its explaination				
3.4 Construction and working principles of Trinitron picture tube.				
3.5 Colour signal transmission,signal modulation, transmission, bandwidth,weighing factors & chrominance signal				
3.6 Block diagram of PAL TV transmitter & receiver.				
4 TYPES OF TV & APPLICATIONS	15	11	**3**	**L1, L2**
a. Introduction to DIGITAL TV (DTV):Advantages (picture quality,special features,special effects,high reliability) Digital Video production & Reproduction (Block Diagram) Digital picture transmission & Reception (Block Diagram) Picture in picture feature in DIGITAL TV Principles of working HDTV				
4.2 Principle of working, features& Block diagram of Cable TV, PAY TV THROUGH CABLE,CCTV and DTH.				
4.3 LCD TV & LED TV :Introduction & block diagram				
4.4 Night vision camera				
5 VIDEO RECORDING & PRODUCTION	9	6	**3**	**L1, L2**
5.1 Comparision VCD verses DVD				**L4**
5.2 DVD formats, recording and playback on DVD				
5.3 Introduction to BLU-RAY DISC, Block diagram BD player & operation				
5.4 Comparision of BLU-RAY &DVD				**L4**
Total	**75**	**48**		

8. COURSE DELIVERY:

The course will be delivered through lectures, class room interactions, exercises and case studies.

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Sound Transducers	9	15
2	TV Communication system	12	18
3	Colour Television	10	18
4	Types of TV & Applications	11	15
5	Video Recording & Production	6	9
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1	Test performance of pattern generator.	
2	Compare composite video signal (B/W) of different patterns	
3	Test performance of picture tube (B/W).	
4	Compare composite video signal (colour) of different patterns.	
5	. Test performance of TV receiver controls	
6	Test performance of picture tube (colour)	
7	Tracing of different sections of TV receiver	
8	Location of faults in the different sections of TV receiver	
9	. Study of a TV cable network system through internet	
10	Study of a CCTV system through internet	
No	**Class room Assignments**	**Marks**
1	At least 02 assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1		
2		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	R.R Gulati	Modern Television Practice Principles,Technology and Servicing 2/Ed	New age Internationl Publisher, New Delhi **ISBN-** 9788122413601
2	. R.R Gulati	Composite Satellite & cable Television	New age Internationl Publisher, New Delhi **ISBN-** 9788122413601
3	A.M.Dhake	TV and Video Engineering	TMH Publication, New Delhi **ISBN**: 9780074601051
4	Gordon J King	Audio Handbook	Newnes-Butterworth **ISBN-13:**9780408001502
5	Maini	Colour T.V. and Video Technology	PHI Publications. New Delhi
6	K.D. Desai,	Video Cassette Recorders	Jeevan Deep Prakashan, Mumbai, 2nd , 1988
7	Ibrahim, K.F. Newnes	Guide to Television and Video Technology, Fourth Edition	Newnes-Butterworth **ISBN-13:** 9780750681650
8	John D. Lenk	Complete Guide To Laser Video Disc	PHI Publications. New Delhi, 2nd, 1995
9	R.G.Gupta	Television Engineering and video systems . second edition	second edition ,MH New Delhi
10	R.G.Gupta	Audio &Video Systems	TataMc-GrawHill education ,Delhi.
10	LCD LED Screen Panel Repair Guide	http://lcdrepairguide.com/screen-repair/	

(CC602) Business Communication

1. AIM: To enable students to communicate effectively in oral and written form at workplace.

2. COURSE OBJECTIVES :

The students will able to:
1.use speaking , writing and presentation skills to communicate effectively .
2. develop business etiquettes , manners, grooming and improve personal appearance
3. improve non verbal forms of communication.

3. PRE-REQUISITES: (GC101) Communication skills

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**									
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**				
						Theory Marks		**Practical Marks**		**Total Marks**
(CC602) Business Communication		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		-	**-**	**2**	**2**	**-**	**-**	**50**	**50**	**100**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
1. understand the principles of effective communication
2. use the principles of communication effectively in the corporate environment
3. analyse and organize information for effective communication
4. develop soft skills in order to adapt to the changing and competitive corporate work environment.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopmen t of Solutions	Engg. Tools, Experiment atn& Testing	Engg. Practices for Society,Sus tainability	Project Manageme nt	Life -long Learning
CO1	1	1	1	1	1	2	3
CO2	2	2	2	1	2	2	3
CO3	2	2	2	1	2	2	3
CO4	2	2	1	1	2	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**

Unit	**M**	**Thr**	**CO**	**levels**
1 COMMUNICATION SKILLS AT WORKPLACE		**04**		
1.1 **Principles of communication in business** Importance of communication in a business organization, types of communication(formal and informal Internal and External Communication), Channels of communication: Vertical, Horizontal, Diagonal, Grapevine			1	
1.2 **Modern Office technology for communication**: email communication and sending text (etiquettes, components, tips for writing effective emails, spellcheck) ,internet and use of social media for work (to communicate, search for information about suppliers, specifications, networking, quick feedback ,e-commerce, video conferencing)			**1,2,3,4**	
2 SEMINARS		06		
2.1 **Organization of seminars and workshops** Organizers role: planning, objectives, topic selection,planning the date			**1,2,3,4**	

,time ,venue , creating event organization material : creating facebook page ,WatsApp group, invitations , advertisement on pamphlet , hand-outs ,signage ,name badges, registration form, press note, inviting key note speaker, schedule.				
2.2 **Presentation** Speakers role:Gathering relevant material, organization of the material, knowing the occasion and audience,preparing handouts for distribution, time management, ,interaction with audience, non verbal communication. (Checklist of significant aspects of oral presentation to be provided)			**1,2,3,4**	
2.3 Role of audience Audience's role: Listening effectively and asking relevant questions, note taking			**1,2,3,4**	
3 TECHNICAL WRITING		10		
3.1 Reports **Understanding objective report writing, types of reports, parts of a formal report, illustrations** inspection reports: procedure and format ,Project Report			**1,2,3,4**	
3.2 Business letters Sales letters : parts of sales letter complaint letters: elements of a complaint letter adjustment letters: elements of an adjustment letter			**1,2,3,4**	
3.3 Tenders procedure, Preparation, Types of tenders, Single tender, limited tender, Open tenders, government e tender, structure of a tender document, tender notice, terms and conditions, payment details, specification, documents to be submitted, drafting advertisement for tender. **3.4 Generic notices, notice for meetings :purpose, format of notice for meeting, agenda , quorum and writing minutes**			**1,2,3** **1,2,3,4**	
4 JOB INTERVIEWS		06		
4**.1 Job application and resume** draft job application and resume, draft letter of acceptance and cold contact letter			**1,2,4**	
4. 2 **Job interviews** preparing for job interview, guidelines on facing job interviews, mock interviews			**1,2,4**	
5 SOFT SKILLS **5.1Business etiquettes** Importance of business etiquettes and manners, Tips for good business		06		

etiquettes			**1,2,4**	
5.2 **Non verbal Communication** grooming, personal appearance, hygiene, deportment and body language 5.3 **Interpersonal skills** Leadership skills, team work , active listening 5.4 **Critical thinking** How to improve critical thinking, tips for critical thinking			**1,2,4** **1,2,3,4** **1,2,3,4**	
Total	**50**	**32**	**-**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of HOURS**	**Marks**
1	COMMUNICATION AT WORKPLACE	04	
2	SEMINARS	06	
3	TECHNICAL WRITING	10	
4	JOB INTERVIEWS	06	
5	SOFT SKILLS	06	
	Total	32	50

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	**Practical**	**Marks 50**
	Practical Title	
1.	Modern office technology	
2.	Seminar	
3.	Technical writing	
4.	Job interviews	
5	Soft skills	
No	**Class room Assignments**	
1	Email communication	
2	Power point presentation	
3.	drafting seminar invites	

4.	Drafting hand outs for seminars	
5	Drafting sales letter	
6	Drafting complaint letters	
7	Drafting adjustment letters	
8	Drafting tender notice	
9.	Filling maintenance reports	
10.	Drafting inspection reports	
11	Drafting abstract	
12	Drafting notice for meetings	
13	Drafting agenda of meetings	
14	Drafting minutes of meeting	
15	Drafting resume and job application	
16	Drafting letter of acceptance	
17	Drafting cold contact cover letter	
18	Group discussions	
19	Debates	
20	Group presentations	

11. LEARNING RESOURCES

Reference books

S. No.	Author	Title of Books	Publishers
1	P.Prasad, Rajendra k. Sharma	The functional aspects of communication skills	s.k. kataria &sons
2	Pal & Rorualling	Essentials of business communication	Sultan chand & sons
3	Grount Taylor	English conversation practice	Tata MCgraw Hill
4	R.C. Sharma & Krishna Mohan	Business Correspondence & report writing	Tata MCgraw Hill

(EX 602) Industrial Electronics

1. AIM

To explore different areas of process controls of the industry where electronic circuits can replace the conventional methods, for efficiency, ease of method and economic advantages.

2. COURSE OBJECTIVES:

The students will able to:
1. Understand industrial requirements for controlling different processes
2. Applications of different components and circuits using these components.

3. PRE-REQUISITES:

Students should know
1. Working of thyristors, Timer IC 555
2. Amplifiers and Oscillator circuits

4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX602) Industrial Electronics	L	T	P	C	TH	TM	TW	PR/OR	
	3	-	2	5	75	25	25	-	125

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:
1. Explain different industrial, ultrasonics , high frequency heating process control circuits
2. Explain use of electronics switches to industrial circuits and in speed control of motors
3 Apply knowledge of Timers for different industrial circuits and resources used in control engineering
4. Analyze output for different variables.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO2	3	3	2	2	3	2	3
CO3	3	3	2	3	3	2	3
CO4	3	3	3	2	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	3

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	**L - Levels**

Unit	**M**	**Thr**	**CO**	**LS**
1 Industrial circuits	**22**	**13**	**1,2,3, 4**	**1,2**
1.1 Circuits using thyristors : Burglar alarm, smoke detector, Temperature controller using thermostat,, battery charger, Emergency light, thermistor controlled heater, power flasher,automatic Street light control using LDR				
1.2 Ic 555 Timer : Design Astable mutivibrator for specific Ton, Toff or frequency, Design of monostable multivibrator for specific pulse width				**4**
1.3 circuits Using 555 Timer : Bistable Multivibrator, Water level indicator, water level controller, photocounter				**1,2,3**
1.4 Cell phone jammer using tuned oscillator circuit				
2 Ultrasonics	09	06	**1,2,3**	**L1,2**
2.1 Wavelength and velocity in air, liquid and solid.				
2.2 Piezoelectric generation of ultrasonic waves				

2.3 Application : Flaw detection, Flow meter List of applications in Medical field				
2.4 Ultrasound welding : Principle, advantages, disadvantages				**3**
3 High Frequency heating	14	9	**1,2**	**L1,2**
3.1 Induction heating: principle, Features, skin effect, advantages, disadvantages, List of applications in industry Applications in detail: surface hardening , brazing				
3.2 Dielectric heating : principle, features, generation, advantages, disadvantages, Enlist applications				
3.3 comparison : dielectric and induction heating				
4 Electric motor speed control	15	10	**1,2,3, 4**	**L1,2**
4.1 DC motor :Operating principle, types, Dc shunt motor :concept of back emf, equivalent diagram, simple numerical to calculate back emf, relationship between speed, voltage, current , torque, characteristics of shunt motor : torque, current, speed.				
4.2 Numerical on speed calculations for variable flux, torque, current , terminal voltage.				**4**
4.2 Speed control of Dc motor using thyristors: advantages, speed control using full wave SCR. Speed control and regulation by tachometer method: for increased and decreased load.				**1,2**
4.4 Simple calculations between speed, voltage and firing angle.				**3**
4.3 Speed control of AC motors : Single phase AC series motor speed control using SCR				**1,2**
5 Process control Engg	15	10	**1,2,3**	**1,2**
5.1 Process control : Basic objective, Simple block diagram Pressure control using Pneumatic amplifier: Definition of Pneumatic amplifier, basic components, block diagram and pressure control Liquid flow control using flow control valve Mechanical movement control using Solenoid coil				
5.2 concept of servomechanism, block diagram DC servo speed control(separately excited) :Field controlled method: advantages and disadvantages armature controlled method, comparison between above two methods				

Speed control of AC servo motor				
5.3 Stepper motor : Basic principle of operation of 4 position Synchros : definition Synchro Transmitter and Receiver				**3**
Total	**75**		**-**	

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Industrial circuits	13	22
2	Ultrasonic	06	09
3	High Frequency heating	09	14
4	Electric motor speed control	10	15
5	Process control Engineering	10	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS (Any 8)

No	**Practical**	**Marks**
1.	Assemble and Test burglar alarm	
2	Assemble and test smoke detector	
3	Assemble test power flasher	
4	Assemble and test photocounter using 555	
5	Assemble and test water level indicator	
6	Assemble and test water level controller	
7	Test Induction heating	
8	Test dielectric heating	
9	Test motor speed control, using thyristor	
10	Test synchro transmitter and receiver control	
11	Flaw detection using ultrasound waves	
	TOTAL	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Rao, Sutrave	Industrial Electronics	Tata McGraw Hill
2	S.K Bhattacharya, S. Chatterjee	Industrial Electronics and control	Tata McGraw Hill
3	Curties Johnson	Process control Instrumentation	Pearson Education
4	B.L. Theraja	Electrical Engg	S. Chand

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Chute and Chute	Industrial Electronics	Tata McGraw Hill
2	J.D. Ryder	Electronics Engg	Prentice Hall India
3	Bimbhra P.S.	Power electronics	Khanna publishers

(EX603) PROJECT

1. AIM

This is intended to integrate several skills and competencies which have been developed in the students during his/her course of study and gets manifested through this project.

2. COURSE OBJECTIVES:

The students will able to:

i. Cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, and to enhance the generic skills & professional skills
ii. Develop problem solving, analysis, synthesis and evaluation skills.
iii. Encourage teamwork.
iv. Improve students' communication skills through project reports and presentations of their work.

3. PRE-REQUISITES:

i. Basic Engineering Skills
ii. Electronics & allied Courses

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX 603) PROJECT		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		-	**-**	**08**	**08**	**-**	**-**	**100**	**50**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Identify, analyze & define the problem
2. Apply acquired knowledge of engineering to execute solution
3. Develop leadership skills & teamwork to design & execute hardware & related software
4. Compile the relevant data in the form of a report and defend the project

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Devlopment of Solutions	Engg. Tools, Experimentatn & Testing	Engg. Practices for Society,Sustain ability & Environment	Project Management	Life -long Learning
CO1	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3
CO4	2	-	-	-	-	3	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

The following are some of the suggested activities which the student has to undertake (which may slightly differ depending on the project chosen) during the project work. In so doing some process related and project related skills need to be evaluated.

- Selection/Identification of project Work by market survey/industrial survey.
- Project Proposal
- Market survey for product sales & economic viability of product (for entrepreneurship)
- Costing of the project/product i) Capital costs ii) Material & production cost
- Design of project to obtain desired output.
- Procurement of components & equivalents.
- Working skill of fabrication.
- Testing of product
  - i. Drafting
  - ii. Sketching
  - iii. Layout
  - **iv.** Presentation

ELECTIVES – SEMESTER VI

(EX619) Data Communications

1. AIM

1. To introduce students to Data Communication through a network.

2. COURSE OBJECTIVES:

The students will able to:

1. To understand data flow through a computer network.

3. PRE-REQUISITES:

Students should know

1. Analog and Digital Communication Techniques.

4. TEACHING AND EXAMINATION SCHEME

Semester	VI								
Course code & course title		Periods/Week (in hours)			Total Credits	Examination Scheme			
						Theory Marks		Practical Marks		Total Marks
(EX619)		L	T	P	C	TH	TM	TW	PR/OR	
Data Communications		3	-	2	5	75	25	25	-	125

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Describe various Protocols for Data link layer.
2. Identify Components of computer communication and types of Computer Networks.
3. Analyse functions of various layers in the OSI model of a computer Network.
4. Interpret various errors and their control in a network.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y&	Project Management	Life -long Learning
CO1	2	1	0	1	0	2	3
CO2	2	1	0	1	0	2	3
CO3	2	1	0	1	0	2	3
CO4	2	2	0	1	0	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	Thr = Teaching hours	CO = Course Objectives				
Unit			M	Thr	CO	Levels
1 Introduction to Data Communication and Computer Networks			15	10	CO2	**L1,L2**
1.1 Components of Data Communication system **Five major elements of the system and their meaning.**						
1.2 Types of Data **Various types of data(Picture, Video, Audio etc.) and various types of data signals (Analog and digital).**						
1.3 Direction of Data Flow **Simplex, half and full Duplex.**						
1.4Modulation techniques used **List of Analog and Digital modulation techniques, Quadrature Phase Shift keying and QAM system working.**						
1.5Type of Connection **Point to point and multipoint.**						
1.6Topologies **Mesh, Star, Bus, and Ring topologies and their comparisons.**						
1.7Categories of Networks **Brief description of LAN, WAN, MAN.**						
1.8 Protocols and Standards **Meaning and key elements of protocol, Important standard organizations.**						
2 Network Layers (No Mathematical treatment)			10	07	CO3	**L1,L2**

2.1 Internet Model **Organization and Functions of Physical, Data link, Network, Transport and Application layers.**				
2.2 OSI Model **Functions of Session and Presentation layers, Data flow through all layers.**				
2.3 Data Transmission Modes **Parallel, Serial, Synchronous and Asynchronous.**				**L3,L4**
3 Error Detection and Correction	12	06	CO4	**L1,L2**
3.1 Types of Errors **Single bit error, Burst Error.**				
3.2 Detection of Error **Redundancy, Parity Check, CRC, Checksum.**				
3.3 Correction of Error **Forward Error Correction, Hamming Code, Burst Error correction.**				**L3,L4**
4 Data Link Control & Protocol	27	18	CO1	**L1,L2**
4.1 Flow and Error Control **Flow and Error control meaning and Operation of error control mechanisms - Stop-and-Wait ARQ, Go-Back-N ARQ, and Selective Repeat ARQ.**				
4.2 Data Link Protocol **HDLC Protocol- Types of frames, Frame formats of I frame, S frame and U frame, Data transparency.**				
4.3 Point – to – Point Protocol **Meaning, services provided, frame format and transition states.**				
4.4 Multiple Access Protocol **Random Access meaning, CSMA/CD procedure and CSMA/CA procedure.** **Controlled Access meaning and methods.**				
5 Local Area Networks	10	07	CO2	**L1,L2**
5.1 Wired LAN/ Ethernet **Main features of Traditional Ethernet, Fast Ethernet and Gigabit Ethernet.**				
5.2 Wireless LAN **Main features of IEEE 802.11 and Bluetooth.**				
5.3 Connecting Devices, backbone Networks and VLANs **Repeaters, Hubs and Bridges, Bus and Star as backbone networks and main features of Virtual LANs.**				
Total	75	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to Data Communication and Computer Networks	10	15
2	Network Layers	07	10
3	Error Detection and Correction	06	12
4	Data Link Control & Protocol	18	27
5	Local Area Networks	07	11
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	**Study of different types of transmission media.**	
2.	**Study and analysis of QPSK Modulation.**	
3.	**Study and analysis of QAM Modulation.**	
4	**Study of Serial Interface using RS-232.**	
5.	**Study of Pc to Pc or PC to Printer Communication using parallel port.**	
6.	**Study of LAN using Bus topology.**	
7.	**Study of LAN using Star topology.**	
8.	**To study/configure a MODEM for Computer to Internet connection**	
9.	**To configure a hub/switch**	
10.	**Study interconnection of cables for data communication.**	
11.	**Study Pc to PC communication using Ethernet LAN**	
12.	**Study Pc to PC communication using Wireless LAN**	
	Total	25
No	Class room Assignments	Marks
1	At least 02 assignments on relevant topics	
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Behrouz A Forouzan	Data Communications and Networks 3rd Edition	Tata McGraw-hill publishing

(EX620) Mobile Communication

1. AIM

i. **To make students aware about the evolution of cellular communication**
ii. **To provide basic knowledge of various concepts & processes used in cellular communication**
iii. **To introduce students to the features & services provided by modern cellular systems**

2. COURSE OBJECTIVES:

The students will able to:

i. Understand the basic cellular communication concepts
ii. Describe various features & services provided by GSM & CDMA
iii. Understand features of modern cellular system.

3. PRE-REQUISITES:

i. Communication Engineering

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX620) Mobile Communication		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand various concepts, components & processes used in cellular communication
2. Classify & compare various multiple access techniques used in cellular communication
3 Compare & Contrast various features & concepts of GSM & CDMA
4. Analyze features of various modern cellular systems

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	2	2	2	-	1	2	3
CO2	3	2	2	-	-	1	2
CO3	2	2	2	1	1	2	3
CO4	2	3	1	-	2	-	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	3	1
CO3	3	1
CO4	3	1

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 Introduction to Cellular Communication Systems	24	16	CO1	**L1,L2**
1.1 Need of Mobile telephone system, Conventional Mobile telephone system & its limitations				
1.2 Analog & digital cellular system : Brief comparison				
1.3 A basic cellular system: Diagram & operation of each subsystem				
1.4 Cellular communication Concepts: • Cell, Cell geometry • Frequency reuse concept, frequency reuse schemes, frequency reuse distance • Co-channel interference & adjacent channel interference(definitions) • Co-channel reduction factor • Cell splitting: need & types, sectoring, segmentation & dualization Handoff: need, types (based on signal strength and C/I ratio),delayed handoff, power difference handoff, mobile assisted handoff , soft handoff & Intersystem handoff.(No Mathematical Treatment)				**L3** **L3**
2 Components and Working Principle of Cellular Communication	15	09	CO1	**L1,L2**

Systems			& CO2	
2.1 Components of cellular communication system: Base station, MTSO, Mobile handset (Block Diagram Operation).				
2.2 Processes: Logon & Monitoring Process in cellular system				
2.3 Routing cellular calls: mobile to land line, landline to mobile, mobile to mobile & handoff mechanism.				
2.4 Frequency spectrum utilization, Setup Channels: Access & Paging Channels				
2.5 Multiple access techniques: Basic concepts & features of FDMA,TDMA & CDMA				
3 Digital Cellular system-GSM	09	06	CO3	**L1,L2**
3.1 Global system for mobile(GSM): • Services & Features • Architecture & Operation of each subsystem • Frequency channels(TCHs,CCHs in brief) • Location update management • Authentication & encryption				**L4**
4 Digital Cellular system-CDMA	09	06	CO3	**L1,L2**
4.1 CDMA cellular system: • Services & Features • Radio aspects, forward channel structure and reverse channel structure • Power control • Soft handoff • Authentication, encryption and privacy				**L4**
5 Modern cellular systems	18	11	CO4	**L1,L2**
5.1 Limitations of 2G Cellular System				
5.2 Features of 2.5G Cellular system, Features of EDGE and GPRS systems				**L4**
5.3 3G technology networks: Features of • CDMA-2000 • WCDMA(UMTS). • Wireless Local area network(WLAN) • Bluetooth & Personal Area Networks(PANS)				
5.4 Features of 4G cellular system , Comparison of 3G & 4G cellular system				**L4**
5.5 Overview of 5G cellular system: • Performance Targets • Usage Scenario: Enhanced Mobile Broadband (eMBB),Ultra Reliable Low Latency Communications (URLLC), Massive Machine Type Communications (mMTC) • Advantages of 5G				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	Introduction to Cellular Communication Systems	16	24
2	Components and Working Principle of Cellular Communication Systems	09	15
3	Digital Cellular system-GSM	06	09
4	Digital Cellular system-CDMA	06	09
5	Modern cellular systems	11	18
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Study the features, specification and block diagram operation of mobile handset	
2.	Identify various sections of a mobile handset (hardware)	
3.	Measure/Observe signals at different sections of Mobile Phone	
4.	Identify various hardware faults in a mobile handset	
5.	Comparision of GSM & CDMA technology	
6.	Study of merits & limitations of Bluetooth technology	
7.	Study of merits & limitations of Wi-Fi(WLAN)	
8.	Transfer of data using Bluetooth & Wi-Fi	
9.	Visit to GSM /CDMA Base station (Optional)	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 2 assignments	
...		
No	**Tutorial Exercise**	**Marks**
1		
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	William Lee	Mobile cellular telecommunications	McGraw Hill ISBN 978-0-07-063599-9
2	Theodore s. Rappaport	Wireless communications-Principles & Practice	Prentice Hall of India ISBN 81-203-2381-5
3	Raj Pandya	Mobile & Personal Communication systems & services	Prentice Hall of India ISBN 81-203-1710-6
4	Wayne Tomasi	Advanced Electronic Communication systems	Pearson Education ISBN 81-297-0107-3

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	T.G.palanivelu & R.Nakkeeran	Wireless & Mobile Communication	PHI learning pvt ltd ISBN 978-81-203-3607-0
2	Rishabh Anand	Wireless Communication	S.Chand &company Ltd. ISBN 81-219-4055-9

Internet and Web Resources

1	https://en.wikipedia.org/wiki/5G
2	https://www.zdnet.com/article/what-is-5g-everything-you-need-to-know/
3	https://pdfs.semanticscholar.org/b2ab/1c503c76a4b3870feaec5c3a6a157972a555.pdf

(EX622) Digital Signal Processing

1. AIM:-To study signal representation in time and frequency domain,DFT,Z transform and design of digital filters.

2. COURSE OBJECTIVES :To learn different types of discrete signals ,its classification and representation.Introduce Z transforms,DFT,FFT and study FIR and IIR filters.

The students will able to:

1.Analyze given signal or system using tool such as Z transform and DFT

2.learn properties of signal and systems

3.process the signal to make it useful.

3. PRE-REQUISITES:

1. linear algebra,calculus and trigonometry

2. knowledge of complex numbers

3. programming knowledge

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**	**Total Marks**
(EX622) Digital Signal Processing		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**
		3	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5.COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand Fourier transform, Discrete Fourier Transform and Fast Fourier Transform with redards to DSP
2. Interpret, represent and process different types of digital signals and systems and their properties.
3 Make use of Z transform technique for ROC.
4. Ability to analyze DSP systems like FIR and IIR digital filters.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopme nt of	Engg. Tools, Experime ntatn&	Engg. Practices for Society,Su stainabilit y &	Project Managem ent	Life -long Learning
CO1	3	2	2	1	2	3	3
CO2	3	3	2	1	2	3	3
CO3	3	3	2	2	2	3	3
CO4	3	3	3	2	2	3	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
Introduction	**6**	**5**	**2**	**1,2**
• 1.1 Basic components of DSP system • Advantages of DSP • Digital Signal processors • Importance of Digital signal processing				
1.2 **Define**-signal,analog signal,discrete signal,continous time signal, discrete time signal,digital signals,Quantization levels				
2 Discrete Time signals and Systems	24	15	**2**	**1,2**
2.1 **Representation of Discrete Time signals**-Functional, Graphical				
2.2 **Define Standard discrete time signals**-Unit step sequence, Unit Ramp Sequence,Unit Impulse sequence, Sinusoidal sequence. Functional and graphical representation of the above mentioned signals				

2.3 **Classification of Discrete time signals (only definition)** - Deterministic and nondeterministic signals,Periodic and Aperiodic Signals, Symmetric and antisymmetric signals, Causal and noncausal signals, Energy and power signals.(No problem solving)				
2.4 **Mathematical operations on Discrete time signals (with numerals)**- Scaling(Amplitude and time),Folding, shifting(right shift and left shift), addition and multiplication.				**3**
2.5 Explain Discrete time system, LTI and Impulse response.				
2.6 **Classification of Discrete time signals (only definition)**-Static and dynamic systems, Time invariant and variant systems, Linear and non Linear,Causal and non causal,stable and unstable FIR and IIR, Recursive and nonrecursive 2.7 Discrete or linear Convolution and its procedure.				
3 Z transforms	18	**12**	**2,3**	**1,2 ,3**
3.1 Define Z-Transform, one-sided and two-sided Z-transform, Inverse Z-Transform (no proof only equations)				
3.2 ROC Definition, **study of ROC for**- finite duration right-sided(causal) signal, finite duration left-sided (anticausal) signal, finite duration two-sided (noncausal) signal				
3.2 **Properties of Z-transform(only proof, no problem solving)-** Linearity ,shifting, one sided, time reversal, convolution theorem				
3.3 Advantages of Z-Transform				
4 Discrete Fourier Transform(DFT) and Fast Fourier Transform(FFT)	15	**8**	**1,2**	**1,2**
4.1 Definition of DFT, inverse DFT((no proof only equations)				
4.2 **Properties of DFT(only proof, no problem solving)-**Linearity, Periodicity, Time reversal, circular time shift				
4.3 Definition –FFT • Radix-2 DIT FFT-explanation of basic computation and butterfly diagram • Radix-2 DIF FFT-explanation of basic computation and butterfly diagram • Differences and similarities of DIT and DIF Radix-2 FFT				

5 FIR and IIR filters	12	**8**	**1,4**	**1,2**
5.1 FIR filters • Definition ,advantages and Disadvantages • Define window, state different types of window sequences, procedure for designing FIR filter using windows • Define window, state different types of window sequences, procedure for designing FIR filter using windows				
5.2 **IIR Filters-** • IIR filters- Definition ,advantages and Disadvantages • Comparison of analog and digital filters • Frequency response of analog and digital IIR filter • Properties of butterworth and chebychev filters				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
	Practicals to be performed by using signal processing toolbox		
1	Introduction to toolbox and its various instructions		
2	Program to generate unit step, unit ramp, Unit impulse ,sinusoidal		
3	Program to study basic operation on Discrete time signal- amplitude scaling, shifting		
4	Program for linear convolution		
5	Program to perform Z transform for the given sequence		
6	Program to perform Discrete Fourier Transform for the given sequence		
7	Program to design FIR filter using rectangular window		
8	Program to perform Radix-2 DIT FFT and Radix-2 DIF FFT		
	Total	64	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Practical Title	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 02 assignemnts	
2		
...		
No	**Tutorial Exercise**	**Marks**
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Nagoor Kani	Digital Signal Processing	Tata McGraw Hill, India, ISBN:978-0-07-008665-4
2	Anand Kumar	Digital Signal Processing	PHI Learning ISBN-978-81-203-4620-8 (downloadable)

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	V K Khanna	Digital Signal Processing	S Chand
2	Oppenheim & Schafer	Digital Signal Processing	Pearsons Education

EX624 CONSUMER ELECTRONICS

1.AIM:

1. Toknow penetration of electronics applications in various fields of society.
2. Appreciate influence of electronics in consumer, entertainment, automobile applications.

2. COURSE OBJECTIVES:

- Many of the domestic and office gadgets at home and around are electronically controlled. This course on Consumer Electronics will enable students to understand the underlying working principles of many of the electronic devices used in the consumer industry. The student will be able to apply this knowledge to carry out maintenance, fault finding, repairs and servicing of such devices along with laboratory equipments
- The students will able to

  1. To provide fundamental knowledge about the various gadgets of Consumer electronics

3. PRE-REQUISITES:

Students should know

1. Concept**s** of Basic Electronics
2. Concepts of Electronic Instrumentation
3. Concept of communication and computers

4. TEACHING AND EXAMINATION SCHEME

Semester	**V**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
EX624 Consumer Electronics		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		03	**-**	**02**	**05**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the electronics engineering concepts used in consumer electronics
2. Identify the working of various consumer electronic devices used as office gadgets
3 Examine the working of various consumer electronic devices such as washing machine, AC's, Microwave ovens with sketches of the block diagram.
4. Discuss the need of preventive maintenance and safety measures in various electronic appliances

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6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation& Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	2	2	0	0	0	3
CO2	2	1	2	2	2	0	3
CO3	2	0	1	2	2	2	3
CO4	3	3	3	3	2	0	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	

Unit	**M**	**Thr**	**CO**	**levels**
1 Electronically controlled low power Home appliances	**16**	**10**	**CO1,CO2**	**L1,L2**
1.1 Digital Clock:- Detailed block diagram, working 1.2 Digital Calculator:- Structure of Calculator, Block diagram of Calculator, Working 1.3 Digital Thermometer:- , Block diagram of Digital thermometer, Working, Advantages ,Applications 1.4 Digital Weighing Machines:- , Block diagram of Digital weighing machine, Working, Applications, Comparison of Mechanical and Electronic Weighing Machines.				
2 Electronically controlled High power Home appliances	22	14	**CO1,CO3**	**L1,L2**

2.1 Microwave Oven:- Microwaves, Advantages of microwaves over conventional electrical heating system, working principle, Microwave oven functional block diagram, Safety instructions for Microwaves. 2.2 Washing Machines:- working principle, Electronic controller for washing machines, Washing machine hardware and washing cycle. Introduction to types of washing machines---Semi automatic , Fully automatic, Fuzzy logic washing machines. 2.3 Air conditioning :- Introduction to Air Conditioning, Components of Air Conditioning systems, All water Air Conditioning systems, All air Air conditioning systems ,Introduction to unitary and Central Air conditioning systems and Split Air conditioner 2.4 Refrigerators:- Refrigeration ,Vapour Compression Refrigeration System, Domestic Refrigerator 2.5 Voltage Stabilizers:-Introduction to voltage Stabilizer, Need for voltage stabilizer, Need for voltage stabilizer, Specifications,Working of basic Series stabilizer.				
3 Electronicallycontrolled Entertainment,Commercial and surveillance appliances	**18**	12	**CO1,CO 3**	**L1,L2**
3.1 Digital Camera:- Working principle of digital camera,Techanical specifications Features of typical Electronic Surveillance system 3.2 Bar codes:- Introduction to Bar codes, Bar code formats(UPC and AIAC) , Barcode scanner and decoder 3.3Xerography:- Operation of photocopier				
3.4Metal detector :- Working and Applications*(LEVEL4)*				**L4**
4 Electronically controlled Communication appliances	13	08	**CO1,CO 3**	**L1,L2**
4.1 Cordless phones:- Transmitter section and Receiver Section 4.2 EPABX System :- Block diagram and working				
4.3 Public Addressing System*(LEVEL4)*				**L4**
5 Maintenance and safety Precautions	06	04	**CO4**	**L1,L2**
5.1 Electricity in home, Dangers of electricity, Safety Precautions, Hazards associated with electric current voltage, Approaches to prevent accidents, Fire prevention and fire fighting.				
Total	**75**	**48**	**-**	

7. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**Electronically controlled low power Home appliances**	10	16
2	**Electronically controlled High power Home appliances**	14	22
3	**Electronically controlled Entertainment ,Commercial and surveillance appliances**	12	18
4	**Electronically controlled Communication appliances**	08	13
5	**Maintenance and safety Precautions**	04	06
	Total	48	75

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Use of Test and Measurement Instruments and Interpretation of manuals of CRO,Multimeter,Power Supply, and Function Generator	
2	Identification and testing of different types of components such as Resistors,Capacitors,Diodes,Transistors,Switches and Relays	
3	Soldering and Desoldering	
4	Explore the various functions of Washing machines and locate various sensors used in that washing machines	
5	Check the wiring of ACs and explore all functions	
6	Test various functions of Microwave ovens	
7	Explore settings Digital Cameras	
8	Demonstration of Photocopy Machine	
9	Demonstration of EPABX system	
10	Demonstration of CCTV Or simple Public address system	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 2 assignments	
No	**Tutorial Exercise**	**Marks**
1	NIL	
...	Total	

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	S.P.Bali	Consumer Electronics	Pearson Education
2	B.R. Gupta and V. Singhal	Consumer Electronics	New Age Int. Pub.

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	J S Chitode	Consumer Electronics	Technical Publications Pune

(EX625) ROBOTICS

1. AIM

To develop required skills in the students so that they are able to acquire the following competency:
1. Operate and maintain different types of robots.

2. COURSE OBJECTIVES:

Nowadays industries demand continuous and fine quality work in different processes of industries. All process is generally done by humans and as we know humans are not able to give same quantity and quality of work with respect to time, environment and complexity of the work. To get quality and quantity of work in toughest environment or the environment which is not suitable for the humans to work, industries demand for robots and its operator. Operators which operate this robot need some basic knowledge of robotics. To fulfil the demand of industries and advancement in technology it is necessary for the electronic engineers to have knowledge and skill in robotics.

The students will able to:
1. Explain different components of robot & compare various types of Robot.
2. Study the working of various robot controller & Differentiate between various robot controllers.
3. Explain the kinematics & vision system of Robot.
4. Compare the uses of various sensors & warning system & appreciate the application of robot s in various industries.

3. PRE-REQUISITES:

Students should know
1. Basics of C programming.
2. Embedded systems.

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
ROBOTICS		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
		L	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
(**EX625**) ROBOTICS		**3**	**-**	**2**	**5**	**75**	**25**	**25**	**25**	**150**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

CO1. Define and select right parameters for robot for given application.
CO2. Distinguish between various robot controller & Actuators.
CO3. Maintain the different types of robot sensors.
CO4. Operate the robot through software and trouble-shoot minor problems.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y &	Project Managem ent	Life -long Learning
CO1	3	3	3	3	0	2	0
CO2	2	1	1	2	0	1	0
CO3	3	2	3	3	1	2	2
CO4	3	3	3	3	0	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	3	1
CO2	2	0
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**			
Unit			**M**	**Thr**	**CO**	**Level**
1. ELEMENTS OF ROBOT			**18**	**12**	**1/3**	**1/2**
1.1 Basic Concepts in (Fundamentals of) robotics: Introduction, Definition, Automation and robotics, Generations of Robots, Robot applications.						
1.2 Different classifications of robot: By application (Material handling, operations, Assembly, Inspection), by coordinate system (Cartesian, Cylindrical, Spherical, Articulated, SCARA), by actuation (drive) system (Hydraulic, Electric, Pneumatic), by control system (Limited sequence, playback with point to point control, playback with continuous control, Intelligent Robots) and by programming method (Lead-through, Textual).						**3**

1.3 Robot anatomy: Links and joints, Joint notation. Degree of Freedom. Robot resolution, accuracy and repeatability. Concept of workspace.				
2. ROBOT CONTROLLER AND ACTUATION SYSTEMS	**15**	**10**	**1/2/4**	**1/2**
2.1 Robot controller: open and closed loop control systems (explanation with block diagram, advantages & comparison) Controllers: (On-off, Proportional, Integral, Proportional plus Integral, Proportional plus derivative, Proportional plus integral plus derivative- explain in brief)				
2.2 Robot Actuation and feed-back components Position Sensors (Potentiometers, encoders), Actuators (DC servo motors, Stepper motors, Pneumatic and Hydraulic), Velocity Sensors, Power Transmission Systems (Gears, Power Screws)				
3. ROBOT EFFECTORS, SENSORS & MACHINE VISION	**15**	**10**	**2/4**	**1/2**
3.1 Robot End Effectors: Grippers and Tools. Basic Definition and operation: Mechanical grippers, Vacuum cups, Magnetic grippers. Tools as end effectors.				
3.2 Transducers and Sensors Desirable features of sensors. Basic working principle:- Tactile sensors (Touch, Force), Proximity and Range sensors (Light and Ultrasonic) Uses/ Applications of sensors in Robotics.				
3.2 Machine Vision Introduction to Machine Vision (Sensing and digitizing Image, Image processing and analysis, Application) (block diagram and explanation only) Robotic applications of machine vision				**3**
4. ROBOT PROGRAMMING	**12**	**6**	**4**	**1/2**
4.1 Robot programming Lead-through (Powered & Manual) and Textual robot languages. Robot Programme as a Path in Space, Motion Interpolation, WAIT, SIGNAL and DELAY Commands, Capabilities and Limitations of Lead through Methods, Robot Language Structure. Comparison of Lead-through (Powered & Manual) v/s Textual robot languages				
5. ROBOTICS APPLICATIONS, MAINTAINANCE & SAFETY	**15**	**10**	**3/4**	**1/2**
5.1 Robotics Applications Material Transfer (Pick and place) Process operations (Arc wielding) Assembly Application (Peg in hole) Inspection Application (Sensor/Vision based inspection) Non Industrial Application (Health Care, Research and Exploration etc.) Robot maintenance: Need and Types. General Safety Norms, aspects and precautions in robot handling.				
Total	**75**	**48**	**----**	**----**

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	ELEMENTS OF ROBOT	12	18
2	ROBOT CONTROLLER AND ACTUATION SYSTEMS	10	15
3	ROBOT EFFECTORS, SENSORS & MACHINE VISION	10	15
4	ROBOT PROGRAMMING	06	12
5	ROBOTICS APPLICATIONS, MAINTAINANCE & SAFETY	10	15
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	Electronic Control of a DC Servo motor	
2.	Electronic Control of a Stepper motor	
3.	Electronic control of BLDC motor	
4.	Interfacing of proximity and range sensors to Arduino	
5.	Interfacing of Accelerometers and Gyroscopes sensors to Arduino	
6.	Interfacing of force sensors to Arduino	
7.	Programming a robot arm for straight line, circular and curved paths	
8.	Programming a robot arm for pick and place operation.	
	Total	25
No	**Class room Assignments**	**Marks**
1	Atleast 02 assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
...	Total	25

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Mikkel P.Groover, Mite chell weiss, Rogern Negal and Nicholes G.Odress	Industrial Robotics Technology-Programming and Applications	Tata McGraw Hill
2	R.K.Mittal, I.J.Nagrath	Robotics and controls	Tata McGraw Hill
3	K.S. Fu, R. C. Gonzalez, C.S.G. Lee	Robotics: Control, Sensing, Vision and Intelligence	McGraw Hill

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Doughlaes –R. Halcoojr	An Introduction to robotics	

Internet and Web Resources

S. No.	Author	Title of Books	Publishers
1	*http://enggmechanical.blogspot.com/2010/06/classification-of-robot.html*		

(EX626) Image Processing

1. AIM

This course will expose the students with fundamentals of digital image processing and prepare them for a strong footing to pursue advanced digital image processing techniques.

2. COURSE OBJECTIVES:

This course will provide students exposure to digital image processing and impart fundamental image transformations and enhancements along with an insight into image compression. The course will also teach the students to detect basic object boundaries and know how to represent them.

3. PRE-REQUISITES:

1. Basic Mathematics (algebra)
2. Digital Electronics
3. Concept of time and frequency domain

4. TEACHING AND EXAMINATION SCHEME

Semester	**VI**								
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
(EX626) Image Processing		L	T	P	C	TH	TM	TW	PR/OR	
		3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain how an image is represented and processed in a computer system.
2. Apply suitable transformations to images for specific processing.
3. Make use of suitable algorithms to minimize noise in images and enhance them.
4. Compare different algorithms used for processing an image and decide the most suitable, depending on the requirement and resources at hand.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledg	Problem Analysis	Design and Devlopment of	Engg. Tools, Experimentatn&	Engg. Practices for Society,Sustainabilit y &	Project Managem ent	Life -long Learning
CO1	3	2	2	0	0	0	2
CO2	3	1	2	1	0	0	0
CO3	3	2	1	0	0	0	2
CO4	2	3	1	2	2	0	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	1
CO2	3	1
CO3	2	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Objectives**	**M**	**Thr**	**CO**	**LEVELS**
UNIT 1: Introduction and Digital Image Fundamentals			12	08	1,2, 3	L1, L2
1.1 What is digital image processing, applications of Digital Image Processing.						
1.2 Digital Image Fundamentals: Human visual system- Structure of the human eye, Image formation in the eye, brightness adaptation and discrimination.						
1.3 Image sampling and quantization –Basic Concepts, representing digital images.						
1.4 Basic relationships between pixels						
UNIT 2: Image transformation			15	08	1,2, 3,4	L1
2.1 Basic Gray Level Transformations: Image negatives, Log						

transformation, gamma correction.				
2.2 Concept of Piecewise –Linear Transformation Functions: contrast stretching, gray-level slicing, bit-plane slicing.				
2.3 Significance of a Histogram in image processing				
UNIT 3. Image enhancement	18	12	1,2, 3,4	
3.1 Sources of noises (Gaussian, rayleigh, gamma, exponential, uniform, salt and pepper noise)—only brief description)				L1, L2, L3
3.2 Spatial Filtering (smoothing filters, averaging and median filters, sharpening filters- Laplacian filter)				
3.3 Enhancement using arithmetic/logic operations, Image subtraction, image averaging				
UNIT 4: Image Segmentation, Representation & Description				
4.1 Point, line and edge detection	18	12	1,2, 3,4	L1, 2,3
4.2 Basic Global Thresholding				
4.3 Regions Based segmentation- Region growing, region splitting and merging				
4.4 Representation: Chain codes, Polygonal approximations, Signatures				
4.5 Descriptors: Some simple descriptors, Shape numbers, Regional descriptors: Topological descriptors				
UNIT 5: Image Compression				
5.1 Fundamentals of redundancies	12	08	1,2, 3,4	L1, L2
5.2 Basic Compression Methods: Huffman coding, Arithmetic coding, Bit-plane coding, Constant area coding, run length coding.				
5.3 JPEG Compression standard				
	75	48		

7. COURSE DELIVERY:

The Course will be delivered through lectures and practicals.

8. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of hours	Marks
1	Introduction and Digital Image Fundamentals	08	12
2	Image transformation	08	15
3	Image enhancement	12	18
4	Image Segmentation, Representation & Description	12	18
5	Image Compression	08	12
	Total	**48**	**75**

9. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practicals
1.	To read and display images
2.	To identify different types of images and convert from one type to the other
3.	Gray scale transformations programs
4.	Programs illustrating Histogram Processing of an image
5.	Filtering of an image by an averaging filter
6.	Filtering of an image by a median filter
7.	Sharpening of an image using Laplacian
8.	Identification of segments in an image using Region filling/ growing algorithms
9.	Hough Transform for object detection
10.	Study of JPEG Compression standard

10. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Rafael C Gonzalez and Richard E Woods	Digital Image Processing	Pearson Education.
2	Anil K Jain	Fundamentals of Digital Image Processing	PHI

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	Bhabatosh Chanda and Dwijesh Majumder	Digital Image Processing	PHI
2	Rafel C. Gonzalez and Richard E. Woods	Digital Image Processing Using Matlab	Pearson Education

EX627 Smart Grid Technology

1. AIM

This course will present the concept of Smart grids from the multidisciplinary perspectives. It will provide technology aspects of smart grids including smart metering infrastructure, demand side management, electric vehicles, power quality management and information technology.

2. COURSE OBJECTIVES:

The students will able to:

1. Understand concepts of smart grid and various issues related to it
2. Identify different technologies for effective utilization of smart grids.
3. Understand power quality management issues

3. PRE-REQUISITES:

Students should know

1. Basic Electrical Engineering

4. TEACHING AND EXAMINATION SCHEME

Semester									
Course code & course title		**Periods/Week (in hours)**			**Total Credits**	**Examination Scheme**			
						Theory Marks		**Practical Marks**		**Total Marks**
EX627 Smart Grid Technology		**L**	**T**	**P**	**C**	**TH**	**TM**	**TW**	**PR/OR**	
		3	-	2	5	75	25	25	-	**125**

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Explain different concepts of smart grids.
2. Compare conventional grid and smart grid, resilient and self-healing grid
3. Analyze implementation of different technologies and power quality issues in Smart Grid
4. Justify selection of network and computing for smart grid applications

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Society, Sustainability & Environment	Project Management	Life -long Learning
CO1	2	1					1
CO2	2	1			2		3
CO3	2	2	2	2	2	2	2
CO4	2	2	1	3	3	2	2

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1		
CO2		
CO3		
CO4		

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks | **Thr = Teaching hours** | **CO = Course Objectives**				
Unit	**M**	**Thr**	**CO**	**Levels**
1 Introduction To Smart Grid	9	6	CO 1	L1
1.1 Evolution of Electric grid Definition, need and benefits of smart grid	3	2	CO 1	L1
1.2 Opportunities and challenges in smart grid Difference between conventional grid and smart grid Concept of Resilient & self-healing Grid	6	4	CO 2	L2
2 Smart Grid Technologies	18	14	CO 1,3	L1, 3
2.1 Demand response, architecture for DR implementation Smart Substations, Substation Automation	6	4	CO 1	L1
2.2 Transmission systems: EMS, HVDC, Wide area monitoring, protection and control Distribution systems: DMS, Volt/VAr control, fault detection, isolation and service restoration, outage management	6	6	CO 3	L3
2.3 Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid.	6	4	CO 3	L3
3 Smart Meters And Advanced Metering Infrastructure	18	10	CO 3	L3
3.1 Introduction to Smart meters, Advanced Metering Infrastructure (AMI) drivers and benefits, AMI protocols, AMI needs in the smart grid.	6	3	CO 3	L3
3.2 Automatic Meter Reading (AMR), Outage Management System (OMS), Smart Sensors, Home & Building Automation,	6	4	CO 3	L3
3.3 Phase Measurement Unit (PMU).	6	3	CO	L3

Intelligent Electronic Devices(IED) & their application for monitoring & protection			3	
4 Power Quality Management In Smart Grid	15	9	CO 3	L3
4.1 Power Quality & EMC in Smart Grid	6	4	CO 3	L3
4.2 Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid	6	3	CO 3	L3
4.3 Web based Power Quality monitoring.	3	2	CO 3	L3
5 Information Technology For Smart Grid	15	9	CO 3,4	L4
5.1 Local Area Network (LAN), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN).	6	3	CO 4	L4
5.2 Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.	9	6	CO 3	L3
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	**Unit**	**Number of lectures**	**Marks**
1	Introduction To Smart Grid	6	9
2	Smart Grid Technologies	14	18
3	Smart Meters And Advanced Metering Infrastructure	10	18
4	Power Quality Management In Smart Grid	9	15
5	Information Technology For Smart Grid	9	15
	Total	48	75

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical (Minimum 8)	Marks
11.	Simulation & analysis of Grid connected micro grids.	
12.	Simulation & analysis of isolated micro grids.	
13.	Case study on DSM/ Demand response	
14.	Study & analysis of Smart grid technologies	
15.	Study of Communication techniques for smart grids	
16.	Simulation & analysis of different storage systems in micro grid	
17.	Study & analysis of power quality issues in Smart grid	
18.	Field visit to the site of the smart grids	
19.	Study of IEEE standards for implementation of smart grids	
20.	Case study of smart grids	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 2 assignments	
2		
...		
No	**Tutorial Exercise**	**Marks**
1	NIL	
2		
...	Total	

11. LEARNING RESOURCES

Text Books

S. No.	Author	Title of Books	Publishers
1	Janaka Ekanayake, Nick Jenkins	Smart Grid: Technology and Application	Wiley press
2	Clark W. Gellings	The Smart Grid: Enabling Energy Efficiency and Demand Response	CRC Press
3	James Momoh	Smart Grid : Fundamentals of Design and Analysis	Wiley IEEE press
4	James Claude Sabonnadière, Nouredine Hadjsaid	Smart Grids	Wiley Blackwell

(EX628) VLSI Design and Application

1. AIM

To introduce students to chip fabrication and various steps involved in VLSI design flow.

2. COURSE OBJECTIVES :

The Student will be able to :

1. Implement functions using MOS logic following prescribed design rules through mask layouts
2. Develop and model simple MOS circuits through programming

3. PRE-REQUISITES :

Students should have knowledge of

1. Basic Concepts from Semiconductor Physics and Electronics
2. Fundamental Concepts from Digital Electronics
3. Basic Computer

4. TEACHING AND EXAMINATION SCHEME

Semester VI									
Course code & course title	Periods/Week (in hours)			Total Credits	Examination Scheme				
					Theory Marks		Practical Marks		Total Marks
(EX628)	L	T	P	C	TH	TM	TW	PR/OR	
VLSI Design and Application	3	-	2	5	75	25	25	25	150

5. COURSE OUTCOMES:

On successful completion of the course, the student will be able to:

1. Understand the technologies/ processes involved in fabrication of ICs, operation of MOS devices, design rules, modeling commands and the complete VLSI design flow.
2. Apply the knowledge of MOS devices to explore channel length modulation, logic design, circuit modeling and design analysis.
3. Analyze the operation of MOS circuits, Implementation of Boolean functions, modeled circuits and VLSI design stages.
4. Evaluate and Select suitable MOS invertors, design implementation and programmable platforms based on comparative performance and application.

6. Mapping Course Outcomes with Program Outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
	Basic & Discipline Specific Knowledge	Problem Analysis	Design and Development of Solutions	Engg. Tools, Experimentation & Testing	Engg. Practices for Sustainability & Environment	Project Management	Life -long Learning
CO1	3	0	1	0	2	0	2
CO2	3	2	3	2	0	2	0
CO3	3	2	1	2	0	2	3
CO4	3	3	3	1	2	2	3

Relationship : Low-1 Medium-2 High-3

	PSO1	PSO2
CO1	2	2
CO2	3	2
CO3	3	2
CO4	3	2

7. DETAILED COURSE CONTENTS / MICRO-LESSON PLAN

M = Marks	**Thr = Teaching hours**	**CO = Course Outcomes**				
Unit			**M**	**Thr**	**CO**	**Level**
1 INTRODUCTION TO TECHNOLOGIES IN IC FABRICATION			**15**	**08**	**CO 1**	**L1**
1.1 Silicon Semiconductor Technology : Concept of wafer processing, oxidation, epitaxy, deposition, etching in chip fabrication.						
1.2 Description of processes such as Photolithography, Ion Implantation and Diffusion						
1.3 CMOS Technology: Description of n-well and p-well CMOS processes						
1.4 Introduction to Impact of chip fabrication on environment and solutions						
2 MOS TRANSISTORS			**15**	**10**	**CO1/2 /3/4**	**L1/L2**
2.1 Operation and V I Characteristics of NMOS transistor (Enhancement & Depletion types)						

2.2 Operation and V I Characteristics of PMOS transistor (Enhancement & Depletion types)				
2.3 Description of channel length modulation				
2.4 Concept of CMOS transistor, Operation of a CMOS Inverter with DC characteristics, Comparison of CMOS inverter with NMOS inverter and resistive load MOS inverter.				
3 VLSI LOGIC DESIGN	**15**	**10**	**CO1/2 /3/4**	**L1/L2**
3.1 Definition of fan in and fan out, Concept of pass transistor, Implementation of logic gates (OR, AND, NOR and NAND) using pass transistors and CMOS Logic				
3.2 Implementation of simple Boolean expressions using pass transistors and CMOS logic, Comparison of design implementations				**L3**
3.3 Study of lambda rules and magic layout editor				
3.4 Drawing of Stick diagrams				**L3**
3.5 Drawing of mask layouts with concept of Euler paths				**L3,4**
4 INTRODUCTION TO SPICE	**12**	**08**	**CO1/2 /3/4**	**L1/L2**
4.1 Introduction to SPICE Programming commands				
4.2 Modeling of MOS circuits using SPICE (level 1 model equations)				**L3**
5 VLSI DESIGN METHODOLOGIES AND APPLICATIONS	**18**	**12**	**CO1/2 /3/4**	**L1/L2**
5.1 Description of VLSI Design flow, Brief description of design analysis and its types (circuit and logic), Brief description of design simulation and its types (circuit, timing, switch level and gate level, Brief description of design verification and its types (electrical, timing and functional)				
5.2 General test procedure of an IC, Scan based test, boundary scan design, built in self test (BIST), Automatic test pattern generation				
5.3 fault model (stuck at 1 and stuck at 0 fault modeling)				**L3,4**
5.4 Features and Working of FPGA and CPLD, Comparison between them.				
Total	**75**	**48**		

8. COURSE DELIVERY:

The Course will be delivered through lectures, class room interactions, exercises and case studies

9. SPECIFICATION TABLE FOR THEORY/ MACRO-LESSON PLAN

Unit No	Unit	Number of lectures	Marks
1	**INTRODUCTION TO TECHNOLOGIES IN IC FABRICATION**	08	15
2	**MOS TRANSISTORS**	10	15
3	**VLSI LOGIC DESIGN**	10	15
4	**INTRODUCTION TO SPICE**	08	12
5	**VLSI DESIGN METHODOLOGIES AND APPLICATIONS**	12	18
	Total	**48**	**75**

10. SPECIFICATION TABLE FOR TERM WORK & PRACTICALS HOURS

No	Practical	Marks
1.	V I Characteristics of N MOS Transistor	
2.	DC Characteristics of CMOS Inverter	
3.	Mask Layout for logic gates with lambda rules using CMOS logic in Magic Editor	
4.	Mask Layout for Boolean Expressions using CMOS logic in Magic Editor	
5.	Study of commands in SPICE with hands on practice	
6.	Modeling of logic gates using SPICE	
7.	Modeling of Boolean Expressions using SPICE	
8.	Implementation of logic gates using FPGA	
	Total	25
No	**Class room Assignments**	**Marks**
1	At least 10 covering all units above	
2		
No	**Tutorial Exercise**	**Marks**
1	NIL	
	Total	25

11. LEARNING RESOURCES :

Text Books

S. No.	Author	Title of Books	Publishers
1	Sung-Mo Kang, Yusuf Leblebici	CMOS Digital Integrated Circuits Analysis & Design	Mc Graw Hill Education
2	Neil H. E. Weste, David Harris	CMOS VLSI design-A circuit and systems Perspective	Pearson Education
3	Jan M Rabaey	Digital Integrated Circuits- A design Perspective	Pearson Education
4	Douglas Pucknell, Kamran Eshraghian	Basic VLSI design	PHI
5	Wayne Wolf	Modern VLSI Design	Prentice Hall

Reference Books for further study

S. No.	Author	Title of Books	Publishers
1	J Bhaskar	VHDL Primer	PHI
2	Eugene D. Fabricius	Introduction to VLSI Design	Mc. Graw Hill Education
3	Stephen Brown, Zvonco Vranesic	Fundamental of Digital Logic with VHDL design	Mc Graw Hill Education